SOUTHAMPTON
UNIVERSITY LIBRARY

BOOK NUMBER	59-582586
CLASS MARK	SF 375
	PERKINS

59582586

SOUTHAMPTON UNIVERSITY LIBRARY

Date due for Return
(Unless recalled for another reader)

THE
HISTORY, STRUCTURE, ECONOMY,
AND DISEASES
OF
THE SHEEP.

IN THREE PARTS.

Illustrated with fine Engravings from Drawings

By W. HARTY, Esq.

By W. C. SPOONER, V.S., &c.

LONDON:
SIMPKIN, MARSHALL, AND CO.,
STATIONERS' HALL COURT.

THE
HISTORY, STRUCTURE, ECONOMY,
AND
DISEASES
OF
THE SHEEP.

IN THREE PARTS.

ILLUSTRATED WITH FINE ENGRAVINGS FROM DRAWINGS

By W. HARVEY, Esq.

By W. C. SPOONER, V.S.

Member of the Council of the Royal College of Veterinary Surgeons; Honorary Associate of the Veterinary Medical Association; Author of "Treatise on the Influenza," and the "Structure, Diseases, &c., of the Foot and Leg of the Horse;" Editor of White's "Cattle Medicine," and White's "Compendium of the Veterinary Art."

Second Edition.

LONDON:
SIMPKIN, MARSHALL, AND CO.,
STATIONERS HALL COURT.

P R E F A C E.

THE following pages are intended to furnish a manual of the structure, various breeds, and diseases of Sheep—easy of reference and readily accessible—for which purposes each portion of the work is separately arranged. No one can be more sensible than the Author of the defects with which, in common with the productions of all preceding writers on the same subject, the present work may be charged—defects arising from the very slight attention which has been paid by men of science to the diseases of the Sheep, and the want of correspondence and co-operation amongst those whose opportunities have afforded them the means of practical information.

The information derived from works of authority and incorporated in the present work require, in the opinion of the Author, no apology; his object having been to furnish on each branch of his subject the best and most correct information: he has, therefore, taken advantage of all accessible and well-authenticated facts, and, in most cases, has employed the language of the writers, as well as given their names. Justice to them and to the subject required that this should be done. The diseases of sheep are so frequently of an endemical character, and are so modified and governed by the influence of the breed, the mode of management, and the locality,

that if any writer, however extensive his opportunities may have been, relied solely upon his own experience, his work would possess at best but *local* interest and value.

The work is divided into three parts. The first, which embraces the history or description of the breeds of sheep, is arranged somewhat according to the plan adopted by Professor Low in his large work on the Breeds of Cattle and Sheep, and the author has availed himself of this work in the account of the various races of Sheep found in the northern parts of the island; whilst he has relied principally on his own knowledge for the description of the more southern breeds. The most important portion of the anatomical division of the work has been the result of careful dissection; and for the sections on Feeding, Fattening, and Breeding, the Author is alone responsible. In the third part, on the Diseases of the Sheep, free use has been made of the various papers contributed to the '*Veterinarian*,' a monthly journal of veterinary science of established merit and reputation, whilst the elaborate treatise on Sheep, by the principal editor of this journal, Mr. Youatt, has been carefully perused and compared. The Author flatters himself that he has, in a small compass, brought the various branches of his subject up to the present period, and that it will be found by the large and important class it concerns of practical utility.

Southampton, May 30, 1844.

CONTENTS.

PART I.—THE BREEDS OF SHEEP.

SECTION I.—THE ORIGIN AND ANCIENT HISTORY OF THE SHEEP.

Origin of the Sheep involved in Obscurity, supposed by Naturalists to be descended from the Argali and the Musmon—Professor Low's Description of the ARGALI—Description of the MUSMON—The Argali, the Musmon, and the Sheep supposed to be descended from a common Origin, and to have become wild or docile from the direction of their habits—This view in keeping with Sacred History—Abel a Keeper of Sheep—Sheep-keeping one of the earliest Employments of Man—Scripture Patriarchs, their Habits still followed by the Arabs, &c.—Sheep introduced into Europe from Asia—Fat-tailed Sheep—Persian Sheep—Tartar Sheep—Sheep in Britain coeval with its earliest Records Page 1

SECTION II.—THE SHORT-TAILED SHEEP.

Located in the Orkney and Zetland Islands—Introduced from Norway—Habits active, wild, and hardy—Fleece hairy and of various Colours—Horns short—Size stunted—Recent Attempts to improve by crossing 16

SECTION III.—THE SHEEP OF WALES AND IRELAND.

Sheep of the Higher Mountains—Small and wild, with Horns resembling the Goat—The Soft-woolled Sheep small and active—The chief source of the supply of Welsh Flannels and Welsh Mutton—The RADNOR SHEEP—The SHEEP OF IRELAND—The VALE SHEEP large and coarse—The MOUNTAIN SHEEP of two sorts, the Wicklow and the Kerry—The former are small, lamb early, and supply the Dublin Market—The Kerry Breed hardy, unthrifty, with coarse Wool and crooked Horns 18

SECTION IV.—THE FOREST BREEDS.

The DARTMOOR are small with soft Wool—Excellent Mutton—The EXMOOR SHEEP rather smaller, crossed with the Leicester and the Down 24

SECTION V.—THE MOUNTAIN BREEDS.

The BLACK-FACED HEATH SHEEP a small hardy Race with coarse Wool, inhabiting the heathy Mountains on the borders of Scotland—The Mutton greatly esteemed—Seldom killed till three or four years old—Usually smeared in November—Crossing has not been suc-

cessful as a permanent Improvement except with the first Cross, of which those with the Leicesters are the best—The CHEVIOT SHEEP natives of the Cheviot Mountains—White Faces and Legs—Quiet and docile—Hardy, but more profitable than the Black-faced Breed—Wool fine, lamb late—Sheep washing and shearing—Management of the Flocks—Description of the Cheviot Snow Storms—Loss of Life—Sheep breeding—First Cross with the Leicester very successful, also with the Downs—The Breed capable of much Improvement 25

SECTION VI.—THE ANCIENT UPLAND BREEDS.

The OLD NORFOLK, an active, bardy Race—Somewhat resemble the Deer—Good hind, but bad fore Quarters—Inferior to the Downs, to which they have given place—The PENISTONE—Coarse Limbs, Wool long, Mutton much esteemed—The OLD WILTSHIRE nearly extinct—Very coarse and unprofitable—Short fine Wool—The OLD HAMPSHIRE SHEEP—The OLD BERKSHIRE—The DORSET SHEEP found in most Counties, but particularly in Dorsetshire—Rather larger than the South Down—Strong and active—Possess Horns—Excellent Nurses and very prolific—Lamb earlier than any others, whence their peculiar Value—Sold extensively at the autumnal Fairs—Rearing House-lamb—Dorset Ewes often crossed with the South Down—The SOMERSET SHEEP—Very similar to the Dorset in all respects—The PORTLAND BREED—Smaller than the Dorset—Mutton much esteemed, but Sheep unprofitable—The RYELAND SHEEP—Found principally in Hereford—Small, docile—Without Horns—Wool finer than that of any other English Breeds—Used to be in great Demand when foreign Wool was at a high Duty—Since its extensive Importation the Ryeland Sheep have been greatly diminished—Crossing has not succeeded 38

SECTION VII.—THE MERINO.

Spain, the native Country, once celebrated for its woollen Manufactures, has ceased to retain them and now exports its Wool—The Origin of the MERINO—Its Description—Requires a dry Climate—Unprofitable as respects the Carcase, and bad Nurses, but the Wool superior to all others—Migratory Sheep, or Transhumantes—Sheep-shearing in Spain—Singular Shepherds—The Estantes, or stationary Sheep, do better than the others—The Merino introduced into Sweden in 1723, afterwards into France and Germany in 1765—The Saxony Sheep—Two Varieties, the Infantado and Escorial—Account of each—Management of Sheep in Saxony—Baron Geisler's Flocks—Merino Sheep introduced into England by George III.—Crossed extensively with other Breeds, but without Success—Climate not adapted for them—Very few remain, and none pure—Lord Western's Sheep—The Merino introduced into Australia from England by Capt. M'Arthur in 1793—Attended with great Success—Climate suitable—Late Deterioration in the Value of Stock—Suffer much from Want of Water at Times—Sheep-boiling—Want of System and Co-operation in these Colonies

—Great Increase in the Exportation of Australian Wool—Value and Importance of the Trade	52
---	----

SECTION VIII.—THE SOUTH DOWN, OR SUSSEX BREEDS.

The SOUTH DOWN a very ancient Breed—Ranks first amongst the Short-wools—Arthur Young's Account of them in 1776—Mr. Ellman the chief Improver—His Description—Mr. Grantham the most successful Exhibitor—Mr. Jonas Webb's Sheep—The South Down extended to all Parts of Britain and Ireland—The old Management in Sussex, Hampshire, &c.—Present Management—The HAMPSHIRE DOWN SHEEP—Its Origin—The Hampshire Down crossed with the improved Cotswold	72
--	----

SECTION IX.—THE LONG-WOOLLED BREEDS.

The LINCOLN SHEEP—Derived from the Old Lincoln, which is extinct, and the New Leicester—Very large Sheep—Wool long and Mutton rather coarse—ROMNEY MARSH SHEEP—Have been crossed with the Leicester—The TEESWATER—The BAMPTON NOTT—A large fine Sheep with very long Wool—Has been improved by the Leicester—The LONG-WOOLLEN SHEEP of Ireland—The COTSWOLD—A large Sheep—Long Fleece—Hardier than the Leicester; by crossing with which, however, it has been greatly improved, and under the term of Improved Cotswold now rivals the Leicester	89
---	----

SECTION X.—THE NEW LEICESTER.

The NEW LEICESTER moulded, as it were, by Bakewell—The Principles on which he acted—Description of the LEICESTER SHEEP—Bakewell's Mode of letting Rams—His Difficulties at first—Large Sums afterwards received—Rules of the Disbley Society—The Fleece—Early Maturity—Has improved by crossing every other long-woolled Breed, and in many Places has supplanted the short-wools	100
---	-----

PART II.—THE STRUCTURE AND ECONOMY OF THE SHEEP.

SECTION XI.—GENERAL VIEW OF THE STRUCTURE OF THE SHEEP 114

SECTION XII.—SKELETON, OR BONY STRUCTURE OF THE SHEEP.

The Structure and Composition of Bone—The Marrow—The Periosteum—The Bones of the Head, peculiar Structure of—Situation of the Brain—The cranial Cavity—The Bones composing it—The Bones of the Face—The Bones of the Neck and Back—The Ribs—The Loins—Sacrum—The Bones of the fore Extremities—The Foot—Its peculiar Structure in Sheep—The Biflex Canal—The Bones of the hind Extremities	120
--	-----

SECTION XIII.—THE MUSCLES, OR FLESH.

Their Uses, Shapes, and Structure 140

SECTION XIV.—THE BRAIN AND NERVES.

Cerebrum—Cerebellum—Medulla Oblongata—The spinal Marrow—
The cranial Nerves—The spinal Nerves—Their double Origin—
The great organic Nerve 142

SECTION XV.—THE ORGANS OF MASTICATION.

The Lips—The Nippers, or Incisor Teeth—Their appearance, &c. as
denoting the Age—The Molar Teeth—The Cheeks and Mouth—
Saliva—Parotid Glands—The Tongue—Soft Palate—The Os
Hyoides—The Eustachian Cavities 147

SECTION XVI.—THE ORGANS OF DIGESTION.

General Observations on—The Pharynx—The Oesophagus—The Oesophagean Canal—Engraving of the Stomachs laid open—Description of ditto—The Rumen, or first Stomach—Its Size and peculiar Structure—The Reticulum, or second Stomach—Its cellular Structure—The Maniplus, Manifold, or second Stomach—The Abomasum, or fourth Stomach—The Gastric Juice—Its Office—The Course of the Food through the Stomachs—The Chyme—The small Intestines—Duodenum, Jejunum, and Ileum—Engraving of the Stomachs and Intestines—Its Description—The Liver—Gall-bladder—The Bile—The Chyle—The large Intestines—The Cæcum, the Colon, and Rectum—Their Functions 152

SECTION XVII.—THE URINARY AND GENERATIVE ORGANS.

The Kidneys—The Ureters—The Bladder—The Urine of Sheep—The Urethra—Penis—Vagina—Uterus—Testicles 171

SECTION XVIII.—THE CONTENTS OF THE CHEST.

The Nostrils—Septum Nas—Schneiderian Membrane—Epiglottis—Larynx—Windpipe—The Chest—Its Keel-like Form—Sternum—Ribs—The Diaphragm—the Pleura—The Lungs—Parenchyma 175

SECTION XIX.—THE BLOOD AND ITS CIRCULATION.

The Serum—Fibrine—Temperature of the Blood—Its coagulation—The Heart—Pericardium—The Circulation—Arteries—Veins 181

SECTION XX.—ON RESPIRATION AND ITS EFFECTS.

Atmospheric Air—Its Composition—Nitrogen—Carbonic acid Gas—Oxygen—Production of Animal Heat 194

SECTION XXI.—ON FEEDING AND FATTING, &c.

A capacious Chest not connected with fattening Properties—The best Conformation—Analyses of Flesh—Blood—Fat—Hay, Albumen,

Milk, &c.—Nutritious Properties of various Descriptions of Food—
The feeding of Animals—Lord Ducie's Experiment—Mr. Childer's
Experiment—Showing that Warmth and Want of Exercise conduce
to fattening—Feeding with Corn and Oil-cake, its Advantages 202

SECTION XXII.—THE PRINCIPLES AND PRACTICE OF BREEDING.

The respective Advantages of the Leicester and the South Down—The
Cheviot—The Dorset and Somerset—The Romney Marsh Sheep—
The Bampton Notts—The Cotswold—On Folding, its Advantages
and Disadvantages considered—Superior Influence of the Male in
breeding—Form of Sheep desirable to perpetuate—Judicious Selec-
tion—On crossing—In and in breeding—Its Advantages and Dis-
advantages—Principle to be attended to . . . 224

SECTION XXIII.—ON WOOL AND ITS MANUFACTURES.

Woollen Manufactures very ancient—Their Progress in Britain—This
Country not suited for the Production of fine Wool—Long and
short Wool—Carding—Combing—Felting—Mr. Youatt's Disco-
very of the serrated Edge and its Effects in carding and combing—
Cuts of different Wools—Skin Wool—Increase of British long
Wool and Decrease of short Wool—Great Amount and Value of
the Wool Trade, shown by Tables—*Australian Wool*—Its Increase
and Value . . . 251

PART III.—THE DISEASES OF THE SHEEP.

SECTION XXIV.—GENERAL OBSERVATIONS ON THE DISEASES
OF THE SHEEP.

Weak muscular and nervous Development of Sheep—Diseases of the
digestive Organs frequent—Class of Remedies mostly called
for . . . 269

SECTION XXV.—DISEASES OF THE BRAIN.

Turnsick, Giddiness, &c. caused by Hydatids—Their Description—
Remedies—Water on the Brain (Hydrocephalus)—Apoplexy—
Inflammation of the Brain (Phrenitis)—Louping-ill—Rabies, or
Madness—Tetanus (Locked Jaw)—Epilepsy—Palsy—Rheu-
matism . . . 275

SECTION XXVI.—DISEASES OF THE DIGESTIVE ORGANS.

Obstruction in the Gullet—Hoove, Hoven, Blasting, &c.—Mechanical
Distension of the Rumen—Injurious Effects of new Wheat—Ditto
of Soot—Concretions in the Stomachs—Bezoars—Diarrhoea—Dy-
sentery—Flux—Scouring—Diseases of the Intestines—Spasmodic
Colic—Inflammation of the Bowels—Worms—Pining—Red-
water . . . 301

SECTION XXVII.—DISEASES OF THE CHEST.

Catarrh—Bronchitis—Ditto the effect of Worms—Inflammation of the

Lungs (Pneumonia)—Cases of Pneumonia sometimes epidemic and endemic—The Ravages of this Disease in France—Pleurisy, Pleuritis 337

SECTION XXVIII.—DISEASES OF THE URINARY ORGANS.

Inflammation of the Bladder (Cystitis), Cases of—Calculi in the Urinary Organs, Cases of 352

SECTION XXIX.—PARTURITION, AND THE DISEASES CONNECTED WITH IT.

Parturition—Vigilance required—Difficult Lambing—Abortion—Dropsy of the Abdomen—A Disease previous to lambing—Inversion of the Uterus—Heaving, or After-pains—Garget—A peculiar Disease amongst Ewes 356

SECTION XXX.—DISEASES OF THE SKIN.

The Scab—The Acari—Description of—Erysipelatous Disease—Black Muzzle—Sheep Pox (La Clavelée)—The Tick, Fly, &c.—The Gad-Fly (Estrus Ovis)—Sore Heads 375

SECTION XXXI.—THE ROT.

Great Fatality of the Disease in this Country, the Continent, and Egypt—Its Symptoms—Post-mortem Appearances—Description of the Fluke—Engraving of Ditto—Theories respecting—Remedial and preventive Measures 389

SECTION XXXII.—EPIZOOTIC DISEASES.

Influenza—Symptoms, Cases, and post-mortem Appearances—Treatment—Another Account of—The Epidemic of 1840, &c.—Its extensive Prevalence—Nature and Symptoms of—Infectious Character—Causes—Treatment—Epidemic Diseases in Australia—Their great Fatality—Diseases arising from Astringency of the Water in Australia 405

SECTION XXXIII.—SPECIFIC DISEASES.

Scrofula (the Evil)—Cases of Dropsy—Anasarca 423

SECTION XXXIV.—LOCAL DISEASES.

Injuries of the Feet—Foot Rot—Nature of—Causes—Infectious Character—Symptoms—Mr. Read's account of—He doubts its being contagious—Too much paring not desirable—Experiments of the French—Treatment—DISEASES OF THE EYE—Ophthalmia—Injuries—Gutta serena—Amaurosis—DISEASES OF THE MOUTH—Blain, or Gloss—Anthrax—Aphthæ, or Thrush 428

SECTION XXXV.—INJURIES AND OPERATIONS.

Wounds, Bruises, Abscess, Strains, Fractures—Castration—Docking 446

A LIST OF MEDICINES EMPLOYED IN THE TREATMENT OF THE DISEASES OF THE SHEEP 453

DESCRIPTION OF THE PLATES.

	PAGE
Frontispiece—A South Down or Sussex Ram (Young Tytherley) a Specimen from the Flock of Mr. Drake, of East Tytherley, Hants.	
A soft-woolled Ewe from the slaty Mountains of Wales	20
A Ewe of the Black-faced Heath Breed	25
A Ewe of the Cheviot Breed	34
A Ram of the Old Wiltshire Breed, introduced (although the Breed is nearly extinct) in order to exhibit by contrast the superior points of the more improved Breeds	41
A Ewe of the Dorset Breed	43
A Ram of the Merino Breed	53
A Romney Marsh Ewe	93
A Cotswold Ewe	98
A Ram of the New Leicester, or Dishley Breed	101
The four Stomachs of the Sheep cut open and arranged so as to show their internal Aspect—The Bands, Pouches, and Papillæ of the Rumens—The Cells of the Reticulum, the Plaits and Papillæ of the Maniplus, and the smooth longitudinal Plaits of the Abomasum	157
The external View of the Stomachs and Intestines arranged according to a Scale so as to exhibit their actual and relative Size, Length, and Conformation	166
Fibres of the Leicester, South Down, and Merino Wool, showing the relative Size and Appearance of each, with the serrated Structure and the Variety in the Number of the Serrations in different Wools	257
The Fluke greatly magnified, from Mr. Morton's Communication to the 'Veterinarian'	395

ERRATA.

- Page 76, line 11 from bottom, for "Down wethers, which" read "Downs, some wethers from which."
- Page 400, line 8 from bottom, for "me" read "us."
- Page 401, lines 10 and 12 from top, for "I" read "we;" and line 5 from bottom, for "I" and "my" read "we" and "our."

THE HISTORY, STRUCTURE, ECONOMY, AND DISEASES OF THE SHEEP.

PART I.—THE BREEDS OF SHEEP.

SECTION I.

THE ORIGIN AND ANCIENT HISTORY OF THE SHEEP.

THE origin of the Domestic Sheep is involved in much obscurity, but naturalists find amongst the wilder races of animals some strong marks of affinity, and on the same hypothesis that the wolf and the jackal, the hyæna and the fox, were the ancestors of the dog, they assign the progenitorship of the domestic sheep to the Argali, or Wild Sheep of Asia, and the Musmon of the South of Europe and of Africa.

“The *Argali*,” observes Professor Low, “possessing the generic characters of the sheep, is somewhat less than the size of a stag. He has enormous horns, measuring more than a foot in circumference at the base, and from three to four feet in length, triangularly rising from the summit of the head so as nearly to touch at the root, ascending,

stretching out laterally, and bending forward at the point. He has a fur of short hair, covering a coat of soft white wool. The colour of the fur, externally, is brown, becoming brownish grey in winter; there is a buff-coloured streak along the back, and a large spot of a lighter buff-colour on the haunch, surrounding and including the tail. The female differs from the male in being smaller, in having the horns more slender and straight, and in the absence of the disc on the haunch. In both sexes the tail is very short, the eyelashes are whitish, and the hair beneath the throat is longer than on any other parts of the body.

These creatures inhabit the mountains and elevated plains of Asia, from the Caucasus northward and eastward, to Kamtschatka and the Ocean. They are agile and strong, but very timid, shunning the least appearance of danger; their motion is zigzag, and they stop in their course to gaze upon their pursuer, after the manner of the domestic sheep. They are usually found in very small flocks, and at the rutting season the males fight desperately, using their horns and forehead in the manner of the common ram. They are hunted by the people of the country for their flesh, which is esteemed to be savoury, and for their skins, which are made into clothing. In autumn, after having pastured during the summer on the mountains and in the secluded valleys, they are fat, and in high request; but as winter advances, they are forced to descend from the mountains in search of food; they then lose their plumpness, and are sought after only for their skins. When

taken young they are easily tamed, but the old ones never resign their natural wildness.

Allied to this species, or identical with it, is the Rocky Mountain Sheep, or Argali of America. This creature inhabits the loftiest mountain chains of North America. It is described by Spanish writers as the sheep of California, and is familiar to the Indians and fur-traders of Canada. It surpasses the Asiatic Argali in size, and is consequently taller than the largest of our domestic sheep. Its horns are very large, approaching, but not touching, one another at the base. The horns of the female are small, and slightly curved. The fur is of a reddish brown colour, but becomes paler in winter, and in spring the old rams are nearly white. The face and nose are white, and the tail and buttocks present the buff-coloured disc which distinguishes the male of the Asiatic species. They collect in flocks under the guidance of a leader. They pasture on the steepest parts of the mountains, and on the approach of winter descend into the plains. They are wild and timid, betaking themselves on the least alarm to the summits of the mountains. They are pursued and killed by the Indians for their flesh and skins, and have never been subjected to domestication.

The *Musmon* still inhabits the Islands of Crete and Cyprus, and the mountains of Greece. It is found in Corsica and Sardinia, where it is familiar to the mountaineers of the interior. It formerly abounded in Spain, and even yet it is said to be seen in the mountains of Murcia.

The *Musmon* is smaller than the Argali. In the

male the horns are two feet in length; in the female they are often wanting. They are very thick; and they turn inward at the points, in which respect they differ from the horns of the Argali, which bend outward. The fur consists of a brownish hair, concealing a short fine grey-coloured wool, which covers all the body.

The Musmons resemble the Argalis in several characters, but they are less powerful and hardy, and inhabit a lower range of mountains. They are gregarious, assembling in large herds during the summer months; but at the rutting season fierce contests take place between the rams, and the herd divides into smaller bands, consisting of a male and several females. The Musmon is with difficulty domesticated. Judging from the specimens which have been captured and retained in a state of confinement, they are less docile and sensible of acts of kindness than the domestic sheep. The Musmon has been known to breed with the domestic sheep, and the offspring is fruitful. Pliny mentions such alliances as common, and states that the progeny were termed Umbri.

Whether the hypothesis be correct or not that the domestic sheep is descended from the wilder animals thus described, it is evidently the fact that if so, they must have been domesticated, and their habits materially changed, at a very early period of the history of the globe, or rather of man's occupation of the globe. For my own part, although ready to acknowledge that the Argali, the Musmon, and the Sheep, may be descended from a common

parentage, it is no more difficult to imagine that these wild animals may owe their origin to an animal resembling our mountain sheep, than that the latter should be descended from them; but it appears still more reasonable to believe, that both the domestic sheep and the wild argalis, &c., are descended from an animal of an intermediate state, neither so wild and active as the one, nor so quiet and docile as the other; but the nature and habits of each receiving a different direction, from the one becoming domesticated, and the other wild, until, in the course of time, the very different animals may be produced which now appear.

Such view is, I imagine, more in keeping with the inferences to be drawn from Scripture History with regard to the early domestication of the sheep. Abel, we are told, was a keeper of sheep, and it was one of the firstlings of his flock that he offered unto the Lord, and which, proving a more acceptable sacrifice, excited the implacable and fatal jealousy of his brother Cain. *Darwin*

Ere the soil could be cultivated to any great extent, or the mechanical arts advantageously practised, or the precious metals became a source of gain, whilst population was thin and labour necessarily scarce, the cultivation of sheep afforded the ready means of increasing the comforts of man, and, in many communities and localities, laid the foundation of future health and prosperity. Endowed by nature with a peaceable and patient disposition, and a constitution capable of enduring the extremes of temperature, adapting itself readily to different climates, thriving on a variety of pastures, economiz-

ing nutriment where pasturage is scarce, and advantageously availing itself of opportunities where food is abundant,—this animal afforded one of the most profitable and pleasing, as it was evidently one of the most ancient, pursuits of man. Driven, or rather led about, from mountain to mountain, and from plain to plain, these ancient flocks of sheep supplied their possessors with both food and raiment. In the very earliest period, the milk became the first and most profitable application, being either used as it is, or converted into cheese; the skins, too, were employed as garments for the body, as well as coverings for the tents. The flesh was only occasionally used as food. These probably were the earliest purposes to which sheep were devoted; and at the present day, they still form, amongst many uncivilized tribes, the only uses that are known; these tribes being, in fact, inferior in their knowledge of the domestic manufactures, to that possessed by most of the Bible patriarchs, who were acquainted with the use of the fleece, independent of the skin, as may be illustrated by the coat of many colours, which the paternal partiality of Jacob constructed for his favourite son Joseph.

A pastoral life was one of the most favourite employments of the ancient patriarchs, and it is spoken of in the Scriptures with the greatest respect.

Abraham was a possessor of flocks and herds; Isaac pursued a similar occupation; and Jacob for fourteen years tended the flocks of his covetous relative Laban, before he was rewarded by the possession of his beloved Rachel, or became the owner of

flocks himself. The character of Laban is drawn with graphic correctness, and on reading an account of this wealthy but mercenary man, the mind reverts to hundreds such as have lived since his time, and so truth-like is the character, that we are even ready to point to many Labans at the present day. Jacob, we have said, made a coat of many colours, and Laban went forth to shear his sheep; the manufacture of cloth must, therefore, have been known, rude as it may have been, and the felting property of wool could not have been undiscovered.

It is a singular, though not an unpleasing circumstance, that the manners and customs of the patriarchs have become, as it were, indigenous to the soil on which they lived. In the same land where Laban sheared his sheep, and Abraham sat at the door of his tent, viewing his flocks and his herds—where the beauteous Rebecca drew water for her father's sheep, and Jacob mourned for the loss of his beloved son—in the same land, the wandering Arab, or the wild Turcoman, still tends, probably, the very animals descended from the patriarchal flocks and droves, or leads them from pasture to pasture, watering them, and tending them in the same manner as their progenitors were tended four thousand years before. The correctness of the descriptions in Scripture—the best evidence that it was drawn from life itself—is indeed offered by the manners and customs of these pastoral people, who, whilst all the world around them have changed, themselves have remained comparatively the same.

Whenever a country possessed proper pasturage, sheep were invariably introduced with civilization

itself; thus, though Asia, and particularly its western part, was for many years the nursery of this profitable animal, it was probably introduced into the eastern and southern part of Europe with its earliest civilization. Greece alone for many years possessed this valuable animal, and it is accordingly shown by the writings of its poets and historians how highly it was esteemed. After the foundation of Rome it was introduced into Italy, but it was many years afterwards before shearing was practised; though the barbarous practice of plucking was often employed. With the conquests of the Romans the use of the sheep was extended into the conquered countries. The thick forests of Germany forbade their rapid progress, but Spain afforded an abundance of open pasturage well adapted for them; and indeed they were probably previously introduced into this country from Africa, and accordingly it became celebrated in the time of the Romans for the quality of its wool, and it has retained its pre-eminence in this respect over all other countries till the present century, when it has yielded the palm to the wools of Germany.

The fleece of the sheep naturally consists of both hair and wool; in some hot countries the hair predominates, and in the wilder races the wool may be plucked off annually, leaving the hair on the skin. The colour of the wool is supposed to have been naturally of a dark hue; in wild races it is presented of all colours, and the white hue of our present flocks is owing to the constant habit of breeding only from white parents.

"The sheep of Europe," observes Professor Low,

"are wonderfully diversified. A remarkable character which distinguishes the sheep of several regions is the accumulation of fatty matter on particular parts of the body. Fat, we know, is a secreted tissue, which intermingles with and surrounds the muscular substance, and which envelopes the viscera within the body. A large part of it is usually found beneath the skin, more or less thick on different parts of the body, as the rump, the flanks, and the shoulders; but in the sheep of certain countries it accumulates greatly on the posterior parts, namely, the rump, or the tail, just as in the ox of certain countries it accumulates on the shoulder. In the races of sheep which extend from Circassia and Georgia over Asia Minor, Syria, and Arabia, the tail is broad as well as long, and is covered with fat to its extremity, where it terminates in a point. The fat accumulates sometimes on this tail to such a degree as to form a large part of the weight of the animal. It is of a soft oily substance, and is used in those countries in place of butter or oil. Some of these sheep are brought to England from time to time, under the name of Turkish sheep. But that monstrous accumulation of fat which we see in some of them, seems to take place chiefly when they are kept in yards or houses. They then become very large, and the excess of fatty matter accumulates on the tail, where it may be supposed to be less injurious to the animal in a warm country than were it extended over the other parts of the body. In Africa the same character prevails, but in races of sheep entirely distinct from the Syrian,

Northward of the Caucasian range, the sheep are to be found short-tailed, with the fat accumulated on the haunches, forming two great cushions. This character is the most remarkable in the races near the Black Sea and the Caspian ; but it extends over a part of Asiatic Tartary, and Russia in Europe, becoming less prominent however as we recede from those seas, and ultimately disappearing. Pallas conjectures that this character arises from the sheep feeding on the bitter and saline plants found in the countries on the Black Sea and the Caspian ; and he asserts that, when they are removed from the places where these plants grow, the fatty excrescence becomes less. It may justly be assumed, indeed, that this character is the result of peculiarities of food, although we cannot determine physiologically in what manner the effect is produced.

A race of sheep exists in Persia, and to the north of it, which deserves to be mentioned, as being, perhaps, the nearest in its characters to the wild species. There are, indeed, various races in Persia, but this peculiar race is proper to the northern parts of the country on the Caspian, and is greatly the most diffused. It is covered with a very coarse hairy wool of a grey colour ; its horns are bent outwards in the manner of the argali, and, what is worthy of note, its head resembles the common figure of the ram, as depicted in Eastern sculptures. This original race is the most diffused of any in the world, extending across the Indus over a great part of Hindostan. It is to be distinguished, however, from another very remarkable one found like-

wise in Persia, which is destitute of tail, and has an accumulation of fat upon the posterior parts. This breed is frequently termed the Persian, but its principal habitat is the shores of the Red Sea, and it seems to be of African rather than Asiatic origin. It is by some termed the Abyssinian Sheep.

The Tartar sheep have usually horns, and pendent ears; they are strong and hardy, but they are of bad form, and have coarse wool. The finest woolled sheep of this race are said to be produced in the Crimea; but this is partly the result of crossing with the Spanish Merinos. Many of the Tartars under the Russian dominion have vast flocks of sheep, amounting to many thousands. The sheep of Astracan, on the Caspian Sea, are noted for the fine furs which they produce; but these furs are the skins of lambs, taken from the mother before the natural birth.

Proceeding northwards through the Russian dominions in Asia and Europe, the wool of the race there found is much mixed with coarse hair. Sometimes, however, the wool covered by this hair is fine, as in the sheep of the Feroe Islands.

The sheep of Europe seem to be of a more mixed descent than those of a great part of Asia. The original Celtic nations had their sheep, though few in numbers, while their conquerors may be supposed to have brought with them the sheep of the countries from which they emigrated, and hence the mixture of races. The sheep of Africa, too, have been from time to time mixed with those of the south of Europe. In European Turkey and

Greece, the sheep do not correspond with their ancient form. They are of small size and indifferant form. They are often of the flat-tailed variety, exhibiting in this respect an affinity with the sheep of Asia Minor and the adjacent countries. In the Islands of the Archipelago few sheep are reared. Some of them are of the Syrian breed, having long fat tails. But there is a peculiar race existing in some of the islands, which have several horns, and long hairy wool.

Ascending the Danube, the sheep are found to be of the long-tailed variety, although without any tendency to a fatty enlargement of the tail. The breed of Wallachia may be regarded as the type of a race which extends through Moldavia, Transylvania, and westward to Vienna. This breed has black faces, and long wiry wool, much mixed with hair. It resembles in certain characters the Persian breed, and the Black-faced Heathy breed of Scotland. Italy, once so renowned for its sheep, can now boast little of this production of her bounteous clime. The Romans, whose dress was woollen, cultivated in an especial degree the fineness of the fleece; and it was not until the days of the Empire that the silk and cotton of the East began to supersede the ancient raiment of the Roman people. The finest wools of ancient Italy were produced in Apulia and Calabria, being the eastern parts of the present kingdom of Naples. Pliny informs us that the best wool was that of Apulia, on the Adriatic Sea; and the next best was further to the south, on the Gulf of Tarentum; and the Milesian or Asiatic

sheep carried the third prize ; and that, for whiteness, there was none better than that produced on the Po. The care of the Romans in causing the wool to grow fine exceeded, in the case of certain breeds, anything that is now attempted. The sheep were kept in houses, and continually clothed, so that the filaments of the wool might become delicate ; the skin was smeared with fine oil, and moistened with wine : the fleece was combed so that the wool might not become matted, and the whole was washed several times in the year.

This excess of care proved rather injurious to the sheep, rendering them tender and more disposed to disease. With the fall of the Empire these choice breeds were neglected and lost, and though there are still a few fine-woolled sheep in Italy they are neglected and badly formed. This is also the case with regard to Sicily, which was once celebrated for the fineness of its wool, and still retains some fine-woolled sheep.

Of all the countries in Europe, continues Mr. Low, Spain has been the longest distinguished for the excellence of its wool. This fine country, more varied in its surface and natural productions than any other region of the like extent in Europe, produces a great variety of breeds of sheep, from the larger animals of the richer plains, to the smaller races of the higher mountains and arid country. Besides the difference produced in the sheep of Spain by varieties of climate and natural productions, the diversity of character in the animals may be supposed to have been increased by the different

racés introduced into it:—first, from Asia, by the early Phœnician colonies; secondly, from Africa, by the Carthaginians, during their brief possession; thirdly, from Italy, by the Romans, during their dominion of six hundred years; and fourthly, again from Africa, by the Moors, who maintained a footing in the country for nearly eight centuries. The large sheep of the plains have long wool, often coloured brown or black. The sheep of the mountains, downs, and arid plains have short wool, of different degrees of fineness, and different colours. The most important of these latter breeds is the merino, now the most esteemed and widely diffused of all the fine-woolled breeds of Europe.

There are many varieties of sheep naturalized in different parts of Europe, the great portion of which are of the long-tailed sort; the short-tailed kinds, however, exist even in the northern parts of this country, having been imported from Scandinavia, and long cultivated by the Slavonic nations. These sheep are to be distinguished from those belonging to the descendants of the Celtic tribes, having, like their owners, altogether a distinct descent. They are interesting as affording a strong contrast with our improved breeds, and serve to show by comparison the superior points of the latter; they will, therefore, first come before our attention.

The history of the sheep in this country is coeval with its earliest records. In the times of the Romans the wool of Britain was sought after as an object of luxury in the capital of the empire. A manufactory was established at Winchester, and

its fabrics became a subject of panegyric to the historians of Rome.

What the nature of the original breed of Britain was it is impossible to determine; it had no doubt become considerably modified by the variety of pasturage this country affords ere history first takes up the subject, and there was in all probability then, as now, a very different class of animals located on the rich pastures of the midland counties to that spread over the widely extended downs of the southern districts, whose aspect, in all probability, was not very dissimilar to that afforded at the present time. It is, however, extremely probable that it was the long coarse wool that is so commended by the Roman writers, as at that time Spain afforded a nearer market, and produced a description of wool considerably finer and better adapted for clothing purposes. And it must be borne in mind that at this period wool formed the staple commodity for the clothing of the rich, the cotton manufactory was then unborn, and the importation of silks from the east had not been carried on to any extent. At a later period, however, the eastern colonies afforded a lighter and pleasanter garment for a warm climate, and then fine wool became less in demand.

The origin, and indeed the earlier history, of the different breeds of sheep in this country is altogether lost in obscurity. We know that certain breeds existed in certain places at a particularly early period, and this is nearly all we can obtain as to their origin. From this period, however, we are enabled to trace the different breeds through

various countries, and to ascertain the sources of the various improvements which have been made in the flocks of this and other countries. For this purpose it will be desirable to give a brief history of the principal, and a slight sketch of the other breeds existing in this country; and in so doing we cannot do better than give priority to the wilder and unimproved breeds, in order to illustrate better, by comparison, the improvements that have been effected by systematic breeding and nutritious food in the more favoured breeds, whose history will follow. With this view we commence with an account of the breed of the Orkney and Zetland Islands.

SECTION II.

THE SHORT-TAILED SHEEP.

THE short-tailed sheep are little wild animals, located in the Orkney and Zetland Islands, and the Hebrides, where they probably came from the opposite coast of Norway. Somewhat similar to the goat in appearance, they resemble this animal likewise in their habits, in their activity, their hardihood, and their partiality for mountainous spots. The fleece consists of both wool and hair, the former not increasing in length from year to year, as other sheep, if not sheared, but coming off as the summer approaches, leaving the hair alone at this period of the year. The fleece therefore is not sheared; the wool is plucked with the hand,

and thus readily separated from the hair. It is very fine and soft, but not adapted for felting. The fleece weighs only from one to two pounds.

The purest breeds are formed in Zetland, those of Orkney being more frequently mixed with other breeds, particularly with the Dutch, by which admixture the wool is rendered less fine.

The pure breeds are of various colours—black, brown, grey, and white, and often spotted; both sexes have horns, but more frequently they are absent in the female. The horns are short and upright, resembling those of the goat.

Exposed to every vicissitude of the weather, which in these remote and sterile islands is of the most rigorous kind, neglected by their owners, deriving their subsistence from the heath, the marine plants, or what little vegetation can be obtained in these barren spots, their size is stunted, and the wethers when fat do not exceed six or seven pounds the quarter. They exceed perhaps all other kinds in their power of enduring the rigour of the weather and scantiness of food. They will even subsist on animal, and dried salt fish is their common food, when nothing else can be obtained. These little animals are rendered wilder by the neglect of their owners, and vast numbers of them are thereby lost. When a sheep is wanted it is common to hunt it down with dogs, for which animal they therefore engender a great dread. The rams are pugnacious, and will often attack and destroy the ewes, so that, all circumstances combined, little profit accrues to the owner.

The spirit of improvement has, however, found its way into these remote islands, and with the improved attention to the cultivation of the soil, attempts have been made to improve the race of sheep. For this purpose, crosses of the merino have been tried, but with little success, the produce becoming too delicate. Other races have been employed, but the Cheviot only with decided improvement. There has been little or no attempt made to improve the original breed itself by the careful selection of the parents; and we may expect that with the improvement of husbandry the ancient breed will in a great measure be supplanted by more improved animals.

SECTION III.

THE SHEEP OF WALES AND IRELAND.

THOUGH in the valleys and fertile pastures of Wales there are found many of the improved English breeds of sheep, the Leicester, and the South Down, yet the mountains of the principality possess two distinct varieties, which are naturalized to the soil. Professor Low distinguishes them, the one as the *Sheep of the Higher Mountains*, and the other as the *Soft-woolled Sheep*.

The former is very small, seldom exceeding five pounds the quarter, with horns in both sexes resembling the goat, whose habits it otherwise resembles. The tail is of the usual length, and there is a ridge

of hair on the back, throat, and dewlap, and the fleece is of various colours, black, grey, and brown. These sheep are extremely active and wild, and prefer the highest spots and the aromatic plants found there to richer herbage.

Like those of Orkney and Zetland, the rams often attack the ewes when in lamb, and thereby diminish their number, as if for the purpose of repressing their too great increase.

They have black hair on the face and legs, a character which attaches itself even in their improved state, as in the Radnor, a superior variety of the same race, enlarged by better pasturage. These sheep would be improved by crossing with either the South Down, or the Cheviot, though the hardier characteristics of the latter would probably render it more suitable for the purpose.

The Soft-woolled Sheep

may be considered as the distinctive breed of Wales, and is distinguished from others by the whiteness of the nose as well as the face. The fabric known as Welsh flannels is derived from the wool of this breed, and the flesh is still more celebrated under the well-known term of Welsh mutton.

These sheep are small, seldom exceeding six pounds the quarter when fat. They are spread throughout the whole of Wales, but delight in lofty situations. Like all mountain breeds, their habits are exceedingly active, and when enclosed, few fences can confine them; even when removed to distant spots

they will not unfrequently escape and regain their native mountains.

WELSH SHEEP.

Their form corresponds to their habits, being slender throughout, and their hind-quarters long, like those of the deer. The males have their horns curved backwards, but the females do not possess any. The neck is thin, and arched backwards, like the deer, in a greater degree than any other sheep. They have a mixture of hair, though less than other mountain breeds, and this is particularly noticeable on the throat, where it appears like a beard. The fleece weighs between one and two pounds: partakes of the long-wool character, and is

well adapted for flannels and hose, but not for cloths, although used for this purpose in the domestic manufactures, which, however, the more advantageous employment of machinery is rapidly superseding. It is a frequent custom to clip off the wool of the neck and face before the winter, as, if left, it often comes off without assistance.

These sheep are also found in the Island of Anglesea, where, however, from better pasturage, they acquire a larger form.

The Radnor Sheep

found in Wales are of two kinds, the *Old Radnor*, and an improved sort, which are now generally termed *the Radnor*. The former possess some of the characteristics of the soft-woolled variety, but resemble still more the higher mountain breed, but of a larger size and better form than either, fattening to eight or nine pounds the quarter. The latter sort have been crossed with the Shropshire and other breeds.

The Sheep of Ireland,

like those of England, have two distinct divisions, those of the mountain, and those of the vale, but the subdivisions are by no means so numerous as we find in this country. The vale sheep are large long-woolled animals, resembling those which were spread through the Midland counties of England, before the extensive improvements by means of the Dishley breed were effected. Even in Ireland they are not found pure, having been improved by crossing, though there still remains much room for

amendment. There are various breeds of mountain sheep, the principal of which are the *Wicklow* and the *Kerry*. The *Wicklow*, the more valuable though less numerous, are mostly confined to the *Wicklow* mountains on the east coast of Ireland, an elevated locality, but possessing a humid atmosphere.

These sheep resemble in many respects those of the *Welsh* mountains; they are wild little animals, without horns, and with white faces and legs, though there is a tendency to become black, which is shown by the number of black lambs that are dropped. They are larger towards the base of the mountains, where the pasturage is better, and the wool is tolerably fine and rather long, though mixed with hair. Towards the summit of the mountain, the ground being boggy and the pasturage scanty, the sheep are smaller; the wool is less fine and more mixed with hair, which appears in ridges along the spine and neck, which thus causes the rain to shoot off their back; and this provision against the evils of their position is still further secured by the lambs having a sort of hairy covering on those parts which come in contact with the damp ground.

The proximity of *Dublin* occasions a great demand for early lambs, and these sheep are made available for this purpose to a great extent. The mountain sheep are purchased by the farmers of lower and better situations, and the rams being put to the ewes in June, the lambs are dropped about December. They are generally brought up in pens, being separated from the dams in the course of a fortnight, and are forced by sucking those ewes whose lambs have died or have been killed, as well as their

own dams. To this is afterwards added cows' milk, so that they are fit for the market in the course of six weeks. The disposition to take the ram so early, the quality of the mutton, and the fact of the ewes being very good nurses, stamp intrinsic value on this breed, and it is to be regretted that it has not been improved by judicious selection. The breed is preserved pure only in a few places; the improvements must have been by means of the South Down, which has obtained certainly a superior race, though there is danger of some of the intrinsic quality of the aborigines being lost by the admixture.

The Kerry Breed

may be regarded as the type of the various mountain breeds which are found principally in the West of Ireland. Somewhat larger than the sheep of the Wicklow and the Welsh Mountains, they are nevertheless though a hardy, yet an unthrifty, race, feeding slowly, and arriving slowly at maturity. Their fat, when accumulated, is found on the inside, and they never exhibit externally any rotundity of shape. They have coarse hairy wool on the back and haunches, but it is soft and fine on the ribs. They have small crooked horns, which are sometimes wanting in the female. Their habits restless and active, they resemble, in their general appearance, the antelope races; and they pick up their subsistence amidst the bogs and peats, occasionally stealing provender from the neighbouring farms. The only good quality they possess is the excellence of the mutton.

SECTION IV.

THE FOREST BREEDS.

THE *Exmoor* and the *Dartmoor Sheep* are the principal forest breeds in the West of England. Located in the higher situations of Devonshire and Cornwall, they are a hardy race, adapted to the poverty of pasture which the forests of Dartmoor and Exmoor afford. The Dartmoor sheep are very small, having soft wool, and white faces and legs; they thrive slowly, averaging, when fat, about ten pounds a quarter. Though bred on the heath, they are fattened in the plains, and their mutton is highly praised for its excellence, and commands a ready sale, both in the neighbouring and distant markets. They are wild and restless, and apt to break their pastures when removed to the more enclosed country.

The *Exmoor* sheep are rather smaller than the Dartmoor, and the males have a beard under the chin somewhat like goats, and much resemble these animals in their habits and activity and boldness. In other respects they resemble the Dartmoor. Both breeds take the ram early, and when the ewes are put to the Leicester ram, the lambs grow rapidly to a large size. The cross with the Leicester has indeed been found to succeed better than with the Down, but the latter pure sheep has advantageously supplanted the aborigines in many places, though in the most exposed situations the change has altogether failed from, the Downs not being sufficiently hardy.

SECTION V.

THE MOUNTAIN BREEDS.

THE BLACK-FACED HEATH SHEEP.

THIS is a very peculiar breed, habiting the lofty, but barren and heathy, hills which extend from Derbyshire on the south to the confines of Scotland, through the counties of Cumberland, Lancashire, Westmoreland, and Yorkshire.

Thus situated, this tract of land is much exposed to the winds on either side, and this, with the poverty of the soil, permits only a hardy race of animals to thrive. Though this is the native

locality of the breed, it has, however, considerably extended itself through the Highlands and mountains of Scotland, penetrating even to the Orkney and Zetland Islands, where it has to a certain extent displaced the original and more inferior breeds.

"This breed of sheep," observes Professor Low, "possesses characters which distinguish it from every other in the British Islands. It is of the smaller races of sheep with respect to the weight at which it arrives, but is larger and more robust than the Zetland, the Welsh, and the ancient soft-woolled sheep which it displaced. It somewhat resembles the Wallachian, and as the latter has an affinity with the Persian, it might be conjectured that it is derived from the East; but it is more natural to assume that its peculiar characters have been communicated to it by the effects of food and climate in the rough heathy district from which it is derived. The male and the female have horns, very large and spirally twisted in the male, but sometimes disappearing in the female. The limbs are lengthy and muscular, and the general form is robust; but the shoulders are not so low as in the Welsh breeds, nor are the posterior limbs so long. The face and legs are black, and there is a tendency to this colour in the fleece; but there is no tendency to the brown or russet colour, which distinguishes the older fine-woolled races. The fur is shaggy, and the wool coarse, in which respect it differs from that of all the other mountain breeds of the country. It is of medium length, and weighs about three pounds the fleece, when washed.

These sheep are very hardy, and capable of subsisting on the coarsest heaths. They do not, however, like the sheep of Wales, prefer the summits of mountains, but feed wherever pasturage can be obtained; and are not so nice in the choice of herbage as the South Downs, Merinos, and other races derived from countries yielding the finer grasses. Although wild and independent in their habits, they are not so restless as the mountain sheep of Wales and other parts, but can be induced to remain in inclosures when sufficient food is supplied to them. The ordinary weight of the wethers, when killed at the age of about four years, is fifteen pounds the quarter, but individuals are made to exceed this weight when properly treated and sufficiently fed from an early age. The mutton is not so delicate as that of the sheep of Wales or of the South Downs of England, but it is more juicy, has more of the venison flavour, and is preferred to every other by those who are used to it. It is the mutton which is principally consumed in all the larger towns of Scotland, and great numbers of the sheep, at the age of three years and upwards, are carried to the pastures of the south to be fattened for the English markets. An important property of this breed is its adaptation to a country of heaths, in which respect it excels every other. It is this property, as much as its hardiness, that has rendered it so suitable to the heathy mountains, where it is acclimated, and where it finds subsistence beyond the ordinary range of other sheep. It feeds on the loftiest mountains, up to the very verge where the heaths give place to

the musca and other plants of the higher latitudes. Feeding much on the shoots of heaths, these sheep find subsistence in the times of snow and severe frosts better than any other in this country. The mothers are hardy nurses, and are able to bring up their young when they themselves have been exposed to severe privations. A great defect of this breed is the character of the fleece, which, besides being thin on the body, yields wool fit only for the manufacture of carpets and the coarser stuffs. Little general attention has been paid to the quality of the fleece, although it is susceptible of considerable improvement. A defect of the wool, very common in this breed, is the existence of what are termed kemps. These consist of hard and wiry filaments, mixed with the pile. They are deficient in the felting property, and in the oily secretion which moistens the true wool. The removal of kemps is effected by superior food, and by breeding from parents free from the defect. Sometimes individuals of this breed are born with wool, which is fine and short. Were advantage taken of this occurrence, it might be possible by means of breeding to produce a variety with fine in place of coarse wool."

In some places this breed has degenerated from neglect and insufficient food. The sheep of Tweeddale are considered the best; and those of the border counties are superior to the other counties of England. They are rarely fattened on their native pastures, but often pass through several hands ere they reach their final destination, and are often

fattened on artificial food. By means of steam navigation, much of the mutton is sent to the metropolis, where its peculiar flavour creates a demand. They are killed for the most part when three or four years old. The ewes receive the rams about the latter part of November, so that the lambs are not dropped till the season is open and mild, an essential point in their exposed and bleak situation, where it not unfrequently happens that many are overwhelmed and destroyed by the severe falls of snow. A little coarse hay is the only additional food these hardy sheep receive, and this is supplied only in sparing quantities, when the frost or snow altogether precludes the possibility of getting any grass. The result of this is that the ewes are often very weak and poor in the lambing season, and yet, being excellent nurses, they support their lambs well. The lambs are weaned in about three months by being simply removed to another part of the farm, and the ewes are found to do best if they are not milked afterwards. In some farms it is customary to dispose of all the young sheep while still hogs, except those wanted to supply the place of the old ewes. In other farms they are kept till two or three years old, and in these latter cases there cannot of course be kept so many breeding ewes as in the former. One shepherd has usually about twenty-five score of ewes under his care. The flock are sheared in July, and a few days previously are made to swim across a stream, which is all the washing they receive.

The practice of smearing the sheep in November

with tar and butter boiled together, in the proportions of eight pounds of the former to six of the latter, is generally pursued, and the benefits are considered to outweigh the loss in the quality of the wool.

"This breed," observes Professor Low, "does not appear to amalgamate well with other races, so that crossing has not generally been successful as a means of permanent improvement. It has been frequently crossed by the Cheviot, but the descendants have been found inferior in weight, form, and quality of wool to the pure Cheviots, and to the black-faced heath breed in hardiness and aptitude to thrive in an upland country of heaths. But as it is not always deemed safe to change a stock of sheep habituated to their locality, the practice of a continued crossing with the Cheviot until the flock has acquired the characters of the latter has been sometimes adopted, so that the original black-faced stock has become in time almost Cheviot. Another species of crossing has been remarkably successful, namely, the employing of males of the Leicester or South Down for a first cross. The lambs, the result of this mixture, are excellent, rising to a much greater weight than those of the pure black-faced blood. Great numbers of this mixed race are now produced, and an increased source of profit is thus opened to breeders by the sale of their young sheep. Of these crosses, the best has been found to be with the Leicesters. That with the South Downs produces very handsome sheep, having perfectly black faces and legs,

and a close good fleece; but they scarcely attain the size of the Leicester crosses, and the latter accordingly are preferred for the special purpose for which this species of breeding is designed.

THE CHEVIOT SHEEP

is a valuable breed, which has not only maintained its way, but has greatly extended itself. It is a native, as its name implies, of the Cheviot Mountains, which extend from Northumberland into Scotland. Though in many places bordering on the heathy localities of the black-faced breed, and equally lofty in situation, yet the pasturage is altogether different, abounding with fern and wild thyme as

well as grasses, and is locally denominated trap. These mountains reach to 2658 feet above the level of the sea, and are thus exposed to the severe effects of the weather, and remain covered with snow long after it has disappeared from the cultivated plains below. This breed has greatly extended itself throughout the mountains of Scotland, and in many instances supplanted the black-faced breed; but the change, though in many cases advantageous, has in some instances been otherwise, the latter being somewhat hardier, and more capable of subsisting on heathy pasturage. They are, however, a hardy race, well suited for their native pastures, bearing with comparative impunity the storms of winter, and thriving well on poor keep. Though less hardy than the black-faced sheep of Scotland, they are more profitable as respects their feeding, making more flesh on an equal quantity of food, and making it quicker. They have white faces and legs, open countenances, lively eyes, without horns; the ears are large and somewhat singular, and there is much space between the ears and eyes; the carcass is long; the back straight; the shoulders rather light; the ribs circular; and the quarters good. The legs are small in the bone and covered with wool, as well as all the body, with the exception of the face. The Cheviot wether is fit for the butcher at three years old, and averages from twelve to eighteen pounds per quarter; the mutton being of a good quality, though inferior to the South Down, and of less flavour than the Black-faced. This breed has been cultivated and improved with much

judgment, which it is capable of, being under proper care, and considerable difference is perceived both in the size and qualifications of those sheep kept at the base of the mountains and allowed artificial food, and those located towards the mountains' summits. The Cheviot, though a mountain breed, is quiet and docile, and easily managed. The wool is fine, closely covers the body, assisting much in preserving it from the effects of wet and cold; the fleece averaging about three and a half pounds. Formerly the wool was extensively employed for making cloths, but having given place to the finer Saxony wools, it has sunk in price, and been confined to combing purposes. It has thus become altogether a secondary consideration, and though increased in quantity, it is less fine than it formerly was, though where the herbage is short and sweet it is much finer than in coarse and heathy pastures. This breed has extended itself into Wales and the West of England, and may justly be considered as the best mountain breed existing in this country, and is worthy of introduction in numerous districts now occupied by inferior animals.

The food of the Cheviot sheep consists throughout the greater part of the year of the herbage of their native hills, hay being only allowed when the ground is covered with snow or bound with frost. Occasionally turnips are supplied, but it is rarely that the farm will admit their production. The breeding farms are for the most part in lofty situations, and the sheep are disposed of to the farmers in lower and more cultivated places, in order to be

fatted, and sometimes the sheep pass into the hands of several graziers before this is effected. The breeder sometimes sells them the first, but more frequently in the second year, either as hoggets or shearlings, and the wethers are usually fatted in the third year after the second shearing, whilst the ewes are generally kept till they have borne lambs for three years, by which time they are five years old. The period of lambing is necessarily late, in order that there should be a good supply of food; it therefore does not commence till April, the ram having been admitted, at the rate of one to fifty ewes, the latter part of November. During the lambing season greater attention is paid, and the best food supplied. Though twins are frequently produced, it is rarely that the number of lambs reared equals the number of ewes.

"The time of shearing," observes Mr. Low, "is from the middle of June to the beginning of July. The precise period is denoted by the wool being fully grown, and separating readily from the skin when pulled. The sheep are first to be washed, which is done by men standing in a pool and washing each sheep separately, or more generally, when the flock is large, by causing them to swim two or three times through the water to the opposite bank. After being washed they are kept as much as possible on ground where they can be prevented from rubbing on banks, or otherwise soiling their wool. In two days, if there be no rain, they may be shorn, but it is better to wait seven or eight days, in which case the unctuous secretion, which pro-

fects the wool, has again been formed. As soon as each sheep is shorn, it is usually marked with a stamp dipped in boiling tar thickened with pitch. The mark is made on different parts of the body, as the near-shoulder, the far-shoulder, the near-haunch, the far-haunch, so that the different kinds and ages of the sheep may be known at a glance.

“ Soon after shearing, the lambs are weaned, which is simply effected by a short separation of them from the dams. The lambs are now, in the language of farmers, hoggets or hogs, under the respective denominations of tup-hogs, wether-hogs, and ewe-hogs. The tup-hogs intended for use upon the farm or sale, and such of the ewe-hogs as are designed for receiving the male in the following year, are retained. The remainder of the ewe-hogs, and all the wether-hogs, are either now disposed of, or kept throughout the winter and sold in the following year, either, as has been observed, previously to the period of shearing, when they are still hogs, or after having lost their fleece, when they are dinmonts and gimmers. Sometimes they are kept until they have yielded a second fleece. All the old ewes which have borne the required number of lambs are disposed of before winter, and not only such ewes as are old, but such as are of bad form, or which it is wished from any cause to get rid of. The hogs which are retained are treated in the same manner as the breeding-ewes, except that it is common to put them on some grassy and sheltered part of the farm, where they can be best pastured. They receive hay in falls of snow, and, if possible,

turnips are supplied to them during the whole winter, which may be done at the rate of a cart-load per day for every seven or eight scores."

Smearing is less generally practised than with the heath breed, and less than formerly, in consequence of the injury inflicted on the wool from the tar preventing it from being dyed white. Spirits of tar and turpentine, or resin, are sometimes substituted for the tar.

The management of these sheep will admit in many places of much improvement, which can be effected by means of draining and providing more shelter and food in the winter. Vast numbers of them have sometimes been overwhelmed by the snow-storms, which, in these lofty exposed situations, descend with merciless severity. Many years ago, as tradition reports, in one winter alone nine-tenths of the Cheviot sheep were entirely destroyed by the storms. A graphic and interesting description is related by Hogg, the celebrated Ettrick shepherd, of the snow-storm of 1794, in which seventeen shepherds lost their lives, and sheep were destroyed by thousands; one thousand eight hundred bodies being found on the beds of Esk alone after the flood. The difficulties encountered and surmounted by our celebrated shepherd are described with the greatest interest, and the disastrous effects of such storms are strikingly portrayed; and though they occur but seldom, yet the losses are often very severe from ordinary bad seasons, and point out the great necessity of additional shelter.

"The Cheviot breed," says Mr. Low, "amalga-

mates with the Leicester, and a system of breeding has been extensively introduced for producing the first cross of this descent. The rams employed are of the pure Leicester breed, and the progeny is superior in size, weight of wool, and tendency to fatten, to the native Cheviot. The lambs of this descent are sometimes disposed of to the butcher, and sometimes fed until they are shearlings, when they can be rendered as fat as the parent Leicester, and not much inferior in weight; and further, they can be raised to maturity under less favourable conditions of soil and herbage than the Leicester. The benefit, however, may be said to end with the first cross, and the progeny of this mixed descent is greatly inferior to the pure Leicester in form and fattening properties, and to the pure Cheviot in hardiness of constitution. The system is attended with considerable profit in many cases; the danger is that it may insensibly produce a mixture of the Leicester blood on the breeding-farms. Even this may answer peculiar situations; but there cannot be a question that, for general cultivation in the high and tempestuous countries to which the Cheviot breed is adapted, the race should be preserved in its native purity. Every mixture of stranger blood has been found to lessen that hardiness which is the distinguishing character of the race. The beautiful-breed of South Downs would seem to be, of all others, that which is best adapted to improve the Cheviot, and yet the experiments that have hitherto been made have shown that the mixed progeny is far inferior to the native Cheviot in its

adaptation to a country of cold and humid mountains."

This cross, however, has been tried in various situations, and amongst others in the Isle of Wight, where, so late as the last Christmas cattle-show (1843), a prize was awarded to a cross between the Down and the Cheviot as the best fat wethers. We are, however, in spite of this favourable testimony, disposed to doubt the advantage of crossing the Sussex Down in a climate so favourable and mild, where we should imagine the pure Downs would be well adapted and much preferable.

SECTION VI.

THE ANCIENT UPLAND BREEDS.

The Old Norfolk Breed.

THIS breed of sheep was formerly extensively diffused throughout the high lands of Norfolk, Cambridgeshire, and Suffolk. They are a wild hardy race, somewhat resembling the black-faced heath breed, but differing from them in having longer bodies and finer wool. Their habits are active; their limbs long; and they somewhat resemble the deer. The hind-quarter is good, but the fore-quarter deficient. They are black, with horns in both sexes; their wool is adapted for carding, and is used for livery-cloths. They were formerly esteemed as good

folding sheep, but with the improvement of tillage they were put in competition with the South Downs, and proved less profitable in every respect, the latter being found to carry a larger fleece, to fatten quicker on the same pasture, and the ewes were more prolific, and better nurses.* In many instances they have been crossed with the Downs, and improved in every respect; and in others, they have been altogether supplanted by them, with still greater advantage to the breeder.

They have also been crossed with the Leicester,

* The late Lord Leicester, one of the most successful agriculturists this country ever produced, first introduced the South Down into Norfolk in the room of the Old Norfolk. He effected this change, however, slowly and cautiously. On first commencing his agricultural improvements he still preserved the old breed, but, as Lord Spencer informs us, "When, some time afterwards, he found that the Norfolk sheep were a very unprofitable sort, the same reasons induced him to try the new Leicester breed, a variety of sheep probably as ill calculated to succeed on such a soil as the one he occupied, as any breed which he could have selected. He at last found that the best sort of sheep he could adopt were the South Downs. In this, however, as in every other of his farming experiments, Lord Leicester acted with great caution, and did not make the changes which he did make till thoroughly convinced by practical experience that they would answer. Accordingly, for several years, he had upon his farm at the same time, Norfolk sheep, New Leicester, and South Downs: he also tried the Merinos, but he did not persevere long with them. I find that so late as the sheep-shearing of 1812, there were still at Holkham both Norfolk and Leicester sheep. Since that time South Downs have been the only sort which he has kept.

"The stock upon this farm, and, still more, the annual exhibitions of the sheep-shearing, proved the great superiority of the South Down over the Norfolk breed of sheep: the latter were abandoned rapidly by the neighbouring farmers, and now, in the whole tract of country between Lynn and Holkham, such an animal as a Norfolk sheep is not to be seen. The Norfolks have been entirely superseded by the South Downs."

but though the lambs of the first cross are very fine, they are not found to amalgamate so well with this breed as with the South Down, with which their nature and habits more nearly accord.

The Penistone

is a breed of sheep found on the borders of Yorkshire, Lancashire, and Derbyshire, on a heathy tract of land about twenty-six miles in length by twenty in breadth, and they are called the Penistone from the market-town of that name where they are sold. They are described by Mr. Low as having wool of a medium length, of a silky appearance, but harsh and wiry, and weighing from four to five pounds the fleece. They have white faces and legs. The rams exceed the size of the ewes and wethers in an unusual degree, a peculiarity which is ascribed to their being taken to the lower country to be reared. The rams alone have horns, which are very large, lying close to the head, and projecting forward. A distinguishing character of this breed is an extreme coarseness of form, and especially of the extremities. The feet are large; the limbs bony; the shoulders heavy; the sides flat: but the most singular characteristic is the length and muscularity of the tail, in which respect the Penistone sheep differ from all others in this country. This enlargement of the tail is merely muscular and bony, and not at all analogous to the growth of fat which takes place in the tails of certain sheep of Eastern countries. The mutton of these sheep is highly valued for its juiciness and flavour.

THE OLD WILTSHIRE BREED.

This race of sheep, now nearly extinct, formerly extended over the greater portion of Wiltshire. Indeed the only place where they are preserved pure is on a farm near Hindon, bequeathed on the condition that a flock of this breed should be preserved pure. They are large sheep, horned in both sexes, with large coarse heads, Roman noses, white legs and faces, flat sides, long thick limbs, presenting altogether a most unfavourable specimen of sheep abounding in those qualities which it is necessary to avoid. The wool, however, was fine, though scanty, the belly being destitute of wool, and the fleece weighing only two and a half pounds. They were

very slow in getting fat, and we cannot be surprised that these unprofitable animals should have given place to a superior breed.

The Old Hampshire Sheep,

which very nearly resembled that just described, but with black faces, may be considered as quite extinct as a pure breed, and are now only subjects of tradition. Some of the blood, however, is still preserved in a race of sheep which occupies most of the northern part of this county, and called the Hampshire Down, and which is considered to have sprung from crossing the Old Hampshire with the South Down, the latter blood being allowed to predominate greatly.

The Old Berkshire Sheep

have shared the same fate as those just mentioned, having been either altogether superseded or neutralized by crossing. There were, however, two breeds of sheep in this county, one horned, resembling that just described, and the other polled, but both large unthrifty animals, with fine wool, but with few merits otherwise.

The Dorset Sheep.

This is a very ancient breed, preserved unmixed from a very remote period, and decidedly the best of all the old horned sheep. Though now found in many parts of Britain in small scattered flocks, they are principally met with in the county after which they are called. They do not, however, extend

entirely over the county, but divide it with the South Downs, and are mostly found in its western part, and particularly in the neighbourhood of Dorchester, the county town.

DORSET SHEEP.

This sheep is somewhat larger than the South Down, longer on the legs, with a white face, and legs and horns of moderate size in both sexes. The wool is moderately fine, and somewhat longer than the South Down, averaging about three and a half or four pounds the fleece. The hind-quarter is good, but the fore-quarter somewhat deficient, and the wethers at three years average from eighteen to twenty pounds

the quarter, though in some this weight will be greatly exceeded. They are a strong, hardy, active sheep, good travellers, and well adapted for folding, though somewhat apt to break their fences, and are by no means so docile as their rivals the South Downs. Although some of their principal breeders contend strongly for their superiority, or at any rate their equality, as regards the general purposes of husbandry, yet public opinion is very justly opposed to these claims. Their principal value consists in their excellence as nurses, great prolificness, and the early period at which they take the ram. They very frequently have twins, and will rear a greater number of lambs than any other description of sheep. They take the ram so early as May and June, and their lambs are usually dropped in October and November, so that they are the principal source of the supply of house and early lamb, which about Christmas and the following month is esteemed a great luxury, and accordingly commands a high price. The tails are usually allowed to remain at their full length, and it is common to ruddle them, that is, cover them with the red earth called ruddle; and with these distinctive marks they are driven to the Wiltshire and Hampshire fairs in the fall of the year, in great numbers, and at Weyhill, one of the largest sheep-fairs in the kingdom, they form a very large proportion of the sheep offered for sale. It is the ewes in lamb that are thus driven, in the month of October, a distance frequently of fifty or sixty miles, which journey, occupying upwards of a week, they generally

bear remarkably well. The wethers are usually slaughtered for local consumption, and a sufficient number of ewes are of course preserved to perpetuate the breed, and these (mostly young ewes) are put to the Dorset ram; whilst the old ewes, or those which it is intended to sell, it is customary to put to the South Down ram, by which means the lambs are free from horns, with dark faces, and thrive faster, and are accordingly greater favourites both with the butcher and the public. It is usual for the farmers living in the counties bordering on the metropolis, as well as those within a reasonable distance of it—as for instance Hampshire, and particularly the Isle of Wight—to purchase, at the fairs before mentioned, ewes in lamb, of the Dorset and Somerset breeds, with the view of fattening the lambs first and the ewes afterwards. The earliest lambs slaughtered previous to Christmas are most of them bred in the house, and with much attention and care. The practice of rearing house-lamb is, however, not so much adopted as it used to be, probably because the demand for it is somewhat fallen off. The system adopted in the districts near London was thus described by Mr. Middleton:—

“The ewes are always, without exception, of the Dorsetshire breed, and the early-lambing species are sought for throughout the country with great diligence; for it is thought that not more than one in three will lamb sufficiently early for the purpose. Those of large size with white noses are most in esteem, and anything like black on that part would occasion their being rejected. The colour of the

flesh of those lambs when butchered is also a matter which in a great measure governs their value; and therefore those which can be warranted to die *fair* always bear the highest price. This evidently cannot be guaranteed when produced by ewes which have been promiscuously purchased at the fairs: those breeders, with whom the sucklers usually deal, are consequently careful in the selection of rams, the issue of which is said to be known by certain marks in the mouth, even before any previous knowledge of their progeny.

“ The rams and ewes should be put together at such a time that the lambs may fall at the proper season, say somewhere about Michaelmas, from which period there is usually a succession of them until towards Christmas. The ewes, both sometimes previously to this, and during the whole period of suckling, are kept in a croft adjoining the lamb-house, and must be well fed, in addition to after-grass, with turnips, cole, cabbage, or any succulent roots which may be in season, together with brewer's-grains, pollard, ground oats or barley, pea-meal, and linseed, or, in short, any food which will best promote an abundance of milk, and the consequent growth of fat in the lambs.

“ The lambs are separated from their dams and put into the house, which should be well littered with clean wheat-straw, a little of which should also be placed in racks, with the ears downwards, in order to amuse themselves and prevent them from gnawing each other's wool. Some chalk baked in an oven should likewise be put in the troughs, both

in lumps and powder, in order to guard them as much as possible against looseness; and the most scrupulous attention should be paid to cleanliness, as they do not leave the house until sent to the butcher. To prevent them from playing, and thus ensure quiet, light is excluded from the house, until partially admitted at such times when the dams are brought to suckle them; which, in most cases, is three or even four times in the day. If the house, however, be large enough to admit of the ewes being allowed to remain with them during the night, the usual plan is to admit them at sun-down, and turn them into the pasture soon after the dawn of day, in which case they should be again brought to them about noon. The lamb-house is, however, generally too hot, and this successive change from hot to cold is so very injurious to the ewes, that it is no uncommon thing for a ewe or two to die in the night.

“When the ewe is not capable of supplying so much milk as the lamb will consume, those which have lost their own, or which have been sold early, are brought in and held by the head, or put into a yoke, till the lambs by turns suck them dry; they are then turned into the pasture, and at twelve o'clock the dams are driven into the lamb-house for an hour, in the course of which time each lamb is suckled by its mother. At four o'clock all the dam-ewes—as those which have not lambs of their own are called—are again brought to the lamb-house and held for the lambs to suck; and the mothers of the lambs are afterwards brought to them for the

night. Lambs thus treated, and kept free from all disturbance, will in about eight weeks' time become sufficiently fat, and their flesh extremely white and delicate. The price varies greatly, according to the season of the year when they are ready for the butcher; for they sometimes bring as high as 5*l.* per head, and at others not even half that sum.* When many lambs are not suckled, an empty barn is not uncommonly used; but when the house is built for the purpose, if calculated to suckle from 160 to 180 lambs at a time, it should be 70 feet long and 18 wide, with three coops of different sizes at each end, so constructed as to divide the lambs according to their ages. Deal hurdles are also placed for this purpose about the middle of the house, in order to enable the lambs to find their mothers without difficulty; and it is latticed, in this manner, in order to admit a free circulation of air.

"Grass-lamb, although requiring particular attention to the season of coupling the ewes, and great care in feeding them, so as to bring it to perfection in time to meet the fall of Easter, at whatever period that may occur, yet does not of course fetch so much at market as house-lamb; but then the trouble and expense of rearing it is not nearly so great."

"One hundred and fifty ewes of the Dorset breed," says Arthur Young, in his 'Survey of Hertfordshire,' "are said by the lamb-breeders to produce them 200 lambs, of both kinds, on an average of years, exclusive of twins, in this manner:—100 of the old stock, tupped in the month of June, drop

* The price is now still further reduced.—AUTHOR.

their lambs some time before Christmas, so as to have them gradually at market previous to grass-lamb coming into season; then 50 purchased in lamb at Michaelmas produce 50 lambs in the latter end of October and 50 more in July; all of which are sold within the year."

It is at the present day, however, very rarely, if ever, the case to raise so large a proportion of lambs from such a number of ewes. Whilst there is less demand for house-lamb there is a greater supply of grass-lamb, and consequently the price of the former is reduced, and will not repay so great an expense as well as trouble as used to be bestowed on the production of this luxury.

The Somerset Sheep

is a variety of the Dorset, possessing the same peculiarities, and differing from it in being larger and taller, and having more arched profiles, and pink noses instead of black or white. The wool, too, is somewhat longer, and the lambs are larger. In the neighbourhood of Southampton, where many lambs are reared for the London market, preference is generally given to this breed. The observations we have made on the Dorset sheep will in great measure apply to this variety.

The Portland Sheep

is a much smaller variety of the Dorset breed, bred on the Island of Portland, which maintains about four thousand. They have horns, white faces, and legs

with a tinge of dun. The mutton is excellent and delicate, and commands a good price, and the wethers, when fat and about two years and a half old, weigh from ten to twelve pounds per quarter. The wool is coarser than the Dorset, and the fleece is very light. The sheep are rarely fattened on the sterile soil which produces them, but are usually purchased by the farmers in the neighbourhood of Weymouth, which town indeed is their principal market when fat.

The Ryeland Sheep.

This breed of sheep has been preserved pure from the most remote period of our history in the county of Hereford, from which it extended itself into the counties of Shropshire, Monmouthshire, Gloucestershire, and Warwickshire, where it received various names, after the localities of the district, such as the Ross breed and the Archenfield, whilst it was termed the Ryeland from some sandy spots used in the production of rye, and in Hereford it is frequently denominated the Hereford breed.

These sheep are of small compact forms, without horns, quiet in their habits, patient and hardy; the mutton is delicate and juicy, and the carcase from twelve to fifteen pounds per quarter. The wool is white, and extends over the face and forms a tuft on the forehead. They are principally distinguished for the fineness of the wool, which is superior, for carding purposes, to all other of English produce, the Merino alone excepted. This formerly occasioned it to be in great demand, and to realize a good price; but

since the general importation of the Merino wool, its great superiority has caused the demand for the Ryeland to be greatly diminished, and its price to fall in proportion. Thus the fleece being light, averaging only two pounds, it will not repay the trouble and expense that used to be incurred in keeping these sheep in large cots or houses, containing from one to two hundred, where they were fed with peas-straw and dry forage, a practice found to conduce very much to the fineness of the fleece, and which was generally practised when the Lemster wool, as it was termed from the city of Leominster where it was sold, was in the zenith of its prosperity.

The low price of the wool, the small size of the sheep, and the improvement in agriculture enabling the land to support a much larger animal, altogether have conspired to render this breed less profitable than others, and thus it has gradually given place to them, until at the present day very few flocks are to be found in a state of purity. This, however, was not done until many attempts at improvement had been made. It was thought that an infusion of Spanish blood would greatly improve the fleece, but it was found that the carcase was deteriorated in a still greater degree. Attempts were also made to enlarge the size of the sheep by crossing them with the South Down, the Cotswold, and the Leicester; but though this succeeded to a certain extent, it generally proved more profitable to substitute the new breeds altogether. It was found that this breed was naturally diminutive, and amalgamated less readily than any with other breeds, and a great

portion of the land which formerly was comparatively unproductive, and well adapted for the small Ryeland, is now capable of supporting profitably the larger kinds of sheep. Thus the breed has greatly diminished, and although the practice of crossing them with Merino sheep has long since discontinued, still many flocks betray the mixture of this breed. The cross with the Leicester has been found most successful, but the quality of the fleece has been altogether changed, thereby becoming long and fit for combing purposes.

SECTION VII.

THE MERINO.

SPAIN, the native country of the Merino sheep, has for many centuries been celebrated for the quality of its wool. During the prosperous ages of Roman dominion, its woollen fabrics were the most eminent in Europe, and also in the later times of Moorish sway, its woollen manufactures were rendered by these industrious people the most celebrated in the world. With the forced departure of the Moors, after a residence of nearly eight centuries, arts and manufactures began to decline, and the progressive effect of bad laws, tyrannical governments, ignorance, superstition, and priestcraft, consummated the fate of one of the richest and most powerful kingdoms of the world. The soil retains its natural productiveness, the sun continues his benignant influence, the

hand of Nature is as bountiful as ever, but the perversity of its rulers has marred the whole. Its manufactures are gone, its wealth is consumed, its colonies dissevered, nought remains but the wreck of its former greatness, and those perennial favours which Nature supplies, which man has been unable altogether to destroy. Spain no longer manufactures its woollen fabrics for other countries; it cannot clothe indeed its own inhabitants; but preserves its existence by the exportation of the productions of its soil, of which its fine wool has long been greatly esteemed.

MERINO SHEEP.

There are various breeds of both long and short

woolled sheep in Spain, but the latter are the more numerous, and amongst them the Merino is the most esteemed. The origin of this breed it is difficult to ascertain. The native breed was probably improved by the importation of the best fine-woolled rams from Italy and Africa, in the period of the Romans, and the improvement in the wool was still further carried on during the time of the Moors. The dry climate and the pasturage is also well adapted for the production of fine wool, and these various causes have conduced to render the Merino the most celebrated, on account of the quality of its wool, throughout the whole world.

The Merino sheep are small in size, with flat sides, narrow chests, and long legs. The wool is usually white, but darker on the legs, and face, and ears, and a tuft of coarse wool is found on the forehead; the skin is of a reddish colour, and there is a looseness of the skin under the throat, which is considered favourable, as indicative of a good fleece. The males have large spiral horns, but the females are without any. With these peculiarities it must be evident that, as regards the carcass, the Merino is by no means a profitable animal, and to this must be added that they are bad nurses, so that one hundred ewes will not bring up more than fifty lambs; they are also by no means hardy, and the flesh is inferior. To atone for these bad qualities the wool is superior to every other kind, and forms indeed the principal source of profit; the fleece is close, short, and abounding in yolk, weighing heavy, and is superior to all others in its felting properties.

It is computed that not less than ten millions, or a moiety of the whole number of sheep kept in Spain, are migratory, and occupy no less than a quarter of the year in going and returning to their summer and winter pastures. These Transhumantes, as they are termed, leave their winter quarters in the south about the middle of April, and proceed slowly on their six weeks' journey. One division travels towards the east, and the other in a more westerly direction. During their journey they are shorn in large buildings, built expressly for the purpose, which are divided into two large compartments, with a smaller one adjoining. Those sheep which are to be sheared first are driven into the small hut as closely as possible, and there remain throughout the night, so as to occasion a considerable sweat, which softens the unctuous matter, and renders the shearing easier. No previous washing is employed, but in this manner a thousand are shorn in a day, there being a sufficient number of shearers in attendance for the purpose. This singular custom, which has existed for centuries, is protected by certain laws, which give to these sheep the right of pasturage on the common lands on their passage, and regulate other matters relating to it. It is stated that there are no less than fifty thousand shepherds employed in tending these sheep, which are generally divided into flocks of a thousand each. These shepherds are a singular race of men, sleeping on the ground whilst on their journey, and living in huts during the rest of the year, and existing on a spare diet, varied occa-

sionally with some mutton from their flocks, which accident or disease may have afforded them.

The sheep remain in their summer quarters till September, when they set out for their return. The rams are put to the ewes in July, so that the lambs are dropped soon after the flock arrives at their winter quarters.

In these long and tiresome journeys it cannot be otherwise than expected that great loss should be experienced from casualties and disease. A great mortality takes place, and no less than half the lambs are destroyed, in order that the others should have the advantage of a double number of nurses. The migratory system is more ancient than advantageous. It would indeed be far more profitable if the sheep were stationary, and the breed varied so as each to be bred on the most suitable pastures.

The stationary sheep are termed *Estantes*, and consist partly of large sheep, and partly of Merinos, besides the mixed breeds; and it is found that the stationary Merinos do better than the migratory ones in every respect.

For many centuries the Merino sheep were confined to Spain, and preserved with jealous care. Sweden appears to have been the first country which succeeded in procuring them; and in 1723 a small flock was imported from Spain, and there are now about seven hundred thousand in this country, but they are somewhat inferior to the original breed. In France many attempts have been made to cultivate them during the last century, but altogether with but little success. In Germany, however, the

experiment has been eminently successful. The Elector of Saxony introduced the first flock in 1765, and about ten years afterwards another small flock was brought to Austria; and in 1786, and 1802, they were introduced to the imperial domains of Holditch in Hungary, and Maunersdorf in Austria. Such is the origin of the German Merino, which has now spread so extensively over these vast countries. There appear to be now two distinct breeds, differing from each other both in appearance and the quality of the wool. First the *Infantado* or *Negretti*, having shorter legs and a stouter body than the others, and the head and neck comparatively short and broad; the nose short and somewhat turned up, and the body round. The wool, observes Mr. Carr, is often matted upon the neck, back, and thighs, and grows upon the head to the eyes, and upon the legs to the very feet. The grease in its fleece is almost pitchy, so as to render the washing difficult. This breed is descended from the sheep imported directly from Spain into Austria, whilst the other breed, called *Escurial*, are those which were first imported into Saxony. They have longer legs, with a long spare neck and head, with very little wool on the latter; and a finer, shorter, and softer character in its fleece, but less in quantity than the other breed. The fleece, in the *Escurial*, averages from one and a half to two pounds in ewes, and two to three pounds in rams and wethers; whilst in the *Infantados* it is from two and a quarter to three and a quarter in ewes, and from four to six pounds in rams and wethers.

Many attempts have been made to amalgamate these breeds, but without success; the advantages of each can only be retained by preserving them pure.

"These sheep," observes Mr. Carr, a large sheep owner in Germany, "cannot thrive in a damp climate, and it is quite necessary that they should have a wide range of dry and hilly pasture of short and not over nutritious herbage. If allowed to feed on swampy or marshy ground, even once or twice, in autumn, they are sure to die of liver-complaint in the following spring. If they are permitted to eat wet grass, or exposed frequently to rain, they disappear by hundreds with consumption. In these countries it is found that the higher bred the sheep is, especially the Escorial, the more tender. They are always housed at night, even in summer, except in the very finest weather, when they are sometimes folded in the distant fallows, but never taken to pasture till the dew is off the grass. In the winter they are kept within doors altogether, and are fed with a small quantity of sound hay, and every variety of straw, which has not suffered from wet, and which is varied at each feed; they pick it over carefully, eating the finer parts, and any corn that may have been left by the threshers. Abundance of good water to drink, and rock-salt in their cribs, are indispensables."

Baron Geisler was some years since one of the most successful breeders of Merino sheep, and for many years, observes Dr. Bright, "he has exercised unwearied assiduity by crossing and recrossing, so

that by keeping the most accurate registers of the pedigree of each sheep, he has been enabled to proceed with a mathematical precision in the regular and progressive improvement of the whole stock. Out of seventeen thousand sheep, comprising his flock, there is not one whose whole family he cannot trace by reference to his books; and he regulates his yearly sales by these registers." He considers the purity of blood the first requisite towards perfection in the fleece. He adopts pretty nearly the same system mentioned by Mr. Carr, and keeps the young and the old separate from each other, and among his regulations we find the following:—"For fourteen days before the coupling-season the rams should be daily fed with oats, and this food should be continued not only during that particular period, but for fourteen days, and one ram will thus be sufficient for eighty ewes, provided great care and attention is paid to him in every other respect during the whole of the season.

"During the lambing period a shepherd should be constantly day and night in the cote, in order that he may place the lamb, as soon as it is cleaned, together with its mother, in a separate pen, which has been before prepared. The ewes which have lambed should, during a week, be driven neither to water nor to pasture; but low troughs of water for this purpose are to be introduced into each partition, in order that they may easily and at all times quench their thirst.

"It is also very useful to put a small quantity of barley-meal into the water, for by this means the

quantity of the ewes' milk is much increased. When the lambs are so strong that they can eat, they are to be separated by degrees from their mothers, and fed with the best and finest oats, being suffered at first to go to them only three times a day, early in the morning, at mid-day, and in the evening, and so to continue till they can travel to pasture, and fully satisfy themselves."

To such an extent is this carried, that though superior rams are becoming more numerous every year, yet some distinguished rams have, within these few years, realized from one to nearly three hundred pounds.

Thus the greatest care is taken, both in the management of the flock, and the selection of males for breeding, so as not only to preserve, but also to improve the quality of the wool. So successful have been these endeavours, particularly in Saxony, that the wool is superior to that of Spain, commands a better price, and principally supplies the English market, where it stands unrivalled for the manufacture of the finest cloth. The sheep for the most part are housed during the winter, where they are fed principally on hay, straw, and corn; the improvement of the carcase is altogether a secondary matter, the fleece being the primary consideration. The Merino sheep have been mixed extensively with other breeds, particularly in Prussia and Austria, and in fact this breed has been introduced more or less in every country in Europe.

In England it has likewise received a fair trial, but, from causes which can readily be explained,

they have not been profitably cultivated. The first attempt was made by George III., who was a very zealous agriculturist. A flock was first procured clandestinely from Spain, but they were found altogether inferior. In 1791 a small but very superior flock was presented to his Majesty, and though at first they suffered much from the rot and the foot-rot, yet the survivors became naturalized to the soil, and remained healthy, and the wool maintained its quality. The breed became fashionable; they were crossed extensively with the South Down, the Wiltshire, the Leicester, and the Ryeland ewes, and for some years the rams were let or sold at high prices. It was thought that by these means the wool of our breeds would be greatly improved, and their other qualities retained; but it was found that, whilst the wool was still greatly inferior to the pure Merino, the other qualities were deteriorated to a great extent. The carcase became inferior, the constitution less hardy, and the experiments so unprofitable that they were almost universally abandoned. The improvement of the wool would by no means compensate for the loss arising from a deficiency in the carcase; for such is the demand for meat of the best quality in this country, and such is the price it accordingly commands, that the flesh must still remain the principal source of profit, and indeed the only one that can meet the heavy expense incurred in raising artificial food. As this cannot be retained in connection with the finer description of wool, we must be content with possessing it with wool of an inferior description.

Very few, if any, flocks of Merino are still preserved pure in this country; Mr. Bennett retains a flock in Wiltshire, it is said, in a state of purity, or nearly so; but in most cases they are considerably crossed with other breeds, and in many cases so largely as to cause the principal characteristics of the Merino to have disappeared. Lord Western still retains a flock of Anglo-Merinos, that is the Merino crossed with the Leicester and the mixed breed, thus produced, afterwards perpetuated. A few years ago it is said that these were very fine sheep, but those exhibited at the present Smithfield Show (1843), I understand from some eye witnesses have very much degenerated.

Although, however, the Merino is found unsuitable for this country, it is not so in our colonies. In the extensive natural pastures of New Holland and Van Diemen's Land the Merino Sheep have been introduced and cultivated with great advantage. The first sheep, however, imported into these colonies were those of a very inferior description from India. But, although these animals were half covered with hair, their fleece improved to a great extent, and they became more prolific, showing the adaptation of the climate and soil for the production of wool, a fact which has been since satisfactorily proved. Soon afterwards sheep from the mother country were imported, principally of the South Down and the Leicester breed. They likewise succeeded well, and proved highly serviceable in supplying the infant colony with meat. Being crossed with the Indian sheep, they greatly improved both the fleece and the

carcase. At length some Spanish sheep were sent from England, and, being crossed with the existing breed, the fleece so improved as almost to rival the wool of Spain.* In consequence of this success, Sheep were selected and imported direct from Saxony, and the result was attended with similar success: they were crossed with the native sheep

* The account given by Mr. Hood, one of the latest writers on Australia, assigns the merit of the introduction of the Merino sheep to Captain McArthur, who first went to New South Wales as an officer in the 102nd regiment, in 1791, but retired from the service in 1806, and became a store-keeper in Sydney. Before this, however, he became a breeder of stock, and in 1803 returned to England and presented an address to the then Secretary for the Colonies, Lord Hobart, representing the peculiar fitness of New South Wales for the growth of wool. He took with him some samples of wool from sheep in the colony, originally sent from Holland to the Cape, and taken thence to Port Jackson; these sheep were of the Spanish breed, and the fleece was considered excellent. In 1797, Mr. M. procured three rams from the flocks of George III., at Windsor, and from these and thirty ewes previously purchased in 1793 out of a ship from India, and eight or ten Spanish and Irish sheep, have arisen the million and upwards of sheep that now cover the hills and plains of Australia. This is the part of Mr. M.'s career that is of most interest to the public; by this step he became a benefactor to his country and the colony to an extent that may be incalculable. In 1791 Mr. J. M. got his first grant of land, 100 acres; his next was also 100; next, from Lord Camden, 5000; next was 700 acres to his excellent wife from Governor Macquarie. From Earl Bathurst the sons got 5000 acres: and from Governor Macquarie 2300; in all, their grants have amounted to 18,000 acres; and they have acquired by purchase 32,000 acres more, at an average cost of 7s. 6d., the highest price paid being 18s. In all, the landed property obtained by grant and purchase by Mr. J. M. and his sons, now of C—, amounts to 50,000 acres!! Mr. M. never keeps above 25,000 sheep, in consequence of the great expense and difficulty of managing a larger number. He has 700 acres under the plough. Mr. J. M. purchased, in 1800, sixty acres of land in the township of Sydney, for 25*l.*, which, in 1836, were valued, according to the government land price, at 1000*l.* an acre!

and also preserved pure, and the wool from the latter was found very superior, and commanded a high price in England, though, from the want of that personal attention which the sheep receive in Germany, the wool is not equal to that of Saxony. The greater scarcity of labour in these colonies, and its abundance and consequent cheapness in Saxony, will sufficiently account for this fact. The sheep cannot receive in the colonies the shelter or the dry food they enjoy during the winter in Germany.

The cultivation of sheep in Van Diemen's Land was later than in New Holland, but the same course was pursued. The Merinos, however, were first supplied from Sydney in 1820, but were afterwards imported from Saxony. Such has been the success and the increase of sheep in these settlements, that whilst in the year 1810 167 pounds of wool only were imported into England from New South Wales, in 1832 the quantity brought from both colonies was 3,516,869 pounds, and it still continues to increase, as well as from the other settlements on the coast of New Holland.

"The attention," observes Mr. Low, "of the Australian colonists has been naturally directed to the cultivation of fine wool; but it is evident that there are limits to the profits to be derived from this commodity, both from the increasing production of the country, and from the rivalry of the districts of Europe where the Merino wool is cultivated. It is a question, therefore, whether the colonists should not now direct attention to the long or combing wools as well as to the short or felting. It is pro-

bable that the long wools of England would acquire in these favoured climes the very properties which would benefit them the most, and that the heavier fleeces of the Leicester, the Cotswold, and the Old Lincoln sheep would yield a larger profit to the wool-grower than even the higher priced Merino. But the two classes of sheep should be kept entirely distinct. The Merino breed should be selected and cultivated with all the care which the state of the country will allow. Merinos of the pure race may be obtained in England; but in numbers too small to supply any considerable demand. They would be more conveniently procured from Saxony, proper precautions being employed in making the selection from flocks of established reputation. The best period for examining the flocks is the month of January, or even February. The cheapest mode of getting an improved stock is to purchase the refuse, or cast ewes; but the proper mode to insure the obtaining of them of the best sorts is to make a selection out of the good flocks of the country. Unless, however, the purchaser is a very good judge of the quality of the wool, he will require an assistant in the country, who for a fixed amount per head will make the selection; and it will be proper for those who are to make considerable purchases to send a trusty person to the country. The price for refuse ewes is from four to eight dollars, at 3s. per dollar; of selected ewes, from ten to twenty dollars; and of rams from 3*l.* to 20*l.* Some remarkably fine rams even bring prices so high as from 50*l.* to 200*l.*; but this great expense can never be required, except in the case

of individuals who already possess highly improved flocks which they are desirous of bringing to the greatest degree of perfection. In the case of Australian settlers it would be well for several to combine and purchase a considerable number at once, as from 1000 to 2000 ewes, with a corresponding number of rams. The best mode of proceeding would be to collect the sheep at Riesa, on the Elbe, and ship them to Hamburg, a separate boat being hired for the purpose. Shipments might also be made from Dresden. The precautions to be used in making these purchases are, to deal only with persons of known character, and, as has been said, to obtain an assistant in the country to select the sheep, and to send a trusty servant to take charge of them. The expense of purchasing and transporting the sheep to England is not considerable; and when we consider the immense national importance of conveying to our Australian possessions the best of the race that can be obtained, it is to be trusted that the colonists will find it for their interest to resort to countries where the animals can be obtained in the greatest purity and perfection."

It appears, however, since the information was procured that enabled Mr. Low to give the above statement of the prices of sheep in these colonies, they have, in consequence of the derangement of the monetary and commercial affairs of this colony, undergone a very considerable depression in value.

"Sheep," observes Mr. Hood, "that sold at 16s. and 20s., may now (December 1841) be had for 8s. and 10s., and cattle have fallen from 5*l.* to 35s.;

while at sales in Sydney the former fetch 1s. 6d., and the latter 30s." Although this certainly offers a very favourable opportunity to the large capitalist for investment, it yet strikingly displays the fluctuations to which the value of such stock is exposed, and which must ever continue until some better method is adopted for supplying water, and obviating the sad losses which so frequently occur from the droughts to which this country is liable. "It will scarcely be believed in England," observes Mr. Hood, "that the estimated number of sheep which have died within the last twelvemonths in the colony from catarrh and drought is seventy thousand!! that colonists are compelled, in order to save the dam from starvation, to cut the throat of her lamb; that no means are adopted for securing a stock of lambs for next year; or that a stockholder would offer eight thousand sheep to any one that would remove them from his runs, and finding that no one could be prevailed upon to taint his own flocks by accepting so dangerous a present, had recourse to consuming them by fire, and had actually killed and burnt two thousand.* Such things are

* The sad destruction of property here described will, we trust, not again occur, or at any rate not be attended by the same pecuniary loss, for it appears that considerable attention has lately been bestowed in boiling down the sheep for the sake of the tallow, which is prepared for the English market, and thus, in such cases as that described in the text, a considerable portion of the value of the sheep may be saved. The colonist cannot be otherwise than aware that the flesh, as well as the bones, form the most valuable of all manures, and if well mixed with earth and made into a compost, its application to the land under cultivation will abundantly repay the cost of labour, dear as that cost may

nevertheless perfectly true. I myself know the parties; and it all goes to prove that everything depends upon the healthiness and character for feed and water of the country in which a stockholder locates, and the freeness from disease of his stock, and not so much upon his commencing with what

be. It appears from the following advertisement, extracted from a Sydney paper, that the preparation of tallow is in many cases the most profitable mode of disposing of the carcasses of superfluous sheep. An animal weighing about 60 pounds will, we understand, generally yield about 25 pounds of tallow.

"SHEEP-BOILING AT WINDERMERE, NEAR MAITLAND.

"Mr. Wentworth, having engaged a competent superintendent to boil down his own surplus sheep, is willing to accommodate the settlers in the districts of the Hunter, Wellington, Liverpool Plains, and New England, at the following charges:—

"Slaughtering, skinning, cutting up and boiling sheep, rendering caul and kidney fat separately, packing the tallow and hoiled fat in the sheep skins, in suitable and secure parcels for exportation, marking and lettering those bags so as to distinguish the quality, and putting the same on board the steamer at the Green Hills—at per sheep 9*d.*

"Washing skins, taking off the whole of the wool, drying and putting into clean packs, and carrying those bales to the steamer—at per sheep 3*d.*

"The proprietor of the sheep will have to pay the freight of the wool and tallow to Sydney: or if he should wish it to be paid for him, he must, before boiling the sheep, give notice of such to the superintendent at Windermere, who will take at his option, wool at 1*s.* per lb., or tallow at 2½*d.* per lb. in payment of all charges: the freight of wool being 7*s.* per bale to Sydney, and of tallow 1*s.* per cwt. The goods will be shipped on board the steamer on account and risk of the proprietor.

"Grass will be provided gratis, and shepherds will receive rations at a moderate charge. And if required by the master, the wages coming to them will be paid, and deducted at the above rates.

"The offal and refuse of the carcass, after extracting the tallow, to belong to the establishment.

"Such of the hind legs as may be required for the use of the establishment will be allowed for at ½*d.* per lb."

is called a great bargain. The first object on the arrival of every settler should be to procure a good country for his flocks, and this, I have elsewhere said, is his grand difficulty. Let him be wary upon this point. Almost every desirable or habitable spot in the old countries, as the early settled districts are called, is already occupied, but there is ample space in the south and north, and will be, I believe, for years to come, though enterprise is fast penetrating into these regions also; I have recommended a box and apple-tree district as the best, but in these he may find that there is no water, or that in times of drought it has been known to fail; or again, where water is always abundant, the forests may be of stringy bark, which always denote a district of inferior value, or even not worth possessing at all. He will be told that Artesian wells may be sunk, by which water may always be obtained; but though too much cannot be said in favour of Artesian wells, they are not calculated for the purpose of washing sheep. Troughs filled by these wells may supply sheep with drink; but the grand object in the possession of flocks is their wool, and means of duly preparing *that* must always be kept in view. A dry climate is essential to the Merino, and one not too cold in winter; and therefore too great an elevation above the sea is objectionable—a short distance from some water-carriage is equally indispensable."

What this country appears to want is a more general and systematic arrangement in the modes of management, and a greater combination amongst

those interested in the same pursuit. "There is no union or spirit of co-operation," says Mr. Hood, "amongst the settlers, any more than there is among the store-keepers—not so much even as would induce them to establish, what is evidently for their common interest, a public market, for the purpose of keeping themselves out of the power of the Sydney butchers, who at present dictate both as to time and price, in all the sales of fat stock."

When we bear in mind that in 1840 there were no less than 1,334,593 sheep, and that the export of wool from Australia in 1843 was 16,226,400 lbs.—when we consider the vast importance of this growing trade, its actual amount, and its value to the mother country as an outlet for her manufactures, we feel a strong conviction that, in spite of recent disasters and present distress, it will not be allowed to drop or dwindle, but with the brighter prospect of the general affairs of the colony, the cultivation of wool will again receive a stimulus, and again enjoy a career of prosperity which, though not so rapid as before, will, we trust, be more steady and permanent, and based on surer foundations. As the colony increases in population, and other branches of agriculture obtain attention, some regard will be paid to the carcase of the sheep, as well as the wool; and while the more distant settlements will continue to be the great breeding districts, those nearer the ports will probably be more devoted also to fattening those sheep, purchased from the more distant flocks, at the most suitable age for the market: unless, indeed, the advice of Mr. Low, of

paying a greater attention to the long-woolled breeds, be not likewise adopted.

It would greatly facilitate the prosperity of these valuable colonies if an Agricultural Society were established, after the model (though on a more humble scale) of the Royal Agricultural Society of England. The annual journeys to the metropolis for the sale of wool, which now too frequently ends in the dissipation of a great portion of the funds of the colonist by extravagance and improvidence, may then be made available for the communication of ideas amongst the farmers, a mutual giving and receiving of the knowledge derived from experience—a fund which all may supply, and all receive in return abundant interest. Premiums may be given for the best wool and the best animals of all descriptions; the aids of science may be obtained; the results of machinery taken advantage of; and each colonist return to his station a wiser and a better man. In reading an account of the business of these stations, we find that a very considerable portion of the time of the colonist and his assistants is employed in hunting for strayed sheep. Now might not the sheep be readily folded at night, and with little labour by means of nets, particularly those made from the cocoa-nut, which are found both strong and durable; and might not the dung of these animals thus folded be rendered available in the production of turnips, as well as corn, to a far greater extent than at present? Although the general employment of turnips might be unfavourable to the quality of the wool, yet a very mode-

rate use would not be prejudicial, and would often prevent disease.

SECTION VIII.

THE SOUTH DOWN OR SUSSEX BREED.

WHILST the Leicesters cannot trace their origin more than eighty years, when they, as it were, sprung into being a different animal altogether from their predecessors ; the South Down, on the other hand, can trace a long line of pure descent from a period antecedent to William the Conqueror. It is unquestionably the purest and most unmixed breed in the kingdom. It holds a place in the esteem of breeders inferior to no other, and though its different qualities altogether preclude any competition with the Leicester, year after year we find the élite of this breed carrying off prizes of equal amount and importance. It ranks with the Leicester—the former first among the short-wools, as the latter is amongst the long-wools. It is pleasing to find in each of these breeds the success of different, though equally good, principles. Whilst the Leicester sprung, as it were, from a few individuals possessing the qualifications which the breeder thought desirable, the South Downs have reached their present perfection by the constant and unremitting attention to the purity and perfection of the original breed ; added to the fact that the downs of Sussex, the native locality of the breed, being though extensive yet

narrow, were connected with, and indeed formed part of, the farms at their feet, and thus permitted the extensive cultivation of artificial food, which tended greatly to increase the number and improve the quality of the sheep. The improvement of the Downs has therefore been slower in its progress, but it has been obtained without any sacrifice of the intrinsic qualities of the original breed. We are, however, chiefly indebted to the late Mr. Ellman of Glynd in Sussex, as being the first and most successful improver of this breed. In 1776 Arthur Young speaks of them as having a fine coat, but at the expense of a thin chine, low fore-end, and rising back-bone. The chief principle adopted in improving them has been to amend these evils, and in so doing the improved breed have become smaller in bone, with greater disposition to fatten, an earlier maturity, a heavier carcass, whilst still retaining their former hardihood and capability of doing well on scanty pasture. This constitutes the perfection of the breed; they can endure the rigour of the weather, and preserve their flesh where a Leicester sheep would die, and thus they are so admirably adapted for the Downs, often travelling to and fro a considerable distance every day and bearing with impunity close folding, to a degree that no other sheep can endure, and thus are so well adapted for the system of agriculture practised on light lands.

The fineness and quality of the fleece was no doubt one of the original recommendations, but this has become long since a secondary consideration, from the lower price realized, and the altered state

of the wool market; and yet with the improvement of the breed, the fleece has also improved and become more abundant.

Mr. Ellman thus described an improved sheep:—
“The head small and hornless; the face speckled or grey,* and neither too long nor too short. The lips thin, and the space between the nose and eyes narrow. The under-jaw or chop fine and thin; the ears tolerably wide, and well covered with wool, and the forehead also, and the whole space between the ears, well protected by it, as a defence against the fly. The eye full and bright, but not prominent. The orbit of the eye (the eye-cap or bone) not too projecting, that it may not form a fatal obstacle in lambing. The neck of a medium length, thin towards the head, but enlarging towards the shoulders, where it should be broad and high, and straight in its whole course above and below. The breast should be wide, deep, and projecting forwards between the fore legs, indicating a good constitution, and a disposition to thrive. Corresponding with this the shoulders should be on a level with the back, and not too wide above; they should bow outwards from the top to the breast, indicating a springing rib beneath, and leaving room for it. The ribs coming out horizontally from the spine and

* Though at first a speckled face might have been permitted, yet for many years past it has not been tolerated by eminent breeders, and the present Messrs. Ellman, it is said, cannot even endure a spot on the face or ears. Thus it is probable that the colour of the face has become more uniform and of a darker shade in choice flocks, and the term brown-grey may perhaps be a more appropriate description.

extending far backward, and the last rib projecting more than the others; the back flat from the shoulders to the setting on of the tail; the loin broad and flat; the rump long and broad; and the tail set on high and nearly on a level with the spine; the hips wide; the space between them and the last rib on either side as narrow as possible, and the ribs, generally, presenting a circular form like a barrel.

"The belly as straight as the back. The legs neither too long nor too short. The fore legs straight from the breast to the foot: not bending inward at the knee, and standing far apart both before and behind; the hocks having a direction rather outward, and the twist, or the meeting of the thighs behind, being particularly full; the bones fine, yet having no appearance of weakness, and the legs of a dark colour.

"The belly well defended with wool, and the wool coming down before and behind to the knee and to the hock; the wool short, close, curled, and fine, and free from spiry projecting fibres."

A favourable specimen of a South Down Ram is exhibited in the title-page. It is taken from life, from the flock of Mr. Drake of East Tytherly, one of the most successful breeders of pure South Downs in the county of Hants.

Nothing perhaps can better show the sterling qualities of this breed, than the facts, that at one time the wool ranked as fine wool, and was generally adopted for carding purposes, and then commanded a high price, whilst now, in consequence of the large supply of superior foreign wool, that of

the South Down is no longer considered fine, but is confined principally to combing, and consequently the price is considerably reduced, being less than half what it once realized; yet, notwithstanding this change, the South Downs have not only maintained their numbers but considerably increased, and in many districts have altogether supplanted other sheep.

The county in which this breed was first so much improved, viz. Sussex, still retains its pre-eminence in this respect, and most of the modern breeds are founded on Ellman's. The present Mr. Ellman does not exhibit his sheep, but they offer sterling qualities that the careful breeder may always resort to with safety. Mr. Grantham, of Lewes, has of late years carried off the greatest number of prizes at the Smithfield Show, and he has various breeders around him but little inferior to himself. He has also had a formidable competitor, and one not unfrequently successful, in Mr. Jonas Webb, of Babraham, Cambridgeshire, who possesses a flock of pure South Down wethers, which in the year 1841 carried off the principal prizes at the Smithfield Show, and their qualities were so eminent in relation to the carcass, as to occasion doubts in the mind of an eminent agriculturist whether there was not in them at some period some mixture of the Leicester blood. This suspicion was met, however, by the positive assurance of Mr. Webb that his breed has been always preserved perfectly pure.

We have said that an earlier maturity of this breed has been attained, the wethers being fre-

quently fatted at twenty-two months, sometimes as early as fifteen, and rarely exceeding thirty-two months. At the latter age they have occasionally reached the weight of twenty stones, though this vast bulk is very seldom attained, and indeed would not be generally preferred. From eight to twelve stones is usually about the average. They make more fat internally than the Leicester sheep, and thus are greater favourites with the butchers, who usually display their front parts to the street in their shops when hung, whilst the Leicesters are generally turned the contrary way, each being exhibited thereby to the greatest advantage.

The South Down breed has extended itself to all parts of England, Scotland, and Ireland, and where the country is suitable has not failed to give satisfaction—it would indeed be difficult to point out a county that does not possess them. They have to a considerable extent supplanted the native breed in Norfolk, South Hampshire, Wiltshire, Dorsetshire, and many other counties; and in North Hampshire, Berkshire, Somersetshire, Wiltshire, Cambridgeshire, &c., their influence has prevailed almost as much by crossing with the native breeds. It is a breed indeed well adapted for hilly pastures wherever the chalk prevails, but it is unable to withstand the severities of the winter in some situations, which the several mountain breeds bear with impunity. It cannot as yet take the place of the black-faced or the Cheviots in the north, or those of the Welsh and Irish Mountains in the West, and it has been tried as a substitute for those

of Exmoor, and has been found wanting in the requisite hardihood. The superior quality of the mutton, and the due proportion, but not superabundance of the fat, render the South Down a much greater favourite than the Leicester in the London market, and of late years this preference has been so marked as to induce many breeders, amongst others the venerable and respected Mr. Hillyard, the author of 'Practical Farming,' to cross his Leicesters with the Down rams, and the result of the first cross has been very superior sheep with dark faces, and partaking of the mingled character of both parents. They have been much more saleable than the pure Leicesters, and with earlier maturity and superior feeding qualities to the pure Down. It is better to stop at the first cross, devoting the produce entirely to the butcher, and preserve the stock sheep pure.

In Hampshire and other places, the Down ewe has been crossed with the improved Cotswold ram, and the result has been a much larger sheep, with long wool and good feeding qualities. In some flocks, where the object has been principally to increase the size of the sheep, one cross of the improved Cotswold ram has been employed, then returning to the South Down ram again; and it is astonishing how long the traces of the foreign blood are seen. Some wethers of the fourth cross of this breed were exhibited at the Romsey prize market in this neighbourhood (Christmas 1843), and succeeded in gaining the prize for the best fat wethers, although there were some splendid pure bred Downs as com-

petitors. These wethers averaged upwards of 30 lbs. the quarter.

The system of management of the South Down sheep varies with the nature of the farm or district, and the amount or quality of sheep that can be afforded. On the Down farms, both of Sussex and Hampshire, as well as Wiltshire and Dorsetshire, the old system used to be to keep them almost entirely on the Downs throughout the greater part of the year, folding them on the arable land at night, where, during the winter and sometimes most of the year, they were allowed hay. The object in a great measure was confined to breeding, and few attempts at fattening any portion were made, but the cast ewes, lambs, or young sheep, were generally sold off to lowland farmers.

With the introduction of the turnip-husbandry during the last century, the system on these farms has in many respects altered. With an increased quantity of winter food the size of the flocks was enlarged, and the turnips were, as they are still, on many farms, devoted to the support of the young sheep, which the farmer was enabled to retain much longer, and which enabled him likewise to keep a larger number of ewes. The chief difficulty, however, which arose with this system, and which has not even now been entirely obviated, was the deficiency of food in the spring for the increased size of the flocks. The turnips were to a great extent consumed by Christmas, or soon after, and if allowed to remain during the frosts of January they generally rotted in the ground. Many were the schemes

which were attempted to relieve this difficulty; and where there were any pastures sufficiently dry for sheep, the autumnal grass was carefully preserved untouched, and though to a great extent decayed, it yet afforded encouragement and protection to a new shoot of grass, which was thus, under the denomination of fog-grass, preserved for the sheep when the turnips were gone. The remedy was at best partial, though expensive, and in many farms altogether inapplicable; and it was generally necessary for the farmer to regulate or diminish the size of his flock, according to the prospect of feed which was offered for the spring, to supply which the hay-rick still continued to be the principal resource. These difficulties were, however, to a great extent relieved, though not entirely removed, by the introduction into this country of the Rutabaga, or Swedish turnip, which valuable root, having the property of resisting the influence of the frost, occasioned almost a revolution in husbandry, by supplying wholesome and nutritious food at that season of the year, the latter part of the winter and the early spring, when the greatest difficulty had previously been experienced. The effect of this improvement may readily be conceived: an increased number of sheep were easily kept, and the value of light turnip land became greatly increased, and has ever since continued in demand, for not only is there a greater profit attending the flock itself, but by its means land can be economically manured that would otherwise have received no dressing; and with this addition of valuable manure a very large increase of wheat and barley, and other

corn, has followed. Sheep can now be as readily kept and fattened through the winter as the summer; and a remarkable contrast is offered at the present day to that afforded a century or more ago, when it was customary to slaughter vast numbers of sheep, and salt them for the winter's provision; at the present day we know nothing of salt mutton, except as a curious incident in history.

The usual system still adopted on many Down-farms in the South of England, is to keep their stock-ewes on the Downs, or on what little dry pasture they may have, giving them hay in winter, and a few sweetees after they have lambed. They give the bulk of their turnips to their hogs, and they sell off more or less according to the quantity of turnips they may have at their disposal. On other Down-farms, where the turnip-husbandry is carried to a greater extent, it is customary to give the breeding-ewes a portion, and where they are judiciously confined to the leavings of the young sheep (which have been exposed to the air and thus partly evaporated, and thereby become much drier than before), the practice is unattended with any injury, and, indeed, is productive of benefit by keeping the ewes in better condition. On such farms it is often customary to fat off a number of ewes or wethers every year, to the facility of doing which nothing has tended so much as cutting the hay into chaff and adding a portion of crushed or bruised corn or oil-cake, as well as cutting the turnips themselves, for which purposes a number of very ingenious implements have been constructed. Sheep husbandry is, however, by no

means confined to these Down-farms, for many farmers keep large breeding-flocks without an acre of down and with a very limited quantity of dry pasturage. They make this pasturage extensively available by the assistance of hay and turnips, and, indeed, some farmers do not scruple to fold their heavy ewes on turnips almost as they would young or fat sheep; but although the practice is often followed with impunity, yet it is by no means to be recommended, as it is often the cause of abortion as well as red-water. It is sometimes the custom, and a good custom too, to divide the flock into three portions—the fat sheep, the hogs, and the breeding-ewes,—and in this order to put them on turnips. On such farms as those we are now speaking of there is often a greater difficulty in finding sufficient food during the summer than the winter, unless by sacrificing a considerable portion of the anticipated crop of hay. It is here that the great benefit of the broad clover crop, the introduction of which was almost as beneficial to agriculture as that of the Swedish turnip, was experienced, affording as it does an abundant feed even after a crop of hay has been cut, and being often sown with other seeds and allowed to remain in pasture for two or more years, thus supplying in some measure the want of downs. On light chalky farms sainfoin is also extensively cultivated, and though it produces but one crop of hay in the year, it also affords excellent pasture, and when the land is carefully laid down there will remain a good plant for many years. The aftermath is in high estimation for lambs, and

by its stimulating or aromatic qualities counteracts or cures diarrhœa.

Tares or vetches, too, of both the winter and summer variety, are also very extensively employed for the purpose of affording green food for sheep during the summer. The former is sown soon after harvest, and is fit to feed generally about the succeeding June; lasting, however, till the end of July, if sown at intervals of a fortnight, till the end of October; by the time they are consumed the spring tares sown in April and May are fit, and thus a succession of wholesome food is afforded for several months till the clover leys are ready to receive the flock, which is thus kept in an improving state without the assistance of downs or natural pastures. The chief difficulty experienced on these farms, and, indeed, on most others, and which, in fact, has been a stumbling-block to many excellent farmers, is the inability of procuring sufficient feed in the latter part of the spring, after the Swedish turnips are consumed. To obviate this difficulty many attempts have been made; some resort to fog-grass before noticed, others feed off the young wheat, often to the great injury of the crop; but one of the best methods is to sow rye with a little cole-seed immediately after harvest, which may be fed off early in May, and once or twice afterwards, till when, Swedish turnips and particularly mangold wurzel may be preserved; and by the time the rye is consumed the winter tares, if sown early and of an early sort, are ready, and both the tares and the rye may be succeeded by turnips, so that another

crop is procured the same year, the land having been manured by the sheep feeding off. Another plan occasionally adopted is to sow trefoil and ryegrass (sometimes the latter only) with the corn crop of the previous year, instead of a portion of the broad clover, and thus feeding off this in May and following it with summer vetches. This plan is recommended as preventing the too frequent repetition of clover. Useful, however, as all these plans unquestionably are, a still better mode of answering the purpose is yet a desideratum. Besides the methods of management which we have noticed, we have also to observe that many farmers keep wether flocks alone, which they buy in the autumn and sell off fat in the following spring, keeping them, of course, on turnips and hay, to which some add corn and oil-cake. On such farms there is generally a deficiency of summer pasturage. On other small farms it is also customary to buy cast ewes in the autumn and fat them off in the same manner as wethers during the winter.

Thus the system of management of South Down sheep is very varied, depending as it does on the nature and quality of the particular farm and the general method adopted in its management. On some farms, too small or otherwise unsuitable for keeping a constant flock, it is customary to take in and keep the sheep of other farmers at so much a-head, the price varying, of course, with the abundance of feed, being sometimes 2*d.* to 4*d.* per week, and at other times, when feed is very plentiful, it is given for the sake of the manure left behind.

Some farmers will put out their own heavy ewes in the winter to keep on some park or dry pasture, and take in a wether flock to feed on their own turnips. Sometimes vetches or turnips are thus fed off by the acre, the price being generally moderate, such as 20s. to 50s. per acre, in consideration of the dung and urine left behind.

Of the various systems of management which we have noticed, that which appears to be adopted by the most eminent and successful sheep-owners is the combined practice of breeding and fattening. By careful and judicious selection in breeding they possess themselves of the best animals, the qualities of which they are enabled to test when preparing their wethers for the market and the prize shows. It is on such farms the practice of corn-feeding is chiefly followed, and which is well worthy the attention of all sheep-owners. The importance of this subject, however, demands a separate article.

The Hampshire Down Sheep,

as it is locally termed, is to be found pretty generally in the northern division of Hampshire, and with a little variation, being sometimes understood under the term West Down, it extends into Berkshire and Wiltshire. The precise origin of this variety it is somewhat difficult to discover, but it may be considered about sixty or seventy years old. The original breed of Hampshire was a large long-horned sheep, with tolerably fine and short wool, hardy and good milker, resembling in many respects the remnant of the Old Wiltshire still pre-

served, being unthrifty and coarse in the bone, particularly about the head. This sheep had probably existed on the downs of Hampshire for ages, and, no doubt, furnished the principal supply of wool to the manufactory at Winchester established by the Romans, although the Sussex Down might also have assisted. Soon after the improvements in the Sussex sheep were effected, the Hampshire farmers used to purchase at the annual sales, some say, the largest and coarsest animals they could find, and cross them with their native sheep and also the Berkshire ewe. These crosses were carried on again and again both by means of ewes as well as rams, until at length the South Down prevailed in the greatest degree, and the horned sheep were succeeded by a race without horns. It is the opinion of an experienced Hampshire farmer that in effecting this change the Leicester blood was also had recourse to. It then became the custom for the North Hampshire farmers to breed and employ, or let their own rams, and the breed then continued unchanged; and, indeed, the Hampshire Down rams are those which supply the greater part of Berkshire at the present time.

The Hampshire Down sheep are larger than the South Down, with stouter and coarser bone, and longer on the legs. The rams, particularly, are remarkable for the largeness of the bones of the face and the roundness of the profile. This is considered a good point, and prevails in a lesser degree in the offspring. The quantity and quality of the fleece is pretty similar, or rather shorter, and there

is more wool about the legs. They are quite as hardy as the Sussex, good travellers, and adapted for folding, and their faces are somewhat blacker. Many North Hampshire farmers contend that they can keep quite as many of these larger sheep, and that therefore they are more profitable. This is disputed by others, and, at any rate, there are few, if any, of the Hampshire Downs that receive prizes at the Smithfield Show, or at the meetings of the Agricultural Society. It should be observed that in the next country meeting of the Royal Agricultural Society prizes will be offered for the best short-woolled sheep not South Downs, so that these sheep may have an opportunity of gaining a few prizes or, at any rate, testing their qualifications. In the more southern part of Hampshire these sheep are mixed extensively with the Sussex, the latter blood, however, greatly prevailing.

In the neighbouring county of Berks, the character of the sheep is pretty similar to those found in North Hampshire, from whence the rams are now principally supplied.

The *Old Berkshire* sheep had a mottled face, that in most other respects resembled the Old Hampshire, with which it was frequently crossed in each county, and mingled, as before noticed, with the Sussex blood.

In the neighbourhood of Whitchurch, in the northern extremity of the county of Hants, the system of extensive crossing has been carried on for some years by an enterprising breeder, Mr. Twynham, who now possesses a breed of sheep differing

in some respects from most others. His object was at once to hasten the maturity, and improve the carcass and the fleece, and yet preserve the hardihood possessed by the Hampshire Downs. For this purpose he sought for those sheep which possessed these requisites in the greatest degree, and believing them to exist in the New Leicester and the Old Cotswold, he availed himself of the ram produced by this cross, and put it to his Hampshire Down ewes; and the produce approximated both to the Cotswold as regards the fleece, and the Leicester with respect to the carcass, and much exceeded the parent ewes in size, but retained their hardihood. He states, in a letter to the author, that the produce was an animal much improved in symmetry, with a fleece nothing deficient in weight from the parent Cotswold, but much firmer and finer in texture, while it retained a great length of staple, say from five to seven inches on the average in the shearlings. Having by this means obtained the animal he wished, he did not pursue crossing any further, but afterwards bred from the same affinity a first cross ewe and a first cross ram, carefully culling those which were faulty, or exhibited too much of the character of either the dam or sire, and studiously aiming at the required mixture of character, which, he observes, may be perhaps properly described as a middle-bred sheep, possessing in combination the qualities of Down and Cotswold. Having first of all selected for uniformity of character, in course of time he turned his attention to procuring a uniformity of colour; and he now boldly

states that his sheep, although possessing a larger carcass and a much longer fleece, are yet adapted for the various purposes for which the Hampshire Downs are employed; and he asserts that under the improved system of farming, there is no description of sheep which will pay the feeder so well for consuming the produce of the farm on the land producing it. They are hardy, make an average of ten or eleven stone (of eight pounds), at fourteen months old, when well fed give at that age eight or nine pounds of wool, of a very saleable description, and, under the future prospect of the wool trade, likely to be more in demand than that from the Downs. And though the flesh, he adds, as old mutton, is inferior to the Downs, yet, at the age above mentioned, it is superior; and having earlier maturity, his sheep will yield the largest return for the food consumed, and are, therefore, the most desirable for the grazier.

SECTION IX.

THE LONG-WOOLLED BREEDS.

THE long-woolled breeds of sheep are properly natives of the rich and marshy pastures of England, from whence, with the improvement of agriculture, they have extended to all parts of Britain, encroaching in many places on the land previously appropriated to short-woolled sheep; so that for years past they have been gradually increasing,

while their rivals have decreased or remained the same. The cause of this may be found in the fact that in suitable land they are undoubtedly more profitable than the short-woolled varieties, the much greater weight of the fleece, yielding as much per pound, will account for this, even if the superior aptitude for fattening and earlier maturity of one particular variety were not also in operation. Yet, whilst many of the upland and mountain breeds have been preserved unmixed from time immemorial, most of the ancient long-woolled breeds have either altogether disappeared, or been preserved by the curious in individual flocks; they have either been altogether supplanted by the New Leicester, or in a great measure changed by extensive crossing with this improved breed. Mr. Low makes a distinction of two classes of long-woolled sheep, one belonging to the marshes and fens, and the other to the inland plains. The former includes the *Lincoln* and the *Romney Marsh*; the latter, the *Tees-water*, the *Leicester*, and other varieties.

The Lincoln Sheep.

The fens of Lincolnshire, extending into Norfolk, Cambridgeshire, and the adjoining counties, are well adapted for the support of a heavy breed of sheep, and this accordingly is the native district of the *Old Lincoln*, a breed in its pure state almost extinct, but a flock is still preserved by Mr. Jex in Norfolk. They are of a large and coarse form, with flat sides and hollow flanks, and large legs and feet. Their fleece, from ten to twelve pounds and upwards,

almost touches the ground, and is long and oily. They fed slowly, but made much internal fat, and were therefore approved of by the butcher. Such was the Old Lincoln, the progenitors of the present race, which have been greatly modified by extensive crossing with the New Leicester, the effect of which has been to diminish the size and the weight of the fleece, but greatly to improve the form, giving a greater aptitude to fatten, an earlier maturity, and a capability of keeping a greater number on the same extent of land. Though for many years this innovation was violently opposed by the admirers of the old race, yet the alteration gradually worked its way in spite of all obstacles, and the mixed breed now presents the largest sheep in Europe. The wethers, when fat, have been known to reach the enormous weight of sixty pounds per quarter, but the mutton is of course not so delicate as the smaller breeds. Mr. Clarke, of Canwick, in 1827, exhibited two wether sheep in Lincoln market, the fleeces of which had yielded twenty-four pounds of wool; and, when slaughtered, one weighed 261 lbs. and the other 250 lbs. The fore-quarters of the former were each 73 lbs., and the hind 57½ lbs. This of course is an extraordinary instance, and considerably above the average, both with regard to the carcass and the wool, the latter of which may be considered to average eight or nine pounds. It is somewhat coarser than the Leicester, but well adapted for worsted goods.

Messrs. Kennedy and Grainger state that the

sheep bred in the wolds are deeper crossed with the New Leicester than those on the marsh lands, which may account for the fleece of the latter being heavier. "The breed of sheep generally," they observe, "has been greatly increased since the turnip husbandry has been introduced. Those bred in the wolds, and indeed in every part of the district where this system is pursued, are reared chiefly on artificial grasses. There are, however, great numbers bred on old pastures, the best of which are kept for the purpose of fattening sheep. The usual time for sheep-shearing is about the month of June; the washing taking place ten days previously. No ointment or grease is used after the shearing. The average weight of a fleece from the present sheep is about seven pounds (from the true Lincoln it would not be more than nine pounds), and the length of the staple from eight to nine inches. The sheep are not kept in flocks, but in separate pastures, and are classed according to their different sorts and the respective qualities of the pastures. They have their first lamb when about two years old, in March or April. Of the returns from a sheep-farm, the fleece is estimated at about one-fourth, or between a third and a fourth; but this depends upon the state of the markets at different periods, the prices both of the wool and the carcass greatly varying; but those considered remunerating are 30*s.* per tod for the wool, and 52*s.* for two year old wethers, 35*s.* for one year old do., 27*s.* for ewes, and 21*s.* for lambs."

ROMNEY MARSH SHEEP.

The other breed of sheep proper to marsh lands is that which from time immemorial has been found in the extensive fens on the southern coast of Kent, denominated the Romney Marsh. It is nearly on a level with the sea, from which it was reclaimed many centuries ago, and from its encroachment is preserved by means of dykes, similar to much of the land of Holland. It extends fourteen miles in length, and ten in its greatest breadth, and for the most part consists of a rich clay soil, well adapted for the production of a large breed of sheep; and consequently we find they are more numerous than on any other space of land of equal extent, it being

not uncommon for seven young sheep and as many fattening wethers to be placed on an acre. The native breed of this district were large coarse animals, though somewhat smaller than the Old Lincoln. They had coarse heads and limbs, narrow chests, and flat sides but with large bellies, fatted slowly, not being fit for the butcher till three years old, when the wethers averaged from 35 lbs. to 40 lbs. per quarter, and yielded much internal fat; the fleece averaged from 6 lbs. to 7 lbs. This breed is rarely preserved in a pure state, and then not in the marshes. For the most part they have been extensively crossed with the New Leicester, and have in consequence been greatly improved in form: though the bulk is somewhat reduced, there is an earlier maturity and a greater disposition to fatten imparted; and, though the pure Leicester Ram is now but rarely employed for the purpose, from the fear of inducing a too great delicacy in the breed, and an inability to withstand the exposure to the weather, and the absence of shelter, yet the present race evidently shows the source from whence it derived its improvement. With the improvement effected by the introduction of the Leicester blood there also arose a greater disposition to select the most improved specimens for the perpetuation of the race, and the adoption of this principle has in great measure prevented the necessity of returning to the pure Leicester.

The long-established custom of the Romney breeders has been to send their lambs to the farmers on the uplands, to be kept during the winter; but

they are usually kept very hard, principally in the stubbles for a long time, and are often much weakened before they are put into the pastures. They are seldom allowed hay, and this thriftless economy is often very destructive. This want of care is also strongly exhibited in the management of the ewes in the marshes. Shelter is very rarely afforded, however severe the weather may be; but where this moderate expense has been incurred, the cost has been amply repaid, and the lives of many have been saved. If a more general system of shelter were adopted, the breed would, doubtless, admit of much greater improvement, and would therefore become still more profitable.

The Tees-water.

This is an ancient breed of sheep, called after the Tees, a river separating the counties of Durham and Yorkshire, and running through a fertile valley, from which the breed has extended both to the north and the south.

The *Old Tees-water* was a large tall sheep, of very uncouth form, having a coarse head, rounded haunches, and long and large limbs. The fleece was very long, though rather coarse and thin. These sheep fattened slowly, requiring very good pasture; but they possessed the quality of being very prolific, commonly yielding twins, and supplying them with an abundance of milk. This breed, in its pure state, has become altogether obsolete, having either been entirely supplanted by the New Leicester, or extensively and repeatedly crossed with it.

Other large breeds of sheep formerly existed in the midland counties, but most of them (though quite or nearly as ungainly in form) were of smaller size than the Tees-water. The *Warwickshire* ram is described by Mr. Marshall as having a large loose frame, heavy bone, long thick legs, with great splay feet; his chine, as well as his rump, sharp as a hatchet, and his skin rattling on his ribs. These, and similar breeds, have altogether disappeared in England.

The Bampton Nott.

This is a long-woolled breed of sheep found in the fertile valleys of Devonshire and Somersetshire, and called Bampton from a village of that name, on the borders of the two counties. They had white faces, long and heavy fleeces, coarse forms, thick skins, and weighed from 30 lbs. to 35 lbs. per quarter, at two years old. A smaller variety, having brown faces, crooked legs, and flat sides, were denominated the Southam Notts, and they weighed, at thirty months, 25 lbs. per quarter. The fleece was long and soft, weighing 9 lbs. or 10 lbs. Both these breeds fattened slowly, and were long in coming to maturity; but being extensively, though slowly, crossed with the New Leicester, their defects have in great measure been removed, and they now form a large and valuable breed of sheep; so much so, that a wether slaughtered in 1835 weighed no less than 70 lbs. per quarter.

These sheep, under the general designation of Devon Sheep, are met with in the shops of butchers

much further east than their native county. They supply the greatest proportion of large mutton killed in the southern part of Hampshire, and the wethers frequently average 40 lbs. per quarter.

The *Long-woolled Sheep of Ireland*, though very numerous, and occupying a large extent of level humid country well adapted for their support, were a sad ungainly sheep, inferior to the worst of English breeds, being, as Mr. Culley observed, deficient in nearly all the requisites a good sheep should possess. The introduction of the Leicester blood effected, however, a rapid and considerable improvement, and the present, though still capable of much improvement, are greatly superior to their progenitors in every respect.

The Cotswold Breed.

This is an ancient and celebrated breed, its wool being spoken of very favourably by many old writers. Cotswold signifies a sheep-fold and a naked hill. The Cotswold hills, the native tract of the breed, are of moderate elevation, possess a sweet herbage, and though formerly consisting mostly of bleak wastes, have been latterly much improved. Camden speaks of the breed as having fine and soft wool. Drayton writes of its fleeces as more abundant than those of Sarum and Leominster. Speed, writing two hundred years ago, speaks of the wool as similar to the Ryeland and rivalling that of Spain. Indeed, some imagine it was the origin of the Merino sheep, as in 1464 Edward IV. permitted a number to be exported to Spain, where

THE COTSWOLD BREED.

they greatly increased and spread. Spain, however, before this was celebrated for the fineness of its wool. Markham, in the time of Queen Elizabeth, speaks of the Cotswold as having long wool, and Mr. Marshall and other writers consider that they have always been a long-woolled breed. Mr. Low inclines to the opinion that the Cotswold were short-woolled, and supposes that the present race was introduced during the last century. It is difficult to reconcile these differences of opinion ; for my own part, I am disposed to think that the present are the ancestors of the old race : be this as it may, we have no evidence, either oral, written, or tra-

ditional, of the change having been made. The Cotswold is a large breed of sheep with a long and abundant fleece, and the ewes are very prolific and good nurses. Formerly they were bred only on the hills, and fattened in the valleys of the Severn and the Thames; but with the enclosure of the Cotswold hills, and the improvement of their cultivation, they have been reared and fattened in the same district. They have been extensively crossed with the Leicester sheep, by which their size and fleece have been somewhat diminished, but their carcasses considerably improved, and their maturity rendered earlier. The wethers are now sometimes fattened at 14 months, when they weigh from 15 lbs. to 24 lbs. per quarter, and at two years old increase to 20 lbs. or 30 lbs. The wool is strong, mellow, and of good colour, though rather coarse, six to eight inches in length, and from 7 lbs. to 8 lbs. the fleece. The superior hardihood of the improved Cotswold over the Leicester, and their adaptation to common treatment, together with the prolific nature of the ewes and their abundance of milk, have rendered them in many places rivals of the New Leicester, and have obtained for them of late years more attention to their selection and general treatment, under which management still further improvement appears very probable. They have also been used in crossing other breeds, and, as before noticed, have been mixed with the Hampshire Downs. It is, indeed, the improved Cotswold that, under the term New or Improved Oxfordshire Sheep, are so frequently the successful candidates

for prizes offered for the best long-woolled sheep at some of the principal agricultural meetings or shows in the kingdom. The quality of the mutton is considered superior to that of the Leicester, the tallow being less abundant with a larger development of muscle or flesh. We may, therefore, regard this breed as one of established reputation, and extending itself throughout every district of the kingdom.

SECTION X.

THE NEW LEICESTER.

THE Dishley, or New Leicester, which at the present day has altogether superseded its parent stock, so as to be generally denominated "*the Leicester*," is, perhaps, with reference to its origin, the most artificial breed of any, having been moulded, as it were, by the master-hand of Bakewell, obedient to certain wise principles which he believed to be correct, and which the experience of subsequent years has now fully corroborated. Mr. Bakewell considered that in the productive district in which he resided the carcase of the animal afforded the principal profit to the breeder, and, therefore, ought to have his principal attention. He, therefore, banished in great measure other considerations, and applied himself to the selection of sheep, for the purpose of breeding, having in the greatest degree the qualities which he approved; and it is still a matter of doubt whether he confined his selections to the

THE NEW LEICESTER SHEEP.

native breed of his county, or chose them indiscriminately wherever he could find the required qualifications. The old Leicester breed were large, coarse sheep, possessing an abundant fleece with a fair disposition to fatten. Mr. Bakewell found that by selecting smaller and more compact animals he produced an earlier maturity and a greater disposition to fatten, which more than compensated for the loss of weight in the fleece and the diminished size; and by systematically and unremittingly carrying out his principles, he at length produced an animal which surpassed all others in the qualities above mentioned, comprising, as Mr. Culley ob-

serves, in the same apparent dimensions greater weight than any other sheep, with an earlier maturity, and a greater propensity to fatten, a diminution in the proportion of offal, and the return of most money for the quantity of food consumed.

The actual sources from whence Mr. Bakewell derived his breed cannot be accurately ascertained. The Old Lincoln, the Teeswater, and the Warwickshire have each been named, and it has been stated that crosses with the Ryeland, the South Down, and other short-woolled breeds have also been employed. It is probable that Mr. Bakewell was not particular as to the source, so that he could obtain the desired qualifications. He himself was very uncommunicative on this point, and the knowledge of the origin of the breed perished with him. It is even unknown whether, and to what extent, he benefited by the previous improvements of others, though it is very reasonable to presume that he did so as much as possible. It is probable, however, that the foundation of his breed was the best existing specimens of the Old Leicester breed. This breed has been still further advanced; some of the evils which crept in with the earlier improvements, such as weakness of constitution, sterility, and inferiority of wool, have been, to a greater or less extent, amended; and at the present day the breed remains the most perfect of any as respects the carcase, and, in the opinion of its advocates, though disputed by others, the best adapted and most profitable for fertile pastures. And while there is no breed of long-wools but what has obtained some

improvement from a cross with it, the Leicester, as regards its peculiar qualities, has derived no advantage from a cross with others; but its unrivalled qualifications can only be retained by preserving the breed pure and untainted.

The various points of the Leicester sheep have been thus correctly described :—

“ The head should be hornless, long, small, tapering towards the muzzle, and projecting horizontally forwards; the eyes prominent, but with a quiet expression; the ears thin, rather long, and directed backwards; the neck full and broad at its base where it proceeds from the chest, but gradually tapering towards the head, and being particularly fine at the junction of the head and neck; the neck seeming to project straight from the chest, so that there is, with the slightest possible deviation, one continued horizontal line from the rump to the poll; the breast broad and full; the shoulders also broad and round, and no uneven or angular formation where the shoulders join either the neck or the back, particularly no rising of the withers, or hollow behind the situation of these bones; the arm fleshy through its whole extent, and even down to the knee; the bones of the legs small, standing wide apart, no looseness of skin about them, and comparatively bare of wool; the chest and barrel at once deep and round; the ribs forming a considerable arch from the spine, so as in some cases, and especially when the animal is in good condition, to make the apparent width of the chest even greater than the depth; the barrel ribbed well

home, no irregularity of line on the back or the belly, but on the sides, the carcase very gradually diminishing in width towards the rump; the quarters long and full, and, as with the fore-legs, the muscles extending down to the hock; the thighs also wide and full; the legs of a moderate length; the pelt also moderately thin, but soft and elastic, and covered with a good quantity of white wool, not so long as in some breeds, but considerably finer."

The various qualifications here mentioned were not obtained until great and long-continued attention had been paid to the peculiarities of individuals, adapting the ram to the ewe so as to correct the faults or deficiencies either may possess; and thus, by carefully and progressively getting rid of faults, gradually approaching to perfection, which, though it may be rarely or never reached, should yet be the constant aim of the breeder.

It was formerly the custom, as it is still in many places, for the sheep-breeder to set aside the most promising of his pur or tup lambs for the purpose of breeding; and this, with the occasional exchange of animals with other breeders (an exchange probably influenced and guided by caprice rather than by discretion), constituted the only sources of improvement or preservation possessed. Mr. Bakewell introduced a novel plan, which, although at first sight it may appear selfish, yet perhaps has served more to the improvement of stock than any other system yet invented. After he had established his own flock, and had fully tried and proved its supe-

rior qualifications, instead of selling his rams, he offered to let them at a certain price, and although the plan was much opposed and discountenanced at first, to his great loss and disappointment, yet it gradually got into use, although the prices he at first obtained were very insignificant, and particularly so compared to what he afterwards attained. The advantages of this plan must be self-evident. It enables the breeder who wishes to improve to do so at a moderate price compared to what it would cost to purchase his rams, and thus in the course of a few years perhaps to become a ram-breeder himself, whilst at the same time the larger remuneration it affords is a proper inducement to the owner of the ram to continue his plans of improvement, whilst it repays him for the outlay of money, and time, and trouble which he has already incurred. The difficulty and opposition the plan first met with, as well as its ultimate success, is well illustrated by contrasting the prices realized at different periods. In the year 1760 the first Dishley Ram was let for sixteen shillings the season, and it was not till twenty years afterwards that Bakewell received anything like a remunerating price. It was then only ten guineas, and it afterwards rapidly increased, till in 1786 he realized three hundred guineas for one ram, and three years afterwards he obtained no less than six thousand two hundred guineas, thus handsomely repaying and rewarding him for his long-continued and untiring exertions under difficulty and opposition, beneath which most men would have sunk and abandoned their pursuit as

hopeless. This system could not be carried on without rapidly extending the improved breed, and of course amending the flocks of breeders to a vast extent, and inducing others to seek a participation in the profits of the system. Accordingly its advocates and promoters formed themselves into a club, denominated the Dishley Society, with the object of extending their breed, preserving it pure, and benefiting and protecting themselves. This society was established by Mr. Bakewell, and the following laws were adopted, the purpose being in the first place to preserve the purity of the breed, and in the second to benefit the members:—

- 1st. No member shall hire or use a ram not belonging either to Mr. Bakewell or to one of the members of the society.
- 2nd. No member shall give his rams, at any season of the year, any other food than green vegetables, hay, and straw.
- 3rd. No member shall let more than thirty rams in one season.
- 4th. No member shall let a ram for less than ten guineas to any person, nor less than forty guineas to any person who lets rams.
- 5th. No one ram shall be let to serve the flocks of more than two persons.
- 6th. No member shall let a ram to any one who lets or sells his rams at fairs or markets.
- 7th. No member shall take in ewes to be served by more than one ram, at his own residence, in any one season, unless they belong to members

of the society; nor to be served by any ram he uses for his own flock, with the same exception.

8th. Mr. Bakewell engages not to let any ram for less than fifty guineas to any person residing within one hundred miles from Dishley.

9th. No member shall let a ram to any person residing within thirty miles of Leicester, and not being a member of the society, who shall have hired a ram of Mr. Bakewell during the preceding season.

10th. No member shall sell any ewes or rams of his own breed, to breed from, unless he sells his whole flock of sheep, except to members of the society.

11th. From the 1st to the 8th of June the members shall not show their rams, except to one another. They shall begin their general show on the 8th of June, and continue to show their rams till the 8th of July. From that day until the 8th of September they shall not show them to any one, but shall then open their show again, and continue it until the end of the season.

12th. On the 8th and 9th of June, although the rams may be shown, no ram shall be let or engaged to be let, nor shall the price which will be required for him be mentioned by any one.

13th. Every member refusing or neglecting to abide by the rules of the society, or withdrawing himself from it, shall no longer be considered a member. From that time he shall

not be permitted to hire any ram or share of a ram from any of its members, until re-admitted into the society at a general meeting.

It was by attention to these rules and the principles adopted by Mr. Bakewell that the Leicester sheep continued to improve, and to be introduced into one county after another, until they are now adopted in every grazing district in England, either as a pure breed or as a cross with others. Their merits are sufficiently tested by the fact that they almost invariably bear away the prizes given for long-woolled sheep at the shows of the Smithfield Club and the Royal Agricultural Society of England. They are unquestionably a more profitable sheep for rich pastures, as regards their feeding qualities, than any other: they come to maturity so much earlier; in this respect excelling even the South Downs, the wethers of the former being fat at twenty-two months, whilst the latter are usually unfit until they are a twelvemonth older. Since then a grazier can fatten two sheep on the same food that one formerly consumed, and in the same period of time: it cannot be doubted that such quick returns must prove the most advantageous system, and a preference will be given to the animal that possesses this earlier maturity. The dead weight of the Leicester sheep is greater in proportion to the live weight than in any other breed, the flesh and fat being accumulated more externally, and acquired in the greatest degree in the most profitable places, and the least in the coarse points.

The perfection to which this breed has now been

brought is owing to various other breeders, besides Mr. Bakewell; amongst whom may be mentioned Mr. Culley, as one of the first and most successful.

The disadvantages of the Leicester are, compared with many other breeds, a certain weakness of constitution, an inability to bear exposure to the weather, and a greater predisposition to inflammatory disease, to which may be added a want of prolificacy in the ewes, and an inferiority as nurses. These points, however, have been much improved since the time of Bakewell, and where the purity of the breed is not an object, they have been altogether avoided by crossing with those breeds excelling in the qualities in which the Leicester is deficient, such particularly as the Cotswold and the Bampton Notts.

The fleece of the Leicester averages about $7\frac{1}{2}$ lbs. in sheep sixteen months old, is soft, but somewhat inferior for combing purposes to that of the older races. The carcase, however, is the principal consideration, and the early maturity is such that the wethers are not unfrequently fattened at fifteen months, and at two years old will often weigh from 25 lbs. to 35 lbs. per quarter. The flesh too is accumulated most where it is most valuable, and the fat is distributed for the most part on and amongst the muscles, and less within the body and around the kidneys than other breeds. The weight of the hind and fore quarters also approximates much nearer than most other breeds.

These various advantages in a great measure counterbalance and indeed outweigh the defects of the

breed, and sufficiently account for the facts that in the course of fifty years it had either supplanted or greatly changed nearly every long-woolled breed in the country, that it had in numerous instances caused the substitution of long for short woolled sheep, and that it had added greatly to the value of the sheep-stock of this country both as regards the wool and the flesh. After producing these changes, intermixing with so many other breeds in so many various degrees, it still, in most respects, maintains its ground; but of late years the opinions of breeders have inclined towards producing a large animal as being attended with more profit, and thus the improved Cotswold, often denominated the new Oxfordshire, and some of the heavier kinds, are now successful rivals of the pure Dishley breed. The improved Leicester, however, still commands a large extent of the most fertile districts of England, and is also cultivated in Scotland with equal care and success. It is of course in both countries principally confined to the lowlands or land of pretty good quality; and the following account of the modes of management in Roxburghshire, on the borders of the Teviot and the Tweed, from the Journal of the Royal Agricultural Society of England, vol. i., may be taken as a fair sample of the system adopted in superior districts in either country, and a good example, as regards long-woolled sheep, to less improved localities.

After observing that in the district in question, amounting to about 42,000 acres, prior to the commencement of the present century the Cheviot were

almost the only sheep found, whilst at the present time the Dishley breed have with little exception the entire possession of the country, greatly exceeding their predecessors in numbers, but still more in weight, which is no less than double, he goes on to say:—"On nearly all farms of any considerable extent what is called a breeding-stock of these sheep is kept, and the system pursued is generally the following. From the ewes three successions of lambs are taken, the dams being sold off at the close of their third breeding season, or when four and a half years old. In general, the whole produce of these ewes is retained upon the farm on which they are bred, a proportion of the ewe-lambs, when gimmers, coming in to take the place of the old ewes sold in each year. The wedder-lambs, again, are disposed of as fat, many of them immediately after being deprived of the first fleece, and the remainder, after being fed on turnips, in the winter or spring of the second year. Not unfrequently, however, upon farms where a large proportion of turnips cannot be raised, the whole wedder-lambs, and sometimes part of the ewe-lambs, are disposed of at weaning-time; and those ewe-lambs kept beyond the number required to maintain the complement of the year are sold when gimmers, generally at about eighteen months old. These young sheep, being thus so early matured for the butcher, are maintained from their earliest time on full feed, it being a great object to prevent them losing any of the condition they generally possess when taken from the ewes. With this view, also,

they are early put upon turnips, as it is very desirable they should be well acquainted with this their essential means of support previous to any failure in the nutritious properties of the grass, or the occurrence of severe weather. When either of these events takes place, the turnip forms the chief or only source of their subsistence.

"To the young stock intended to be kept for breeding fewer turnips are commonly allowed, although they are seldom, during any part of the winter, entirely deprived of this useful assistance. The ewes, having at this season the range of the whole pastures, are only allowed auxiliary food during the severity of a storm and in hard winter weather, until towards the approach of the period of lambing, when a proportion of turnips becomes indispensable to maintain them in sufficient condition to bring them well through this critical and interesting season. In general, more sheep are fattened than are bred in the district.

"Exclusive of a considerable number of sheep that are brought into the district to be fed on turnips during the winter months, the number of Leicesters we think we may assume to be maintained now throughout the year cannot be less than 25,600. Of these somewhat more than the half, or 14,500, are disposed of annually, and the quantity of wool produced has been estimated at upwards of 5100 stone. Under the former system we may conclude that not quite 20,000 smaller sheep were maintained; and, allowing for a proportion being of a better description, it may fairly be estimated

there would not be greatly above a third sold in each year, or say 7000, of such comparative weight as to cause the produce in mutton certainly not to be fairly considered more than a fourth part of the result of the yield of the present time. In wool the deficiency would thus be equal to a half."

The system here detailed prevails with little difference throughout the midland districts of England, modified, of course, by the fact as to whether pasture or arable land is most abundant on any particular farm. The Leicester ewes, we have said, are but indifferent nurses; their milk is not sufficient to fat their lambs as in the South Down and most other breeds; consequently the lambs are nearly always kept on till of a more mature age, and many farmers throughout this district purchase Cheviot ewes and put them to the Leicester ram, and the former being good nurses, the lambs are very fine and fatten quickly.

The lambs of the pure Leicester are rarely shorn until the second year, when the fleece often weighs 8 lbs., and is very long in the staple, and, as teg-wool, is more valuable. The ewe fleeces are about 6 lbs., and those of the fat wethers, though shorn in May, average from 7 lbs. to 9 lbs.

PART II.—THE STRUCTURE AND ECONOMY OF THE SHEEP.

SECTION XI.

GENERAL VIEW OF THE STRUCTURE OF THE SHEEP.

THE body of the sheep resembles, in most respects, that of the ox; with a somewhat less degree of nervous energy it possesses a greater capability of enduring the extremes of cold and heat, and still stronger digestive organs. Much of the nervous energy is, indeed, expended on these parts, and a diminished degree is possessed by the organs of locomotion and sensation, in which respect both the ox and the sheep differ considerably from the horse.

The body of the sheep, in common with other animals, is composed of solids and fluids, the latter exceeding the former in weight in the proportion of six or eight to one. To the solids, however, is owing the organization of the frame, for they surround and contain the fluids. Late anatomists consider that animals are composed of three forms of tissues, which they have denominated the *fibrous*, the *lamellar*, and the *globular*. The two former are exemplified in the structure of the cellular substance, which composes the greatest proportion of the animal fabric: the fibrous is characteristic of the muscular and

ligamentous structures; the fibrous united with the granular is exhibited in the texture of the glands, and in the medullary substance of the nervous system; and the globular is shown in the composition of the chyle, the blood, and several of the secretions. These several textures being combined together in different proportions, we have the various organs of which the body is composed.

To give support to the animal frame, and afford fixed objects for the attachment of various parts, is the use of the *skeleton*, which is composed in the sheep of nearly two hundred bones of various sizes and shapes. These bones, in order to admit of motion, are connected one to another by means of strong bands called ligaments, the ends of the bones being constructed in various ways so as to admit of motion; in many we have the form of a hinge, in others that of a ball and socket. The motion of the limbs is effected by means of the *muscles* or flesh, which, although to a casual observer appearing as a homogeneous mass, is readily separable into a greater number of distinct bodies of various forms and sizes. These muscles have commonly two separate attachments, which are usually bones, and by contracting in length, they bring these points of attachment nearer to each other. Muscles are composed of a vast number of fibres, which, on being acted on by nervous influence, diminish in length and increase in bulk, and thereby approximate the different objects to which they are attached. They are usually fastened to bones by means of a strong white substance called *tendon*, which, however, possesses in

itself no power of contraction, but merely communicates the contractile force to the object to be acted on. Where the two objects of attachment are distant from each other, the greater portion of the distance is occupied by the tendons, the advantage of which is owing to their diminished size in proportion to their strength; thus we find the legs of sheep below the knee are light and slender, from the absence of muscular and the substitution of tendinous substance. The greater part of the muscles are voluntary, being under the control of the mind; but some are involuntary, such as the heart and the diaphragm.

Muscles are extensively supplied with vessels of various kinds, such as *arteries* for their nourishment, and *veins* for the return of the blood after this purpose is effected. They have likewise *nerves*, which not only furnish sensation, but also communicate to them the mandates of the will.

These nerves proceed either from the brain or spinal cord, which, therefore, may be considered as the fountain of sensation and the residence of the mind. And thus sensation is first sent from the extremities to the brain by the nerves, and then by another set of nerves the will is conveyed to the muscles.

The *brain* is a soft pulpy substance contained within the head, and the spinal cord is somewhat similar in structure, and extends from the brain to the tail, through a hole in the bones which form the spinal column. The body is divided into two principal cavities, the *chest* and the *abdomen*, and sepa-

rated by a muscular partition called the *diaphragm*. The former contains the *heart* and *lungs*, whose uses are principally to purify and distribute the blood by means of the *respiration* and the *circulation*; and the latter contains the *stomach* and *bowels*, in which the functions of *digestion* are carried on, besides several important glands, such as the *liver*, *kidney*, and *pancreas*, together with other supplementary parts. Both the small and large intestines are fastened to the spine by means of a strong membrane called the *mesentery*, which, besides veins and arteries, is furnished with a vast number of small vessels called *lacteals*. These *lacteals* open into the intestines, and there absorb the nutritious part of the food, which is a white milky fluid called the *chyle*, and convey it to a vessel running along the course of the spine, which empties itself near the heart into the circulating system. Thus by these means the blood becomes enriched with nutriment, and is thus enabled to supply the constant waste the system is continually undergoing.

The *blood* being furnished with nutriment requires to be purified before it is fit for circulation; for this purpose it passes into the right side of the heart, by the muscular contraction of which it is sent to the lungs, where it becomes exposed to the action of the atmosphere, by which it is changed from a dark to a light red colour, and being freed from impurities, it enters the left side of the heart, and from thence is sent, by means of the arteries, to all parts of the body, supplying every part with nourishment, and furnishing the various glands of the body, not only

with their own proper nourishment, but with material for the secretion of their peculiar fluids. Thus the salivary glands separate the saliva from the blood; the pancreas, a juice somewhat similar; the testicles, the semen; and the kidneys, the urine. Each gland separates its peculiar fluid and no other. The urine being secreted by the *kidneys* is conveyed by means of two small but long tubes into the bladder, whence it is excreted from the body.

The *liver* is nourished by the arteries, but separates the bile from the dark impure blood, which is conveyed to it by a large vein. The contents of the bowels are passed onwards by the influence of their peculiar action, and having had the nutritious part extracted are excreted from the body, generally in a solid form.

The *cellular membrane* is a very elastic substance, and enters largely into the composition of the body: it connects the various glands together, forms frequently a covering for the muscles as well as for various vessels, and exists in the form of cells, which have communication with each other.

The *adipose membrane* is found in various parts of the body, and, indeed, secretes the fat, which is deposited in a liquid form, and in small circumscribed bags. The *fat* thus contained often performs the important office of affording a cushion for parts that would otherwise be exposed to injury; thus we find that the socket of the eye is abundantly furnished with this material.

There are two other important membranes which are extensively found in animal bodies: they are

the *serous* and the *mucous* membranes. Whenever an internal part has an external opening, we find that it is furnished with a mucous membrane which secretes mucus for its protection; but when the cavity has no external opening, then it is lined with a serous membrane which secretes a thin watery fluid to lubricate the parts, and preserve them from injury by friction. Thus from the entrance of the mouth and nostrils to the anus, throughout the whole internal surface of the bowels, a mucous membrane exists, by which the fluid is secreted, the nature of which gives a name to the membrane, and which protects it from injury either by the external air, or by the contents of the bowels. In like manner we find the bladder and urinary organs similarly lined.

On the other hand, the cavity of the chest and the abdomen, with their contents, as well as the internal surface of blood-vessels, are furnished with a *serous* membrane, which secretes a watery vapour. These different membranes are very frequently the seat of disease, and are subject to severe and dangerous inflammation. The admirable manner in which the various organs are packed away in their proper cavities is worthy of particular notice. The lungs and the heart are so adapted to the shape of the chest, that there is at no time any vacant spot; and the more numerous contents of the abdomen are so disposed, that while each has sufficient freedom for the proper performance of its functions, yet the whole are packed away with the most economical care: there is no void whatever to be found.

SECTION XII.

SKELETON OR BONY STRUCTURE OF THE SHEEP.

THE skeleton of animal bodies is formed of bone, a substance possessing firmness and stability for the attachment of muscles, the protection of the vital organs, and the support of the softer parts. It is composed of animal matter and earthy salts; the former consisting of cartilage, gelatine, and fat or marrow, and the latter of phosphate of lime in considerable proportion, a lesser quantity of carbonate of lime, and a small portion of other salts. The cartilage of bones is formed before the earthy matter, and constitutes, in fact, the nidus in which the latter is deposited. Bones can be freed from their earthy portion by immersion in an acid, by which process the gelatine is also dissolved, and pure cartilage is left, which is elastic, but retains the original figure of the bone. On the other hand, bones, by exposure to a great heat, are deprived of the animal substance, and the earthy part remains.

The use of the *marrow* is more particularly to prevent the too great dryness and brittleness of bones. To the animal portion of their composition they are, therefore, indebted for their shape and what degree of elasticity they possess, and from the earthy portion they derive the important purposes of strength and stability. Thus are these different elements combined together, and by an union of their different principles form a substance admirably adapted for affording full scope for the play of the

various organs of life, protecting at the same time the vital parts from external injury, admitting and assisting the powers of locomotion, and, in fine, forming a secure fabric for the beautiful building of animal frames.

Every bone is covered by a membrane called the *periosteum*, which also lines the internal cavities and secretes the marrow; its use is to circumscribe the form of bones and protect them by its tenseness, as well as to afford the medium whereby they are furnished with their vessels. The shape of particular bones intimately corresponds to the purpose for which they are intended; where for the office of protection we find them flat, and where for the purpose of motion, long and cylindrical, as in the extremities.

The Bones of the Head.

In the construction of the skull the most perfect mechanism is displayed. The first object to be obtained is the protection of the brain from the accidents to which, from the peculiarities of animals, it is mostly exposed. For this purpose the skull consists of two tables or plates; the outer thick and tough, the inner hard and brittle: the former, by yielding in a measure to resistance, diminishes concussion, whilst the latter, by its hardness, prevents sharp bodies from penetrating to the brain. Now, if these two plates were reversed, the brittle would not only be in great danger of fracture, but would also vibrate considerably; and the injurious effect of this vibration may well be conceived when we are told that, even with the present wise precaution,

it often occasions in the human subject, greater mischief than the most serious fractures.

There is a remarkable difference in the appearance of the head in the horned and the polled sheep; the former have a more pugnacious, and it may be a more sensible, appearance, owing to the elevation and projection of the upper part of the head. This, however, is in appearance only, for the prominence of the head is not formed by any increase in the brain, but is owing to the considerable space which exists between the two tables of the skull, the outer being half an inch or upwards from the inner. This separation accomplishes two purposes, one being the additional security it affords to the brain by the interposition of this vacant space, and the other the greater root or basis it affords to the horns. And when we consider that horned sheep are generally more pugnacious than others, and that they have not only the will, but the power, of butting each other with great force, the additional security is not without use. In fact the brain is seated so much beneath and behind the forehead, that very little of the shock can be communicated to it. This circumstance too operates in affording protection to the polled sheep as well. Between the skull and the brain are interposed several membranes, which also assist materially in preventing vibration, like a piece of parchment on the inside of a rummer glass. The skull in quadrupeds is composed of upwards of thirty bones, which are connected together by dove-tailed sutures. It used to be considered that the object of this extensive division

of the bones was the convenience of ossification, which always commences at the centre; but a more extended view has discovered other wise purposes; for not only is the dove-tailed suture the strongest mode of union, but it is also the best adapted for securing the brain from injury, as it yields considerably to the impression received, and thus wards off both concussion and vibration. There is an exception, however, to this usual connexion in the temporal bones which form the sides of the cranial cavity, and which are connected to the other bones by what is termed the squamous suture—one bone, in fact, simply overlaps another. This union is inferior in strength to the former; but nature has here another office to perform, and the reason of this exception will at once be comprehended on examining the skull. If a considerable blow be received on the upper portion of the arch, its sides are the parts most likely to give way; and to guard against this consequence, the under bone overlaps the upper, and thus acts like the tie-beam of an arch in keeping the parts together. This dove-tailed suture does not connect the bones of the inner table; for, though a carpenter might find this mode of union serviceable in joining the sides of a wooden box, it would by no means be found applicable in connecting together brittle substances, as it would be extremely liable to chip off at the edges.

The *cranial* cavity, or that part which contains the brain, is not more than a third the size of the other parts of the skull, the remaining portions being devoted to mastication and smelling.

There are no less than nine bones which enter into the composition of the cranium. The two *frontal* bones form the anterior part usually called the forehead; but the internal plate of these bones separates and recedes from the external plate so as to form a cavity between them, which is called the frontal sinus, and is divided by a septum or ridge of bone between them. The internal plate forms a covering for the anterior lobe of the cerebrum. In horned sheep the separation of the plates of the frontal bones is considerably greater than in others. The horns proceed on each side from the frontal bone, and seem, as it were, prolongations of the bone; for although externally we find the structure of horn, internally we have bone, and between this horn and bone we find the vascular structure by which both are secreted. In many animals the age can be judged of by the horn, which each year presents an additional ring round its base. In the cow this is not an uncertain guide, and is owing to the irregular growth of the horn at different periods of the year, growing probably with greater force in the spring than in the winter; but in the sheep, although the same causes obtain, yet it cannot be depended on with accuracy. At the root of the horn we observe a cavity which communicates with the frontal sinus.

The two *parietal* bones are proportionately shorter than in the horse, and are situated at the upper and middle parts of the cranium, and cover the middle lobes of the cerebrum, to which their internal part closely corresponds.

The *occipital*, a single bone of great strength, is found at the back and base of the cranium. Its internal surface covers the cerebellum, and on a strong process at the base the *medulla oblongata* rests. The external surface of this bone is extremely irregular. At its lower and back part is the occipital hole, through which the spinal cord, as well as some nerves and an artery, make their exit from the brain. On each side of this hole the bone is smooth and rounded for the purpose of articulating with the *atlas*, the first bone of the neck; besides which there are several curious processes for the attachment of muscles.

The *temporal* bones forming the sides of the cranium are composed of two parts, the squamous and the petrous. Though in man these pieces are united, yet in the sheep they are distinct from each other. The squamous portion is externally a convex plate with a hooked projection arising from it; this process assists in forming the *zygomatic* arch. The squamous portion affords at the posterior part a shallow cavity for the articulation of the lower jaw-bone. This *glenoid* cavity, as it is termed, is much deeper in carnivorous animals, which require to open their jaws more extensively: and an inspection of this portion of the skeleton alone will enable the comparative anatomist to decide to what order the animal might have belonged. In herbivorous races a grinding lateral motion of the jaws only is required, and accordingly the articulation is wide and shallow. The *zygomatic* arch, too, is much more arched in the carnivora, in order to afford more

room for the development of the temporal muscle, which governs the jaw, than is required for the more moderate exertions of herbivorous animals. The petrous portion of the temporal bone, so called from its rocky nature, is apparently a solid convex figure. It contains, however, the organ of hearing, and has on its internal surface orifices for the passage of the auditory nerve, and on the external we find a larger orifice for the passage of sound. The internal structure of this bone is as beautiful as it is curious, possessing vestibules and canals for the ramification of the nerve, and a singular cavity having a communication with the mouth, in which are discovered four diminutive bones, with their corresponding muscles, which serve the purpose of propagating and modifying the sound.

The inferior and middle parts of the cranium are formed principally by the *sphenoid*, a bone which somewhat resembles a bird in flight, having a body and four processes, two of which are called the wings and two the legs. This bone supports the middle lobes of the cerebrum, and presents holes and depressions for the passage of nerves. The cranial cavity is separated from the nasal by the *ethmoid* bone, which also somewhat resembles a bird in flight, but without legs, and is situated in front of the bone last described. It supports the anterior lobes of the cerebrum, and has holes for the exit of the olfactory nerves; and on its internal and inferior surface it forms cavities called the ethmoidal sinuses, which are separated by a long septum from each other, and are perforated by a vast number of

small holes for the passage of the olfactory nerves to the nasal cavities. It is this thin part of the bone which is penetrated in the operation of wiring giddy sheep. Such is a brief description of the various bones which form the cranium and envelop the brain, and which are connected together and arranged on principles more durable and economical than can be displayed by the noblest specimens of mechanical skill.

The *face* occupies a larger portion of the head than the cranium, but is less in proportion than the ox and the horse, and particularly the latter animal. Its upper part is formed by the lower portion of the *frontal bones*, which are considerably longer in the sheep than in the horse, descending much lower down, and in fact forming the roof of a great portion of the nasal cavity. Another peculiarity in these bones is, that whereas in the horse they descend in a straight direction, in the sheep, just above the orbit, they form almost a right angle.

The *nasal* bones are much less developed in the sheep than in the horse.

The *superior maxillary* bones, though relatively smaller than in the horse, yet form a great portion of the face, extending the whole length of the molar teeth, for which these bones form suitable sockets, and laterally from the molar teeth to the frontal and nasal bones. Within the cavity of the mouth these bones form the roof of the palate, being united together by a suture. This portion of these bones is wider though shorter than in the horse, so that the molar teeth are farther apart, and the mouth thus

gains in width what it loses in length. Thus situated, these bones have three surfaces—the facial, the nasal, and the palatine. At the superior part of their palatine surface we find what are called the *palate bones*, which, in the horse, chiefly consist of narrow curved bones, forming together the semi-oval border dividing the cavity of the mouth from that of the nostril, and serving for the attachment of the soft palate. In the sheep, however, these bones extend further down into the mouth, and form, indeed, a portion of the palate, which, in the horse, is formed of the maxillary. The border, too, instead of being nearly semi-circular, is almost conical, from being so very narrow. The consequence of this structure is, that the upper entrance to the cavity of the nostrils is much less in proportion than in the horse, and the soft palate is less developed, so as not to close the cavity of the mouth. The nature of the sheep corresponds with this structure: not being an animal of speed, it does not require to inhale so much atmospheric air; and the purposes of rumination require the food to ascend from the stomach to the mouth, which it could not do if the soft palate were developed, as in the horse, where it closes the back part of the mouth, except when food is passing from the mouth towards the stomach.

The *anterior* or *inferior maxillary* bones, which are wanting in the human subject, are attached above to the superior maxillary bones, and thence descending and enlarging, in the horse form the sockets of the upper incisor teeth, but in the sheep and other ruminating animals not possessing these teeth, they

become smaller instead of larger as they descend, merely forming the basis of the hard pad which meets the under incisor teeth.

The *molar* bones, comparatively larger in the sheep than in the horse, and irregular in shape, are situated on the sides of the face above the large maxillary, and partly within and partly without the orbit of which they form the lower part.

The *lachrymal* bones, so called because the lachrymal duct for the conveyance of the superfluous tears to the nostrils passes through them, is situated about half within and half without the orbit, the latter portion being between the molar and frontal bones—a different arrangement from that which obtains in the horse. The orbit or bony socket which contains the eye is thus composed of a variety of bones.

There is a long but very thin bone called the *vomer*, situated at the floor of the nostrils, and running throughout their length, and having a groove into which is imbedded the cartilaginous substance which divides the nostrils into two equal cavities.

The *posterior maxillary* or lower jaw bone is formed of two halves, united at the inferior part by cartilage in the young subject and by bone in the adult. This united portion forms the sockets for the eight incisor teeth, which sockets, however, are by no means so deep or so strong in proportion as in the horse, and thus it is common for sheep to lose or break these teeth soon after they are fully developed. From the place of junction the lower jaw bones separate and gradually recede from each other, becoming wider and deeper, and forming strong and secure

sockets for the molar teeth, after which the bones become thinner, turn upwards, and terminate in two extremities, one rounded, which, with the temporal bone above, forms the maxillary joint, which is secured from displacement by a hook-like projection which is the other termination of the lower jaw bone.

The bones which we have mentioned as composing the face are none of them solid in their structure, but most of them hollow, and thus various cavities or sinuses are formed which are called after the boxes in which they appear. Accordingly we have the *frontal*, the *maxillary*, the *sphenoidal*, the *ethmoidal*, and the *palatine*. The frontal are the largest and most important, particularly in the horned sheep, in which they are partly divided into cells and communicate with other sinuses immediately surrounding the horn. These singular cavities are not found in the young subject, but are gradually formed as the size of the head increases. They thus serve the important purpose of increasing the size of the head without adding to its weight.

The Bones of the Body.

The *neck* is formed by seven bones, which, with the exception of the two first, are very much alike. The first is connected with the occipital, or bone of the skull, with which it forms a joint possessing much motion in a vertical direction. In the human subject it is termed the *atlas*, from its supporting the head. It forms a joint behind with the *dentata*, as the second bone is termed, from its having in the front part a process like a tooth, which, however,

affords the head considerable lateral motion. All the bones of the neck are extremely irregular in shape; they all possess a large hole through the centre for the passage of the spinal marrow, and small ones at the sides for the exit of nerves and arteries. They have also projections on each side and above for the attachment of muscles, and each one forms a joint both before and behind which affords that great flexibility to the neck which most animals possess.

The *back* or *chine* is composed of separate bones called *vertebræ*, of which there are thirteen belonging to the back alone. They all possess, like those of the neck, a hole through the centre for the passage of the spinal cord, as well as a small one at the side for the exit of the nerves. The superior projections or processes are much higher than those of the neck, but considerably shorter than we find in the horse; and thus we have high withers in this animal and low ones in the sheep, and they are also shorter in the improved breeds than in the wilder races of sheep, a channel between the shoulders and along the back being justly regarded as a sign of a disposition to fatten. These processes serve for the attachment of muscles, as well as of a strong elastic substance which is attached to all the bones of the neck as well as to the occiput and serves to support the head, and thus relieves the muscles to a great extent.

The *ribs* are attached to the *vertebræ* by means of a joint—one rib is joined to two *vertebræ*, and *vice versâ*, thus affording the ribs a certain extent of motion. There are thirteen ribs on each side, eight

true and five false; the former are attached to the sternum or breast-bone, and the latter are merely joined to the former at their lower parts, which is formed of cartilage. The ribs should spring from the back bone as horizontally as possible, as thereby the rotundity of the frame is increased.

The *loins* are formed by five bones, which partly resemble the bones of the back; but instead of ribs springing from the sides there are fixed bony processes, several inches in length, which afford a protection or roof for the abdomen. These processes, in a well-formed sheep, should be long and horizontal.

After the loins the spine continues in the *sacrum*, which, in the lamb, is composed of separate pieces, but is consolidated into one bone in the sheep. This bone is perforated for the passage of the spinal cord, which, however, diminishes in size, and terminates at the end of the sacrum in several nerves which run to the tail. The bones of the tail are numerous, but are not perforated.

The Bones of the Fore Extremities.

The joints or articulations of the extremities are the same in number as those of the horse, but the limbs, on reaching the fetlock joint, become divided, and the four bones situated below the fetlock are consequently double. The *scapula* or blade-bone is similar in shape to that of the horse, having a spine or ridge down its middle for the attachment of muscles, but in sheep the bone is not so long in proportion to its width. It is attached to the ribs by muscular substance, by means of which the body

is suspended or hung like a carriage between the two fore-legs, and concussion is thereby materially diminished. From the more circular shape of the ribs the shoulder-blades are attached to them with much less mechanical advantage as far as speed is concerned. They are placed wider apart, both above and below, but particularly at their lower parts, so that the limbs spread open, at a greater angle, much more like a pair of compasses than do those of the horse, and even the ox, thus giving the sheep that rolling walk so peculiar to the animal and so disadvantageous with regard to speed.

The *humerus*, or shoulder-bone, strong and cylindrical, forms with the blade above the shoulder-joint, the action of which, with that of the elbow-joint below, is more limited than that of the horse.

The *radius* or bone of the fore-arm is comparatively shorter than that of the horse, and we find that it is always long in animals of speed and short where speed is not required: this bone is also strong and cylindrical.

The *ulna*, or bone which forms the elbow, does not support the weight, but serves for the attachment of the powerful muscles so conspicuous in a shoulder of mutton and which are generally divided by the first cut. For this purpose it is attached to the radius, and rises above the elbow-joint, the back of which it forms, but does not reach the knee. This joint, the *carpus*, is composed of seven bones, arranged in two rows, the upper of which articulates with the radius, and the lower with the cannon or metacarpus.

The *metacarpus* or shank much resembles that of the horse, until it reaches the fetlock where it is to some little extent cloven, so as to articulate with the double arrangement of the bones below. Instead of the two small metacarpal or splent-bones that we find in the horse, there is merely one, and that of small extent and use.

The small bones situated at the back of the fetlock, called the *sesamoids*, and which serve as levers for the attachment of ligaments and the action of the sinews, are double those of the horse, being four in number.

The bones below the fetlock, viz., the large pastern or *os suffraginis*, the small pastern or *os coronæ*, the *os pedis* or coffin-bone, and the *navicular bone*, are all double, and, like the same parts in the ox, somewhat resemble in shape the bones of the horse sawn in two.

All these joints have less extent of motion than we find in the horse, and the bones therefore present a more upright appearance. In the horse and in the ox an angle is formed at the fetlock with various degrees of obliquity, and the three bones below pass down in a straight line though in an oblique direction. In the sheep, however, there is a different conformation; the large pastern-bone passes down in an oblique forward course, as in the ox, but the small pastern descends in a perpendicular direction so as to form an angle with the bone above almost as great as, though precisely opposite to, that of the fetlock-joint. This it is which gives the more upright appearance to these

parts in sheep, though the cause is not externally visible, and it throws the centre of gravity on the back part of the coffin-bone and on the horny heels of the foot. The small pastern bone is relatively longer than in the horse, and there is more motion in the pastern-joint, though much less in the fetlock; indeed the action of the former is quite as much as the latter.

Though not belonging to the skeleton, this will yet be the most convenient situation for noticing the structure of the other parts of

The Foot.

The bones dividing at the fetlock, the tendons likewise, both before and behind, become divisible, and there are consequently two flexor tendons or benders and two extensors to each division. The former, as in the horse, consists of a perforans and a perforatus, the latter forming a sheath for the perforans just above the fetlock, in which it continues to the small pastern-bone, into which the perforatus is inserted. The perforans then glides over the back of the navicular bone, which forms a sort of pulley, and is inserted into the lower and back part of the coffin or foot-bone. Of the extensors one is inserted into the upper and front part of the small pastern and the other is continued to the coffin-bone. These bones are connected together by capsular and other ligaments, and there is one very strong one in particular, which passes from the lower, inner, and anterior part of the large pastern in a perpendicular direction to the inner and back part of the coffin-

bone. To the lower and back part of the coffin-bone is attached an elastic pad of a fibrous and ligamentous nature, which receives the greater part of the superincumbent weight, and by yielding to it takes off the jar. It rests on the horny heels of the foot, which thus supports the principal part of the animal's weight, very little resting on the anterior portion of the foot. It is thus very evident that there is a considerable difference both in the structure and functions of the various parts of the foot in the sheep and in the horse. In the latter we find that the crust or wall of the foot is connected to the coffin-bone by means of a double arrangement of a vast number of horny and fibrous plates, the former connected with the inside of the crust, and the latter with the coffin-bone. These laminae, as they are called, are dove-tailed together, and thus the connection is rendered of great strength; and the vast extent of surface thus afforded, and the elasticity of the parts, obviate concussion, and afford, indeed, an admirable spring and a principal cause of the elastic tread of the animal. In the ox we observe an arrangement somewhat similar, though the laminae are much less developed; but in the sheep, so little weight being supported by the crust and front part of the foot, such a complicated structure is not required, consequently we find no laminae, but the crust is connected to the bone by a simple vascular structure, which secretes the principal part of the crust, in the same manner as the sole or lower part of the foot is formed. The coronary substance which in the horse secretes the

greater portion of the crust is wanting in the sheep. The sole of the foot is secreted as in the horse by the vascular membrane above, and there is a greater thickness of this dense substance interposed between the coffin-bone and the sole of the foot.

We can thus understand from this description how it is that the horn of the foot is so speedily restored in sheep when the hoof is lost in foot-rot or the epidemic by the matter insinuating itself between the horn and the bone: it has not, as in the horse, to wait for the slow and tedious growth of the horn from the coronet downwards. The inside of the crust is considerably thinner and weaker than the outside, particularly towards the back part, where foot-rot most frequently commences.

The horny part of the foot may be considered to consist of the crust, or wall, and the sole. The former surrounds the outside of the foot and turns inwards at the toe, and passes in a straight direction to the heels. It is thickest at the toe and thinnest on the inside. The sole is situated at the bottom of the foot between the outer and inner part of the crust, but it is difficult to say where the crust ends or the sole begins, the structure of each being so much alike. The heels are formed both by the crust and the sole, though principally by the former, which turns inward and joins the inner crust, and it here becomes more elastic and spongy, resembling very much the frog of the horse. This part supports the principal part of the weight, and suffers most when sheep are driven much on the hard road.

We have yet to notice a very singular peculiarity in the foot of the sheep, which is the

Biflex Canal.

The large pastern-bones are connected together by ligamentous substance, and it is not till the pastern-joint that the foot becomes exteriorly disunited. At the situation of this joint in front we can detect a small opening sufficiently large to admit a small probe; this is the entrance of the canal just spoken of, which presently enlarges, and passes first downwards, and then winds round in a semicircular direction, ending in a sort of *cul de sac*. On cutting into this canal it appears to be a duplication of the skin; its internal surface is lined with hair, and there is found a considerable quantity of detached hair mixed with a waxy secretion in the canal, secreted by various glands. This hair is no doubt excreted from the internal surface, and which, from the smallness of the opening, cannot escape, or rather is detained for a useful purpose. The use of this canal thus stuffed with hair is self-evident. We have mentioned the great motion possessed by this pastern-joint, which is so great as to threaten to chafe the skin by the friction of one side against the other. It is to prevent or ward off this friction that these biflex canals, or rather hair-stuffed cushions, are provided; and they act, indeed, precisely like the fenders which are lowered down the side of a vessel to prevent it coming into contact with another. The ox possesses little or no motion in this joint, and consequently requires no such pro-

vision to prevent friction. The benevolence of Nature is strikingly exemplified by this simple structure.

This part occasionally suffers from the insinuation of dirt and sand, and is subject to inflammation and ulceration, which sometimes prove very troublesome.

The Hind Extremities.

The *haunch* is formed by three bones in the young subject, but these bones soon become consolidated into one, and is called the pelvis or basin, within which is situated the bladder and part of the organs of generation. Viewing this bone from below it appears pretty nearly circular within, but externally the circle is broken by various irregular processes, two of which project upwards on each side the spine which lies between; then two others extend backwards below the tail and are called the haunch bones, and two project laterally and are termed the hips. These bones project but little in a well-formed sheep, being altogether clothed with flesh and fat.

The bones of the *pelvis* extend downwards and backwards from the spine, and towards the inferior part form on each side a deep cap or socket, into which fits the upper part of the thigh bone, which is formed like a ball so as to fit into the socket. The thigh bone, or *femur*, extends forward, and is relatively longer in the sheep than in the horse. It is the flesh surrounding this bone which composes the bulk of a leg of mutton. Its lower part forms with the *tibia* below the *stifle* joint, which is singular from having two cartilaginous bodies within it; and

is protected in front by a small bone called the *patella* or knee-pan, which bone becomes a sort of pulley, receiving the insertions of the very strong muscles above, and is attached below to the tibia by strong ligaments.

The *tibia* or leg bone runs backwards from the stifle, and is not so long in proportion as in the horse; it corresponds to the radius in the fore extremity, and it forms the upper part of the *hock* joint.

This joint is composed of six bones arranged in rows so as to form three articulations, but motion is confined to that formed by the astragalus or knuckle bone and the tibia; the other bones serve as cushions to diminish concussion, with the exception of the *os calcis*, situated at the back, which acts as a lever receiving the insertions of the powerful muscles which straighten the hock. This bone is much shorter than it is in the horse, speed not being required. The bones below the hock correspond with those found below the knee in the fore extremity.

SECTION XIII.

THE MUSCLES OR FLESH.

ALTHOUGH the shape of the body depends materially on that of the skeleton, so that if the latter is anywise faulty the former will not be perfect, yet there is a very great contrast between the appearance of the skeleton and that of the body itself, of which it forms a part. Whilst the former is angular

and extremely irregular, the latter is round and smooth, so that though the good shape of the animal depends on the skeleton, yet it requires the eye of the anatomist to detect, in the conformation of the latter, the good points which in the body itself are readily observed.

The bulk of the body is formed of flesh or muscles; their principal use, when living, is to effect the movement of the limbs; when dead, to afford nutriment to man. The motion of the body is occasioned by the contraction of the muscles, which, being fastened to different bones, draw these bones towards each other, and thus the limbs are bent whenever particular muscles shorten or contract. These muscles, which bend the limbs, are called the flexors, whilst an opposite set which straighten them again, are denominated the extensors; the latter, however, are mostly smaller and weaker than the former. The size and shape of muscles are very diversified, some being so minute as to be scarcely visible, as those within the ear; whilst others, namely, those of the loins and buttocks, are large enough to afford a feast for several persons; some muscles are thin and spread out like a fan, others are thick and bulky, and whilst some are extremely short, others are cylindrical and of great length. Muscles are furnished with nerves both of motion and sensation: the former convey the mandates of the will, and are thus the cause of motion; the latter communicate the sense of feeling, and are the medium both of pleasure and pain; but there is considerably less degree of feeling possessed by the flesh than by the skin. The muscles are

composed of fibres, and are bound together by cellular membrane, and they are, in sheep, mostly clothed with fat, which also is deposited amongst the fibres. It is the capability of containing this fat, and the abundance and laxity of the membrane containing it, which distinguishes a sheep of a good breed from one of a bad breed, and gives to the former that softness and elasticity or resiliency which is felt on handling it, even when poor. The former sheep, too, possesses large muscles, particularly at those parts where the meat is most esteemed. Thus the loins of a good sheep are broad, and abundantly covered with flesh and fat, and so likewise are the buttocks and the shoulders, whilst the head and neck are small. The muscles that are in most constant use are more interlaced with tendinous fibre, and consequently are much less tender, as meat, than those which are less actively engaged. The muscles of the lower part of the legs between the knees and hocks and the joints above, as well as those of the neck and head, are instances of the former kind; whilst the muscles of the loins, and more particularly those within the pelvis, are examples of the latter, and afford the most tender meat in the body.

SECTION XIV.

THE BRAIN AND NERVES.

THE brain, the seat of the mind, and the fountain of sensation, is a soft body, situated in a cavity of the

skull called the cranium. In man it occupies by far the greater portion of the skull; but, in the sheep, from its much smaller size, and from the large space devoted to the face, its cavity, the cranium, is much the smaller part. It is closely invested by a membrane called the *pia mater*, whilst the cranium is lined by a firm, strong membrane called the *dura mater*. Between these there is another delicate membrane called the *tunica arachnoides*. The *dura mater*, by its duplications, forms several processes and sinuses; the former, by descending between its divisions, serve to secure the brain in its position, and the latter act as reservoirs for the venous blood, thus preventing the brain from being injured by any temporary impediment in its passage.

The *pia mater* closely embraces the brain, and dips into its convolutions. The brain consists of three parts—the *cerebrum*, the *cerebellum*, and the *medulla oblongata*.

The *cerebrum* is considerably the largest, and is divided into two hemispheres, each of which closely corresponds with its fellow.

On cutting into the cerebrum, we find that it consists of two portions—the medullary or white, and the grey or cortical part. The latter is mostly situated towards the surface, and the former towards the centre, but both appear to run into each other. Within the hemispheres there appear to be various cavities, canals, and membranes, which, in this work, it is unnecessary to describe.

The *cerebellum*, or little brain, is situated behind the

cerebrum, than which it is considerably smaller. It appears to consist of medullary and cortical substance mingled together.

The *medulla oblongata*, the smallest division, is situated at the base of the brain. It is medullary in its structure, and gives origin to the greater part of the cranial nerves. It is by far the most sensible part of the brain, for whilst portions of the cerebrum have been cut away in some animals without giving any apparent pain, the least pressure on the medulla is productive of injury or death. The brain is largely supplied by means of the carotid arteries with blood, which is returned to the heart by the jugular veins.

The *spinal marrow* may be considered as the continuation of the brain, running from the medulla oblongata, throughout the spinal canal, to the tail. It is enveloped by the same membranes as the brain, and continues to the sacrum, where it ends in several nervous cords. Its form is cylindrical, and it has been found to consist of six bands, in the centre of which there is a sort of canal. The nerves arising from the brain and spinal cord, in sheep, are forty pair, ten of which proceed from the brain and the remainder from the cord, and are therefore called the spinal nerves.

On examining a nerve, we find that it consists of a vast number of white filaments, each having its particular covering, and yet compactly bound together and invested by membrane.

Of the *cranial nerves* the first pair is the *olfactory*, the nerve of smelling, pulpy in its structure, and the

largest in the body. It rises from the cerebrum, passes out of the cranium, and is spread out on the membrane lining the nostrils.

The second pair, the *optic*, rise from the cerebrum, but, before they pass out of the skull, join together and decussate, the right nerve going to the left eye, and *vice versâ*. Each takes an oblique course, pierces the outer coats of the eye, and is spread out in the form of the retina, and thus conveys the impressions of objects to the brain. The sense of hearing is supplied by a soft nerve, the *auditory*, which enters an orifice in the temporal bone, where the seat of hearing is contained. The sense of taste is supplied by the fifth, which is a compound nerve, conveying both sensation and motion. The other cranial nerves convey sensation and motion to the various parts of the head; but there is one nerve which demands more particular notice. This is the *par vagum*, or *pneumo-gastric* of the French. It rises from the brain, passes down the neck close to the carotid artery, and distributes branches to the pharynx, larynx, and œsophagus, heart, lungs, stomach, and liver. If divided on both sides in the living animal, death immediately ensues. Its importance may thus be readily conceived; it is intimately connected with life itself, giving to the heart and stomach their power of motion, independent of the will. The *spinal* are compound nerves; having a double function, and a twofold origin, they convey both sensation and motion. They arise by numerous filaments from both the upper and under surface of the spinal cord. The filaments coalesce, and, before they emerge

from the *dura mater*, join together, previous to which the upper nerve forms a sort of knot called a ganglion. This latter is the nerve of sensation, the other the nerve of motion; and thus, though united together, the filaments are yet distinct, and a part is endowed mostly with sensation, or with motion, according as the filaments of the former or the latter predominate.

There is yet another nerve which requires to be noticed as being of great importance. It has been called the *ganglial*, from the nature of its apparent origin, and *sympathetic*, from its functions, but more properly the *great organic nerve*. It appears to arise from a small red ganglion or knot at the base of the brain, and just previous to the commencement of the spinal cord. It appears to have intimate communication with all the other nerves, and distributes branches to all the glands, arteries, and absorbents of the system—the heart, lungs, and digestive organs; it is the soul, as it were, of the organic system, influencing the functions of nutrition and secretion.

We have before observed that the brain of the sheep is small as compared with the size of the body. In fact, the whole nervous system is, as it were, feebly developed, and this peculiarity has a considerable influence over the diseases of the animal, and accounts for the fact that in the greater number debility quickly supervenes, and in many the animal speedily sinks.

SECTION XV.

THE ORGANS OF MASTICATION, &c.

THE mouth of the sheep and its contents are admirably adapted for their natural functions. The sheep is intended by Nature to thrive on scanty pasture and to take a considerable bite, and much closer to the ground than the ox. The lips are therefore protected by hair, which defends them from injury from the ground; they approach somewhat to a point, and the upper lip is cleft, which suits it well for the purpose.

The *incisor* teeth or *nippers*, like those of the ox, are situated only on the lower jaw, the upper having instead a firm fibrous pad, sufficiently strong to retain the food between it and the teeth. The incisor teeth are eight in number in a perfect mouth, but the lamb, when dropped, has only two, and sometimes none visible, but in a few weeks the others make their appearance: these, however, are but temporary teeth, smaller than the permanent ones, and adapted to the size of the mouth. By two years old the central teeth drop out, and are succeeded by two larger and stronger teeth—the permanent. These teeth are formed within the sockets in the bone some time previous to their appearance, and pressing against the root of the temporary incisors, gradually induce their absorption. By three years old the two next teeth have

undergone the same change, and are succeeded the following year by those adjoining, so that by five years the whole eight teeth are thus renewed, and the sheep is then said to be full-mouthed. Although the order and period of these changes are sufficiently regular to ensure them as a sufficient criterion for a general rule, yet it is not without exception, as sometimes the permanent teeth appear much earlier, and at others their appearance has been protracted to a later period.

After the sheep becomes full-mouthed, there is no method of judging of the age with accuracy, but the teeth rarely remain perfect long, particularly if fed on turnips; some of them are lost or become broken, and the sheep is then said to be broken-mouthed.

The incisor teeth are somewhat conical in shape, the point being inserted in deep sockets; the portion visible is covered by a very hard transparent material called the enamel, and it is brought to a sharp edge at the anterior part, so that it cuts very much like a chisel. Compared with those of the horse the incisor teeth appear somewhat loose, but this is rather an advantage than otherwise. The food, being embraced between the incisor teeth and the pad above, is torn asunder by the nodding action of the head, and the food is conveyed by the tongue to the molars or grinders. When turnips, however, form the diet, the food is scooped out, as it were, by the teeth alone, and they are consequently sooner worn out and broken; but even otherwise, this effect generally follows a few years after the mouth

becomes perfect. The *molar* teeth are six in number, on each side of each jaw; they are firmly planted in deep sockets, and their faces are covered with enamel. These faces are very irregular, but admirably adapted for tearing and grinding the tough and unyielding grass; and they are also secured in their positions by means of the gums, which, in common with the other parts of the mouth, are covered with a mucous membrane, and in some parts a firm dense material is interposed between the mucous membrane and the bone.

The sides of the mouth are formed by the *cheeks*, which are composed of skin and membrane sufficiently loose to admit the limited motion of the jaws; they are connected with the powerful masseter muscles, which form the greater part of the bulk of the face, and principally occasion the grinding motion of the jaws. In the skull we find the lower jaw considerably narrower than the upper, but in the living animal this does not appear, the space being occupied by the masseter muscles.

The *lips* greatly assist in gathering together the food, and are largely furnished with the nerves of feeling; they are composed of skin, muscle, and membrane, and possess the powers of motion and sensation in a high degree.

The mouth is abundantly supplied with a watery fluid called *saliva*, particularly during mastication, when it is secreted and poured in in considerable quantities. This fluid is principally secreted by three pairs of glands, the largest of which are the *parotid*, situated at the root of each ear, and from

which two ducts on each side convey the fluid and unite in one previous to entering the mouth. The *submaxillary* glands are situated under the jaws, and their ducts terminate in tubular eminences near the frænum or bridle of the tongue. The other salivary glands are the *sublingual*, situated under the tongue: its ducts terminate rather higher up than those last described. Besides these there are other small glands connected with the check and the bottom of the mouth; and one peculiar to sheep situated behind the lower jaw, and extending towards the eye, and communicating with the mouth by means of a duct opening near the last molar tooth. There is thus from these various sources an abundant supply of saliva more copious than most animals possess, and which is rendered necessary by the hard and woody nature of the food consumed in a natural state. And it has been found that a large supply passes into the stomach independent of mastication, and is there required for softening and macerating the dry food; for, when deprived of this supply by an experiment, it has been found that the contents of the paunch remained dry.

The mouth is principally filled with the *tongue*, which is muscular in its structure and very flexible, being, indeed, a principal agent in mastication and swallowing. It is larger at the upper part than towards its tip, and is confined posteriorly to the muscles between the branches of the lower jaw, by a sort of fleshy bridle, and above to a singularly shaped bone called the *os hyoides*. It possesses both the power of feeling and tasting, and for this pur-

pose is well supplied with two descriptions of nerves, and is covered by both cutis and cuticle.

There is a marked distinction in the back part of the mouth between the horse and the sheep and other ruminating animals. In the former the *velum palati*, or soft palate, a fleshy substance attached to the semicircular border of the palatine bones, is sufficiently long to fall down on the back of the tongue, and thus effectually to close the back part of the mouth, except when food is passing, and prevent either the air or food returning through the mouth. Thus a horse can breathe through his nostrils only, and whenever food is vomited it passes in the same direction. The sheep being a ruminating animal, such a structure would be inapplicable, as it would prevent the food being returned to the mouth; consequently the soft palate is considerably shorter and narrower. It does not reach the tongue, and the diminished extent of the palatine bones, to which it is attached, as before observed, also limits its action.

The *larynx*, the *pharynx*, and the *tongue* are connected together and to the upper jaw-bone, or rather to the bones of the head, by means of the *os hyoides*, so called from its resemblance to a spur. The semicircular part of the spur embraces, in a manner, the larynx, whilst the shaft is intimately connected with the root of the tongue. The *os hyoides* has two long appendages, which articulate with the temporal bone. Thus situated and constituted, this bone gives great support to the soft parts connected with it, whilst, at the same time, it freely admits

their extensive mobility. In the act of swallowing, therefore, this bone is greatly called into action.

Adjoining the pharynx are two large spaces called the *Eustachian cavities*, situated one on each side, and communicating by means of a tube with the internal ear.

SECTION XVI.

THE ORGANS OF DIGESTION.

THE digestive organs of the sheep, like those of graminivorous animals in general, are extensive and complicated, having a far more difficult and elaborate office to perform than those of carnivorous animals. The food of the latter is taken, as it were, ready prepared; its constituents closely resemble those of the blood itself, and, of course, it is exactly similar to the flesh it is intended to nourish. A small quantity of food only is required to be taken, and nearly the whole of this food is employed in nourishing the system or supplying its waste, the *fæces* being exceedingly scanty. The digestive organs of herbivorous animals have a much more onerous task to accomplish; the food is in a more crude or less prepared state; the nutritious portions bear a much smaller proportion to the whole mass, and, accordingly, the food taken is of very considerable bulk. To meet these peculiarities the digestive organs are much more spacious and more complicated than those of the carnivora; means are afforded

for detaining the food until the nutriment can be properly extracted, a larger amount of chemical and vital force is employed, and a more abundant supply of nervous energy afforded. The horse, in a state of nature, is almost continually feeding; he bites short and well triturates his food, but is almost constantly so engaged; and though, in a domesticated state, the food is not so abundant nor so frequently taken, it is in a much more nutritious form. Corresponding to these natural habits, we find that though the alimentary canal altogether is of enormous bulk, the stomach itself is single and of moderate size. Digestion is almost constantly going on; food is passing out of one orifice of the stomach as it comes in at the other, and the supply of bile is constant, there being no reservoir for it—no gall-bladder. The smallness of the stomach is compensated for by the prodigious bulk of the large intestines. Thus the horse, though an animal that requires a large quantity of food, is yet able to perform great physical exertions, and can make them after a full meal more readily than any other animal.

The ox, the sheep, and other ruminating animals, have, like the horse, very extensive digestive organs, but very differently arranged. The horse, in a state of nature, will rarely get fat; the ox and the sheep, in good pasture, will almost invariably do so, and will otherwise greatly increase in size; the digestive organs are, therefore, more bulky than in the horse, and much more complicated. The intestines are of greater length, though not so large,

and instead of one stomach there are no less than four.

The natural food of the sheep is embraced by the joint apposition of the incisor teeth of the under jaw and the cartilaginous pad on the upper, and is separated mainly by the action of the muscles of the head and neck, giving the head an almost constant motion, which may be readily observed when the animal is feeding on pasture. The grass is torn off, not bitten; but when turnips form the food the teeth are more actively employed, and consequently are more worn and become sooner lost. The food being moderately chewed by the molar teeth or grinders, to which it is conveyed by the tongue, is by the same organ carried to the back of the mouth, and being softened by the saliva and thereby mixed with atmospheric air, enters a fleshy bag called the *pharynx* or gullet.

This *pharynx* is lined by the same membrane as the mouth, and is surrounded by, and, in fact, composed of various muscles, which contracting force the food forwards into a long tube called the *œsophagus*, which leads to the stomach. The *pharynx* is situated immediately above the *larynx* or cartilaginous box which forms the entrance to the windpipe, and the food in entering the gullet passes over the entrance to the *larynx*, which it is prevented from entering by a triangular lid termed the *epiglottis*, which in the act of swallowing shuts down on the *larynx*, but otherwise leaves it open for the purpose of respiration. The food after leaving the gullet enters the *œsophagus*, a very long tube lined internally by a white

insensible membrane, and externally by muscular coats, which, by contracting, force the food onwards to the stomach. The œsophagus passes down the neck towards its left side and somewhat above the wind-pipe, with which it enters the chest between the two first ribs; it then takes an upward or ascending course through the cavity of the chest over the base of the heart, passes the midriff or diaphragm, and then descending soon afterwards reaches the stomachs. On entering the chest it somewhat diminishes in size, but again expands in the abdomen. It does not actually terminate in either of the stomachs, but in what is called the *œsophagean canal*, which is about four inches and a half in extent, and is formed above by a continuation of the œsophagus, and below by a sort of muscular pillars—duplications of the upper portions of the first and second stomachs. Thus the œsophagean canal is a sort of lobby or passage having entrances to the different stomachs, and which, with the exception of the second and fourth, are the only entrances these stomachs possess. By the annexed cut it will be seen that the food duct commences at the entrance to the rumen, and for the space of three inches its floor consists of muscular pillars or lips, formed by the upper part of the second stomach, the entrance to which is between these lips. The pillars then continue within the cavity of the third stomach for the space of an inch and a half to the entrance of the fourth stomach, the cavity of the third being principally situated above, forming the roof of the œsophagean canal. The entrance, however, to the third commences before the opening

INTERNAL VIEW OF THE STOMACHS.

DESCRIPTION OF THE CUT.

- A. The lower part of the *œsophagus*, showing its external coat.
- B. Its internal coat at its termination.
- C. The upper compartment of the *rumen*, or first stomach, showing its internal coat.
- D. The strong muscular band which divides the lower from the upper compartment.
- E. The lower compartment of the *rumen*.
- F. Another muscular band.
- G G. The external coat of the *rumen*.
- H. The entrance to the *rumen* cut open, and its opposite part reflected back, so as to exhibit an internal view of the second stomach.
- I. The external coat of the *reticulum*, or second stomach.
- J J J J. The muscular pillars forming the floor of the *œsophagean canal* when close, but now spread open to show the second stomach.
- K K. An internal view of the *reticulum*, or second stomach, showing its peculiar honeycomb structure.
- L L. The continuation of the *œsophagean canal* at the entrance to the third stomach.
- M M. An internal view of the *masculus*, or third stomach, showing its peculiar folds or plaits.
- N N. The fleshy lips, which act as valves to guard the entrance between them to the fourth stomach.
- O. The termination of the *œsophagean canal*.
- P P. The external coat of the *abomasum*, or fourth stomach.
- Q Q. The internal coat of the *abomasum*, or fourth stomach, showing its folds.
Both these coats are displayed by slitting open the stomach and then pinning the duplications together, at its upper part.
- R R. The valve formed by puckering of the internal coat, and guarding the entrance into the small intestines.
- S. The internal coat of the small intestines.

into the second stomach ceases. The entrance to the fourth stomach is two inches and a half in extent, and is formed by duplications of the mucous and muscular coats of this viscus, which meet so as to close the entrance when either the will of the animal or the necessity of nature requires.

The usual course of the food is into the *rumen* or *first stomach*, whose entrance is close to the termination of the *œsophagus* and the entrance of the canal. This stomach is of enormous extent, occupying, indeed, when full, nearly three-fourths of the abdomen. It lies towards the left side extending to the flank, and by a sort of muscular band it is partially

divided into two principal compartments. It is lined externally by the peritoneal membrane, in common with the other contents of the abdomen, and internally by an insensible membrane, called the cuticular, between which there are two other coats—the mucous, which secretes the fluid found in the stomach, and external to this the muscular coat, which is formed of two orders of fibres running in opposite directions. Its interior aspect presents a number of pouches or compartments, which are formed by muscular bands thrown across from one part to another; and the surface presents an innumerable number of papillæ or eminences, not sharp, but blunt-pointed, which are formed by the mucous coat and merely covered by the cuticular. These papillæ are coarser in the lower compartment of the viscus than in the upper. We have said the rumen consists of two compartments, but with greater propriety it may be stated that there are three, a smaller one being situated immediately below the termination of the œsophagus and adjoining the second stomach. The use of these partial divisions is very evident. They relieve one portion of the stomach from sustaining the whole of the weight of the food, and they afford a sort of steps or resting-places for the food that has undergone maceration, the upper and smaller compartment being that into which the food is raised just previous to being ruminated. The rumen is partly attached to the second stomach, but only communicates with it through the common opening into the œsophagean canal.

The second stomach is called the *reticulum*; its size is considerably less than the rumen, but it possesses much strength in its coats, and its muscular fibres are more developed. It is globular in shape and somewhat larger than the manipulus, and is familiar to us in *tripe*, not only from its cellular structure, but from its being thicker than the others. Its internal aspect is very singular, having a vast number, indeed several hundred, of shallow cells somewhat like a honeycomb. These cells are much smaller at the part of the viscus nearest the entrance, and gradually increase in size from this point. The sides of these cells consist of ridges formed by the mucous and cuticular coats, and smaller ridges are also observed running across within the cells. Most of them are pentagonal, but many have six sides, and on their surface we observe an immense number of sharp-pointed papillæ much smaller in size though sharper than those of the rumen, and which secrete a mucous fluid. This viscus has the same coats as the rumen, but the muscular coat has two layers of strong fibres arranged both transversely and longitudinally. The opening into this stomach is of some extent compared to its size; the duplications or lips which form it are indeed the floor of the greater portion of the œsophagean canal. Though in the ordinary state the roof or upper part of the reticulum is the floor of the œsophagean canal, yet if air is pumped into the œsophagus so as to distend the stomachs, the situation of the reticulum will become reversed, rising up towards the œsophagus; and thus if this viscus is distended in hoove, as

from its free communication with the rumen it probably is, it must press upon the diaphragm with very considerable force, greater in proportion even than the rumen itself. The contents of this stomach are more liquid than those of the others.

Somewhat before the end of the entrance of the second, the canal terminates, as it were, in the third stomach, the *manipulus* or *manifolds*, so called from its curious internal structure, which is formed by a great number of plaits or folds arranged longitudinally in a direction from the entrance of the stomach; so that although it is not large, externally not exceeding the reticulum, its internal surface is increased in more than a tenfold degree. These plaits are very curiously arranged, being in the form of seven or eight groups of six leaves, each leaf dissimilar in length, the longest extending almost from the upper to the lower part of the stomach. These leaves are studded with numerous small papillæ, much harder than those of the reticulum, and some on the edges of the plaits of the shape of a bent cone, thus , the point directed towards the entrance.

It has been found in certain cows that would never retain their food, but were continually scouring, that these plaits were unusually short.

The manipulus has but one opening, but this opening is in direct communication with both the canal and the fourth stomach, as may be seen in the sketch, page 156. The plaits are studded with numerous minute papillæ, somewhat similar to those found in the reticulum. The manipulus possesses

four coats like the others, and its external appearance is globular. Its contents are generally found of a much harder consistence than those of the other stomachs.

This stomach, when full, is found above the œsophagean canal, forming, indeed, a portion of its roof, and its longest leaves fall down, as it were, almost into that canal.

The *abomasum*, as the fourth stomach is called, is, in fact, the true stomach, being that which secretes the gastric juice by which the food is converted into chyme. It is this peculiar acid which gives it the power of coagulating milk, and in calves it is particularly employed for this purpose in the manufacture of cheese, under the term rennet.

Externally this organ is somewhat conical in shape, its apex being the part which joins the intestines. It possesses three coats, like the other stomachs; but its internal surface is very different, being smooth and shining, and of a pale red colour. Its mucous membrane is, indeed, very vascular, and this secretes the gastric juice. The internal surface is greatly increased, and exceeds the external, by being, in the form of plaits, arranged longitudinally, but very different from those found in the *manipulus*. The entrance to this stomach (its *cardiac* opening) is close to the entrance to the *manipulus*; it is arranged somewhat in a crescentic form, and is situated at one extremity of the base, whilst the *pyloric* opening, leading into the small intestines, is, as before observed, situated at the apex. Having thus described the situation and appearance of the

stomachs, an external view of which may be seen at page 166, we must return to the consideration of the course of the food through them.

The situation, the structure, and the size of the rumen point it out as the first and general receptacle for the food, which receives in the mouth only sufficient mastication to enable the animal to swallow it. It is then received by the rumen, and morsel after morsel is taken until this viscus is comparatively full. The animal then feels some repletion, and rumination usually takes place, the animal generally preferring a recumbent posture. It has been shown, however, that it is not the food just taken, but that which has been swallowed some twelve or sixteen hours previously, that undergoes the ruminating process. The food, indeed, is turned and shifted about the stomach by its muscular action, and well mixed with the fluid secreted by its internal surface: it, of course, enters at first the superior compartment, from which it passes to the inferior, and again enters the former division ere rumination takes place. A tolerably full stomach is necessary for the act; for it has been found in sheep that had fasted for several days that a tolerable portion of food still remained in the rumen. Before rumination can take place it is evident that the food must rise to the upper part of the viscus and enter the œsophagean canal. What, then, is its direction? The liquid portion passes on in the course of the canal; but it is contended by some physiologists that the second stomach, the reticulum, is the active agent in rumination, and that the food enters it

previous to its being returned to the mouth, and they are supported in this opinion by the muscular strength possessed by this viscus. In opposition to this opinion it may be urged that it requires but little more force to raise the food to the root of the œsophagus than to the entrance of the reticulum, and also, that the contents of the second stomach are of a more fluid nature than those of the first. It is not to be supposed that all the food taken is again ruminated; it is only the hard indigestible portion that undergoes the process. Rumination is assisted by the pressure of the abdominal muscles and the diaphragm, and the larger and more distended the stomachs the more likely they are to receive assistance from these aids. Keeping these facts in view, we are inclined to believe that both the first and second stomach may have equal power in the process of rumination. In accordance with this idea we must suppose that a mass of food is raised from the rumen into the œsophagean canal, that the hardest and driest portion is selected by the root of the œsophagus, and that the other part passes onwards, and whilst some portion may reach the third, the great part will fall, as it were, through the trap-door into the second stomach, there to undergo a further macerating or digesting process. When this viscus is moderately full it will contract on its contents, and first squeeze out the fluid portion, which will, of course, pass onwards into the third and fourth stomachs, whilst the solid part will be embraced by the œsophagus and returned to the mouth.

It is evident that the functions of the œsophagus are much more onerous than in non-ruminating animals, and accordingly it is furnished with more muscular power; the lower portion particularly is surrounded with spiral muscles, by which the selected pellet is first sent upwards.

It is not unlikely that some portion of the food may be submitted two or more times to the process of rumination.

It is probable that the most liquid portion of the food at once enters the fourth stomach, and that of a harder nature the maniplus. The singular construction of this viscus evidently shows that it must effect an important office, and it has been found that in animals which through life have never thriven well, notwithstanding that they have consumed a larger quantity of food than other beasts, the maniplus has been imperfectly formed, the plaits being short, so as to afford considerably less surface than usual. The use of this stomach, therefore, is to detain the food, to press it between its folds, and to soften it by the secretion afforded by its extensive surface, and thus to prepare it for the action of the gastric juice in the fourth stomach, to which organ we now trace it.

In the young animal living entirely on its mother's milk, the fourth is the only stomach employed; it is, therefore, then fully developed, whilst the others are small and imperfectly formed. The milk contains the elements of nutrition in a much more perfect state than it exists in vegetable food. It requires but a little separation in order to fit it for nutrition. As

the young animal gradually becomes inured to other food, the other stomachs become more developed. By the time the food reaches the *abomasum* it is in a macerated pulpy state, and fit to be exposed to the powerful solvent action of the gastric juice. This fluid is secreted in abundance by the mucous coat of the fourth stomach. It is a peculiar fluid, acid in its nature, and so powerful a solvent that it has been known after death to dissolve a portion of the coats of the stomach itself. It has in its composition hydrochloric acid, and its action on the food is of a chemical nature, converting it into *chyme* and rendering it into a fit state for the other digestive processes. The food being thus dissolved passes through the pyloric opening into the small intestines; this orifice has a valve-like construction (see p. 156), admitting the food to pass in one direction only and then not until it has been sufficiently acted on by the gastric juice.

The small intestines are of considerable length in the sheep, being upwards of sixty feet. In the human subject it is customary to divide them into three portions, and they are called the *duodenum*, the *jejunum*, and the *ileum*. These distinctions are arbitrary even in man, but still more so in the sheep, and, in fact, cannot be properly applied. The first portion of these intestines (the duodenum in man) differs much from the rest. It lies comparatively loose, and on opening it we observe a yellow substance, which is, in fact, the bile, which enters by a duct or very small tube some eighteen inches from the stomach, and at nearly the same place another

EXTERNAL VIEW OF THE STOMACHS AND INTESTINES
 Spread apart and arranged according to the following scale, so as to show their
 actual and relative size.

1 foot.

DESCRIPTION OF THE CUT.

A A. The *œsophagus*.

BBBB. The *rumen*, or first stomach, showing its compartments.

C. The *reticulum*, or second stomach.

D. The *omasum*, or third stomach.

E. The *abomasum*, or fourth or true stomach.

F. The commencement of the small intestines at the pyloric orifice of the stomach.

G. The situation where the biliary duct empties its contents into the duodenum.

HHH. The small intestines freed from the mesentery, and arranged evenly, so as to show their length.

I. The termination of the small and beginning of the large intestines, guarded by a valve.

JJ. The *colon*, or first large intestine.

K. The blind extremity of the colon, by some termed the *cæcum*.

L. The *rectum*, or straight gut.

fluid flows in from the pancreas or sweetbread. These fluids, it may be supposed, exercise an important office in the process of digestion, and the early portion of the small guts is the situation where the admixture takes place.

The *liver* is a bulky organ whose size, general appearance, and shape must be familiar to most people. Its weight in sheep is about one-fiftieth that of the carcass, and its specific gravity is somewhat greater than water. It is partially separated into divisions or lobes, and is principally situated towards the right side. Its office is to separate the bile from the venous blood—that which has circulated through a great portion of the body and is on its way to the lungs to be re-purified. It is called a gland, and is, in fact, a fine sieve or filter, having the power of separating a peculiar substance from the blood and no other. It is supplied with arterial blood for its own nourishment, but by means of a large vein called the *vena porta* it is furnished with venous blood for the exercise of

its functions. The bile being thus separated is then conveyed into a reservoir attached to the liver and called the gall-bladder, from which the gall-duct rises, and enters the intestine about eighteen inches from the stomach. Ruminating animals, in common with man and the carnivora, are furnished with a gall-bladder, whilst horses and the other solid ungulous animals do not possess them; the reason being that in the latter the digestive process is continually going on, and therefore a constant supply of bile is essential, while in the former the food is either taken in distinct meals, as in man and the carnivora, or otherwise the ruminating process is carried on and renewed at different periods, as in sheep and cattle—in either case requiring large and copious supplies of bile to complete the process of digestion. It must be evident from the existence of the gall-bladder in some species of animals and its absence in others that the bile must perform an important part in the digestive process. One of its functions is to neutralise the acidity which the food or *chyme* has acquired in the stomach by means of the gastric juice, and thus prepare it for the separation of the chyle which may be seen on the surface of the food. For this purpose it is largely supplied with an alkaline fluid, which unites chemically with the acid of the chyme. The quantity of bile secreted by the sheep in 24 hours is very considerable, probably from 3 lbs. to 5 lbs.; but we are not to suppose that its sole use is that above stated, for it has been proved that the bile does not pass away with the excrements, but is again taken into the system

to perform an important office to be noticed when we speak of the circulation. Thus the liver separates that which would be detrimental to the blood, and it supplies what is wanted for digestion as well as for another important process in respiration.

Besides the bile the duodenum receives a copious supply of fluid of a thin watery nature from the pancreas. This fluid closely resembles the saliva, and its principal use appears to be to liquefy the contents of the intestines.

The remaining part of the small intestines understood under the terms *jejunum* and *ileum* are confined to, and connected with, the spine by means of a thin transparent membrane called the mesentery, which not only supports the intestines, but prevents their entanglement, and serves as the vehicle by means of which the arteries, veins, nerves, and absorbent vessels are transmitted to and from the bowels. Amongst these there are some very minute, though very numerous vessels, called the lacteals, whose office it is to convey the chyle, a white milky liquid resembling albumen, from the intestines to a duct termed the *thoracic*, which passes along the spine and terminates in a large vein just previous to its arrival at the heart.

The composition of the chyle is very similar to the blood, differing from it in little more than the absence of its colouring principles. The lacteals, of course, open into the inner coat of the intestines, and the greater portion of the chyle is taken from the food in the small intestines and in the earliest portion of them in the greatest degree. The small intestines

are remarkably long in the sheep, exceeding, indeed, sixty feet, and this great length renders them capable of containing much more than the large guts.

In man, the large intestines are distinguished as the *cæcum*, the *colon*, and the *rectum*; in the horse, these divisions likewise obtain, and with much more propriety than the artificial distinctions of the small guts. The *cæcum* and the *colon* in the horse commence almost close to each other, but the former is a blind gut, having but one entrance. The sheep, however, can scarcely be said to possess a *cæcum*, unless we term the blind portion of the *colon* by that name; for the fact is, the small intestines terminate in the large at a right angle with them (see I. in cut p. 166), and the blind portion extends about a foot in one direction from this angle and maintains its size for the space of two feet.

The termination of the small intestines in the large deserves particular notice. The internal membrane of the former projects into the latter so as to form a sort of valve, which, admitting the *faeces* to pass forwards, effectually prevents their passing backwards, and thus, too, prevents the effects of clysters operating beyond the large intestines. The diameter of the *colon* is about treble that of the small intestines, but this increased size only reaches the extent of three feet, when the intestine gradually diminishes to about the size of the small guts, and so continues for about nine feet, when it enlarges about a foot prior to its termination. This latter portion may be termed the *rectum* without impropriety.

Soon after the large intestines become narrow, the fæces gradually become hard, and acquire the form of small black balls, in which state they are dropped.

The chyle, we have observed, is principally absorbed from that portion of the small intestines termed the ileum; there is little or none remaining by the time the fæces reach the large intestines, but the fluid absorbed from these guts is principally of a watery nature.

SECTION XVII.

THE URINARY AND GENERATIVE ORGANS.

THE urine is separated from the arterial blood by means of the *kidneys*, which are two large glands shaped like a bean, situated within the abdomen, but attached firmly to the loins. These glands are largely supplied with blood by important arteries; and the urine being separated as by a filter enters two long white ducts termed the *ureters*, one of which rises from the pelvis or central notch of each kidney, and passes on to the bladder, whose coats are pierced in an oblique direction (which, forming a sort of valve, prevents the urine returning) not very far from its extremity or fundus.*

* The urine of the sheep is much less copious than that of the cow, and, though less abounding in substances containing nitrogen, possesses

The *bladder* is situated partly in the pelvis and partly in the abdomen, the latter part being comparatively free, whilst the former is closely attached to the pelvis. The shape of the bladder is too well known to need description. It becomes smaller as it approaches its posterior part, where it contracts and forms the neck just prior to its opening into a canal called the urethra. The bladder, although apparently so thin, yet has three coats, the middle one of which is muscular and possesses the power of contracting so as to expel the whole of its contents when required, and the opening is usually kept closed by a sphincter or circular muscle, which relaxes when the bladder is being emptied. The urethra in the ewe is very short, a few inches only in length, and it is guarded by muscles which are employed both in expelling the urine and in the act of procreation.

In the ram the urethra is of considerably greater length, extending the whole length of the penis; a larger proportion of salts. The following is an analysis of 100·000 parts by weight:—

Water	96·000
Urea, along with some albumen and colouring matter	2·800
Salts of potash, soda, lime, and magnesia, with traces of silica, alumina, iron, and manganese .	1·200
	<hr/>
	100·000

This gives 4 per cent. more water than the urine of cows, than which it is less fertilising to the soil, if the latter is properly prepared; but the dung of sheep is much more nutritious than that of cows, and the urine likewise, when dropped on pasture land, is more serviceable, in consequence of the small quantity deposited at a time, and the less proportion of caustic ammonia contained, so that it does not render the herbage rank, as is the well-known effect of the fresh urine from cows.

it forms an acute angle at the perineum, just under the anus. The *penis* is a muscular organ, having a very curious structure, which enables it to receive at times a considerably increased quantity of blood, which causes the erection of the organ and fits it for the purpose of generation. Its usual state, however, is flaccid, when its use is confined to the ejection of the urine.

The *vagina* and *uterus*, or womb or lamb-bag, lies between the rectum above and the bladder below, and though much within the pelvis in their ordinary state, yet when pregnant they rise into the abdomen to a great extent. The *vagina*, which commences a few inches within the body, is a cylindrical cavity several inches in length, and opens into the uterus by a round opening called the mouth of the womb, which is naturally open, but becomes closed after impregnation. Its shape corresponds with the extremity of the penis, and these parts come into contact in the act of coition. The womb consists of a body and two branches or horns. It has the same number of coats as the bladder, but they are much stouter and more so than those of the *vagina*. Attached to the extremity of each horn by a membranous substance are two red bodies called the ovaries, each of which consists of a number of ova or eggs, the germs of the offspring, one of which on being impregnated escapes into the uterus, and thus, in the course of time, becomes a young animal; sometimes, indeed, two or even three ova may be impregnated, and twins or triplets are produced.

The *testicles*, or stones, as they are commonly

termed, are two oval glands situated in the scrotum, a sort of bag formed by the skin and two membranes within, which are so disposed as to form two separate cavities, each containing a testicle. The testicles are first formed in the abdomen of the foetus, and each possesses a covering closely attached to the gland. They escape from the abdomen through the openings called the abdominal rings and take with them portions of the peritoneum, the membrane which lines the abdomen and its contents; thus it is that they possess two coats besides the skin. The abdominal rings remain open afterwards, contrary to what takes place in the human subject, so that a fluid can be injected from the scrotum into the abdomen, and thus it is that sometimes after the operation of castration inflammation takes place and spreads upwards into the belly and destroys the lamb. In those cases where portions of the intestines are found in the scrotum they escape from the abdomen together with the testicle, and the case is denominated congenital hernia. The testicles are also each connected with the belly by means of the spermatic cord, which consists of a long slender muscle, nerves, veins, arteries, and a strong hollow tube called the spermatic duct. It is the latter which conveys the seminal fluid secreted by the singular structure of the testicle into the urethra, where, after mixing with other secretions from some small glands, it is forcibly ejected by the muscles of the penis in the act of copulation.

The testicles are very large in proportion to the size of the animal, and are in keeping with the

powerful seminal powers possessed by the ram, and which enable him when full grown to serve properly eighty ewes or upwards.

SECTION XVIII.

THE CONTENTS OF THE CHEST.

THE *mouth* in the horse is almost entirely devoted to the office of mastication. It is separated from the cavity of the nostrils by a loose fleshy membrane called the *velum palati*, which is confined to the bone above by a semicircular border, and falls downwards and backwards so as to prevent, in a natural state, any communication between the windpipe and the mouth. The sheep likewise possesses this *velum palati*, but it is not so long, and therefore permits this animal to respire through the mouth as well as the nostrils. The importance of this construction is seen in the process of rumination, and also accounts for the horse vomiting through the nostrils, on those few occasions when this animal has been known to vomit. The nostrils, however, are the principal channel through which the air passes to and from the lungs. Their entrance is comparatively small and confined; the sheep does not require so extensive a supply of air as other animals that are called upon to make considerable exertions. The cavity of the nostrils is divided into two compartments by a thick cartilaginous substance, termed by anatomists

the *septum nasi*, fixed to the nasal in front, and behind to the maxillary bones. This cartilage, as well as the other parts of the nostrils, is lined by a fine delicate membrane which secretes a mucus for its protection. It is indeed an inflammation of this membrane which constitutes a catarrh or cold, and an increase of its natural mucous secretion is the discharge from the nose which is visible in this disease. This membrane is called the *Schneiderian*, from the name of its discoverer, as well as the *pituitary*, and it is endowed with a high degree of sensibility, which it derives from an abundant supply of sensitive nerves; it is also the principal seat of the sense of smelling, and for this purpose the nerve devoted to this function is spread out on its surface. This membrane also covers four curious bones, thin and gauze-like in their structure, and rolled up like a turban, so that they are termed turbinated, and attached to the chambers of the nostrils. These greatly extend the surface on which the nerve of smell is diffused, and consequently increases the function of this sense, which sheep enjoy in a very high degree. The nostrils at the upper and back part terminate in a cartilaginous box called the *larynx*, which is situated immediately beneath the pharynx or food-bag, so that food, in passing into the latter, traverses the entrance of the former, which, however, it is prevented from entering by a triangular lid called the *epiglottis*: this lid in its usual state is elevated from the glottis or entrance of the larynx, so as to admit the free entrance and exit of the air, but the passage of food forces it down so as

to close the entrance of the windpipe. The *larynx* is formed by four separate cartilages besides the epiglottis just spoken of. One is shaped like a shield, and forms the front of the larynx and great portion of its sides. Another below this is circular, and two other smaller ones, shaped like an ewer, form the rims on which the epiglottis shuts down. The larynx is lined throughout by a mucous membrane, which is endowed with a high degree of sensibility, particularly at its upper portion; and thus when any foreign body accidentally enters, or the mucus is in undue quantity, it excites the membrane, and coughing is produced, by which it is expelled. The *windpipe* consists of a number of cartilaginous rings connected together by elastic membrane so as to form a continuous tube passing down the front part of the neck and entering the chest between the two first ribs. The rings are not completely cartilaginous, but the circle is made up of membrane, the membranous part being on the upper portion of the tube. This structure permits the windpipe to be bent in any direction or compressed without injury, its elasticity quickly restoring it to its former shape, or position. The windpipe, on entering the chest, divides into two portions, going to each division of the lungs; and these subdivide into others, which again ramify into numerous small tubes, which ultimately terminate in very minute air-cells. The lungs, which receive these terminations, form by far the greater portion of the contents of the chest, which, however, it will be proper to describe first.

The *chest* of the sheep, in common with most quadrupeds, is unlike that of the human body, becoming narrow towards the lower part and terminating like the keel of a ship; a form more favourable to the flexion and extension of the fore-legs, as well as of the shoulder-blades, than any other. This keel-like form is, however, much less developed in the sheep than in the horse and many other quadrupeds. The upper part of the chest is formed by the spine or back-bone, the sides by the ribs, and the lower and front part by the sternum or breast-bone. The number of ribs varies in different animals; in man there are twelve, in the horse eighteen, but in the sheep there are only thirteen pair. Each rib possesses two heads or protuberances, each of which is connected by a joint with two vertebræ or bones of the back, and to the breast-bone by means of cartilage. The sternum or breast-bone, in young animals, is chiefly cartilaginous, and may be separated into eight pieces; it afterwards becomes divisible into four only, and with age is consolidated into one. The ribs are externally convex, and are divided into the true and false; the former being situated anterior to the others, and immediately connected with the sternum, whilst the latter are implanted into each other at their cartilaginous extremities, and are only connected with the breast-bone by means of the true ribs. Their connexion with the spine, by means of a double joint, affords to the ribs a motion backwards and forwards, by which means the cavity of the chest is enlarged or diminished. This motion, however, is considerably less in qua-

drupeds than in man, for in the latter the rising and falling of the chest is seen in common respiration, whilst in the former it is not perceived, unless the breathing be embarrassed. The ribs are connected together by fleshy substance, termed the intercostal muscles, which are disposed in an oblique course, by which means their length considerably exceeds that of the space between one rib and another, so that a contraction of one-third their length will bring the ribs together, which could not be the case if the muscles took the shortest course from one rib to another.

The chest is separated from the abdomen or belly by a very singular and important muscle, called the *diaphragm* or midriff, which is convex towards the chest when in a state of rest. This muscle is shaped somewhat like a fan, and is attached to the inferior extremities of the ribs and the spine, by which means its position is rendered oblique, its development more extended, and its action greater than it would otherwise have been. The diaphragm, unlike every other muscle, is fleshy at its circumference and tendinous at its centre. The reason of this peculiar construction may be thus explained:—the central part of the diaphragm is pierced with two holes, for the passage of the œsophagus (the tube which conveys food to the stomach) and the vein which conveys the blood to the liver for the secretion of bile. Now, if these important vessels were surrounded with muscular substance, they would be forcibly compressed every time the diaphragm contracted, and would in consequence be liable to con-

siderable injury ; but being surrounded with tendinous substance, which possesses no such power of contraction, all danger of compression is at once removed, without any sacrifice of strength or power in the muscle. The diaphragm, when in a quiescent state, is convex towards the chest, and when in action it becomes flat, thus enlarging the cavity of the chest.

The *thorax* is everywhere lined internally by a thin serous membrane, which secretes a fluid by which the surface of the cavity is lubricated, and its contents are enabled to glide upon each other without occasioning any friction or inconvenience. This membrane is called the *pleura*, and the portion which lines the chest itself is designated the *pleura costalis*, while that which covers the lungs is distinguished as the *pleura pulmonalis*. This membrane divides the chest into three cavities, one on the right side containing the *right* lung, and the other two on the left side, the smaller of which contains the *heart* and the larger the *left* lung.

The *right* lung is thus the largest, and consists of three lobes or divisions, whilst the *left* lung only contains two. These divisions of the chest do not communicate with each other, so that if one cavity is injured, or air is admitted into it, respiration can be carried on in the other.

The *lungs* are light spongy bodies, their specific gravity being one-half less than water. They are composed of the air-cells before spoken of, the bronchial tubes connected with them, and a vast number of arteries, veins, and absorbent vessels, the whole

being connected together by cellular substance, or *parenchyma* as it is termed: thus constituted, the lungs are closely packed away in the cavity of the chest, filling every part of it, so as to leave no vacant space whatever.

SECTION XIX.

THE BLOOD AND ITS CIRCULATION.

THE blood is by far the most important fluid in the animal machine: it stimulates the heart to contract, secretes and nourishes the various organs of the body, and supplies it with heat; and although it is the source whence other fluids are obtained, it is yet a fluid *sui generis*, differing from all others. Soon after it is drawn from the body it coagulates, and then separates into two parts: the *serum*, a watery, colourless fluid, which floats on the top, and the *crassamentum*, which appears of a firm consistency and a red colour. The serum is a peculiar fluid, and may be separated into its constituent principles. If subjected to a temperature of 150°, a portion is converted into a substance resembling albumen or the white of an egg; the other portion remains fluid and is termed the *serosity* of the blood, and is that which constitutes the gravy in meat. The serum contains several salts in solution, the most abundant of which is soda. The crassamentum is likewise divisible into two portions: the *cruor*, which gives to the blood its purple hue; and

the lymph, which is more solid in its nature, and is considered the basis of the coagulum. The latter can be separated from the former by washing, and likewise separates when the blood is a long time coagulating, in which case the red portion of the blood, being the heaviest, falls to the bottom of the vessel, leaving the lymph on the top. The cruor, or red portion of the blood, has been found, on being submitted to a microscope, to be composed of globules, which are supposed to be each about the three or four thousandth part of an inch in diameter. It is therefore to these globules that the blood owes its redness; but the intensity of the colour is subject to great variation, being darker in animals that are poorly fed, or when exposed to carbonic acid, and becoming more florid in others that are well fed, and also when exposed to oxygen, or to atmospheric air.

The other part of the crassamentum, the lymph, which from its nature is also called the *fibrine*, is, in fact, the most important of all; for it is that which mainly supplies the different parts of the body, particularly the muscles, with nutriment, and repairs wounds and fractures in an extraordinary manner. Unlike the cruor, it exists in the blood of all animals, and in every part of the system. Some animals have entirely white blood, the cruor being absent; and in red-blooded animals there are some portions of the body, such as the white of the eye, where the vessels are so small that they do not admit the red globules. The specific gravity of blood rather exceeds that of water; but venous

blood is somewhat heavier than arterial. The temperature of the blood varies in different animals; in man it is 90°, but in the sheep nearly 100°. It is rather warmer in the arteries than in the veins, and is liable to variation from disease, it having been found in severe inflammations to be raised 7° in man, and in the cold fit of agues 4° lower than in a state of health. It is, however, but slightly raised or depressed by external temperature. It was not till comparatively a recent date that the blood has been considered to possess vitality, which, however, is now generally acknowledged. The vitality and fluidity of the blood are intimately associated; in fact, its coagulation, when removed from the body, constitutes its death. The time in which this is taking place is different in different animals, and is influenced by various circumstances. In strong animals, such as the horse, it is longer than in such weak animals as the sheep: in the former it is often as long as fifteen minutes; and if the body be in a state of plethora, the vital power being too highly developed, the death of the blood is much longer resisted. In these cases coagulation is delayed, and, in consequence, the red portion of the blood, being the heaviest, falls to the bottom of the vessel, and the fibrine remains at the top, constituting the buffy coat of inflammation. This separation, when arising from the above cause, takes place long before the serum is developed. The coagulation of the blood has been endeavoured to be accounted for without success: it was held by some that it was produced by the cessation of its motion;

but it has been found that if stirred in a vessel it will coagulate quicker than before. It was thought that exposure to the atmosphere was the cause; but it has been known to coagulate in a vacuum, and likewise in the body when a vein has been tied. It was next conceived that it was caused by the low temperature to which it is exposed; but it has been ascertained that it will coagulate quicker if the temperature is either higher or lower than natural; but if so low as to freeze the blood, it will not coagulate when afterwards thawed. These experiments show that the blood is analogous to no other fluid, and that coagulation cannot be owing to physical causes, but can be explained only by reference to its vitality.

Although the blood will coagulate in the body if obstructed, yet there is a considerable difference between this state and its coagulation out of the body. In the former instance coagulation is longer occurring, new vessels are thrown into its substance, and it becomes organised. So, likewise, if a part be wounded, the divided vessels throw out clots of blood, which adhere to the surface of the wound; the red particles become absorbed, the glutinous fibrine organised, and the breach is thus gradually restored. Thus we see how important it is that the blood should possess its peculiar properties, its state of fluidity, and its disposition to coagulate: if the former did not exist, the blood would be obstructed in the capillary vessels, and the vital functions could not be carried on; and if deprived of its coagulating property, no wounds could heal, or loss of substance

be restored, but the most trifling cut would be the precursor of death.

The quantity of blood contained in the body is very difficult to ascertain; for if an animal be bled to death, a good deal will still remain in the blood-vessels. It has, however, been estimated to be about one-fifth the weight of the body; and of this, about three-fourths are contained in the veins, and one-fourth in the arteries. In young animals there is more than in old ones, as in them the body must not only be sustained, but increased in size. It is likewise more abundant in wild animals than in tame ones, and in proportion to the vigour of the animal.

The *Heart* is a strong hollow muscle, of a conical shape, with its base towards the spine, and its apex towards the left side, against which it is thrown at every contraction. It is double, having a right and left side, the former containing black, and the latter red blood; the right side is the thinnest and weakest, being devoted to the lesser office of the circulation of the lungs; the left the stoutest, having to govern the general circulation of the system. Each of these halves consists of two cavities, an auricle and a ventricle; the former, which derives its name from its resemblance to a dog's ear, is considerably thinner than the latter, and is situated towards the base. The heart is formed principally of fleshy fibres, connected together by cellular tissue, whence it obtains its elasticity: and its surfaces, both internal and external, are lined by a transparent membrane. The blood is prevented

from moving in a retrograde course by means of a number of valves: there are three in the left ventricle, the edges of which are connected by tendinous cords (*cordæ tendinæ*) to small fleshy eminences on the inside of the ventricle, called *carneæ columnæ*, or fleshy columns. These tendinous cords are more numerous in the valves of the left ventricle than in the other parts, and being supposed, with the valves, to resemble a mitre, are named mitral valves. There are valves also in the right ventricle for similar purposes, which are named tricuspid, or three pointed; also in the great artery, or aorta, and in the pulmonary artery, where, having no cords, and resembling, or supposed to do so, a half-moon, they are named semilunar. The heart is enclosed in a strong membranous bag, which is named *pericardium*, and this encloses also the trunks of the veins and arteries, as well as the appendages or auricles.

The heart is a muscle, but, unlike other muscles, it is involuntary, being altogether independent of the will, and is for this purpose supplied by a peculiar set of nerves. It is also furnished abundantly with blood for its support, by means of arteries which are the first that are given off; and these arteries are accompanied by veins for the return of the blood to its proper receptacle.

The Circulation of the Blood

Is one of the most important processes in the animal economy: when suspended for a few moments, a state of insensibility is produced, and if this suspension continues a little longer, death quickly supervenes.

The heart, we have seen, consists of two halves or sides, the right being devoted to the pulmonary circulation. The *right auricle* receives from a large vein, called the *vena cava*, the blood which has travelled throughout the system; whence it passes, by the action of the heart, into the right ventricle, which by its contraction forces it into a large vessel, called the pulmonary artery. Thence the blood is sent into the lungs and ramifies throughout its minute vessels, where it is exposed to the action of the inspired air, and becomes, by means we shall afterwards speak of, reddened and purified. This process being accomplished, the blood passes into minute vessels, which, coalescing, become the pulmonary veins, and through them the blood again returns to the heart; thus finishing the circuit of the pulmonary circulation.

The *left auricle* receives the purified blood from the pulmonary veins, forces it into the left ventricle, which, contracting, sends the vital fluid into a large strong vessel called the aorta, whence it enters smaller arteries, to be distributed throughout the whole system. The remote divisions of the arteries are called the capillary vessels, and in them the blood, after having accomplished its purposes and conveyed nourishment to all parts, becomes black and impure, and in this state enters the capillary veins, which, conjoining and increasing in size and diminishing in number, convey the blood again to the right auricle of the heart. Just before it enters the heart it receives a supply of chyle, which, as we have before observed, is extracted from the food,

absorbed by certain small vessels called lacteals, and conveyed by a specific channel to the heart. Such, then, is the circle, or rather the double circle, which the blood takes, and by which so many important purposes are beautifully and correctly accomplished.

The circulation of the blood is accomplished by the joint action of the heart and arteries, but principally by that of the former. The contraction of the ventricles and of the auricles immediately succeed each other: as the one expands to receive the blood, the other contracts to force it forward, thus producing the unequal double action of the heart that we feel. These actions, however, of the different cavities could not be correctly performed unless some provision were made for preventing the blood, when the ventricles contract, from retrograding into the auricles. This, however, is effected by means of a valve, situated between these cavities, which is formed by a duplication of the inner membrane of the heart, thickened by fibrous substance. The floating edges of this valve in the right ventricle present three points and in the left two; whence the former is called the tricuspid, and the latter the mitral. The edges of each valve are joined by numerous short tendons to the fleshy columns of the heart; and whilst the blood is flowing into the ventricles the fleshy columns are passive; but when the ventricles act these columns also contract and draw the edges of the valve together, and thus close the cavity in that direction and prevent the blood re-entering the auricle.

There are also valves that guard the entrance of

the aorta and pulmonary arteries, but they are of a different description, being of less strength, because they are not called upon to oppose the powerful action of the ventricles. Accordingly we find they consist of three folds of membrane, and are called, from their shape, semilunar. They are so situated that when the blood passes into the arteries they are thrown against their sides, and when the blood has passed they are thrown up so that their edges meet, and thus prevent the blood returning to the heart.

In fishes the heart is single, and only serves the office of the pulmonary circulation, that of the system being accomplished by the arteries alone. In the sheep, though the heart is the principal power, yet the arteries greatly assist. The aorta, which receives the blood from the left ventricle, divides into two branches, called the anterior and posterior aorta; the former conveying the blood to the head and neck, and the latter to the lower parts of the body. These arteries are strong and thick, and consist of three coats; the outer, the strongest and thickest, gives the vessels the remarkable elasticity which they possess; the middle coat is the fibrous, which seems to be a modification of muscular power, and enables the arteries to contract on their contents; the third coat is the serous, which lubricates the interior of the vessel and facilitates the passage of the blood. Thus to these several coats, but particularly to the two former, do the arteries owe the remarkable property they possess of contracting when distended with blood, and almost immediately

afterwards expanding to receive a fresh supply, and which, assisted by the action of the heart, constitutes the pulse ; and may be felt in every part of the body where an artery is sufficiently near the surface to be perceptible.

The arteries, however, do not all possess an equal thickness and power ; for instance, the pulmonary artery, though quite as large as the aorta, is neither so thick nor so strong ; and the reason is, that the same power is not required to send the blood over the smaller circuit of the lungs as over the larger one of the whole system ; and, for the same reason, the right side of the heart is weaker than the left. The arteries, as they divide and subdivide in their course, become weaker in their coats in proportion to the diminution of their size, till at length they terminate in the minute branches called the capillary vessels, which do not possess any pulsating power, and many of which do not contain red blood. Diminutive, however, as these branches may be, yet it is by them that the most important offices are performed ; by them the different parts of the body are nourished, whether bone, flesh, nerve, or skin ; by them the various fluids are secreted, however different in appearance they may be ; by them the most ghastly wounds are healed, and often in a remarkably short space of time ; and all these various offices are performed not only by the same class of vessels, but by the same fluid, the blood. Having accomplished these important purposes the capillary arteries terminate in equally minute vessels, called the capillary veins ; and so abundant are these

diminutive vessels that the finest point of the finest needle cannot be plunged into the body without penetrating some of them. By the time the blood reaches the veins it becomes dark and impure, and loaded with carbon: the office of the veins, therefore, is to return it to the heart to be again purified. The circulation, however, becomes much slower as it is further removed from the impulsive power of the heart, and the veins, which are supposed to contain two-thirds of the whole blood circulating in the system, are consequently much more numerous than the arteries: they do not, however, possess the same strength in their coats as the arteries, nor have they any pulsating power. They have, however, the assistance of other agents in propelling the blood to its destination. The greater number of them possess valves, which admit the blood to pass in one direction, but effectually prevent its passing in any other. It was, indeed, from reflecting on the structure and necessary office of these valves that led the immortal Harvey to discover the circulation of the blood. Another circumstance peculiar to the veins is their situation, being mostly near the surface of the body, whilst the arteries are generally deep seated. The wisdom of this provision is evident: it is well known that in wounds it is readily ascertained if an artery be wounded by the jet of blood that ensues, and which even from an artery of small size is very considerable, and the danger of death from bleeding is often great in consequence of the force with which the blood is thrown into these vessels. Now such being the danger attending the

division of arteries, it was necessary to remove them as much as possible from the risk of injury, and accordingly they are almost invariably deep seated, and when they do approach the surface it is in parts least likely to be injured. Thus round these important vessels nature throws a thick muscular covering, and protects the whole by a mantle so sensitive as to give warning to the least attack. The veins, however, do not require this care; in them the circulation is languid, and their wounds are comparatively unimportant and unattended with danger, for the blood generally stops, without assistance, from its coagulating quality. It is also of importance that the greater portion of the veins should be situated near the surface, in order to receive the influence of the atmospheric pressure, which greatly assists the motion of the blood; and it has also been found that veins possess a power of absorption in common with a particular order of vessels called the absorbents; thus these various purposes are effected by the relative position of the veins and arteries. The structure of the veins is very different from that of the arteries; for, whilst the latter are thick, elastic, and composed of three coats, the former are thin, inelastic, and composed only of two coverings. But although thin they are yet capable of affording great resistance to pressure.

We have seen that the blood is sent to all parts of the body by the action of the heart and arteries, but what is the cause of its return? First in importance is the law of hydrostatics, "that all fluids support their level." Thus the same law by which springs

arise, and streams are produced, and rivers flow towards the sea, is brought to bear in the living system, and enables the blood in the arteries to support that in the veins. This effect is greatly assisted by the action of the valves in supporting the column of blood. The blood thus supported and propelled by the arteries, assisted by atmospheric pressure, must go somewhere, as the valves prevent return; it goes, therefore, where alone a vacancy is afforded, and that is in the right auricle of the heart, which has just propelled its contents into the ventricle. To these several forces may be added a power of suction the heart possesses whenever the chest is enlarged in respiration.

The manner in which the chyle is mixed up with the blood, so that its colour quickly disappears, is worthy of particular notice. It is owing, indeed, to the great agitation the blood receives, and to the irregularity of the heart's internal surface. When the auricles contract, their contents are, in a great measure, discharged into the ventricles, but a portion is thrown back into the veins, which constitutes what is called the venous pulse, and may sometimes be seen in the jugular veins. In like manner, when the ventricles contract a portion of their contents is thrown back into the auricles, at any rate that part of it situated behind the valves. By these means an agitation is produced which effectually mixes these different fluids together.

It has been ascertained that the veins possess a power of absorption in common with a numerous class of vessels called the absorbents, or lymphatics.

These vessels are very minute, and are distributed throughout the whole body; they generally accompany the veins, and, like them, are furnished with valves.

SECTION XX.

ON RESPIRATION AND ITS EFFECTS.

THE phenomenon of respiration, which is carried on from the first minute after birth to the last of existence, consists of two acts, inspiration and expiration. The former, that of inhaling the atmosphere, is accomplished mostly by the diaphragm, which, in its relaxed state, is convex towards the chest. As its fibres contract, the muscle flattens, and thus enlarges in a considerable degree the cavity of the thorax. A vacuum is thus produced, or rather a tendency towards it; for the air rushes into the lungs, and the blood into the heart; and, as the lungs are elastic and spongy in their nature, they become closely adapted to the enlargement of the chest, and prevent any vacuum from taking place between them and the sides of the thorax. The diaphragm is thus the chief agent in the act of inspiration, although in some degree assisted by the intercostal muscles, which raise the chest, and also, when the breathing is violently excited, by those muscles that in quadrupeds attach the fore extremities to the body. The air thus drawn into the lungs traverses throughout its internal surface, and, having

fulfilled its office, is forced out by the act of expiration. This part of the process is effected chiefly by means of the elasticity of the lungs, which acts as soon as the diaphragm becomes passive, assisted, however, in some degree by the elastic cartilages of the chest, and occasionally by the abdominal muscles.

Atmospheric air consists of unequal parts of two æriform fluids, viz., four-fifths of nitrogen or azote, and one-fifth of oxygen in each 100 parts; besides which it contains other heterogeneous matters, such as odorous effluvia, aqueous exhalations, electric matter, and carbonic acid gas. It everywhere surrounds and embraces the globe, extending, in the opinion of some, a distance of forty-five miles, and in that of others a much greater height. Its gravity differs very much at different times and in different places, being heavier on a clear than on a close day, and also in low places than in lofty ones. The small portion of carbonic acid gas which the atmosphere contains is not chemically, but mechanically mixed with it. This gas is evolved by the fermentation of beer, and the decomposition of vegetables, and is often found in wells and deep places. It is much heavier than the atmosphere, and thus remains in these low places by its gravity. A lighted candle placed in this gas is immediately extinguished; so that it is used as a safeguard in descending into these low and foul places; for whatever will not support combustion will not support life. It is not a simple gas, like oxygen, but is formed by the union of carbon and oxygen.

Nitrogen or *azote* is a simple gas, but its use in

the atmosphere seems to be principally of a passive nature, being for the purpose of diluting the oxygen and rendering it less stimulating: it will not alone support life or combustion, but is chemically mixed with the oxygen. Oxygen is essential for the support of life and combustion; for if air be deprived of it no animal can live, nor will a candle remain lighted. It is abundantly furnished by plants and shrubs, which thus restore the loss of it occasioned by animals. When a flame is exposed to this gas it greatly increases in brilliancy; and when venous blood is submitted to it, it quickly becomes florid.

We have before shown that all the blood in the body was in its turn carried from the heart to the lungs by means of the pulmonary artery, which divides and subdivides into the smallest branches, and terminates in small capillary veins, which, coalescing, become larger, and convey the blood again to the heart by the pulmonary veins. Before it reaches these veins, however, an important change takes place: the blood proceeds from the heart in a black and impure state; it returns reddened and purified; it is submitted in its course to the action of the air in the air-cells, not by actual contact, but through the membrane which forms these cells: and by this means the important change is effected.

There is, we well know, a considerable difference between the expired and the inspired air; the former is hot, the latter cold; this is healthy, that injurious; one will support combustion and life, the other is unfit for breathing, and will extinguish a

flame. There is but little difference in quantity between the air in its different states, but the oxygen in expired air has nearly disappeared and carbonic acid gas is found in its stead; it also contains much aqueous vapour, which is condensed in a visible form, at a temperature of 60° . Thus, although the carbonic acid gas is much heavier than common air, yet, partly from the aqueous vapour which the expired air contains being much lighter, but principally from its own increased temperature, the expired air, notwithstanding its carbonic acid, is yet specifically lighter than the atmosphere; and consequently rises upwards, and thus, in great measure, is prevented from being respired a second time. It has been found by experiment with a portion of atmospheric air, containing 80 parts of nitrogen, 18 of oxygen, and 2 of carbonic acid, that, on being respired, the nitrogen continued the same, but the carbonic acid was increased to 13 parts, and the oxygen reduced to 5; whence it appeared that 11 parts of carbonic acid were substituted for 13 of oxygen, 2 parts having entirely disappeared. Thus the disappearance of the greater portion of the oxygen was accounted for by its being converted into carbonic acid; but there remained a small portion, whose absence could not be thus explained, more particularly as Sir H. Davy calculated that about 32 ounces of oxygen were necessary for 24 hours' expenditure in a man; but only $26\frac{1}{2}$ ounces are requisite for the formation of even 37 ounces of carbonic acid gas, giving us an unexplained surplus of $5\frac{1}{2}$ ounces of oxygen, during the above period. By

some it was supposed that this surplus oxygen united with the hydrogen thrown off by the blood, and is thus converted into watery vapour: by others it is held, that this oxygen is absorbed by the blood, and enters the circulation. Carbonic acid gas is exhaled from the lungs in different quantities during different periods of the day, being generated in the greatest quantity about noon, decreasing in the afternoon and night, and again increasing in the morning. It also increases in man by taking animal food.

Sir H. Davy contended that a small portion of nitrogen is absorbed by the blood; but this has been denied by others. The chief use of nitrogen, however, is to dilute the oxygen; for if the latter is inspired pure a sense of warmth is felt in the chest, the heat of the skin is raised, the pulse quickened, and other symptoms of excitement are produced. A given quantity of oxygen will, however, support life longer than the same quantity of atmospheric air. It has been computed that, in the course of twenty-four hours, about 2lbs. 8ozs. of oxygen is consumed by a man. After an ordinary respiration a considerable quantity of air still remains—perhaps four-fifths, one-fifth having been expired.

Having mentioned the changes that take place in the atmosphere, we must next consider in what manner the blood becomes so altered by its passage through the lungs.

The blood, as it traverses through the body, gradually becomes darker; it is loaded with carbon, and is rendered unfit for the circulation, and in this.

state it is called venous blood. If venous blood, taken out of the body, be exposed to oxygen, it quickly becomes red; and so it does if exposed to the atmosphere, but not so rapidly. So, likewise, if arterial blood be exposed to carbonic acid, it quickly acquires the colour and character of venous blood. In the same manner is the colour of the blood changed in the lungs; thus the principal use of respiration appears to be to free the blood from its impurities; and this is effected although the air and the blood do not actually come in contact. It was found, that if blood in a common bladder were exposed to the atmosphere for some time, it acquired a coating of florid blood; and thus, as the membrane lining the air-cells is by no means so thick as that of the bladder, there is no longer any difficulty in accounting for the change taking place. It has been the subject of some dispute as to when the change, or rather exchange, takes place, some contending that the carbon unites with the oxygen in the air-cells, whilst others maintain that the oxygen enters the blood, and there unites with the carbon, forming carbonic acid gas, which is then exhaled into the air-cells. It was found, however, that if venous blood were put within the exhausted receiver of an air-pump a quantity of carbonic acid escapes; thus proving the presence of this gas in the blood, and supporting the second theory. And as there appears to be a greater quantity of oxygen abstracted from the atmosphere than can be accounted for by the formation of carbonic acid, we must conclude that a portion mingles with the blood and enters the

circulation ; which theory agrees with the fact, that it has recently been discovered, by correct analyses, that both venous and arterial blood contains carbonic acid, nitrogen, and oxygen ; but that the latter gas is most abundant in arterial and the former in venous blood.

Although the action of the heart is much more frequent than that of the chest in respiration, yet there is a most intimate connexion between the one and the other ; for, besides the changes which we have spoken of in the blood, it rushes into the heart when the chest is expanded, and when, from any cause, respiration is delayed, the pulse becomes less frequent and more languid in consequence of the obstruction in the current of the blood. Thus, in violent fits of coughing, the chest collapses, the air is expelled, and the blood not being purified, is unfit for circulation, and the consequence is the veins of the head become distended, and, in man, the person becomes red or black in the face, and sometimes a blood-vessel has ruptured and death supervened.

The Production of Animal Heat.

This important operation is effected by means of respiration, the chemical process carried on in the lungs.

The sensation of heat is derived from the presence of an extremely subtle fluid called caloric, the particles of which have a tendency to repel each other and unite with other substances. Thus, if we touch a body whose temperature is lower than that of our

hand, caloric passes from the hand to this substance, and the sensation of cold is experienced: and if, on the contrary, the temperature of the substance is higher, we feel a degree of heat from the passage of caloric into the hand. It is a singular fact, that this caloric may exist in two different states—the one in a free or sensible form, the other in a latent or combined form. Thus two substances may appear to be of the same temperature, and yet one may contain a much greater degree of caloric than the other, but so combined with the substance that it is not sensible to the touch. If, however, the object be exposed to the influence of some chemical agent, its latent caloric may be set free or rendered sensible. For instance, if sulphuric acid and water be mixed together, although each fluid were before cold, the mixture is raised to a high temperature, and caloric is evolved. In the fermentation of malt liquors the temperature of the liquid is raised with the process, and carbonic acid is produced; and whenever, indeed, this material is formed, heat is evolved. Animal heat is kept up and supported by the chemical union of these two substances, oxygen and carbon—the same that produces combustion in our fires and candles. Carbon may be considered as the fuel, not only in ordinary combination, but also in the animal economy, whilst oxygen may be regarded as the fire; and, in fact, this agent, throughout nature, is the cause of what appears to be destruction, but is, in fact, only change of form; such, indeed, is its tendency to combine with other substances. Carbon is supplied by the food, and it is necessary that suffi-

cient should be furnished to counteract the consuming tendency of oxygen, which would otherwise gradually waste and destroy the system. In cold weather and cold climates more oxygen is taken into the lungs, the air being more condensed, and a greater waste of the system would be the consequence were it not for the fact that the appetite is increased, and more food is taken, particularly that which contains most carbon. This accounts for the fact of the people in cold countries having such a great inclination for oily food, which consists chiefly of carbon, whilst those in hot climates dislike fat of every description, and prefer a vegetable diet: thus the functions of the lungs and the stomach most intimately agree. In cold weather a large fire must be kept up to preserve the animal warmth, and the digestive organs furnish the fuel, or otherwise the tissues of the body would be wasted or consumed.

SECTION XXI.

ON FEEDING AND FATTING, &c.

THOUGH in many countries the principal value of sheep is to be attributed to their woolly covering, yet in this country, for some years past, the flesh has been the greatest source of profit, and the carcass therefore the paramount consideration.

This has naturally led the attention of breeders to the consideration of what particular breed has the most aptitude to make flesh and fat, how these qua-

lities could be improved, and what particular shape or form is connected with this propensity to fatten? But though the above has been perhaps the principal consideration kept in view, there are other subordinate ones springing out of it of scarcely inferior importance—such as which breed, or individual sheep, will fatten soonest on good pasture? Which on indifferent or bad pasture? Which has the earliest maturity? Which can bear wet and dirt with the greatest impunity, or can best endure exposure to the weather in a cold and severe locality?

These several points must all enter into the consideration of the sheep-owner, who must of course pay the utmost attention to the nature and quality of his land and its suitability for particular sheep, being, after all, governed by the ultimate calculation as to which brings in the greatest return of profit.

The various points in the form of a sheep, connected with the aptitude to fatten, have received the utmost attention from practical and sagacious breeders, although some of these points are still matters of dispute. The superiority of particular improved breeds is now generally acknowledged, and may indeed be considered to be established on certain principles, though in arriving at these principles it must be confessed that we are little indebted to science, but to the long and attentive observation and correct reasoning of sagacious and practical men. It is, indeed, only very lately that anything like a correct explanation could be offered for the various phenomena that attend the fattening of animals, or why one description of food

should be more suitable for the purpose than another. It had, indeed, been laid down as a fact, that a large capacious chest and lungs were necessary for the production of fat, and that its secretion depended in a great degree on the quantity of air that could be respired; whilst the researches of modern chemists have shown that nothing could be further from the truth. And now that the fallacy has been exposed by chemistry it can also be readily shown by anatomy, for we find that whilst the horse and the camel have eighteen ribs the ox and the sheep have only thirteen. The absence of these five pair of ribs must of course materially diminish the cavity of the chest, and its greater breadth (necessary for another purpose) does not by any means compensate for its diminished length. Animals of speed have rarely a propensity to fatten, but in greyhounds, hares, foxes, deer, &c. we find the chest is long and deep though not wide, whilst in pigs, sheep, and oxen we notice an opposite conformation. The fact is, in proportion to the activity of the animal is its respiration and its demand for oxygen, and in proportion to the consumption of oxygen is the wear and tear of the system and the consumption of the elements of the food. If the exertions are therefore excessive, that portion of the food that would have increased the weight of the body is called for to support respiration.

In animals having a propensity to fatten, we find the chest of a circular form; the ribs spring from the spine more horizontally than in others, almost at right angles: this is observed in the ox, compared

with the horse, and still more so in the sheep. The effect of this conformation is certainly in one respect to increase the width of the chest, but another important effect is to increase very considerably the size of the abdomen; for in order to obtain the greatest possible nutriment from the food, it is essential that the organs of digestion should be capacious, which cannot be the case unless the cavity in which they are situated is large. The abdominal muscles and membrane which supports the bowels are attached to the cartilages of the ribs, and the short ribs in some measure cover the abdomen. It must, therefore, be evident that in proportion to the width between the posterior ribs must, in a great measure, be the size of the abdomen; and this width must be in proportion to the horizontal direction in which the ribs are given off. The loins must correspond with the ribs; the transverse processes are long and horizontal in proportion to the horizontal manner in which the ribs spring from the spine; for, in fact, they are but a continuation of the same roof, and must possess the same relative proportions. We must illustrate this point by comparing it with an umbrella, which, when thoroughly open, the whalebone ribs, so to speak, coming off at right angles may be compared with the broad circular animal, and, when only half extended, to the narrow-chested flat-sided beast. In its former state the umbrella forms the roof of a much larger space of ground than it does in its latter state; and, in the same manner, the long transverse lumbar processes must form the roof of a larger abdominal

cavity than the short transverse processes found with narrow loins. The same form that extends the roof of the abdomen also gives a larger surface for the muscles of the back and loins to rest on; and thus we find in sheep of this description a very considerable development of the flesh or muscles of the loins—the primest part of the carcass. It is a common observation with judges of sheep, that one of the best points is a channel between the shoulders and along the back. This is, indeed, a desirable form, for it is connected with those necessary qualifications for producing flesh and fat. The channel along the back is owing partly to the large development of the muscles of the loins and back arising from the form we have commended, and partly to the shortness of the upright or spinous processes of the vertebræ of the back. Now the use of these processes is to afford leverage to the muscles, and their length, therefore, enhances the activity of the animal. Sheep, however, do not possess nor require these active powers, and they would, in fact, be very detrimental to the principal object of the animal's existence; it is a quiet state and a quiet disposition that disposes an animal to increase in flesh and fat. The shortness of these processes is illustrated in the sheep as compared with the goat, and in the improved breeds of the former as compared with those of the mountain and the forest.

It is an ordination of nature that nothing is lost or actually destroyed. If we set fire to a quantity of straw, a few ashes only remain; but the rest does not cease to exist, but has merely assumed other

forms—it has assumed a gaseous character, and passes into the atmosphere. A majestic tree, in the course of years, is produced from an acorn or nut. In reaching this form and bulk it does not produce any new elements, it merely has the power of assimilating or assuming to itself that which before existed either in the atmosphere or the soil. Vegetables derive their subsistence chiefly from the atmosphere; animals, on the other hand, entirely from the food conveyed within the body. A young animal increases daily in size and weight; in so doing it has the power of assimilating the nutritious portion of the food, and causing it to assume the form of blood and flesh, &c. The various parts of the body possess, therefore, that which previously existed in the form of food. The locomotion of animals requires a certain force, to produce which a constant waste or loss of substance is undergone—living parts become dead parts, and are at length cast from the system. To supply this waste, food is required; and when the animal neither increases nor diminishes in weight, the waste of the system and supply of food are equivalent to each other. When the body decreases in weight, the waste is greater than the supply; and when the body increases, the supply is superior to the waste. The latter is the state in which sheep usually exist, so as to be profitable to man. The food, however, has two purposes to accomplish; one to support the system, the other to keep it warm. The body, it is well known, is considerably warmer than the surrounding atmosphere, and it preserves a pretty uni-

form temperature throughout the whole year. To create this high temperature, caloric, the principle of heat, is required, to supply which combustion is necessary; and, strange as it may appear, this combustion is continually going on in the system, and is produced, on the one hand, by the carbon taken with the food, and, on the other, by the oxygen imbibed from the atmosphere. These elements uniting, the heat of the body is thereby maintained in much the same manner, though apparently so different, as a candle burns, the carbon being supplied by the grease, and the oxygen by the air; deprive it of either, and the candle is extinguished.

In carnivorous animals the carbon required for the warmth of the system and, of course, the respiratory process, is supplied by the waste of the tissues of the body, which waste is very considerably greater than in herbivorous animals; but in the latter the greater part is supplied by the food itself. In the former, the whole of the food can be converted into flesh; in the latter, a portion only is capable of being thus assimilated. Another considerable part is employed for the production of animal heat, and what is not required for this purpose, for the formation of fat. This, however, can be best shown by the result of the analysis of the structures we are speaking of. Flesh and blood consist of the following elements, subject, of course, to some variation, and to the water being removed. By supposing the substance to be analysed to consist of 10,000 instead of 100 parts, we avoid having re-

course to decimals, which may not be intelligible to every one:—

	Flesh.	Blood.
Carbon	5182	5195
Hydrogen	757	717
Nitrogen	1501	1507
Oxygen	2137	2139
Ashes	423	442
	<hr/> 10,000	<hr/> 10,000

By comparing together these two analyses it will be seen that there is but a trifling difference between the composition of either, and that the relative proportion of carbon and nitrogen is the same. These are the proportions in which these two elements unite in the tissues of the body; and it is found that the characteristic of muscle or flesh is the possession of nitrogen; and unless food possesses this element it will not nourish the body. It will be seen that the principal difference between flesh and fat consists in the absence of nitrogen, as the following analysis of mutton fat will show:—

Carbon	7900
Hydrogen	1170
Oxygen	930
	<hr/> 10,000

Thus particular articles of food, such as sugar, starch, gum, oil, or butter, which possess no nitrogen when taken as food, though they will increase the development of fat, will not nourish the flesh; and if animals are confined to this diet alone, they will surely die.

The analysis of hay is the following: 1162 parts being dried in the air will contain 162 parts of water,

which, being deducted, leaves 1000 parts, which are thus composed:—

Carbon	.	.	.	.	.	458
Hydrogen	.	.	.	.	.	50
Oxygen	.	.	.	.	.	387
Nitrogen	.	.	.	.	.	15
Ashes	.	.	.	.	.	90
						<hr/>
						1000

Now it is evident, on comparing this analysis with that of the blood, that an animal to make 10 lbs. of the latter must eat 100 lbs. of hay before he acquires sufficient nitrogen to compose it. By consuming this 100 lbs. of hay, which we will suppose divided into 10,000 parts, he will take 4580 parts of carbon, whilst not more than 520 parts are required by the blood, leaving 4060 portions not required for nutrition; there will also be 424 parts of hydrogen unrequired, and 3656 of oxygen; what then becomes of these superfluous elements? Why, they are required principally for the purpose of sustaining the heat of the body; the hydrogen and oxygen unite to form water, and the carbon unites with the oxygen taken by respiration, producing heat by the combustion, and is given off by the lungs in the form of carbonic acid gas. The nutritious portions of the blood are fibrine and albumen, whose elements are almost exactly the same, and correspond also with the fibrine and albumen found in vegetables. Although nitrogen forms such an essential part of nutritious food, yet it cannot, in any way, enter the system or afford nourishment in a simple or uncombined form, but only in such com-

bination as we find in albumen. It is evident, therefore, that to form blood food must be taken which contains albumen, or substances analogous to it, in order to be nutritious, and in proportion to the amount of albumen it possesses will be its nutrient properties. Modern chemists designate food which is thus capable of nourishing as nitrogenized or azotized, from its containing nitrogen; whilst other varieties of food, such as starch, gum, sugar, fat, wine, beer, and spirits, which contain no nitrogen, are denominated carbonized or azotized.

Albumen is thus composed—carbon 550, hydrogen 70, nitrogen 159, and oxygen 221 in 1000 parts.

Fat, we have seen, differs from flesh in containing no nitrogen, and it is formed, therefore, from the carbonized portion of the food by that which is superfluous, after sufficient for respiration has been supplied. Starch, and other similar substances, is also converted into fat by the abstraction of oxygen. Some animals possess a much greater capability of acquiring fat than others. Sheep possess this quality in a high degree, and, with their inactive habits, the formation of fat undoubtedly wards off disease by affording an employment for the large amount of unazotized food consumed. Young animals make but little fat; their digestive organs, and indeed the whole vital system, is fully demanded in increasing the size of the flesh or muscles, and consequently we find that lambs take a much greater amount of exercise than their dams. Their breathing being thus increased more oxygen is consumed, more carbon given out, and their animal heat is thus

kept up, which in them is doubly necessary from the little protection the mothers afford, and from their being dropped at a cold period of the year. The milk of sheep contains a much greater proportion of nitrogenized matters than does the food afterwards partaken, and thus is so well calculated to assist the growth of the flesh.

The following shows its analytical composition:—

	Cow.	Ass.
Cassein	40	19
Butter	46	13
Sugar	38	63
Ashes	6	..
Water	890	905
	<hr/> 1000	<hr/> 1000

Cassein is here the only nitrogenized substance; it is the principle of cheese, which usually consists of that and butter, and it very nearly resembles albumen, into which it can be readily converted in the system. The butter and the sugar are the carbonized constituents required for respiration, and the ashes contain phosphate of lime and common salt.

Cassein is more easily digested than any other substance, and being, as it were, ready formed albumen, the weak digestive powers of the young animal are thus relieved from the necessity of separating or forming it. We have seen that the use of the carbonized portion of the food is to keep up the temperature of the body by uniting with the oxygen of the atmosphere, and to produce fat; and we shall see by the following tables that the usual food of sheep abounds very considerably with the carbonized constituents,

	Water.	Organic matters.	Ashes.
100 lbs. of Hay contain . . .	16	76½	7½
„ Turnips	89	10	1
„ Swedes	85	14	1
„ White Carrots	87	12	1
„ Potatoes	72	27	1
„ Peas	16	80½	3½
„ Oats	18	79	3
„ Oatmeal	9	89	2

The organic matters thus separated are found to consist of the following proportions:—

	Albumen.	Unazotized matters.
Hay	8	68½
Turnips	1	9
Carrots	2	10
Potatoes	2	24½
Oats	10½	68
Peas	29	51½*

* Dr. Daubeny, in the third volume of the "Journal of the Royal Agricultural Society of England," supplies the following corrected Table of the constituents of certain crops. The total amount of each substance analyzed is 100,000.

	Volatilizable Ingredients, viz.		Fixed Ingredients.	
	Water and Carbon.	Azote in the dried vegetable.	According to Sprengel.	According to Boussingault.
Wheat	94,353	3510	2137	2430
Wheat-straw	96,132	350	3518	6970
Oats	95,180	2240	2580	3980
Oat-straw	93,880	380	5740	5090
Rye	97,270	1690	1040	2370
Rye-straw	96,907	300	2793	3680
Potatoes (dry)	95,854	1500	2646	3900
Peas	93,356	4180	2464	3140
Pea-straw	92,719	2310	4971 (not dried)	11,000 (dried)
Clover	96,369	2060	1571 (not dried)	7760 (dried)
Beet-root	92,354	1660	5986	6240
Turnips	92,762	1680	5558	7580

These tables are very useful as exhibiting the amount of azotized constituents in the food, but not as regards the quantity of non-azotized matters, either employed in respiration or in forming fat, for it cannot be supposed that 100 lbs. of hay will furnish as much carbon for respiration or for fat as seven or eight times this quantity of turnips; undoubtedly much of the hay is excreted as vegetable fibre in the fæces in an unchanged state. These theoretical facts, therefore, highly valuable as they are and are likely to be, must be tested and proved by practical experiment in order to render them useful in the feeding of animals. And here it will be both proper and profitable to contrast the foregoing tables with others deduced from the basis of practical experiment. The first is translated by the late Rev. W. Rham, from the French, and is the mean of the result of the experiments made by some of the most eminent agriculturists of Europe in the actual feeding of cattle:—"Allowance must be made," observes Mr. Rham, "for the different qualities of the same food on different soils and in different seasons. In very dry summers the same weight of any green food will be much more nourishing than in a dripping season. So likewise any fodder raised on a rich dry soil will be more nourishing than on a poor wet one. The standard of comparison is the best upland meadow-hay, cut as the flower expands, and properly made and stacked, without much heating: in short, hay of the best quality. With respect to hay, such is the difference in value that if 100 lbs. of the best is used it will require 120 lbs. of a second

quality to keep the same stock, as well as 140 lbs. of the third, and so on till very coarse and hard hay, not well made, will only be of half the value, and not so fit for cows or store cattle, even when given in double the quantity. While good hay alone will fatten cattle, inferior hay will not do so without other food.

"I shall give the table as it stands, and add the notes which accompany it.

	lbs.	
Good hay	100	is equal in nourishment to
Lattermath hay	102	
Clover hay	90	made when the blossom is
		completely developed.
Ditto	88	before the blossom expands.
Clover, second crop	98	
Lucerne hay	98	
Sainfoin hay	89	
Tare hay	91	
Clover hay, after the seed	146	
Green clover	410	
Vetches or tares, green	457	
Cow-cabbage leaves	541	
Shelter wheat-straw	374	
Rye-straw	442	
Oat-straw	195	
Peas-halm	153	
Vetch-halm	159	
Bean-halm	140	
Mangold-wurzel	339	
Turnips	504	
Carrots	276	
Swedish turnips	308	
Ditto, with the leaves on	350	
Wheat	45	
Barley	54	
Oats	59	
Vetches	50	

	lbs.	
Good hay	100	is equal in nourishment to
Peas	45	
Beans	45	
Wheat-bran	105	
Wheat, peas, and oat chaff	167	

Observations.

"Lattermath hay is good for cows, not for horses. The second cut is generally considered as inferior in nourishment to the first. New hay is not wholesome. At Paris, when a load of 1000 kilos is bargained for, the seller must deliver—if between hay-making and October 1, 1300 kilos—from October 1 to April 1, 1100 kilos—and after April, only 1000. This is fair, and allows for loss of weight in drying. In London, a load of new hay is 20 cwt.; of old hay, only 18 cwt.

"Raw potatoes increase the milk of cows, but they must be given with caution, and only a few at first, till the stomach is accustomed to them; boiled, they fatten every kind of stock; mixed with cut chaff they are excellent for horses; 14lbs. of boiled potatoes will allow a diminution of 8lbs. of hay; hence their value in this way is easily calculated. When hay is 4*l.* 4*s.* a load, it is just $\frac{1}{2}$ *d.* per lb.; the 14lbs. of boiled potatoes are therefore worth 4*d.* And 56 lbs. being reduced by boiling to 42 lbs., the potatoes are equal in value to 2*s.* per cwt., which is 40*s.* per ton. From this must be deducted the expense of boiling; where fuel is cheap, this will be compensated by the dung, which would have been lost had the potatoes been sold. If 14lbs. of boiled potatoes are equal to 16lbs. raw, raw potatoes are

one-half the value of hay; and if hay is $\frac{1}{2}d.$ per lb., raw potatoes are worth $\frac{1}{4}d.$ per lb., 1s. 2d. the half cwt., and consequently more than when boiled.

Every kind of cattle eat turnips except horses. Turnips will feed store pigs, but they will not fatten them. Carrots and parsnips are excellent for horses, and, when boiled, will fatten hogs. Rutabaga is liked by horses: it makes their coats fine, but it must not be given in too great quantity, or it will gripe them.

Bran is good for horses mixed with oats, and for milch cows excellent. If it can be had good for $\frac{1}{2}d.$ per lb., it is worth as much as the best hay.

On the Feeding of Animals.-

A certain quantity of food is required to keep the animal alive and in health: this is called its necessary ration of food: if it has more it will gain flesh, or give milk or wool.

An ox requires 2 per cent. of his live weight in hay per day; if he works, he requires $2\frac{1}{2}$ per cent.: a milch cow, 3 per cent.: a fatting ox, 5 per cent. at first; $4\frac{1}{2}$ per cent. when half fat; and only 4 per cent. when fat; or $4\frac{1}{2}$ on the average. Sheep grown up take $3\frac{1}{2}$ per cent. of their weight in hay per day, to keep in store condition.

Growing animals should never be stinted.

On this subject there is an excellent article by Mr. Hyett, in the fourth volume of the Journal of the "Royal Agricultural Society of England."

Quietude and warmth greatly contribute to the fattening process. This is a fact which has not only

been developed by science, but proved by actual practice. The manner in which these agents operate are simple and easily explained:—motion increases respiration, and the excess of oxygen thus taken requires an increased quantity of carbon, which would otherwise be expended in producing fat. So likewise, cold robs the system of animal heat, to supply which more oxygen and more carbon must be employed in producing extra combustion, to restore the diminution of temperature. Nature enforces this restoration of warmth by causing cold to produce both hunger and the disposition for motion, supplying carbon by the gratification of the former, and oxygen by the indulgence of the latter. The above facts are illustrated by the following experiment of Lord Ducie:—

One hundred sheep were placed in a shed, and ate 20 lbs. of Swedes each per day, whilst another hundred, in the open air, ate 25 lbs., and at the end of a certain period the former animals weighed 3 lbs. more than the latter, plainly showing that, to a certain extent, warmth is a substitute for food. This was also proved by the same nobleman in other experiments, which also illustrated the effect of exercise:—No. 1. Five sheep were fed in the open air, between the 21st of November and the 1st of December; they consumed 90 lbs. of food per day, the temperature being about 44° ; at the end of this time they weighed 2 lbs. less than when first exposed. No. 2. Five sheep were placed under shelter, and allowed to run at a temperature of 49° ; they consumed at first 82 lbs., then 70 lbs. per day,

and increased in weight 23 lbs. No. 3. Five sheep were placed in the same shed, but not allowed any exercise; they ate at first 64 lbs., then 58 lbs., and increased in weight 30 lbs. No. 4. Five sheep were kept in the dark, quiet and covered; they ate 35 lbs. per day, and increased in weight 8 lbs.

A similar experiment was tried by Mr. Childers, M.P., and is thus related by that gentleman in the Journal of the Royal Agricultural Society of England for that year. He says, "I last winter enclosed a small yard with posts and rails, and erected a low thatched shed, just large enough to allow a score of sheep to lie down at once. The floor of this shed was boarded with common rough slabs, and was raised eighteen inches above the surface of the ground, the boards being placed three-eighths of an inch apart, in order to allow the free passage of water and keep the boards dry, as my great fear was that the sheep might get the foot-rot.

"I then proceeded, on the 1st of January, to draw forty wether hogs out of my flock of Leicesters, and divided them into two lots, as equal in quality as I could get them. On weighing each sheep separately, I found the weight of one score to be 183 stone 3 lbs., and that of the other 184 stone 4 lbs. I put the first lot into the yard, and placed the other lot on turnips. The field was a dry sandy soil, well sheltered, and peculiarly favourable and healthy for sheep. Each lot had exactly the same quantity of food given them, which was as follows:—

"1st. As many cut turnips as they could eat, which was about 27 stone per day for each lot.

" 2nd. Ten lbs. of linseed cakes, at the rate of half a pound per sheep per day.

" 3rd. Half a pint of barley per sheep per day.

" 4th. A little hay and a constant supply of salt.

" For the first three weeks both lots consumed equal portions of food; but in the fourth week there was a falling off in the consumption of the hogs in the shed of 3 stone of turnips per day; and in the ninth week there was a falling off of 2 stone more; of linseed cake there was also a falling off of 3 lbs. per day. The hogs in the field consumed the same quantity of food from first to last. The result of the experiment is as follows:—

	20 shed hogs.		Increase.			20 field hogs.		Increase.	
	st.	lbs.	st.	lbs.		st.	lbs.	st.	lbs.
January 1 . . .	183	3			..	184	4		
February 1 . . .	205	0	21	11	..	199	8	15	4
March 1	215	10	10	10	..	208	2	8	8
April 1	239	9	23	13	..	220	12	12	10
<hr/>									
Total Increase			56	6				36	8

Consequently the sheep in the shed, though they consumed nearly one-fifth less food, made above one-third greater progress. The circumstances of the experiment were, if anything, unfavourable to the sheep in the shed. The turnips, by being stored in a house for their use, became drier than those consumed by the sheep in the field; and also in February the shed-hogs were salved or rubbed with mercurial ointment, which is generally supposed to give a check to feeding sheep.

" N.B. The boarded floor was swept every day, and fresh straw was given after every shower of rain."

The result of these important and valuable experiments is precisely what we should expect from theoretical reasoning on the principles of the subject. It shows the pecuniary advantage of attending to the comforts of sheep and other animals, the expediency of providing proper sheds, and affording shelter when the weather is severe, and lessening, as much as possible, their exercise.

The various inorganic constituents of food, though they do not contain nutriment, are yet of much importance. The soda, for instance, is required to form the bile; iron is necessary for the blood; sulphur and phosphorus for the brain: thus the advantage of a moderate portion of salt is shown; for this being the chloride of soda, the chlorine is required to form the gastric juice; and the soda, as before mentioned, is necessary for the bile.

A considerable quantity of air is taken into the stomach with the food, being contained in the bubbles of the saliva. This appears to be one of the uses of rumination, viz., to supply a sufficiency of oxygen for the purposes of digestion, and it shows the importance of giving hay or straw with turnips, in order to afford sufficient consistency to the food to adapt it for rumination. Thus chaff should not be cut too short for sheep; but it diminishes the labour of mastication and rumination considerably, and therefore is much preferable to hay.

The modern practice of feeding sheep for the butcher consists in forcing them on with corn and oil-cake in addition to turnips. Now, when we consider the high price of the former and the compara-

tive low value of the latter, it at first sight appears very doubtful whether such a system can be profitable. Beans, which, perhaps, are most frequently given, are little less than 1*d.* per lb., and oats and oil-cake about the same price; whilst turnips, even at 10*s.* per ton, are but 6*d.* per cwt., or upwards of 18 lbs. for 1*d.*; and although the single pound of beans contains more albumen than the 18 lbs. of turnips, and will accordingly make more actual muscle or flesh, yet the turnips contain three times the quantity of unazotized substance, or that which may be converted into fat; and the feeding properties of each having been tested by experiment, an equal weight of beans is supposed to be equal to twelve times the quantity of turnips. According to this experiment it would appear that 12 lbs. of turnips contain equal nutriment to one pound of beans, whilst the latter is equivalent in value to 18 lbs. of the former. How then can beans be profitable for sheep? To answer this question we must bear in mind that every animal requires a considerable quantity of food to keep it in the same state. A sheep requires nearly three and a half per cent. of its weight in hay to keep in store condition; but to become fat it requires considerably more, perhaps half as much again if it will take it. So large a quantity being required merely to keep the animal in the same state, it follows that the more rapidly an animal is fattened, the more profitable it must be. For instance, let us suppose that 4 cwt. of hay will keep a sheep in the same state for four months; now if the animal will consume this quantity in

three months, then the extra hundredweight will go towards fattening or increasing its size. In the same manner if, by giving corn in addition to turnips, we render the animal as fat in three months as it would otherwise be in six, we shall then save the value of the turnips which would be consumed in the extra three months, which will compensate, or more than do so, for the value of the corn, to say nothing of the greatly increased value of the dung. The appetite of the sheep is of course daily satisfied by means of turnips—it can take no more of this food; but by giving another description, different in taste, more attractive to the palate, more stimulating, and considerably more nutritious, the animal is induced to take, and enabled to digest it, and thus can make more blood and increase more rapidly in fat. A variety of food operates like cookery in the human subject, enabling more sustenance to be taken.

With respect to the most advantageous food to be given, there is some difference of opinion, some preferring oil-cake, some beans or peas, and others oatmeal or barley-meal. It must of course depend in some measure on the nature of the farm, as it must, to a certain extent, be preferable to use the product of the land. Sheep certainly prefer beans to oats; and where the former are grown they can be undoubtedly used to advantage. They abound in that principle in which turnips are most deficient, and thus are adapted to counteract, in a measure, the too weakening effect of the turnips; and the latter, abounding more in the elements of fat, probably

prevent the beans from hardening the flesh too much, which they are otherwise apt to do. Oats and barley are more fattening than beans, both contain less albumen; and oil-cake nourishes but little, but possesses the principle of fat in a concentrated form. Perhaps the best plan would be to begin with beans, gradually mixing oil-cake, and finishing with that and turnips alone; or it may be prudent to mix other grain with the beans; or, if more convenient, substitute peas. Mr. Childers states that sheep fed with the addition of half a pint of barley per sheep per day, half a pound of linseed-cake, a little hay, and with a constant supply of salt, become ready for the butcher in ten weeks, and gain of flesh and tallow 33 lbs. to 40 lbs. per head (one sheep gained 55 lbs. in twelve weeks); and that with artificial food 30 tons of turnips will feed 60 sheep; while, on the usual plan of feeding on turnips alone, out of doors, the average of the country is that 20 tons of turnips will feed in sixteen weeks 10 sheep, with a gain of only 20 lbs. of flesh and tallow. The barley and cake cost 6*d.* to 10*d.* per week for each sheep; and the turnips, with this addition, thus go eight times as far, or produce eight times the amount of flesh and tallow.

SECTION XXII.

THE PRINCIPLES AND PRACTICE OF BREEDING.

THE management and selection of any breed of sheep must after all become a matter of pounds,

shillings, and pence. The question the farmer has to consider is, what description of sheep will in the long run return the most profit; and this question must be viewed in strict relation to the management he will be able to adopt on the particular farm on which he may be located. It is not therefore a simple, but a compound question. It is not merely which breed will make most flesh and fat, but which will make it in the shortest time and on the least food; which can bear the weather, or hard keep, or travelling, or a particular mode of management, with the greatest impunity. All these considerations must enter into the farmer's mind before he can come to a sound conclusion. From the want of making these considerations many fatal mistakes have been made, and a flock has been selected altogether unsuitable to the soil, and incapable of bearing the severity of the weather.

The two breeds which appear as rivals in their claims on public attention are the *New Leicester* and the *South Down*. It cannot be doubted that, as far as propensity to fatten and early maturity is considered, the Leicester will not only rival, but eclipse all others; for these qualities the form may justly be considered as a model, and all other breeds will possess these qualities in a greater or lesser degree, in proportion as they possess the similitude of the form and points of the Leicester sheep. The South Down itself will not be an exception to this rule, for if the improved and the neglected specimens be compared together, it will be found that the excellencies of the former consist in those points

which approximate most to the Leicester. The wool, too, is also a consideration; for the fleece, from its greater length and weight, will bring in nearly double that of the Down. Where, therefore, the pasture is very fertile, and the sheep can be tended with much care and without exposure, the Leicester may be justly regarded as the most profitable of the pure breeds. Its drawbacks, however, are the incapability of the animal for bearing exposure, or travelling, or living hard; in fact, its weaker constitution, and greater liability to inflammatory disorders. It is thus unfitted for the purposes of folding, or for the exposure of the South Downs, and still more for contending with the severities of the Grampian Hills or the Welsh Mountains. In such localities these sheep could not endure. Then again the mutton is by no means so good as the South Down, which, however, is partly, not wholly, owing to the early period (twenty months) at which they are fit for the butcher, and partly to the very large proportion of tallow in proportion to the lean. Thus it is not a favourite in the London markets, and accordingly, of late years, the first cross between the Leicester and the Down has been produced instead of the Leicester; and it is contended that this first cross is the most profitable sheep that can be fattened, making greater and more rapid progress than the Down, and better meat than the Leicester, and possessing, to some extent, the dark faces of the Down, which sign-manual of their origin renders them a greater favourite with the butcher.

The South Down, or rather the improved South Down—for there is a great difference between the two—possesses most valuable qualities; with a propensity to fatten inferior only to the Leicester, but with later maturity (often thirty-two months, though considerably shorter than what it once was), this breed are excellent travellers, well adapted for folding, hardy compared with the Leicester, and capable of living on short pasture, and perhaps the best of all breeds for the down farms of the south of England. The mutton, too, is more esteemed than any other, with the exception of the small mountain sheep. Perhaps there is no ancient pure breed of sheep that has undergone so much improvement as the South Down, and it affords the owners of other breeds a proper example, showing what can be done by care and attention, and the application of proper principles. Nothing can afford a better proof of the sterling qualities of this breed than the facts that some twenty or thirty years since, the price of South Down wool rendered the fleece a matter of great importance; and now, although the price is reduced to one-third, and it can never expect to realize much advance, yet, notwithstanding this, the valuable qualities of the animal and the improvements that have been made have enabled the breed still to retain a foremost rank in public favour.

With these two valuable breeds, each adapted for different pastures, it may, perhaps, be asked, what need is there of any other. It will, however, be found that in the marshes of Kent and many other places, the superior hardihood of the native breeds

has rendered them more profitable than the Leicester, though, unquestionably, crosses with the latter have much improved their value. And notwithstanding the eminent qualities of the South Down, they have been found not sufficiently hardy to endure the severities of the Grampian hills or the Welsh mountains. They have been tried and found wanting: vast numbers have been destroyed by the rigours of winter in these bleak situations, and the losses that have accrued to many parties have deterred others from following their example.

The *Cheviot* sheep possess many valuable qualities; decidedly inferior to the South Downs in their fattening powers and their early maturity, they are superior in these points to all other mountain sheep, and, in hardihood, even to the South Down, and are thus the best adapted to their native hills, and all other pastures of a similar character. When carried, however, to the extreme north and the islands of Zetland and Orkney, it is said they are not sufficiently hardy for these extra-rigorous places, although it is probable, with a little increase of care, they might be rendered so, and they would then be far more profitable than the ungainly forms of the native breed.

These three breeds—the Leicester, the South Down, and the Cheviot—may be considered as the principal pure breeds which this country possesses. They are essential to the variety of pastures which obtain, and without them this country could not be properly stocked. Other breeds, which it may be advantageous to adopt, either possess peculiar qua-

lities which render them valuable or have been crossed extensively with more improved breeds.

The *Dorset* and the *Somerset*, for instance, are valuable on account of the ewes taking the ram so much earlier than other breeds, so that the lambs come into the market when scarce, and thus command a higher price. These qualities have caused this breed to be diffused to a great extent, within the circuit of a hundred miles of London. It is a common practice to purchase these ewes in lamb, at the Michaelmas fairs in Wiltshire and Hampshire, and to fatten the lamb first and then the ewe, renewing the flock the following year. This practice can be pursued most advantageously by farmers possessing farms with sufficient pasturage in the neighbourhood of the London railroads, and the demand they excite makes it answer the purpose of breeders in the west to supply them. The qualities of this breed, in other respects, are inferior to the Downs; the mutton is not quite so much esteemed, the sheep are not so hardy, and do not possess equal fattening powers.

The ewes, previously to being sold, are usually put to a South Down ram, by which means the lambs have a greater propensity to fatten, and they exhibit no appearance of horns—which is a feature much looked to in the London markets.

The *Leicester* have been extensively employed in improving the breed of other sheep, and so successful has this practice been in many instances that the result of the cross has produced a breed more profitable than the *Leicester* itself, retaining the fatten-

ing qualities of the sire with the greater hardihood and adaptation to the soil possessed by the native breed.

The *Romney Marsh* sheep have been thus improved. The size and strength of the original breed were, to a great extent, retained; and, exposed as these sheep are to occasional floods, and the deep dikes requiring much activity, the Leicester blood itself would not have contended against these difficulties; but, mingled with the native breed, it improved its fattening qualities and disposition to early maturity, and destroyed much of the old coarseness.

The *Bampton* sheep, or *Devon Notts*, are also striking instances of the benefits of this cross, and are thus so well adapted for the rich grazing land of Somersetshire and Devonshire.

The *Cotswold* sheep have been similarly improved; the large frame and length of wool of the Cotswold have been retained, together with much of the fattening qualities of the Leicester sire. The product of this cross has also been employed in Hampshire in combination with the native Hampshire Downs; and the result of this plan, carefully pursued, has been to unite, in a striking degree, the peculiarities of each of the three breeds, the fattening properties of the Leicester, the size and length of wool of the Cotswold, and the hardihood and adaptation to the soil and folding capabilities of the Down. It is indeed boldly urged by the principal breeder of these sheep that he will challenge all England to produce sheep that will yield a larger return.

Another plan, very frequently followed and with

much success, is that of being satisfied with the first cross with the improved Cotswold, after which it is contended that they degenerate. Others prefer a second, third, and even a fourth cross; that is, they put the produce of the South Down or Hampshire Down and the improved Cotswold, to the South Down ram, and use the same bred ram again and again, for several generations. By this plan the size of the sheep is enlarged, and the fleece is much more abundant, and it is really astonishing to observe, even after the Down ram has been employed for several generations, how much even then of the qualities of the Cotswold and the Leicester is still retained.

The South Down ram has been employed extensively for the purpose of improving the mountain breeds, both of Wales and Ireland, and the result, when care is taken to retain a preponderance of the indigenous breed, has been very successful.

The Cheviots have been employed for a similar purpose, and the result has been pretty generally attended with success.

Whatever breed may be selected as most suitable to the soil, one thing has been fairly shown—that the most profitable way of management is to bestow on them considerable care and attention. The thriftless economy that would deny them shelter from the pitiless blast, or expose them during the lambing season to the unprotected rigours of winter, has been proved, both by practice and theory, to be as unprofitable as it is cruel.

It has been clearly shown, both by theoretical

reasoning and actual experiment, that warmth and thriving are closely connected—that the influence of cold is to waste the body or to render more food necessary; in fact, that, to a certain extent, warmth is a substitute for food. Thus we see the importance of the fleece during the winter; it preserves the temperature of the sheep and prevents waste, and we cannot be surprised that animals thrive more during the summer than the winter, unless during the very hottest period.

On the majority of farms there is much room for improvement in this respect, and in no case will the advantage of shelter be uselessly bestowed, and the many plans of affording it is a matter worthy of much consideration.

If the lambing season should be early or the weather severe, the benefit of shelter will be doubly apparent, and will abundantly repay the expense bestowed. It is a pleasing circumstance to find that the profit of the breeder and humanity to the sheep are so closely connected together.

The advantages and disadvantages of folding have been the subject of discussion, and have given rise to much difference of opinion. In many farms the advantage of folding is the principal purpose for which the flock is kept; and, indeed, on many light hilly farms at a distance from a town, it would be impossible to cultivate the land without a flock. The custom used to be to fold the sheep on a naked fallow every night, and to do this it was often necessary to drive them a considerable distance. Much loss in the carcase was the result of this prac-

tice: the tiresome travelling of the flock and the long deprivation of food materially retarded the thriving of the sheep.

The turnip system of husbandry, and particularly the introduction of the Swedish turnips, created a sort of revolution in agriculture. As a substitute for a fallow, turnips consumed on the land afforded an abundant dressing for the succeeding crop. And the Swedish turnip, by affording a good supply of food at the most difficult period of the year, viz., the latter part of the winter and the early spring, when the common turnips, if kept, would have been rotted by the frost, enabled a much larger number of sheep to be kept on each farm. Whatever doubt, therefore, there may be as to the advantage of folding sheep on a naked fallow, there can be none as to the benefit derived from folding them on turnips, and thus consuming the greater portion of the latter on the spot. The expense both of the carriage of the turnips and the dung is thereby saved, and on hilly land this is very considerable, and the sheep, having abundance of food, do not suffer in consequence. It is a common and beneficial practice to let the fat sheep have the run of the turnips first, and to follow them by the ewes or the poor sheep. Hay is generally given at the same time, and is extremely desirable, as counteracting the effects of the redundant moisture in the turnips, and thus preventing disease. If turnips unlimited are given to ewes in lamb, they are extremely apt to produce abortion, and particularly if the season is mild and vegetation rank and forward. It will be

more prudent with them to draw a portion of the turnips, and give it to the ewes with hay on some old pasture.

On some farms it is customary, after a light coating of dung has been spread on the land as a preparation for wheat, to enhance its virtue by folding the sheep on it, a plan desirable when manure is scarce or weak in quality; but though beneficial to the land, it is otherwise to the sheep, unless some artificial food be given at the same time. It is customary, however, to adopt this plan with ewes in lamb, and it is found to be safe practice; that is, to give them hay in the fold at night, and keep them on the downs during the day, unless there is a hard frost or snow on the ground.

The value of folding has been estimated to be about 40s. per acre, differing, however, according to the manner in which the sheep have been kept, as turnips and succulent food render it better than grass alone. Four hundred South Down sheep are sufficient to fold twenty perches per day, or forty-five acres per year, the value of which is, therefore, about 90*l.* per year, or 4*s.* 6*d.* per sheep. Whether this is sufficient to repay the loss in flesh and wool over that of a different system of management, has been a matter of dispute and a subject of calculation. Some have advised a standing fold on some dry and convenient spot well littered with straw or stubble. Three hundred sheep have in this manner produced eighty large cart-loads of dung between October and March, and in this manner, after the expenses have been deducted, each sheep has earned 3*d.* per

week. This plan possesses several advantages, which render it greatly superior to folding on a naked fallow. The sheep are kept sheltered and dry, and the sheds or yards in which this plan is pursued will be exceedingly convenient at the lambing season. The dung, too, thus formed can probably be more evenly spread on the land than it would otherwise be.

On heavy lands it is, indeed, impossible to keep sheep in the turnip field throughout the winter; the wet and dirt would be destructive to the sheep, and the treading of the animals injurious to the ground. For four or five months it is, therefore, indispensable that they should be kept in sheds, and the turnips drawn and carted to them. It is satisfactory, however, to find that this plan is so little more expensive on the whole, as to be urged by its advocates as a superior method in all cases. We are, however, decidedly of opinion that on light land the convenience of consuming turnips on the land, and the saving of carriage both of turnips and manure, render it the most advantageous plan, whilst on land inclined to be heavy or wet, the use of sheds or standing folds will be the superior method.

Even on down farms at a distance from a town the practice of folding on naked fallows is susceptible of great improvement, by giving the sheep some portion of artificial food, as corn or cake; the dung will be thus considerably improved, the sheep will be stronger and more healthy; and in fact, a greater number can be kept.

With regard to the application of the manure to

the land, there cannot be a doubt that folding is the more profitable method; for the ammonia, which is the valuable part of the urine, is prevented from escaping by being fixed and absorbed by the humus in the soil, whilst in the standing fold much of it is evaporated. This superior advantage and greater convenience will, no doubt, perpetuate on light soils the practice of keeping sheep in the field, not only with regard to the breeding ewes, but also with the fattening sheep; whilst on heavy lands a contrary practice will be pursued during the winter months; and with reference to the sheep alone there is no doubt whatever that they will thrive far more rapidly and with less food in an enclosed shed than in the open field.

The improvement of a flock by means of breeding requires very considerable and long continued care.

The qualities of both parents must be considered both with a view of correcting bad as well as perpetuating good qualities. It must be acknowledged, however, that in the majority of cases the influence of the male preponderates over the female, and the characteristics of the former are more likely to be impressed on the offspring than those of the latter. This is shown in most animals. The mule partakes much more of the nature and the size of its sire, the ass, than of its dam, the mare. A large Cotswold ram put to a Down ewe produces an offspring much more resembling the former than the latter; and a pony mare put to a full-size horse will produce an animal half as large again as the dam. Though this, however, appears to be Nature's rule, it is not

one without exception, for occasionally we see the very opposite results. In breeding animals of a pure kind the principal rule to be observed is to breed from the very best of both sexes, to cull the faulty ones every year, saving only the female lambs for the future flock that are as free from defects as possible. Of course the flock must be kept up to its proper size, but year by year the finest animals should be selected, until, in the course of time, the flock will entirely consist of them. Until this is nearly accomplished it will not be prudent for a farmer to employ his own tups for the purpose, as he will probably be able to hire superior rams from others, and it will not do to spare some expence in thus raising the character of his sheep. The practice of letting tups is not so profitable as it once was, owing to the extension of improvement throughout a number of districts, and thus further improvement is rendered easier and cheaper.

There are various points that are sought after by breeders, not because of the particular value of those points, but because they are evidence of other valuable qualities, such as aptitude to fatten and early maturity. Thus, in the South Down breed, small heads and legs, and small bones, are esteemed, as they are qualities which are found connected with fattening properties. Black muzzles and legs are also valued, probably because they denote the good constitution and hardihood of the animal. We must, however, take care lest, in carrying these points to an extreme, we neglect other valuable qualities. Straightness of the back, breadth of

loins, and rotundity of frame, are points which cannot be disputed, and are not merely *signs* of good qualities, but good qualities themselves. The straightness of the back, so perfect in the Leicester, is by no means natural to the South Down in an unimproved state, but rather the contrary. In the improved breeds, however, it is present, and is justly regarded as an excellent point, giving a better surface for the laying on of flesh, and affording larger scope for the abdominal organs. Its converse, too, a round or convex back, is produced or increased by the effects of poverty and cold, and is almost sure to follow if the breed is neglected and exposed.

The development of bone, of course requires nutriment, as well as any other part, though not perhaps in the same degree. Large bone, therefore, abstracts nutriment which would otherwise be more profitably employed, and thus is anything but a desirable point in sheep. Horns, for the same reason, are much better dispensed with. One point in sheep, which is justly regarded as extremely favourable, is a soft mellow feeling of the skin and parts beneath. These parts are the cellular or rather adipose membranes, which in fat sheep are full of fat, and in lean sheep, when possessing this mellow feeling, denote the plentiful existence of these membranous cells ready for the reception of fat, which is deposited in them almost in the form of oil.

Breadth of loin and rotundity of frame are qualities that require no observation, having been before

alluded to. The former denotes the presence of a large quantity of flesh in the spot where it is most valuable, and it also bespeaks a large and roomy abdomen. A round frame is also the sure attendant of a large abdomen, and an extended surface for the muscles of the back and loins. A general squareness of frame bespeaks large muscles, particularly of the quarters.

What, indeed, is wanted in a good-formed animal, is as much flesh and as little bone and gristle as possible, and this flesh is required where it is most valuable: for instance, it is much more valuable on the loins and quarters than about the head and upper or scrag end of the neck. A large development of flesh is pretty sure to be accompanied by a disposition to fatten; but for profitable feeding it is essential that these qualities should be developed early—constituting early maturity.

The attempt to improve the breed of sheep by means of crossing is a still more difficult task, demanding not only the application of correct principles, but a great degree of practical judgment and shrewdness. Many have been the fruitless attempts that have been made, and in numerous cases a useful breed have become mongrels in consequence, or altogether unsuited for the climate or the soil. These results have induced many respectable breeders to condemn the practice of crossing altogether, but certainly without sufficient reason; for the lines of demarcation between one breed and another are by no means so strongly marked as to prevent the union of different breeds producing harmonious results.

The object of crossing is either to increase the size, or improve the shape, fattening propensities, early maturity, or the quality or length of the wool. In producing any of these improvements it would, at first sight, appear that all we have to do is to select a ram of any particular breed most famous for the particular quality we wish to produce. But this will not always do; by so doing we shall oftentimes rear a breed weak in constitution; or, from too great a contrast between the parents, shapeless mongrels may be produced.

As a general rule to render crossing successful, we should endeavour to find some affinity of constitution between the improvers and those we wish to improve; sometimes the character of the wool denotes this affinity.

Thus there is scarcely a breed of long-woolled sheep but what has been greatly improved by means of the Leicester ram, whilst it generally failed in effecting any permanent improvement in short-woolled sheep, amongst which the South Downs have been far more successful. As a general rule, the first cross between a superior and an inferior race is very successful, producing animals approximating, in most respects, to their more improved parents, but after the first cross the breed usually deteriorates.

It must, therefore, be borne in mind that crossing is an experiment sometimes succeeding and sometimes failing in producing a proper combination of the qualities of both parents. Judgment is shown in selecting the successful results and rejecting the

others; and thus, after a few generations, a breed of sheep is sometimes produced which it is desirable to perpetuate without further mixture; but this selection must be continued for many generations, as the original sin, almost disappearing in the first cross, is continually reappearing afterwards.

As an instance of successful crossing, I may mention the breed between the improved Cotswold and the Hampshire Down. The Cotswold or Gloucester sheep is a large animal, celebrated for centuries for the length and weight of the fleece. As a long-woolled sheep it is superior to most others, but its carcase was very much inferior to the Leicester, and thus, by crossing with the latter, it has been greatly improved in its fattening properties and early maturity, whilst the quality of its fleece has been retained. The Hampshire is a larger variety of the South Down, derived originally in great measure from the flocks of Sussex. Either from economy or choice, the largest and coarsest animals were selected and crossed with the native horned sheep, and this breed has been perpetuated on the farms of North Hampshire for the last forty years. It is a strong, hardy sheep, thriving well on the open down farms, and well adapted for turnip husbandry. If such sheep were crossed with the pure Leicester, in all probability the offspring would not be sufficiently hardy to endure the treatment the Downs receive. But the old Cotswold being hardier than the Leicester, the improved Cotswold is so likewise, and thus the result of the cross between the latter and the Down is sufficiently hardy to undergo the system of

the country; and at the same time, by careful selection, the peculiar qualities of the three breeds were to a certain extent united into one. It must, however, be confessed, that though highly spoken of by a few supporters, this breed has not met with general patronage; and a more usual plan is, after the size and fleece have been improved by the Cotswold, to recur again, for successive generations, to the Down ram.

The subject of breeding in and in, or from near affinities, is one which has given rise to much discussion, and on which there still prevails much discordance of opinion. Its merits, however, can be best understood by carefully examining into its advantages and disadvantages. In the human subject, sexual intercourse between near relations is very properly forbidden by law, and appears, indeed, altogether foreign to our feelings; and even marriage between relatives of the second degree, such as cousins, is regarded by many persons as subject to great objection, and apt to entail disease on the offspring, and particularly disease of a mental character. Statistical facts bearing on this matter certainly support this opinion in a marked degree.

With animals there is no reluctance to sexual intercourse between the nearest affinities, and the custom of breeding from sheep closely related has been for a long time practised by breeders of considerable eminence. In the human subject the objections to the practice are at once granted, but let us see whether they likewise obtain with animals. In the former, marriages are generally entered into

with little if any regard to the health of the individuals concerned, the consequence of which is that the diseases of the parents, or rather their predispositions, are entailed on the offspring. The result of this is that most families have predisposition to some particular complaint; and thus if two members of the same family have sexual intercourse, the probability is, that if both parents had predisposition to a particular disease in an equal degree, this will be increased in their offspring in a double ratio. But on the contrary, if a man unites with a woman of a different family and a different predisposition, the idiosyncrasy of the offspring to the diseases of either parent is likely to be prevented or retarded.

With animals the case is different. - If due attention be paid, a principal object will be to breed from healthy subjects, by which means one fertile cause of hereditary predisposition to disease is prevented. A healthy form and sound constitution are essential to successful breeding, and for the development of those points we seek to obtain. Thus the principal objection to breeding from near affinities which exists in the human subject, does not obtain amongst animals; and even if, in the former, mental disease is more apt to occur when this practice is pursued, this also is an objection which does not apply to animals, though it has been urged by some that sheep bred in and in are more subject to diseases of the brain—a conclusion, however, which I am much disposed to doubt.

Thus the objections to breeding in and in are not insuperable; what, however, are its advantages?

The stronger resemblance there is in the qualities of both parents, supposing those qualities are good, the more likely is it that the offspring will be perfect. By breeding with a view to improvement the greatest excellencies are likely to be concentrated in one family; if, therefore, the members of this family were not coupled, they must probably be united to inferior animals of either sex, by which practice improvement will be materially retarded. It is, therefore, very frequently the surest method of arriving at the greatest degree of excellency, and thus it is a practice which has been followed by the most eminent breeders of sheep with the greatest success; yet it does not possess any advantages peculiar to itself and different from those we have stated, and if two rams were obtainable possessing precisely equal qualifications, I should not be disposed to select one because he was a near relation to the ewe, but the contrary.

In and in breeding may thus be either productive of good or bad effects, but in neither case is the result to be attributed to the close affinity, but rather to the circumstances connected with it. If no care is employed either in selecting or culling the flock, unquestionably both disease and defect will arise; and two animals, each predisposed to the same bad quality, being allowed to connect, the predisposition to such defect will exist in their offspring in a twofold degree. If, on the other hand, proper care is employed—if those animals only are allowed to breed that possess good forms and healthy constitutions, then undoubtedly the stock will be pre-

served pure, disease will be warded off, and the proper form and qualifications will be perpetuated.

It must, however, be observed, that there are disadvantageous qualities which may become hereditary, independent of disease; thus want of prolificacy in the ewes, and a tendency to lessen in size, may be and are often considered to be the effect of in and in breeding. This fact (and its occurrence cannot be denied) may be thus explained: a disposition to acquire fat and an early maturity do not co-exist with prolificacy of the ewe or her nursing qualities (the Dorset excel in the latter and the Leicester in the former peculiarity); now in improving the breed the former receives all the attention and the latter none at all,—how, then, can we wonder at the result?

Then again, with regard to the size. Animals that grow most in stature have the greatest development of bone—are, in fact, the coarsest. In improving the flock such animals are avoided, not on account of their size, but their coarseness, and thus in the course of time, the larger sheep having been drafted, the flock consists of the smaller and kinder animals.

Many farmers confine their care and attention, as respects breeding, to selecting the ram as distant as possible from their own flock; neglecting the proper consideration of various important points, they avoid, as they would a reptile, the practice of breeding from near affinities, believing it the parent of almost every evil by which sheep are affected. The folly of this idea has been shown; it arises from not

understanding the principles by which breeding is regulated.

There are certain diseases by which man and animals are afflicted, which are far more hereditary than others, that is, the predisposition to them is hereditary. Thus insanity, consumption, gout, are of this class in man; one family may be disposed to one complaint, one to another, but if two members of the same family unite, the idiosyncrasy is greatly increased. So likewise, with sheep, *giddiness* may be hereditary, and some breeds or families may be more disposed to it than others, and then it may be increased in those cases by in and in breeding. An ingenious anonymous writer, indeed, ascribes this disease to the contracted skull which some sheep possess, and the form of such skull being hereditary, the diseases it induces (if such be the fact) must, of course, be the same.

Some farmers are great advocates for a pure breed and a long pedigree, whilst others despise the pedigree and prefer gaining their ends by means of crossing. Each, to a certain extent, is right, and each wrong. A pure breed and a good pedigree are valuable, not simply on account of the breed, but of the circumstances with which it is connected; so, likewise, crossing is often baneful, not simply on account of itself, but for the risks to which it is exposed and the evils which it may induce. A pure breed means a breed which has not been crossed with others, but in this simple view of the case, we may find it with the native flocks of the Kerry mountains or the Orkney Islands. It supposes, however, or is generally

understood to possess, some uniformity of character, and also the exercise of care in preserving it from mixture with other breeds. A long pedigree, though it is possible it may be useless, yet supposes a descent from well-formed animals, and the endeavour, by successive breeding, to perpetuate the good points which the originals possess. It supposes, also, a uniformity of character, both with regard to defects and excellencies; a preservation from those evils which the mixture of a different blood may have occasioned, as well as those good qualities which it is possible a different race may have imparted. Pure breeding is, in fact, to speak metaphorically, the surer and safer, though it may be the longer and more tedious voyage, which leads to excellence; whilst crossing, on the other hand, is the shorter and more rapid course to the same port, but beset with rocks and shoals, through which it requires a more skilful hand than usual to steer the vessel, which may be foundered and lost, or battered and injured, in consequence. A flock of sheep may, by injudicious crossing, lose all their valuable points and become a flock of mongrels, or otherwise so weakened in consequence as to be of much less value. Many flocks of Ryelands and other sheep still show the evil effects of a mixture of the Merino blood, and other similar cases could be mentioned. Defects, too, may be engendered, which, though not perceptible in the first cross, may break out in the third or fourth generation, and the uniformity of character originally possessed may be lost; and it should here be mentioned, that it is a general opi-

nion, and one founded on fact, that crossing succeeds best with the first cross, the offspring of this first cross being generally inferior to their parents.

But though crossing is attended by these dangers, yet it does not follow that they are without remedy, or that the practice should be abandoned in consequence. Its advocates may justly point to the name of Bakewell, and the creation of his hand, the New Leicester breed. It has been stated that in forming his breed he procured animals from a great variety of flocks, both short-wools and long-wools; but, though this is doubtful with regard to the former, it is unquestionably the fact that he selected animals wherever he thought he could obtain the wished-for qualities, with, at any rate, no regard to in and in breeding. And though we have no authentic information as to the origin of the breed, and though probably many experiments that he practised failed and were abandoned, yet we cannot doubt that extensive crossing was employed in the creation of this breed; but it was employed by a master-hand, and for various generations watched over with the most vigilant care, until a uniformity of character was obtained, and the unrivalled Leicester presented to the admiration of the world. Perfection now being obtained, Bakewell cast away the ladder by which he ascended to such excellence, and then advocated pedigree, purity, and in and in breeding; and why did he do so, but because his breed being superior to all others, he of course could not expect improvement from other inferior animals, but could only preserve his own from dege-

neracy by retaining them pure. Thus the Dishly breed affords an argument not only for the advocates of crossing, but also for those of in and in breeding; and it also supplies a caution, both to the one and the other, that either practice must be pursued with the utmost judgment and care.

Neither practice is deserving of condemnation; it is their abuse, not their use, that is to be reprobated; but at the same time it is to be regretted that greater endeavours have not been made to improve many of our native breeds by carefully selecting the best animals for the purpose, instead of, as in many cases, flying heedlessly to crossing:—a real national benefit would thereby have been attained.

If crossing is adopted, it is very desirable to attend to certain principles by which it is influenced. The more closely the natures of different animals approach each other, the more likely is the offspring they produce to be according to our wishes, for Nature does not delight in contrasts. Long-woolled sheep are best adapted to breed with others having likewise long wool. If two animals very opposite in their qualities are put together, the offspring may resemble either one parent or the other, and the faults of either, or both, may appear in the second or third generation. It is found that the Leicester agree better with the Black-faced and other heath breeds than do the South Downs; and the coarseness of the wool of each denotes a resemblance, which, from their very opposite natural pastures, we should not expect.

Crossing should be adopted cautiously, and at first

with only a portion of the flock, for we should not run the risk of spoiling the whole; and the success of the first experiment will then regulate the second. It is not a bad practice, where it is intended to substitute a new for an old breed, to do so by using the male animals alone of the new breed for successive generations, until the character of the old breed is lost. Thus if this plan is pursued for several generations, the great grandson will possess seven-eighths of the new blood, and one-eighth only of the old, and in the next generation one-sixteenth of the latter only will be retained. It is in this manner, though not effected with regularity, that nearly the whole of the sheep of Australia have become almost entirely Merinos. It has also been successfully employed with other flocks, and may be considered the cheapest as well as the safest system by which a new improved breed can be made to supplant an old and imperfect one.

It is a good rule in breeding for improvement, to breed from the best of the kind; and if a superior ram of the same breed can be procured from another flock, by all means to make use of it, and even to give it the preference if it is equal to our own; but if our own excel all others that may be available, then to use it, but with additional caution, taking care to mark those ewes that are deficient in any of the qualities we wish to perpetuate.

And with regard to crossing, if we do it merely for the butcher, then it is better to be satisfied with the first cross alone; but if we cross to correct a bad

or produce a favourable quality, then we should immediately return to our own breed as soon as such effect has been obtained, always bearing in mind that we are treading on soft and treacherous ground, and may, without caution, be plunged into the mire.

SECTION XXIII.

ON WOOL AND ITS MANUFACTURES.

THE woollen manufacture is one of the oldest, as well as the most valuable, which this country possesses. It has been said that the Romans introduced the arts of spinning and weaving, and established a manufactory for the purpose in the ancient city of Winchester. Under the Saxon monarchy it was assiduously cultivated, but in a domestic form. The females of the house were usually devoted to the task, which was esteemed so honourable that princesses and noble ladies did not disdain to employ their hands in the pursuit, and thus indeed the present term of spinsters for unmarried ladies had its origin. The cultivation of wool in the feudal ages formed one of the leading sources of national wealth, and indeed was sometimes used to supply the limited coinage of the country. It often afforded to the sovereign a means of waging a war or paying a ransom. The Low Countries, however, took the lead in the manufacture of woollen goods whilst attached to the Spanish monarchy; but the religious persecutions, and the tyrannical

and oppressive conduct of the government, crippled the industry of the country, and drove its industrious Protestant artizans to other lands. England afforded to them its protecting arm; and from this source the prosperity of our woollen manufactures may be considered to arise. It took the lead amongst the countries of the world, and, in spite of impolitic laws at home and oppressive imposts abroad, it has hitherto maintained its high position, fluctuating, however, according to the degree in which it has been either shackled or unconfined. And notwithstanding the sudden rise and remarkable progress which the cotton manufacture underwent during the latter part of the last century, the woollen trade has continued its steady progress, apparently but little affected by it; and such is the extent to which it has now reached, that it amounts annually to thirty millions sterling, and employs nearly a million and a quarter of artizans.

In almost every country, with the exception of Britain, the fleece of the sheep forms the principal value of the animal; it is, therefore, the chief object of the breeder's attention, and the carcase is comparatively neglected. In this country such is the demand for meat of good quality, and the price it realises, that the wool becomes a secondary consideration. That form of animal most productive of meat is most sought after; and this will continue to be the case whilst wool of the best and finest quality can be readily procured from other countries.

To this may be added the fact that the dampness of the climate in this country is unsuitable for the

production of fine wool, and the system of management altogether is opposed to it. A considerable quantity of straw and other dry food, with nightly shelter, is the method successfully employed in Germany in improving the fleece; turnips and a moist diet are prejudicial to it; and even on our driest pastures, the Downs of the south of England, the chalky soil gives a roughness to the wool. Thus the very same system which improves the carcase deteriorates the wool, so that fat mutton and fine wool cannot exist together.

Wool differs from hair principally by growing in a spiral form, and being more pliable and softer, and having an unctuous secretion, whilst it resembles it by springing from small bags beneath the skin, which it penetrates. Like hair, each filament is a minute tube filled with pulp, but has a scaly external structure pointing to the extremity, and to which it owes its felting power and its adaptation for clothing purposes. In many wild breeds hair is greatly intermixed with the wool, which is thereby deteriorated, but frequent shearing lessens or eradicates it.

In this country the fleece will generally come off itself every year in the warm weather, a period which is anticipated by shearing. Lambs are generally allowed to go unshorn, which improves the fleece of the following year, and obtains for it, as teg wool, a somewhat higher price. The wool of this country has been long distinguished as *long* and *short* wool, to which used to be also applied the terms *combing* and *carding* wool. This latter dis-

tinction, however, no longer applies, for the greater part of the short wool that was formerly applied to making cloths is now devoted to combing purposes. This is owing to the great superiority of foreign Merino wool, and to the restrictions which formerly prevented its introduction now being removed. This, of course, has materially reduced the price of British short wools, and it would have been still further reduced had not the improvement in machinery enabled the short wool to be devoted to combing purposes. The same fleece affords wool of various degrees of fineness, and it is the business of the woolstapler, who purchases the fleece of the grower, to sort these various qualities, and prepare them, indeed, for the manufacturer. The fleece is unrolled, and the workman, having a number of baskets around him, selects the fine locks from the coarse ones, and arranges them in the baskets around him with a degree of celerity surprising to the uninitiated. He is directed both by the sight and touch in this operation, and is obliged to serve a regular apprenticeship before he acquires the proper degree of skill. The finest wool is procured from the neck, shoulders, and sides; the next from the upper part of the legs and thighs, extending to the haunch and tail; and the most inferior is distributed on the upper part of the neck, throat, belly, breast, and part of the legs. The stapler, however, arranges it in six different allotments, and the finest wool is divided into no less than ten, and these are termed according to their degree of fineness, beginning with the picklock, which is the best, then the

prime, the choice, the super, the head, the down-rights, the seconds, the abb, the livery, and, lastly, the breech wool. These divisions, which would be much better expressed in numerical order, denote the variety which exists even in a single fleece.

It will be well here to allude to the two purposes to which wool is devoted. *Carding* is a name given to the process which wool undergoes in being made into cloths or woollen goods, whilst *combing* is a part of the process in making worsted goods. Short and fine wool, for the most part, is employed for the former, and long and coarse wool for the latter. The card is an instrument which breaks and divides the wool into a multitude of fragments, which, from the spiral growth of the wool, are necessarily left in a curved state, and from this and another cause they are disposed to lock together and adhere on being subjected to moisture and pressure, as is shown in the felt of a hat, which is thus made. This disposition is called *felting*. After being broken into fragments which adhere loosely together, it is spun and woven into cloth, being for this purpose well oiled. It is afterwards fullered, that is, the oil is extracted by means of fuller's-earth, and it is the moisture and pressure of this process which call out the felting properties of the wool, and give it that close and dense appearance which fine cloth assumes. Wool for worsteds, on the other hand, is combed smooth and not broken into pieces, and is then spun, so that it retains a looser appearance.

The perfection of wool-spinning cannot be better illustrated than by the facts that in ordinary spin-

ning a pound of wool is made to extend upwards of 1300 yards; in superfine spinning, a distance of 22 miles; and it is an established fact that this quantity has been spun into a thread reaching the incredible distance of upwards of 95 miles.

The felting property and other qualities of different wools have long been made known by practical experience, but we are indebted to Mr. Youatt for the discovery that the felting property depended in great measure on the number of serrations on its surface. This gentleman, after several laborious attempts, at length succeeded, with the assistance of a powerful achromatic microscope and its scientific maker, in developing the singular structure of wool and the difference between wools of different qualities. Each fibre was found to consist of a number of leaves attached to a central stem or band, and extending in one direction, viz., from the root to the point. This was the result of examining a filament on an opaque object; but when viewed as a transparent object, the edges of the leaves were more visibly apparent, appearing like so many teeth pointing in one direction, and thence properly termed the serrated edge. The fibre of wool thus magnified appears somewhat like the common fir-apple. On examining different wools, Mr. Youatt found that the number of serrations corresponded to the felting qualities of the wool, being in the Saxony no less than 2720 in the inch, in the South Down 2080, and in the Leicester 1860 alone.

Thus fine wool differs from coarse in having a greater number of serrations and growing in a more

spiral form, which, of course, increases the number of curves, but to this we must add the fact of its being actually finer or smaller in its fibres; so that whilst a fibre of the coarsest wool is $\frac{1}{450}$, the finest is $\frac{1}{1300}$ of an inch in diameter. The softness of fine wool is another interesting peculiarity, but this may be in great measure owing both to the minuteness of its fibres and the number of its serrations.

1. The Leicester.

2. The South Down.

3. The Merino.

Fibres of three different wools viewed through an achromatic microscope, and sufficiently magnified to show the serrated structure of the wool, as well as the relative size and appearance of the different kinds.

It can easily be conceived how this curious structure of the wool, particularly its serrated edge, must conduce to its felting property. As long as the filaments are kept in the same direction, these serrations are comparatively inoperative; but torn to pieces by the card and mixed in every direction, the serrated edge must tend to hook and entwine together, and this must be pretty much in proportion to the number of serrations in a given space, particularly when this is added to the fact that the wool is more curved as the serrations are numerous.

In preparing the wool for worsted goods the filaments are arranged in a uniform direction by the comb, and spun. Thus carpets and other worsted goods present a looser and more open texture than

cloth or woollen goods. The felting property of the wool is not called into operation, and is in fact much impaired by the necessary processes. The object is to get as fine and even a thread as possible. There are no less than eleven distinct operations under which the wool goes before the manufacture is completed. These are sorting, washing, drying, plucking, combing, breaking, drawing, roving, spinning, reeling, and weaving.

A considerable quantity of British wool is obtained from the skins of slaughtered animals, and the separation of the wool and preparation of the skin is the business of the fellmonger. Mr. Southey, in his little treatise on wool, thus describes the process:—"The skins should be obtained as soon as possible after the death of the animals, when this process is usually adopted:—The first operation is to place the skins, one by one, on a flat stone, and to beat the parts round the head with a wooden mallet, for the purpose of loosening any clots or tufts of coagulated blood adhering to them. The skins thus prepared are then thrown into a vat of water to soak, in order to soften any substance or concretion which might attach to the wool. After remaining immersed from ten to twelve hours, the operation of washing commences by the following method:—

"This process is accompanied by beating the skin with a pole while in the water, which is done for the purpose of removing any dirt which the wool may still retain, it being desirable that it should be made as free from impurities as possible. When this operation is concluded, the skins are placed one

upon another, to the number of twenty or thirty, for the purpose of draining; and when this is accomplished they are laid one by one on a table, with the flesh or pelt side uppermost, when a strong solution of lime and water should be applied to the fleshy side of the skin.

“The brush used on such occasions is similar to the one which whitewashers work with in colouring rooms, and when thus properly smeared over by one person, another should be in attendance to fold the skins, one by one, taking care that the pelt sides are placed inwards; and so soon as this is done they are put on poles and laid about six deep, one above another. This mode is adopted for the purpose of causing the skins to heat, preparatory to the wool being pulled, as the process operates in such a manner as to open or loosen the pores of the skin, by which means the wool is more readily drawn from it.

“The day after the skins have undergone the operation of liming and washing, they are taken down from the pole to shake off any water from the extremity or points of the wool, which, if suffered to remain, would tend to discolour it. The skins, however, remain on the poles until the pores are partially relaxed, which may be ascertained by trying to separate the wool from the skin, as it will leave the pelt when in a proper state of preparation. The skins are then placed in an inclosed shed or warehouse, from which the air is excluded, and each skin suspended by the nostril or nose to afford greater facility in the operation of pulling. Before

this commences a lad is usually employed to cut off the pitch or any hard substance that may adhere to the skin, taking care not to shorten the wool. Previous to the operation of pulling being commenced, the skins should be inspected and assorted somewhat after the following method :—Those which are found deteriorated with kemp, or dead hairs intermixed with the wool, or marked with party colours, should be laid aside by themselves and kept separate from those which are entirely white. It would, in fact, be advisable, where the skins are numerous, to separate those which produce long wool from others of a shorter growth, as each class of wool is by the manufacturer applied to different purposes.

“There are very few party-coloured sheep in English flocks, and not many interspersed with dead or kemp and black hairs. When any perchance do appear, they should be separated from the rest, and their wool kept distinct, any intermixture being extremely detrimental to the consumer, who carefully avoids buying objectionable wool, except at low prices, and to this minute attention should be paid by all those who aim at producing skin wool of an approved quality. The coarse hairy parts about the legs should in like manner be first withdrawn and thrown aside, being entirely useless to the English manufacturer and injurious to his interest.

“When the skins have been properly limed and folded, in the course of two or three days, when the weather is warm, they are generally in a fit state to be pulled, which being done, the wool should be

placed in a loft or open warehouse, and exposed to a free current of air to dry and become fit for packing, as otherwise it might be discoloured by heat, or even ignited, of which I have myself seen a most remarkable instance, by which means a considerable amount of property was destroyed. During a wet season, or in the winter months, the skinner usually has recourse to an inclosed warehouse, heated by iron pipes raised perpendicularly from the floor, in which a large fire is made of coke. These pipes are passed through the several floors where wool is exposed for drying; and at periods when the sun does not afford sufficient warmth to the atmosphere, it is customary to place the skins in an artificial heat of this kind, which proves a substitute for the sun's rays, and prepares the skin for the process of being pulled.

"The English fellmonger draws out the wool from the pelt by hand, the men placing the skins before them on an inclined board, but has occasionally recourse to the aid of an implement called a pulling-knife, which the operator uses in order to assist him in removing the wool from those parts of the skin which have not been sufficiently decomposed, owing to their not being so equally saturated as the rest.

"The skins, after being divested of their wool, are usually placed in a pit or vat filled with lime-water of a moderate degree of strength, compared with that usually applied to skins with the wool attached to them. There they remain two or three days, for the purpose of extracting any portion of the grease

usually found attached to the pelt. Thence they are removed by long iron tongs to a stronger solution of lime-water, and daily drawn up and exposed to the air for several hours during the day, but out of the sun's rays in hot weather. They are then again thrown into the prepared liquid, care being taken to stir up the water previous to their immersion. In this state they continue three or four weeks, or are disposed of in the intermediate time to leathersellers, parchment-makers, or glue-manufacturers, according to their various sizes and condition."

Formerly, and particularly during the continental war, which put a stop to commercial intercourse between this and other European countries, and before we obtained any supply from our colonies, the wool of this country was valued in proportion to its fineness and its adaptation to felting purposes; and wool of this description realised such high prices as induced the growers not only to cultivate the fleece, but to breed from those animals whose fleece was the finest. It was then that the South Down wool was entirely confined to carding purposes, and was highly esteemed. The old horned sheep of Hampshire, Wilts, and Berkshire were devoted to a similar purpose, whilst the little Ryeland bore a striking pre-eminence over all others. It was under the influence of this artificial stimulus that the Spanish sheep were imported into this country, and the most sanguine expectations were entertained as to the result. It was thought to combine, in one animal, the advantages of the fleece

and the carcase too; and even after this was found to fail, the superiority of the Merino fleece was sufficient to induce many farmers to sacrifice the carcase to its cultivation. Soon after the peace, however, a change came over the shadow of the farmers' dreams. Little by little the restrictions on the importation of foreign wool were lessened or removed, and the Merino sheep having been largely and successfully cultivated throughout Germany in the meantime, the superiority of the Saxony over the British wool was immediately apparent; and the price at which it could be procured being comparatively low, down fell the price of wool, and with it the hopes of the farmers, so far as they were built upon it. The pure Merino was cultivated at too great a sacrifice of flesh, and the mixed breed proved to be so inferior to the foreign in quality, that neither were found to pay, and thus we cannot wonder that they have been gradually discontinued; and it has now become a settled point that fine wool cannot be grown profitably in this country. This is the less to be regretted, inasmuch as our widely extended Australian possessions offer a vast field for its successful cultivation, where the extent of pasturage, the cheapness of the land, and the suitableness of the climate, altogether point towards this peculiar branch of industry. The wools from these colonies have gradually improved, and the best qualities nearly rival that of Saxony.

The British fine wool being thus, as it were, driven out of the market by a superior article, attention was very properly directed to quantity rather

than quality, and thus a stimulus was given to the long-woolled breeds. The long and the short wool of this country having nearly, if not quite, approximated in price, it was found, of course, that it was more desirable to have a fleece of six pounds and upwards than one of three only, and particularly as these breeds, having been greatly improved, could be cultivated to greater advantage in suitable soils, with regard to the flesh alone. Thus we have the reasons why the production of long wool has so greatly increased in this country, that whilst in 1800 there were only 131,794 packs, in 1828 there were no less than 263,847, being an increase of 132,053; whilst during the same period the packs of short wool have decreased to the number of 72,820. The improvement in agriculture has enabled the farmer to keep long-woolled sheep in situations where the short-woolled alone could exist before.

During the period of these changes the consumption of worsted goods, both at home and abroad, has greatly increased, and with it the demand for long wool, so that it would soon have realised a superior price to the short wool of this country, had not the improvement of machinery enabled the manufacturer to use the short wool of Britain likewise for combing purposes, and particularly for the production of goods of a peculiar kind, such as the Peter-sham and friezed coatings, army and navy cloths, besides blankets and other coarse woollens; so that at the present time there is but little, if any, difference in price between the long and short wool of

this country. It appears from the tables of Messrs. Luccock and Hubbard, that in 1800 the number of packs of short wool produced in England alone was 193,475, whilst in 1828 it was reduced to 120,655; and on the other hand, in the former year there were only 131,794 packs of long wool, whilst in the latter year there were no less than 263,847. The total number of sheep now kept in Great Britain and Ireland is estimated by Mr. M'Culloch at 32,000,000, and the weight of wool at 124,800,000 lbs.

Though both British long and short wool are mostly used for similar purposes, viz., the manufacture of worsted goods, and carding wool is almost entirely of foreign growth, yet the amount of wool grown at home greatly exceeds that imported, for whilst the latter is about fifty millions of pounds weight, the former is, as we have seen, nearly one hundred and twenty-five millions, from which may, however, be deducted about eight millions exported to other countries, and particularly to Belgium.

This immense trade appears to have gone on, though with occasional checks, yet on the whole progressively increasing up to the present time; so that the declared value of worsted and woollen goods in the year 1838 amounted to nearly six millions sterling, of which the United States, our best customers, took nearly two millions. It has not, however, increased by any means after the same rate as our importation of foreign wool, for whilst the latter increased one-fifth between the years 1835 and 1838, the exportations in the latter year were less than in the former in nearly the same

proportion. The following table will show the difference of the importation of wool between these years, as well as the countries from whence imported:—

Country whence imported.	1835.	1838.
Germany	23,798,186	27,506,282
Russia	4,024,740	3,769,102
Rest of Northern Europe	1,157,345	1,063,074
Spain	1,602,752	1,814,877
Italy	1,051,005	1,758,894
Greece	1,281,839	848,091
Rest of Southern Europe	1,304,416	1,040,613
Northern Africa	816,625	511,426
Southern Africa	191,624	422,506
Rest of Africa	5,102	1,867
Australia	4,210,301	7,837,423
East Indies	295,848	1,897,266
South America and Mexico	2,195,400	4,059,958
North America	239,349	62,976
All countries	42,194,532	52,594,355

From the above table it will be seen that the total amount of foreign wool in 1838 exceeded that of 1835 by upwards of ten million pounds. Of this the highest rate of increase has been from our own colonies in Australia, where it amounts to nearly double, with the exception of an almost new trade which has sprung up in the East Indies, where the amount in the latter year is six times that of the former. The wool thus imported is in great measure produced in Central Asia, as well as the more elevated regions of Hindostan, and is of a peculiar short and soft quality, superior in this respect to all others. This trade is likely to increase to a great extent, since the Indus has been opened to British enterprise, and the province of Scinde

(which appears to have produced a very considerable amount) has come more immediately under British sway. It appears from the report on the Commerce of Bombay for the year 1838-39, that there was in this official year imported into Bombay from the subordinate ports in the Concan and Guzerat, wool 343,981 lbs.; from the Persian Gulf, 12,012 lbs.; from Cutch and *Scinde*, 1,390,043 lbs.; and from Guzerat, 343,981 lbs.: of this, 1,882,285 lbs. were exported to Great Britain, and 57,713 lbs. to France. There appears also to have been a considerable increase from South America and Mexico, and also from Southern Africa and Italy; an increase of one-sixth both from Germany and Spain; and from all other countries a decrease. It should, however, be observed that the importation from Germany in 1825 and 1826 exceeded that above quoted.

The price of wool in this country appears to have varied very much at different times, but on the whole to have gradually fallen. The following table will show the price of the principal sorts at the end of June, 1841:—

	s.	d.		s.	d.	
Saxon . . .	1	9	to	5	0	per lb.
Austrian, &c. . .	1	4	"	3	6	"
Spanish . . .	1	6	"	2	2	"
Australian . . .	1	2	"	2	4	"
Van Diemen's . . .	1	1	"	2	3	"
Cape . . .	1	0	"	1	9	"
British Fleeces . . .	1	1	"	1	5	"
South Down . . .	0	10	"	0	10½	"
Kent Fleeces . . .	1	2	"	1	3	"
Leicester Fleeces . . .	0	10	"	0	11	"
In yolk, Devons . . .	0	7	"	0	9	"

The above are the prices of wools usually found in the market, but particularly fine specimens commanded higher prices than any quoted above.

In addition to the preceding returns we are enabled to bring down our information to a later date by giving the following importation of Australian wool into London, Liverpool, Bristol, Hull, and Leith (extracted from Gooch and Cousen's List):—

1841.		1843.	
	Bales.		Bales.
London	46,581	London	63,275
Liverpool	5,786	Liverpool	3,885
Bristol	648	Leith (about) . .	450
	<hr/>		<hr/>
	53,015		67,610
1842.		<hr/>	
London	46,477	SUMMARY.	
Liverpool	5,970	Bales.	lbs.
Leith (about) . . .	450	1841 . .	53,015 or 12,723,600
	<hr/>	1842 . .	52,897 „ 12,695,280
	52,897	1843 . .	67,610 „ 16,226,400

From this return it appears that, although the importation of Australian wool was less in 1842 than in the previous year, yet in 1843 it again revived, and exceeded the importation of the previous year by upwards of three and a half millions of pounds. This satisfactory increase affords just reason to expect that this trade, so valuable and important both to the mother country and the colonies, will, in spite of temporary difficulties, continue steadily and progressively to advance.

PART III.—THE DISEASES OF THE SHEEP.

SECTION XXIV.

GENERAL OBSERVATIONS ON THE DISEASES OF SHEEP.

THE diseases of the sheep, though numerous, and often fatal, are powerfully influenced by the nature, habits, and constitution of the animal. If we were to take another domestic animal, such as the horse, and judge of the symptoms of disease in the sheep, and regulate our treatment by comparing them with the diseases of such animal, our theory and practice would be alike erroneous and unsuccessful. The sheep is an animal having very powerful digestive organs, a greater capability than any other domestic brute of converting grass and roots into flesh and fat, and of extracting from coarse and comparatively unnutritious food the nutriment which there exists in a very diffused state. If an unlimited quantity of turnips and hay were given to a horse exposed to cold, he would probably lose flesh instead of gaining it; whilst a sheep, on such food, increases daily in bulk. The brain of the sheep is small, its intellect weak, and its whole nervous system feebly developed, and much of the nervous energy actually possessed is devoted to the digestive organs. The muscular

system is comparatively weak, and the sheep is unfitted for laborious exercise even in a state of nature, and this disposition is increased in a tenfold degree in the domestic animal, by the system of breeding adopted, the nature of the food bestowed, and the habits of inactivity and quietude artificially induced. With a weak muscular development, we may anticipate what in reality we find, that the vascular system is more feeble than in many animals, and the blood circulating throughout the body is in fact very considerably less in proportion to the weight of the body than in the horse. The latter is an animal both able and willing to perform considerable muscular exertion, and is often called upon for it. This exertion is never performed without a waste of the muscular tissue, to supply which a constant and copious supply of nutritious blood is requisite. In sheep these exertions are not called for, and there is comparatively but little waste of the system; so large a supply, or rather reservoir, of blood is not therefore required; and although a large amount of blood is actually obtained from the great quantity of food consumed by the sheep, yet this blood is quickly converted into flesh, and but comparatively a small portion remains as blood in the system. One cause, however, of the sheep having so limited a quantity of blood, is the circumstance of its taking so small a portion of water. The pathological effect of a weak vascular system, and a freedom from the consequences of severe muscular exertions, is the comparative immunity of the sheep from diseases of an active inflammatory nature. The

character of the greater portion of its maladies is consequently that of debility. This indisposition to inflammatory diseases is likewise assisted by the great powers of assimilation possessed by the sheep, nutritious food being so quickly and readily converted into flesh and fat. If the horse were fed with food as nutritious as is often given to fattening sheep, and like them debarred from exercise, disease would very soon be the consequence, whilst the sheep can live on from month to month in confined sheds, taking as much of the most nutritious food as the appetite will permit. The superabundant blood that in the horse would cause plethora and inflammation, in the sheep is quickly converted into flesh.

In the *treatment* of its diseases we must, therefore, bear in mind the peculiar physiology of the animal; and even if a disease be of an inflammatory nature, we must not forget that a sheep does not possess above four to five pounds of blood, whilst most animals have a considerably greater quantity in proportion to their bulk.

The nervous system of sheep, we have said, is comparatively feeble, and we find, that though not exempt from diseases of the brain and nerves, they are nearly always of a debilitating character, such as palsy; and those of irritation, as tetanus, spasm, &c., are extremely rare. Thus we find that most of the severe diseases of the sheep are distinguished by a want of tone, and in general this animal quickly sinks under the attack of morbid agents.

The digestive apparatus forms so very important and pre-eminent a feature in the animal economy

of sheep, consisting as it does of a variety of complex parts for the elaboration of the food which do not exist in many other animals, that we cannot be surprised that its organs should be those most susceptible to disease. Accordingly we find that such is the case—that the diseases of the digestive organs are frequent, and both of a mechanical and chemical nature. We have both those arising from a superabundance and a deficiency of aliment, from its too great dryness or too great moisture, from its being too young and luxuriant, or from being too old and withered, from containing unwholesome or poisonous principles, or the minute and invisible eggs of innumerable insects.

Thus we find that diseases connected with the digestive organs are more numerous or more frequent than all the others to which sheep are liable.

Sheep are exposed throughout the year to the vicissitudes of the weather, from the effects of which they are in great measure protected by their woolly coverings; but standing sometimes on a cold and wet soil, and anon on a dry and warm surface, they are subject to the injuries arising from these alterations, from the effects of standing for a long time on a wet surface, and the reaction which afterwards succeeds from evaporation: diseases of the feet are therefore not unfrequent.

Again, from the same exposure they are subject to the attack of flies and other vermin, which, particularly in the summer months, prove a source of great annoyance, and require constant vigilance on the part of the shepherd.

To these morbid causes may be added the circumstance of sheep being kept together often in large flocks, and thus more exposed to the influence of infectious diseases than animals that are kept in a more isolated state.

Such are the principal circumstances to which these animals are subjected, and which form the causes of their principal diseases; and it is useful to keep in mind the nature of these causes, and the peculiarities and constitutional idiosyncrasies of these animals, whilst proceeding to treat separately of their different diseases.

In consequence of the weaker development of the vascular and nervous systems of the sheep, blood-letting is less frequently called for, and should be more moderately employed than in the horse, whilst on the other hand cordial, stomachic and stimulating medicines are much more frequently demanded; and from the large size of the stomachs of the sheep, these medicines may be administered in much stronger doses.

Purgatives are a class of medicines very frequently called for in the treatment of the diseases of the sheep. Not only are the stomachs very frequently diseased themselves, but morbid action is rarely set up in the system, without disturbing in some degree the functions of these organs, and rendering the employment of purgatives desirable. And from the vast amount of surface occupied by the stomachs, and the comparative insensibility of a great portion of this surface, there is not that danger in their administration in diseases of the chest which there is with

horses. In fact purgatives afford us the best means of reducing fever, lowering inflammatory action, and restoring the tone of the digestive organs. In the horse it is the usual custom to administer physic in a solid form, but in sheep it is necessary that it should be given as a liquid, otherwise it would enter the rumen and there remain an indefinite time, producing an uncertain effect, or perhaps none at all. Given as a liquid it may either all, or only in part, enter the rumen, or the whole may pass at once into the fourth stomach. But in any case it does not very long remain in the rumen, but is soon passed onwards. The neutral salts, particularly the sulphate of magnesia, and linseed oil, form the most suitable purgatives for sheep.

The good effects of purgatives are greatly assisted by the combination of stomachics and cordials: they gently stimulate the coats of the stomach and counteract that tendency which they have (particularly the maniplus) to lose their tone and become palsied when the system is affected by morbid action. They are rendered the more necessary either alone or in combination, in consequence of the feebleness of the nervous system.

Blood-letting in the sheep would no doubt be much abused were it not for the fact that from the mode in which it is practised the quantity is rarely sufficient to do either much good or much injury. The vein under the eye or the ear are the situations most usually selected, where the veins are very small. The inside of the arm is a much better situation; but if a large quantity is really required,

the neck is the readiest and most suitable place for the operation. A little wool should be cut off, and the jugular vein made to rise by pressure under with the finger, and the vein opened either with a lancet or fleam. The quantity taken must, of course, be regulated by circumstances, and may range from one ounce to half a pound. It is useless to take less than the former, and rarely prudent to abstract more than the latter quantity.

SECTION XXV.

DISEASES OF THE BRAIN.

Turn-sick, Giddiness, &c.

THIS disease receives a great variety of denominations in different places, such as *sturdy-gig, giddiness, goggles, turn, blob-whirl, &c.*, most of them derived from the symptoms that are present; but it has been correctly ascertained that in all cases it is owing to one or more hydatids on or in the brain, the pressure of which causes the strange symptoms that are observed. These symptoms are a dull, moping appearance, the sheep separating from the flock, a wandering and blue appearance of the eye, and sometimes partial or total blindness; the sheep appears unsteady in its walk, will sometimes stop suddenly and fall down, at others gallop across the field, and after the disease has existed for some time will almost constantly move round in a circle—there seems, indeed, to be an aberration of the intellect of the animal. These symptoms, though rarely all

present in the same subject, are yet sufficiently marked to prevent the disease being mistaken for any other. On examining the brain of sturdied sheep we find, as before observed, what appears to be a watery bladder, termed a hydatid, which may be either small or of the size of a hen's egg. This hydatid, one of the class of entozoon, has been termed by naturalists the *hydatis polycephalus cere-bralis*, which signifies the *many-headed hydatid of the brain*; these heads being irregularly distributed on the surface of the bladder, and on the front part of each head there is a mouth surrounded by minute sharp hooks within a ring of sucking discs. These discs serve as the means of attachment by forming a vacuum, and bring the mouth in contact with the surface, and thus by the aid of the hooks the parasite is nourished. The coats of the hydatid are disposed in several layers, one of which appears to possess a muscular power. These facts are developed by the microscope, which also discovers numerous little bodies adhering to the internal membrane. The fluid in the bladder is usually clear, but occasionally turbid, and then it has been found to contain a number of minute worms. For a further account of these hydatids we must refer to Mr. Youatt's work on sheep.

The manner in which these hydatids are produced and become present in the brain is still a matter of uncertainty, but the most reasonable supposition is that the eggs are taken with the food, and thus enter the circulation and are deposited in the brain, and it has been shown that these hydatids are mul-

tiplied by small bodies forming on the internal surface and after a while separating and floating in the fluid, and at length obtain their exit by the bursting of the parent bladder. Sometimes hydatids are so numerous and extensive as to cause the absorption of a great portion of the brain. A curious instance of this description is related by Mr. Stephens, in the 'Lancet,' in which nearly the whole of the brain had disappeared, a little of the base only remaining. The situation of the hydatid is not always the same; sometimes it is found on the surface immediately under the membrane of the brain, at others in one of the hemispheres, or in the substance of the brain, and sometimes, though rarely, in the cerebellum. It is stated that if the animal moves in a circle the hydatid will be found on the side towards which he moves, and probably in the ventricle. If the sheep sometimes make a circle in one direction and sometimes in another, we may conclude that there is a hydatid in each hemisphere, and when the animal depresses the head and moves straightforward, stumbling against everything in the way, it is probable that the hydatid is about the middle or division of the brain; and if the sheep throws up its head, has a reeling motion, but yet moves onwards, it is supposed that the hydatid is in the cerebellum, or the fourth ventricle.

The French term the sheep either the *turner*, the *trotter*, or the *sailor*, according to the manner in which it moves.

In the majority of cases there is more than one hydatid, often three or four, either together or in

different portions of the brain, thus accounting for the frequent failure which attends the treatment. This disease is principally confined to young sheep, and to the first year, though existing not unfrequently in the second; so that on the continent they, in some places, avoid it, by keeping the sheep in houses or sheds during the first year, which it is stated prevents the disease. It is much more common on the continent, and particularly in France, than in England; and it has been supposed that in the latter country it destroys nearly a million annually, and in Germany upwards of two per cent.

This disease is considered to be more prevalent in wet undrained soils, than in high and dry pastures, and by some it has been attributed, though with little justice, to the practice of breeding in and in; for this is only true when the flock thus bred is predisposed to this disease, for in sheep not so predisposed, in and in breeding is likely to keep them free from it.

It is attributed by an ingenious, though anonymous writer, to a defective formation of the head, which, when cramped up and confined, leaving no room for the due expansion of the brain, conduces, in his opinion, to the establishment of this disease.

Various plans have been recommended for the treatment of this disease, and from the success of each in a few cases, it has for a time been thought a certain cure, and has thus disappointed the expectations excited by partial success. It has been found that when giddy sheep have been rallied by dogs, driven violently, or otherwise used with

roughness, in a few instances the symptoms have left them, which has been owing to the rupture of the hydatid by this violence. In some cases the ears have been violently pulled, and then cut off; and in a few instances this has succeeded. A repetition of this treatment in other cases has failed in nineteen cases out of twenty.

Mr. Hogg, the Ettrick Shepherd, states that he has cured many by pushing a wire up the nostrils and through the brain, so as to puncture the hydatid; and his advice is, to feel for the soft place in the skull, and bring the point of the wire just under it. The hydatid, if thus penetrated, will distil or pass down through the nostrils. If the wire is carried too low, it will injure the sensible portion of the brain, and the animal will either die suddenly, or after enduring much agony. The operation, therefore, is hazardous, and very uncertain, depending so much on the situation and number of the hydatids. It has, therefore, generally failed in other hands, even when the more scientific trochar has been substituted for the knitting needle.

Trephining has been employed successfully in many instances; and amongst others, the late Sir Astley Cooper kept a sheep many years, which he had thus cured. A portion of the skull is separated by means of a small circular saw, and then raised; and if the hydatid should be under, and there should be none elsewhere, the operation will probably succeed. There is danger of inflammation of the brain, and the number of failures has greatly preponderated over the cures.

Perhaps the best, as it is certainly the simplest, mode of treatment, consists in feeling for a soft place; and if found, penetrating the hydatid by means of a small awl. A small syringe may be also used to pump out the contents of the hydatid. Mr. Greaves, of Bakewell, Derbyshire, states, in the first volume of the Journal of the Royal Agricultural Society of England,—“The easiest and most effectual way, not only to cure it, but to prevent its progress, is to take some common tar, and place it between the eyes of all the sheep, spreading it down to the nose, and it is astonishing to find how soon they recover; nor will any of the other sheep, having the tar applied in this manner, be liable to have the complaint.”

We give the above observation, in order that any one who chooses may try this mode of procedure in this desperate complaint; but, for my own part, I cannot understand its *modus operandi*, and am disposed to doubt its efficacy.

Water on the Brain (Hydrocephalus).

Besides the disease just spoken of, the lamb is subject to water on the brain (*hydrocephalus*). It sometimes exists before birth, and the size of the head prevents delivery; and in order to save the ewe, it is necessary to destroy the lamb by penetrating the skull, so as to let the accumulated water escape. The water may be either in the ventricles or under the membranes, and it occasions a stupid appearance and staggering gait, but no circular motion: the head is frequently enlarged.

Nothing can be done in the way of treatment, but it will be prudent not to breed again from the ewe; and if there are many such cases, the ram, too, may be changed with advantage, for it is evident that the disease is owing to some constitutional fault in the parents, or mismanagement during utero-gestation.

Apoplexy.

The brain is liable to two other diseases, apoplexy and inflammation. Though the former will often produce the latter, yet it is a different disease, as it consists in determination of blood to the head, and distention of its vessels. Both diseases may be attributed to the same cause—that is, a redundancy of blood in the system, arising from the forcing plan frequently adopted, or a sudden change from very poor to very rich pastures. The Leicester sheep, from their propensity to make flesh and fat, are more liable to apoplexy than others. The attack is usually sudden: the sheep stands still or moves forward unconscious; the eyes are dilated and prominent, and sometimes almost or quite blind. The membrane of the nostrils and the eyelids are full of blood, and of a deep red or violet colour. If not relieved, the sheep will reel and fall, and die in less than half an hour, or it will terminate in inflammation of the brain.

These symptoms are produced by the pressure of the blood on the base of the brain. The animal being in a state of plethora, every part of the body abounds with blood; but the brain being confined

by an unyielding case, receives the greatest injury, and sometimes a rupture of its vessels takes place.

Inflammation of the Brain (Phrenitis).

Inflammation of the brain may be owing to the same causes as apoplexy, but it consists in a greater activity of the vessels of the brain, and its symptoms are not so lethargic, but more violent. The animals appear frantic, throwing themselves about with great violence; and in lambs their motions are quite ridiculous, and have in consequence, among the ignorant, given origin to the idea of their being bewitched. The treatment in both diseases must be very prompt, and consists principally in active bleeding and purging. A pound of blood, or as much as the sheep can bear, should be abstracted from the jugular vein, and two or three ounces of salts administered; in the lamb half this dose will be sufficient.

In the eighth volume of the 'Veterinarian' Mr. Tait relates some cases which appear to be bordering between inflammation and apoplexy. He says: "Some time ago I was requested to look at a flock of sheep belonging to a farmer in Forfarshire. Upon inquiry I found that the sheep, owing to the dry season (1826), had been considerably stinted in their food in the summer time, and that they had been, about a month before I saw them, staked in a field of very fine turnips. The appearance of the sheep was rather strange; for about a minute they appeared quite dull, and then all at once became quite frantic, dashing themselves on the ground and

running at every person within their reach ; others would all at once spring from the ground and fall down and die. I caught one and bled her copiously, which seemed to relieve her much. I then gave her a dose of Epsom salts, which, in a few days, produced a cure, and by such simple treatment many of the sheep recovered.

“On examining those that died, they invariably presented the following appearances: on opening the abdomen the peritoneal covering of the bowels appeared more vascular than in its natural state, and there were some black spots on the mucous membrane of the small intestines. The lungs were very much congested. On opening the cranium I found the vessels of the brain turgid and almost in a bursting state, and, in fact, in some cases rupture had actually taken place, for there was an effusion of blood on the surface of the brain.

“The flock was immediately removed from the turnip-field, and turnips were given to them more sparingly, which soon put a stop to the epidemic, if I may so term it.”

Louping-ill.

Analogous to the diseases just described, if not altogether the same, is what has been termed the *Louping-ill*, of which there is a very good description by an intelligent agriculturist, Mr. Fair, in the eighth volume of the ‘*Veterinarian*.’ Mr. Hogg also describes the disease under the terms *thwartill*, *trembling* or *leaping ill*. It seems more peculiar, as an epidemic, to North Britain than to England,

for in the latter country it has not been described by any writer.

We will first give Mr. Fair's account, which is well worth transcription:—

“On the animal's being slightly attacked there is an evident falling off in condition, and he exhibits a dull, heavy appearance, with what may be called a deadness of coat. There is a loss of power in one or more limbs, and sometimes of a whole side, or even the whole of the animal, as if struck with palsy or tetanus, of both which diseases, as well as apoplexy, it seems to participate in no slight degree; the head and neck being more or less frequently, according to the violence of the attack, convulsively or spasmodically contracted or drawn towards the shoulder or back, with a violent tremor and constriction of the œsophagus so as to endanger suffocation when any liquid, however small the quantity, is attempted to be conveyed into the stomach. This is also much retarded, or prevented from being accomplished, by a convulsive and spasmodic locking of the jaw, a frothy saliva being at the same time emitted from the mouth, more especially when the convulsive fits have come on, which, in severe cases, frequently takes place from once to twice every five minutes, accompanied by a very laborious and quick respiration. The hurried breathing, however, subsides altogether as soon as the fit has terminated.

“In this deplorable state the animal will remain for minutes, hours, or days, according to the severity of the attack, and if he does not rally from it, death, sooner or later, ensues. Indeed, when sheep affected

with louping-ill have once taken the ground, or, in other words, when the state of collapse has commenced, we must have recourse to the knife as the only means of putting an end to their sufferings.

"Some few instances, however, have occurred among my flock, when they have most unexpectedly recovered so as again to follow their neighbours and get entirely well; and in other cases they have for a length of time dragged a seemingly powerless hind leg behind them, and the left leg oftener than the right one. When this, however, takes place, the limb still remains cold and dead for a time, in despite of the use of friction or stimulants. If it is a fore leg it is not uncommon, after the sheep gets on its feet again, for a tumor, of the size of a pigeon's or even of a hen's egg, filled with pus or ichor, to appear. On being punctured it presently subsides and is lost. These abscesses usually appear in the neighbourhood of the joints, but sometimes about the arms, the brisket, or and neighbouring part of the body. Other symptoms of this disease are a wild, excited appearance on being approached by man, dog, or any other animal, and even by one of their own species, a champing or gnashing of the teeth, and foaming at the mouth while yet on their legs, accompanied by vertigo and delirium, also the assuming of a rotatory or sidelong motion. When these last symptoms, which are those of apoplexy, or determination of blood to the head, are seen, I have restored the animal to perfect health by opening the two veins at the inner angles of the eyes, whence a copious discharge of blood may

be effected; but this can only be done with advantage when the case is taken in time. Venesection would prove highly injurious if performed after the sheep has taken the ground, and entered into the collapsed state of the disease, and ought not to be attempted, although shepherds frequently bleed promiscuously, alike ignorant and reckless of the consequences, and thereby destroy their patient, when tonics and suitable aliment, as warm milk or thin flour gruel in a tepid state, would be dictated by the plainest common sense.

“ In this complaint there is also, not unfrequently when they have taken the ground, a great appearance of sickness. The animal likewise exhibits great restlessness and anxiety, mingled with debility; he trembles and tosses his limbs about, as if enduring great pain. At this time there is also less of involuntary tremor and convulsive twitchings than at other stages of the disease; and it seems as if the seat of the complaint was in the heart, or stomach, or thoracic or abdominal viscera. From such conjectures or realities, medical men may be naturally enough led to conclude that the animal is labouring under the attack of some other disease than louping-ill; but such is not the case. These are only varieties of the same complaint, which had either previously, or will subsequent to these anomalous symptoms, put on its usual and decisive appearances. In fact the disease does occasionally assume so many different forms, although each is, more or less, connected and allied with the other, that the most skilful veterinary practitioner may for a while be puzzled

to say whether it is most akin to tetanus, apoplexy, or palsy.

"The post-mortem appearances are the following:—There is, for the most part, a quantity of thick and turbid fluid, of a greenish or yellowish colour, found collected in the pleural or pericardiac cavity. When the animal dies immediately on being struck, it will often exhibit every appearance of general inflammation. Every part will be turgid with blood, but there has not been sufficient time for gangrene to follow. If the symptoms have not been violent, but the animal lingers for a considerable time, the blood will seem to have been wasted or consumed, and the flesh be as white as if the patient had been bled in the usual manner. A considerable quantity of coagulated or extravasated blood is often found on the brain, and also in the cervical portion of the vertebral canal.

"Louping-ill is not only endemic, or confined to particular localities or districts, but it is often more widely extended, and epidemic. As to its contagiousness there is considerable doubt. It is also a periodical disease. The usual time of its appearance in hill-sheep is from the beginning of April to the end of May, during which months it commits great ravages, both among ewes and lambs. From 20 to 25 per cent. are often lost, and in some seasons considerably more. This is, in a great measure, regulated by the spring being late or early. When the grass comes rapidly to a full bite the apoplectic attacks are most frequent and fatal. A lamb may be eating, and apparently well, and all at once he

springs from the ground, utters a violent scream, and falls dead. A bullet from a rifle could scarcely do quicker and more certain execution. When he is skinned the brain and the upper portion of the vertebral canal are found clogged with blood, and all the vessels of the head and neck are turgid with it. At other times, if the animal is not struck dead at once, but lies stunned and unconscious, a sudden bleeding from the eyes or the nose will give relief. An artificial bleeding from the angular vein, and more effectually from the jugular vein, would have the same effect; but it is a chance whether they are found in this stage, and when alone there is the chance of saving them. There is little or no loup-*ing-ill* during the autumn or winter months. The ewes and lambs in the best condition are the most liable to be attacked by it, although in the months of April and May, after a severe winter, they rarely are so. It is curious that, to the east of the parish, with the exception of only two farms, nothing of this disease occurs.

“If the months of April and May are mild, less of the disease prevails; but if we have cold and sleety easterly winds, it will be more frequent. Dry, easterly, frosty winds, in April and May, are also productive of loup-*ing-ill* to a considerable extent.”

There appears to be some difference between Mr. Fair and Mr. Hogg's account. The former stating that it mostly attacks sheep in good condition, and the latter those that are poor. If each account is correct, and the result of personal observation, we may conclude that the disease is peculiar in its kind,

and produced by causes distinct from either good or bad condition, but considerably modified by these circumstances.

Mr. Hogg says, that "twenty years ago their ravages were so considerable, that farmers believed the disease to be infectious, and that a stock that was infected by it was fully as unsafe as a rotten one. It still exists on some straggling dry farms, where the ground is visibly overstocked, and in dry frosty seasons, when the spring is hard and severe. In such places, if March and April are barren, no succulent nor scarcely any green thing is to be attained by the poor creatures for a long space of time. It is easy, then, to conceive the emaciated state into which this must throw them. If at this time they happen to get an overstretch in running or leaping, or even a hasty start or crush in the fold, numbers fall a prey to this disorder, or rather to these various disorders. Some will fall down and die in two or three minutes; others will lose the power of one side, and lie sprawling until they die of hunger; others, again, will lie shivering, and very sick at times, until death comes to their relief; while a few will go a long time quite lame, sometimes carrying one limb and sometimes another, until they are likewise quite exhausted.

"In the first case, when they fall down and threaten instantly to expire, which is certainly an apoplectic shock, I have seen bleeding, by cutting a piece from the tail or opening a vein on the inside of the fore thigh, give immediate relief. In all the other cases, the best method is to take them home

and feed them with strengthening food, until they gradually recover. If once by this strong feeding they are attacked by a temporary diarrhœa, they will recover very fast.

“This distemper is peculiar to dry soils, and prevails in dry barren springs when the wind settles in the east. If the sheep are in good condition they are not nearly so apt to take it; but if they are either low of body, or the wind has a tendency to centre easterly, the greatest care must be taken to use the flocks gently, and it is highly commendable to decline underlocking them altogether, or cutting off the wool round the udder in ewes that are near the time of yeaning, as the fatigue which they thereby undergo, and the cold which thus penetrates to the most tender parts, are often followed by the most fatal consequences.”

Rabies or Madness.

This disease sometimes makes its appearance in a flock of sheep, and its uniform fatality, together with the number of its victims, renders it sometimes a source of very serious loss to the flock-master. It is invariably produced by the bite of a rabid animal, usually a dog, the inoculation being communicated by means of the saliva. An indefinite period may elapse between the time of the inoculation and the first exhibition of the symptoms, ranging from two weeks to six, and this is a shorter period than usually supervenes both in the dog and the human being. Sheep, we have observed, never engender this disease, and it is a disputed point whether even in

dogs it is ever bred at the present day. Many high authorities incline to the opinion that it is always produced by the bite of another rabid dog; and, indeed, it has been tried by experiment that neither heat, hunger, nor thirst, separate or combined, will produce it. When a dog becomes mad, and breaks away in his mad career, sheep, from their habits and disposition, are frequently the subjects of attack; and would, probably, suffer still more, were it not for the circumstance of the wool sometimes wiping the teeth clean, ere they enter the flesh. As it is, however, the greater number of those bitten become affected with the disease. The first symptoms which are observed are, a diminished appetite, and a disposition to ride each other, to which succeeds a propensity for mischief. The sheep will often butt each other furiously, but will not bite, although they will nibble at a stick if presented to them. There is considerable nervous irritability developed, spasmodic twitchings of the muscles, and quickened respiration. They become drowsy, lose their appetite, and take no notice of surrounding objects. Saliva flows from the mouth, thirst is exhibited, but often without ability to swallow. There is no dread of water at any period of the disease, which in some cases proves fatal in a couple of days, and in others continues upwards of a week.

Although there are no instances on record of the disease being propagated from one sheep to another, and although the saliva is probably much less infectious in the sheep than in the dog, yet it should be mentioned that in some experiments instituted

by Mr. Simonds, with a view to test the fact, it was found that the saliva from a rabid sheep produced the disease in rabbits by means of inoculation: much care should, therefore, be exercised by the attendants, and contact with the saliva carefully avoided.

The *post-mortem* appearances exhibited are of much importance, as, where the symptoms are obscure, they are necessary to establish the proof of the existence of the disease. They are not always alike, but it is very rare that some of the following appearances are not found, and generally they are mostly present together. Much inflammation is found at the back of the tongue, and entrance to the windpipe and the gullet, and the course of the windpipe often shows similar inflammation. Sometimes the first stomach will appear greatly inflamed, and partially filled with indigestible heterogeneous contents; but more frequently the disease will be found most extensively in the fourth stomach, which contains a dark frothy fluid. Sometimes the brain and spinal chord will exhibit the tokens of much inflammation, but in others will appear pretty free from disease.

In the dog these appearances are present in a more marked degree. The stomach is either full of a dark chocolate-coloured fluid, or distended with a mass of indigestible substances, such as hay, straw, wood, &c. &c. The back of the tongue, and entrance to the windpipe, also exhibit a highly inflammatory appearance, and the brain is often likewise affected.

With regard to a remedy, there is none on which the slightest reliance can be placed, either in the sheep or any other animal; and although in the human subject there is a mode of prevention which rarely fails, yet from the sheep being covered with wool, and the uncertainty as to the parts that may be bitten, very little reliance can be placed on it. It consists either in the total removal of the bitten part by knife, or the obliteration of its surface by means of lunar caustic, or the application of both knife and caustic. To have a reasonable chance of succeeding by this method in the sheep, it is necessary to clip off closely the whole of the wool, and examine every part of the body with the greatest care; and then using the knife or a stick of lunar caustic, whichever is most convenient, or a hot pointed iron, to apply it thoroughly to every part which has received the contact of the teeth, though only the slightest scratch. If the sheep is anywise fit for the butcher, it will be proper by all means to kill it, and by carefully removing any part suspected to have been bitten, no danger whatever will be incurred.

As prevention must, therefore, be always our foremost object with regard to this disease, it is very essential that the sheep-owner and the shepherd should be able to recognise the disease as it exists in the dog. If a dog attacks a number of sheep, and, without destroying or devouring any, inflicts bites on a number of animals, it is at once an object of suspicion. Such animal should not, however, be hastily destroyed, but closely and carefully confined. The symptoms that he will probably exhibit are—a

disposition for mischief, which, however, is not invariable, but will be regulated to a considerable extent by the previous disposition of the animal; a peculiar glassy expression of the eye, twitching of the muscles, an unceasing restlessness, a peculiar and unnatural howl, a copious flow of viscid saliva from the mouth, a want of appetite, but a disposition to gnaw, and tear, and swallow wood, straw, hay, or any foreign substance that may be near. These are the leading symptoms: there are no fits, no running round, no turning or falling over. The animal possesses consciousness throughout, and the presence of fits will be almost sufficient to decide alone that the animal is not rabid. It should be also distinctly observed, that in the dog there is no dread of water, though often an inability to swallow. The dog will often thrust his nose in, and lap the water, though unable to swallow a drop. The author would impress this fact the more forcibly, as, a few years since, a case came before his attention, in which a poor child met with its death in consequence of the ignorance and obstinacy of the attending surgeon, who, because the dog had exhibited no dread of water, in spite of the positive assurance of the writer that no such dread existed in the dog, refused to adopt those precautions which in other cases, bitten by the same dog, proved entirely successful.

The rabid dog invariably dies within a week, generally about four days from the first exhibition of the symptoms. This fact, therefore, affords an additional reason why the suspected dog should not be

destroyed, but tied up securely, so as to test by its death, as well as by the symptoms manifested, the existence of the disease.

A much longer time elapses between the period of the bite and the manifestation of the disease in the dog than in the sheep. The time, however, is uncertain, ranging from six weeks to six months, but usually about two or three months. In the human subject the period is still longer.

It has been very properly recommended by the Duke of Richmond, that the sheep-owner should never keep a savage sheep-dog, and although it is not very common for rabies to be communicated by such dog, yet, if it should become affected with the disease, it is more likely than other dogs to attack sheep, and this danger is greatly increased if the animal is of a savage nature.

When sheep have been attacked by a strange dog, it will be the most prudent plan to examine them carefully; and if any bites are discovered, to apply the lunar caustic as before advised.

Tetanus (Locked Jaw).

This disease, which is more usually understood under the term of *Locked Jaw*, this being a principal and common symptom, consists of a violent irritation of the nervous system, occasioning the spasmodic and violent contraction of the voluntary muscles of the body, particularly those of the neck, jaw, and back. It usually commences with a peculiar motion of the head, and sometimes of the limbs, and the jaw becomes fixed, and there is a grinding

of the teeth. These appearances, which are involuntary, increase; and the head is bent round, the neck twisted, and one of the limbs fixed. The muscles feel very hard, being in a violent state of action; and sometimes they become less rigid, and convulsions take place. These symptoms are often fatal in the course of twelve hours; but if the sheep survives more than two days, it is likely to recover.

This disease is more common with lambs than with sheep, and is not unfrequently the effect of castration, particularly when the operation is performed with unusual violence, and by means of twisting. Exposure to wet and cold is also a frequent cause, and deaths oftener arise from this neglect than farmers are generally aware of.

The *treatment* should consist in removing the animal to a comfortable but quiet place, where no disturbance can possibly arise. The body should be kept comfortably warm, and if the subject is a lamb, a warm bath may be used. An active dose of aperient medicine should be given, followed by a dose of laudanum, two to four drachms, with the same quantity of ginger in thick gruel, twice a day. The animal should be disturbed as little as possible, for it has been found in this disease, that quietude is one of the most important agents in establishing a cure.

Epilepsy.

This disease is somewhat similar to tetanus, being an inordinate action of the voluntary nervous system; but it differs from that disease in being

sudden, irregular, and of shorter duration. The sheep when attacked becomes unconscious, will run round, stagger, and fall; and after a while the fit will cease, and the animal will in a measure recover. It appears to be more prevalent on the Continent than in this country. Gasparin states that it is very prevalent in Germany, and is attributed there by the shepherds to feeding on dock and garlic in the winter, and on the young sprouts of the pine in the summer. Tessier speaks of it as being so frequent and fatal in the district of Beauce, in France, though of late introduction there, as to induce many farmers to give up sheep husbandry altogether. He attributes it to some peculiarity in the pasturage. Mr. Youatt states, that having occasion to travel over the downs of Wiltshire some years since, about two hours after daybreak, he saw at least a dozen sheep and lambs with the convulsions of epilepsy strong upon them. The coachman told him that upon every fine cold morning, he saw nearly or quite as many. He had also an illustration of the favourite method of cure among some of the shepherds: it was, to destroy one morbid derangement of the nervous system by setting up another. The dog was turned upon these poor animals, who were speedily frightened, not out of their senses, but into them again. He saw this succeed in various instances, but he thought that it was a dangerous and a brutal mode of cure. This disease is most frequent with young sheep in good condition, in the spring of the year and the early part of the autumn; and it is supposed to

be occasioned by feeding whilst the hoar-frost is thick on the ground. The extremely cold food thus swallowed chills the rumen, and determines blood to other parts, and particularly to the head. It can only be avoided by taking care not to expose the sheep to the danger, by giving them a little dry hay on such mornings, and not permitting them to feed on the grass till the frost has disappeared.

Palsy.

Whilst the disease just described is an inordinate action of the nervous system, this consists in a suspension of its powers, either wholly or in part. Sometimes the animal is totally helpless, every limb being affected; at others it is principally confined to the loins.

The cause of this disease is generally cold combined with moisture; the animal becomes chilled, and is found, perhaps after a snowy night, in the helpless state before mentioned. Though more frequently affecting lambs, it may also attack sheep of all ages, and particularly the ewe that has aborted or produced her lamb with difficulty and after a tedious labour in cold weather. It often attacks the newly dropped lamb, and sometimes proves fatal during the night. When less severe, the lamb is found stationary and with its hind limbs powerless; and when this is the case it rarely becomes otherwise than stunted in its growth, though after a time it may get rid of the paralysis. This disease is often confounded, and not unfrequently connected, with rheumatism; but the former has its origin in the

nerves, whilst the latter, though the more painful, is an affection of the muscles. This disease is sometimes produced by an excess of nutriment or other variety in the food. Mr. H. Cleeve, in the first volume of the Journal of the Royal Agricultural Society of England, relates the following facts: "I had been giving two cart-loads of mangel-wurzel daily to about 150 couples. Finding the pasture get short, I one day ordered an extra load, and the following day I found that thirteen of the ewes had nearly lost the use of their limbs. On another occasion, having some hoggets that would not eat the roots, I enclosed them in a pen in order to starve them to it, but as soon as they began to feed heartily they also were similarly affected. If I rightly attribute the complaint to this cause, and, indeed, I have no doubt on the subject, the treatment is to withhold the mangel-wurzel for a short time, and only to return to the use of it gradually and in small quantities."

The *treatment* of the disease consists in the application of warmth externally, but moderate at first, and gradually increased. A stimulant should be given internally in warm gruel or ale. A drachm each of powdered ginger and gentian, with two drachms of spirit of nitrous ether, is a dose for a sheep, and may be given once or twice a day; and from one-quarter to one-half the above will be sufficient for a lamb. If symptoms of purging should appear, the treatment recommended under the head of Diarrhœa may be employed.

If the palsy continue obstinate, a minute dose of

strychnia may be tried, which is one of the most powerful of stimulants to the nervous system; a quarter of a grain diffused in gruel will be sufficient for a sheep at first, but it may be afterwards slightly increased. It has been administered successfully to other animals in this disease, but should be employed with great caution, being remarkably potent.

Mr. Cleeve, in the cases above mentioned, bled and gave each an ounce and a half of Epsom salts, under which treatment they all recovered, with one exception.

Rheumatism.

We notice this disease in this place, though of a different class from the foregoing, because it very much resembles, and is in fact closely connected with, that last described. It is, however, an affection of the muscles, &c., instead of the nerves, and consists in a peculiar inflammation of those parts, very frequently causing considerable pain when they are called into action. It is usually caused by exposure to cold, and sometimes shifts from one part to another, occasionally degenerating into a slow or chronic form, and attacking the sinews, ligaments, and joints, as well as the muscles. The neck and the loins are the parts most frequently attacked, either separately or combined. The former affection causes the head to be carried in a bent position, and the latter produces considerable stiffness and weakness of the loins.

The *treatment* should consist in removing the animal to a comfortable shed, giving an active pur-

gative, such as two ounces of Epsom salts dissolved in warm water with a drachm of ginger and half an ounce of spirit of nitrous ether. A stimulant, such as hartshorn and oil, or opodeldoc, should be well rubbed over the affected part; and if the disease assumes a chronic form, a seton should be inserted near the part.

SECTION XXVI.

DISEASES OF THE DIGESTIVE ORGANS.

THE most numerous and most frequent class of diseases to which sheep are susceptible are those affecting the organs of digestion, and more losses occur from these diseases than perhaps from all others besides. This might not always have been the case, and perhaps is not so at the present time in all countries. The active Scandinavian sheep of the Zetland Islands, or the hardy breed of the Welsh mountains, living on a scanty pasture, are rarely, if ever, exposed to the mechanical and other diseases of the digestive organs to which other sheep located in richer pastures are so frequently liable. But when we consider the nature and effects of those improvements which have been introduced in the breed of sheep, the object sought to be accomplished being to produce an animal that will convert vegetable food into flesh and fat with the greatest speed and at the earliest period, that to do this it must be almost constantly feeding, taking a large quantity of food, and at the same time converting

as much as possible into mutton, we cannot be surprised that the organs thus severely tasked should be first and most frequently morbidly affected. Delicacy of constitution is, no doubt, produced by the present system of breeding, and the reason why disease does not more frequently occur is owing to the much shorter life which the modern system entails on the animal; the knife of the butcher supervenes ere the softness of the constitution can induce disease, and the animal is converted into mutton before the period which nature has assigned for its term of life has arrived.

Obstruction in the Gullet

is considerably less frequent in the sheep than in the ox, but it does sometimes occur, and gives rise to the same symptoms as are present in the latter animal, which are difficulty of breathing, threatened suffocation, blasting, or hoven, and too frequently death. The food most likely to produce this is turnips, too large a quantity being swallowed, or attempted to be swallowed, at the same time, or a smaller portion not properly masticated.

When these symptoms are observed, the sheep should have its head elevated and held firmly between one man's legs whilst another passes the end of a flexible probang carefully over the root of the tongue into the pharynx and thence down the œsophagus, forcing the obstructing morsel with it. Much care must be exercised in this operation, the probang should be oiled and forced onwards with gentle firmness, otherwise there will be much danger

of lacerating the coats of the œsophagus. *Probangs* suitable for sheep are manufactured, being elastic and hollow, and admitting a whalebone stilette through it. In the absence of this useful article, a cane or any flexible rod may be used; one end, having a bulb formed of tow and being well oiled, may be employed. If these means should fail, it may be necessary to extract the obstructing body by cutting down carefully on the substance through the skin and the œsophagus, carefully closing the wound both of the latter and the former by separate stitches. Much care should be taken in throwing down and securing the sheep for this operation, as there is danger of rupturing important parts. If suffocation is threatened, it is often prudent to relieve the hoove by means of the trochar before the operation is attempted. It often happens that the membrane lining the œsophagus is lacerated in the attempts to force onwards the obstructing body, and the animal refuses to feed or to ruminate, and dies in the course of some days. This circumstance induces the farmer frequently to kill the animal after being relieved, and if it be fat this may be a good plan, and particularly if the above symptoms are present. But the sheep may be poor, or he may be a ram of much value. In either case, but particularly in the latter, treatment should be adopted. Two or four ounces of linseed oil should be given as a laxative, and all solid food for a time prohibited, linseed gruel being substituted for two days, and afterwards followed with good oatmeal gruel carefully strained: plenty of water may be allowed.

If any external swelling is perceptible, it should be fomented and poulticed; but this symptom greatly enhances the danger, as it denotes an extension of the laceration through the other coats, and if it is evident that the passage of the œsophagus is stopped, the danger will be still more imminent: but if the animal is very valuable, the swelling should be cut down upon and the œsophagus opened, and afterwards treated as another wound.

Hoove, Hoven, Blasting, &c.

Sheep as well as oxen are liable to this disease, and in them it is generally produced by being turned into, or more frequently escaping into, young clover. The fatal effects of this, when not early discovered, have been very considerable, numbers having died before assistance could be rendered. The immediate cause of the distressing symptoms is the formation of gas in the rumen, or first stomach, which distends it to an enormous size. The food being of a very succulent nature, the heat and moisture of the stomach cause it to undergo fermentation and decomposition. The gases thus formed have been found to contain in all cases carbonic acid, mixed occasionally with inflammable gas, and at other times with sulphuretted hydrogen, and sometimes with atmospheric air. The frequently fatal result is produced by the enormously distended rumen pressing on the diaphragm, and thus preventing the chest expanding to admit the air, thereby producing suffocation. The reason why

cattle and sheep are so much more subject to this disease than the horse is owing to the very imperfect mastication, and therefore imperfect mixture with the saliva, which the food undergoes. If then it is of a very succulent nature, and is taken very rapidly, fermentation commences, and the gases are given off. It is more likely to occur when the functions of the stomachs are anywise impaired, and it may also be produced by the obstruction of some foreign body in the œsophagus. It is a frequent attendant of other diseases, particularly those of the digestive organs, and it then denotes an imperfect performance of the functions of the rumen, probably a diminution of its alkaline secretion or an alteration in its quality.

It is customary when sheep are first turned upon clover, or trefoil, or other very succulent food, to keep driving them about for a considerable time, the effect of which is to prevent their eating so much or so rapidly as they otherwise would, and also to favour the escape of any gas that is formed, by means of motion. There is more danger of its occurring when the dew or a hoar-frost is on the ground, and it is liable to happen if the sheep should accidentally partake of any food in a state of fermentation.

The remedy must be prompt in order to be successful, and it may either be mechanical, by operation, or chemical. The hollow flexible probang is at once the safest and easiest mode of relief. The probang should be introduced in the manner before advised, and on its entering the rumen the

stilette should be withdrawn and the gases will escape.

Much care and some skill are required in this operation, because if the probang is thrust forward with violence there will be danger of rupturing the sides of the œsophagus. The mouth should be kept open by means of a gag, formed by a round stick having a hole through its middle for the passage of the trochar.

Sheep will sometimes die when hoven in the course of ten minutes, affording even no time for the employment of the probang. In such very emergent cases, the course to pursue is at once to plunge the trochar with its canula into the left flank, then withdrawing the former, so as to allow the gas to escape through the latter; and if it does not at once freely and rapidly escape, the sides of the belly should be moderately pressed so as to force it out.

It is often necessary to retain the trochar in the wound a considerable time, so as to allow the exit of all the gas that may have formed or be still forming. If the trochar is not at hand, a penknife may be used instead, though the former is much preferable, inasmuch as the canula can be retained until all the gas appears to have escaped, whereas when the knife is employed the openings in the flank and the rumen may cease to remain opposite each other, and much of the gas, and with it some of the food, may escape into the cavity of the abdomen, and there produce irritation and inflammation. This, indeed, accounts for the many cases of sheep not doing well after the operation.

The modes of relief which offer themselves in the way of medicine, and which indeed may be first tried, if the case is not too emergent, are those of a nature calculated to condense the gases or decompose them. Those most likely to conduce to this purpose will depend on the nature of the gases, and this will be regulated by the stage of fermentation that is going on. If the early stage, it will be the vinous fermentation; and if later, the putrefactive. In the former carbonic acid will chiefly predominate, and in the latter hydrogen. For the former the preparations of ammonia will be most available, and for the latter those of chlorine. If relief can be given in the early stage, two to four drachms of hartshorn in half a pint of warm water will probably effect the purpose; but if the putrefactive process is going on, a drachm or two of chloride of lime dissolved in water will best accomplish the purpose. The chlorine will leave the lime and combine with the hydrogen, for which it has a much stronger affinity, and the muriatic acid thus formed will be prevented from doing injury by means of the disengaged lime by which it will be neutralised.

A mode of relief combining the mechanical with the chemical is deserving of consideration, and, indeed, should be employed where the probang or the canula is not at hand, or where from the number of cases they cannot be in all available; and that is, forming a number of boluses of flour, lard, and salt, and combining with them, if possible, chloride of lime and carbonate of ammonia, half a drachm of each for a sheep, and forcing down three or four boluses

thus formed over the root of the tongue into the gullet with the fore finger, the mouth being held open with the left hand or by an assistant.

The advantages of this plan are apparent; the balls are sure to enter the rumen, whilst with fluids it is uncertain, and thus by breaking through the floor of the œsophagean canal, which in hoove is closed, exit will be given to a good portion of the gas, whilst the chemical agents will condense the rest. The medicine therefore must be modified or combined according to the time the sheep has been suffering.

Sulphuric ether will also be found valuable, in doses of two drachms, having the property of condensing the gases in a high degree.

It will be prudent to administer some of the above-mentioned medicines with an active purge, even in those cases where relief has been obtained, either by the probang or the puncture, as there is much danger of more gas being formed. The most certain way of doing this is by means of the probang and the stomach-pump, as then it is sure to enter the rumen, whereas if given as a draught it is uncertain what proportion may enter the rumen. In the latter case, however, a larger dose should be administered. Care should also be afterwards exercised with regard to the diet, and the sheep for some little time should be turned into poor pasturage. A more simple plan, perhaps, will be to give the medicine in a solid form combined with vegetable tonics.

Hoove may thus occur either in an acute or sub-

acute state. In the former no time must be lost, but the probang or the trochar should be at once adopted, preference being given to the former. In desperate cases the knife may be used; but from the very great after-danger attending this plan, it is worthy of consideration whether, if the animal is tolerable meat, it will not be most prudent to kill it.

In sub-acute cases the boluses may be employed, and if they do not succeed, the probang should then be used.

When hoove occurs from choking, and suffocation is threatened, it will be necessary to employ the trochar to relieve the distension, before the probang can be employed to force down the obstructing body.

In all cases it will be essential to employ after-treatment, as sub-acute hoove is likely to succeed the acute, as well as indigestion; in both, the following will be a draught proper to be given:—

Sulphate of magnesia . . .	2 ounces.
Ginger	1 drachm.
Gentian	2 "
Chloride of Lime	$\frac{1}{2}$ "

To be dissolved in a pint of warm water or gruel.

The three last ingredients may, if necessary, be repeated in the form of boluses.

In order to prevent this disease, it will be a prudent method to give the sheep a little old hay in the morning previous to their being turned on turnips, clover, or other succulent food. And Mr. Humfrey observes, in the Journal of the Royal Agricultural Society of England, vol. i., "It is an excellent plan to sow common salt over the fold which con-

tains their food early in the morning while the dew is on it. In the year 1836 I experienced its good effects while feeding off a piece of rape, having lost several lambs by their being blown. I bought a sack of salt, and had it sown over the fold every morning before the dew was off; and the consequence was that I only lost one sheep afterwards, and this occurred by accident; the shepherd, through neglect, allowing it to run into the rape which had not been salted. There are two advantages to be derived from this simple remedy: it not only directly benefits the general health of the sheep, but all that falls on the ground acts as manure, so that nothing is wasted."

Mechanical Distension of the Rumen.

Distension of the stomach with food is much rarer in the sheep than in the ox, and when it occurs it is to be attributed to the sudden and rapid consumption of turnips and other roots. It may be distinguished from hoove by the lesser violence of the symptoms; but greater depression and heaviness are present, and the abdomen, though less distended, feels hard and firm, not elastic as in hoove. This is a very dangerous complaint when it does occur, and requires immediate assistance. The animal may be first bled so as to relax the muscular contractions of the rumen, and then the probang and the pump should be had recourse to so as to force liquids into the rumen to soften and dilute its contents, and produce their discharge into the œsophagean canal. With this liquid should be combined stimulants, such as hartshorn, or carbonate of am-

monia, to excite the inner coat of the rumen, together with some alkali to assist its natural function, such as a few drachms of carbonate of soda; with this a purgative, such as from two to four ounces of Epsom salts, may be properly combined.

If these means should fail and the case become desperate, recourse must then be had to an operation which, though formidable, has yet been performed with success. An opening must be made into the rumen at the left flank, midway between the hip and the last rib, and a little below the lumbar processes. The opening must be sufficiently large to enable the contents of the rumen to be taken away; and in order to prevent their escaping into the abdomen, the sides of the wound in the rumen should be confined to that of the flank by means of stitches during the operation, or the end of a clean towel may be passed through the wound into the rumen for the same purpose, or a leather tube sufficiently large for the contents of the rumen to be brought through it.

The food being thus removed, the wound should be united by stitches, taking care that the wound in the rumen be also thus united and the ends of the stitches left through the external opening, which should then be united by separate stitches. The food must be moderate and easy of digestion for some time, gruel being frequently administered. The bowels should be relaxed with saline purgatives, and if fever be present the animal must be bled. In the course of seven or eight days the stitches, if they have broken, may be taken away. It generally

follows that the rumen remains united to the abdomen after the operation.

New wheat has been known to produce very fatal effects on sheep when largely partaken, as the following cases, related by Mr. John Hawes in the 'Veterinarian' for 1840, will show:—

“In the month of September, in the last year, a flock of sheep, more than 200 hundred in number, strayed into a field where there was a quantity of wheat which had not been carried in consequence of the unfavourable state of the weather. They fed rather bountifully on it before they were discovered by the shepherd, when they were immediately removed to the pasture on which they had previously been grazing, and no further notice was taken of them until the following day, when four of them were found dead and several others were evidently ill. To all that evinced any symptoms of disease Epsom salts and castor oil were immediately given; but, on the following morning, finding that twenty-eight had already died and nearly as many more were almost dead, the owner sent for me, as is too frequently the case, when it was too late to be of much service. The first thing that I did was to examine some of those that had died, and I found the rumen in every instance filled with wheat, barley, and straw; the abomasum highly inflamed, as well as the bowels; the spleen had the appearance of a mass of coagulated blood, its structure being entirely destroyed; the lungs, in most of the cases, presented a healthy appearance, as did also the liver.

Fifty-eight died in the course of five days after eating the wheat; the others were bled, and half a pint of linseed oil was given to each, and they recovered, but many of them have since thrown their lambs.

In general, the acute sense of smell which sheep possess enables them to avoid deleterious or poisonous plants; but occasionally, when these plants become dry and deprived of odour, sheep will partake of them with fatal avidity. The dried branches of the yew-tree have thus destroyed hundreds of sheep, and farmers cannot be too careful in not allowing any to be placed within reach of the sheep, and more particularly in not using these dead branches for making fences.

The only plan of treatment that can be adopted is to administer large quantities of liquid by means of the stomach-pump, and then removing as much as possible of these contents by the same apparatus. Purgatives may also be given.

Soot,

When taken internally, as it has been when used as a top-dressing on wheat in the spring and sheep have been turned on soon afterwards, acts as a poison, producing palsy of the limbs and death. The following instance of the kind is communicated to the 'Veterinarian,' vol. xvi., by Mr. Coates, of Gainsborough: "Some little time ago, I was sent for to make a *post mortem* examination of some sheep. They were hogs in fair condition, and I was informed that they had been taken off turnips, and turned on a field

of luxuriant spring wheat. Ten were down, three dead, and seven paralyzed. The respiration was hurried, the ears and extremities cold, the pulse almost imperceptible, the bowels constipated, the fæces hard and dark coloured, occasional struggling of the limbs, but no very evident pain.

"Sectio Cadaveris.—The intestines were free from disease, and rather flaccid; the aliment dark coloured, and covered with mucus. On examining the stomachs, the rumen was found to be half full of dry, impacted, dark-green food, studded over with small black specks, which on further examination proved to be soot. The reticulum contained but little food: its surface and papillæ were covered with black specks, and what food it contained was very dry. The abomasum and its ingesta were much darker than is natural. Its villous coat had a slight inflammatory blush, and the mucous secretion was quite black. The other viscera were apparently healthy. I did not examine the brain or spine.

"On inquiry, I found that these sheep had been turned on a field of spring wheat, which only a short time before had been manured with soot; and no rain having fallen, or dew sufficient to enable the land or the vegetation to absorb this carbon, it had been taken up and swallowed by the sheep along with their food.

"The remainder of those that were paralyzed were destroyed, but all the others, to the number of three or four score, had cathartic medicine given to them, until their bowels were well acted upon.

They were then fed on linseed cake, and ultimately did well."

Concretions in the Stomachs.

Sheep have sometimes suffered and died from the effects of sand and other earths taken into the stomachs, producing there, and particularly in the abomasum, considerable irritation and inflammation. That these foreign bodies should produce this injury cannot be a matter of surprise, though it is much less clear what should induce the sheep to take them. There is, however, no doubt that a considerable portion of earth is taken with the natural food, whether grass or roots; and in tearing asunder the blades of the former, some must be torn up by the roots. The effect of this is, doubtless, beneficial: the alkali contained in these earths combines with and neutralizes much of the acid developed in the rumen, and so prevents the animal from being hoven. In the following cases, Mr. Youatt suggests that the presence of acids in the stomach must have induced the sheep to swallow the large quantities of sandy earth that were afterwards found in their stomachs. The instances referred to are related by Mr. Gutteridge, in the twelfth volume of the 'Veterinarian.' He says, "The flock were turned into a field of turnips, but they had not been there more than a few days, before the shepherd fancied that some of them were not doing well. They were dull, and lagging behind the others, and altogether indisposed to move: the appetite was gone, and there was considerable heaving of the flanks. He drew twenty-

five of the worst of them, and put them by themselves. On the following day three of them were dead. He gave an active purge to the rest, but in the course of four days six more of them had died.

"I was called in, and, of course, availed myself of the opportunity of examining some of the dead sheep. I found the rumen and abomasum, and nearly the whole of the intestinal canal, loaded with sand, and portions of undigested food in various parts of the intestinal canal. I ordered the remainder of the flock to be immediately brought into the fold-yard. Several of them were purging very much. I, however, gave to every one of them a brisk dose of Epsom salts with ginger, and I kept them in the yard all night.

"The next morning I found that the salts had taken very good effect. On the third day a second dose was given to each of them, and they were turned into another field. Only one died afterwards. In him I found very little sand, but there was great inflammation of the intestinal canal, and this was the cause of death."

Mr. Gutteridge afterwards adds, "Since my first letter was written, I have had sixty yearlings labouring under a similar disease. I gave to each an active purge of salts, with gentian and camomile, and afterwards a dose of stomachic medicine daily for ten days. Their food, while under treatment, consisted only of dry meat, as cut hay, and a few oats. I saw the shepherd, and he informed me that they were all going on well."

Bezoars.

In the months of September and October, and seldom at other periods of the year, it is very common to find, sometimes in the sheep, but generally in lambs, a number of small balls, often of the shape of an almond or resembling that of the stomach itself. They are usually of a brown colour, but sometimes inclining to a yellow. On cutting them with a knife they appear to be composed of layers consisting of wool intermixed with earthy substance and mucus. They can be dissolved by means of boiling water, and in all probability by the gastric juice of the stomach, as, though they are common in the autumn, they are rarely found a few months later. These *bezoars*, as they have been termed, are found as frequently in fat as lean animals, and this being the case, we are not warranted in supposing that they are injurious to the health of the sheep. They are probably formed by the animal licking itself, or its dam, or other sheep, and thus gradually swallowing fibres of the wool, and some hard portion of the food forming, the wool entwines around it, and is consolidated by the mucus it meets with.

Diarrhœa, Dysentery, Flux, Scouring.

Under these various terms are comprehended two diseases to which sheep are not unfrequently subject, viz., diarrhœa and dysentery. The former appears to be simply a relaxed state of the mucous membrane of the bowels, producing liquid fœces, whilst the latter is an inflammation of this membrane,

producing not only an increased secretion, but a morbid alteration in its character. Dysentery therefore is a more dangerous disease than Diarrhœa, and whilst the latter is mostly confined to the small, the former attacks principally the large intestines.

The *symptoms* of dysentery, which in some places is called braxy, are those of much constitutional disturbance and fever. The sheep is dull and uneasy, frequently lying down and soon rising again. The breathing soon becomes disturbed, and the pulse wiry and quick, the mouth and nostrils feel hot and dry, and the membrane lining the eyelids red, and it has been stated that the wool feels drier and is more easily removed. The *fæces* are scanty in quantity and hard, though frequently discharged, and attended with blood and mucus, having an offensive smell. This fetor increases and the *fæces* are discharged with pain, and in some cases the animal dies in a few days, and in others the disease takes a chronic form and lingers on for weeks.

Diarrhœa may be known by the absence of these severe symptoms, and it is important to observe the distinction, as the same treatment will not be proper for both diseases.

The causes of dysentery are principally sudden changes of pasturage or situation. The most frequent of these is the removal from succulent to dry pasture in a high situation. In these cases diarrhœa was the first disease, which, however, soon went on to dysentery, and if, when the former appeared, the sheep were early removed to the low pasture, they soon recovered. Lambs are most frequently affected,

but older sheep are also attacked. It is also produced by exposure to cold and wet after travelling, and by anything that can directly or indirectly derange the digestive organs. In sheep that have died of dysentery the mucous coat of the intestines, particularly the large, has been found in a state of high inflammation, even ulceration, and containing hard offensive fæces, and the maniplus also contains hard and indigestible food.

As it is a matter of much importance to distinguish this disease from diarrhœa, it will be well to direct attention to the following distinctive characteristics of the two diseases from the pen of Sir G. Mackenzie, as they are well worthy of attention:—

“1st. Diarrhœa attacks chiefly hogs and weak two-year old sheep; whereas dysentery is frequent among such as are older.

“2nd. Diarrhœa almost always occurs in the spring and ceases about June, when dysentery only commences.

“3rd. In diarrhœa there is no fever or pain before the stools, as in dysentery.

“4th. In diarrhœa the fæces are loose, but in other respects natural, without any blood or slime; whereas in dysentery the fæces consists of hard lumps passed occasionally, the rest being blood and slime.

“5th. There is not that degree of bad smell in the excrement, in diarrhœa, which takes place in dysentery.

“6th. In dysentery the appetite is totally gone; in diarrhœa it is rather sharper than usual.

"7th. Diarrhœa is not contagious ; dysentery is highly so.

"8th. In dysentery, the animal wastes rapidly, but by diarrhœa only a temporary stop is put to its thriving, after which it makes rapid advances to strength, vigour, and proportion.

"9th. Dysentery is commonly fatal, diarrhœa rarely, unless the animal has been previously much debilitated."

In some cases related by Mr. Stevenson, a surgeon who devoted much attention to the disease, the symptoms of dysentery were frequent stools, slimy and mixed with blood, having little feculent matter in them, the wool was clapped, the mouth and skin dry, the eyes languid and red, constant rumbling in the belly, and the animal could with difficulty stand. On laying the hand on the belly, it could be felt in some parts as it were drawn together, and lumps in parts of it.

The treatment of these diseases must of course depend on the stage in which they exist, but it is desirable to attend to it as early as possible, and when diarrhœa only is present. A natural cure which is sometimes practised in Cumberland, is to turn them into pasture where common tormentil or septfoil abounds, and this is frequently sufficient to effect a cure, the properties of this plant being highly astringent.

If the cases are not severe, and entirely confined to diarrhœa, astringents alone may be given ; but if any mucus is perceived, it will be proper to administer a laxative in the first instance. The following

treatment is related by Mr. Sayer, in a useful essay on the disease, read to the Veterinary Medical Association:—

Linseed oil		2 ounces
Powdered opium		2 grains

were given to each sheep in an infusion of linseed, the gruel being repeated several times, and on the following day the opium was again administered, with half a drachm of powdered ginger and the same quantity of gentian, which was given several times, and sometimes combined with linseed oil.

This treatment proved successful, and is indeed as good as can be advised, the food being also attended to, and proper care bestowed.

The treatment adopted by Mr. Stevenson with success was the following:—In a case where the habit of body was good, he bled in one of the veins in the fore-leg, and about two ounces of blood of a dark colour were taken from it. A dose of an ounce of salts was then administered, which in eight hours produced several passages, and the pain in the bowels seemed in some measure to be abated. Next day five grains of ipecacuanha were given every two hours for five hours, which still kept up the purging; and considerable sickness was apparent. In two hours after the operation of the ipecacuanha it began to eat a little, and the skin was somewhat moist. The frequent stools now abated, and there was no more purging, nor was any more blood passed. In six days it was so far recovered as to be able to join the flock.

In cases of simple diarrhœa, the following astringent medicine will be found very useful :—

Powdered chalk		1 ounce.
„ catechu		4 drachms.
„ ginger		2 „
„ opium		$\frac{1}{2}$ drachm.

To be mixed carefully with half a pint of peppermint-water, and two or three table spoonfuls given morning and night to a sheep, and half this quantity to a lamb.

Lambs are, probably, more subject to diarrhœa than sheep. This is owing, in a great measure, to the change of diet which takes place at weaning, and to the functions of the stomachs being called into greater action. It often occurs when they are turned with the ewes into rich pastures, the new stimulus which the food possesses exciting too much the digestive organs. If the looseness is moderate, it may pass off without injury; but if it continue, recourse should be had to treatment. The danger will depend on the appearance of the little animal, which, if lively and cheerful, will probably do well; but if moping and dull, a fatal result may be anticipated. It is often called the *green skit* from the colour of the fæces, and as a distinction from another disease called the *white skit*, which is of a very different nature. It will sometimes be prudent to administer a little opening medicine, such as two drachms of Epsom salts, to clear out the intestines previous to the cordial medicine above mentioned, which will generally succeed.

The *white skit*, so called from the pale colour of

the fæces, is a more dangerous disease; and its danger does not arise from looseness, but rather from constipation, being, in fact, owing to coagulation of the milk in the fourth stomach, where it often increases to the amount of several pounds, whilst the whey passes off by the bowels, and gives this deceptive appearance to the dung. It is a natural function of the fourth stomach to cause this separation in the elements of milk; and, indeed, the dead stomach will produce the same, as is shown by the employment of the rennet, or calves' stomach, in the manufacture of cheese. This property is owing to the gastric juice, secreted by the internal membrane of this stomach, which abounds, indeed, with muriatic acid. The disease is, therefore, an excess of the natural functions of the stomach. The milk is either too rich or taken too largely, or coagulated too quickly from the increased power of the gastric juice, which it acquires when the lamb begins to take other food.

The *symptoms* are, in addition to the colour of the fæces, dullness, heaving of the flanks, hardness and distension of the abdomen, and sometimes costiveness.

The *treatment* must consist in the administration of alkalis, their property being to dissolve the hardened mass. Half an ounce of magnesia dissolved in water, or a quarter of an ounce of harts-horn diffused in water, or both these medicines combined in less quantities, should be given and repeated, and followed with Epsom salts; after which a little of the cordial medicine may be given. It

will be desirable to give the above medicines in a large quantity of water, in order to ensure a sufficient part entering the abomasum, as otherwise, rumination having ceased, a large portion may remain inactive in the rumen.

Diseases of the Intestines.

Diseases of the intestines are much less frequent than those of the stomachs, and, compared with many other animals, their functions are less important. The food has undergone a considerable elaboration before it reaches them, and unless the functions of the stomachs are impaired, the bowels are rarely deranged by the action of the food. Both in constipation and in diarrhœa the stomachs are affected as well as the intestines, and when the latter are inflamed, the former generally participate in the inflammation. *Sheep* are rarely subject to

Spasmodic Colic,

but lambs may be, perhaps, somewhat oftener. The symptoms are those of severe pain, not constant, but in paroxysms.

The *treatment* should consist of the administration of half an ounce of Epsom salts, dissolved in warm gruel or water, with a drachm or two of powdered ginger, according to the size of the animal, and a tea-spoonful of the essence of peppermint. It should be given slowly and carefully, so as to enter the abomasum.

Though the intestines may sometimes be twisted and strangulated, there are no cases on record of

either intus-susception or strangulation, though these diseases are frequent in the horse, and occasionally found in cattle.

Inflammation of the Bowels.

Acute inflammation of the bowels is also of unfrequent occurrence, but it occasionally appears, and sometimes involves disease of all the neighbouring viscera. Mr. Tochenlin, a veterinary surgeon in the grand-duchy of Baden, gives an account of a formidable disease of this nature. He says, "It prevails mostly in July, August, and September, before the heat of the summer has passed over, and when the animals are beginning to moult. Almost the first symptoms are those of influenza; the gait becomes uncertain and staggering, the eyes are half closed, red, and weeping, the appetite fails, and rumination ceases; the bowels are constipated, the flanks are swelled, the breathing is laborious, the emaciation rapid and extreme, and the animal often dies in the course of a few days. Sometimes the sheep perishes suddenly, without any, or scarcely any, symptom of previous disease.

After death, the paunch is found distended with gas and with food—the latter in a state of putrid fermentation, and necessarily producing the former. The small intestines are in a gangrenous state, the liver is partly decomposed, and filled with vitiated bile; but, most of all, the spleen is gorged with blood, softened, enlarged, not unfrequently ruptured, and filled with tubercles and ulcers, with, in short, various appearances of disease, but all of them the

consequence of inflammation principally belonging to this gland, and of the most serious character.

This severe and complicated disease is, fortunately, rarely met with in this country. If it should occur, it should be met with very active treatment. Bleeding from the neck in the early stage, mild aperients, setons, and blisters, appear to be called for; but depletion should not be persisted in long, and should be followed with plenty of gruel, vegetable tonics, and good nursing.

Worms.

Sheep are but rarely subject to injury from the presence of worms in the intestines. Now and then, however, it is the case; and, as in the human subject, young animals are more susceptible than older ones. The following account, in the fifteenth volume of the 'Veterinarian,' furnished by Mr. Copeman, of Walpole, Suffolk, is both singular and interesting:—"September 6th, 1841.—I was requested to look at a flock of lambs, about fifty of which appeared to suffer from violent diarrhœa. Two of the same flock having already died, I proceeded to examine them.

"The first stomach contained only a small quantity of imperfectly masticated food; the second and third were contracted and empty; the fourth, or true stomach, contained only a small quantity of mucus and sand, but there were several large patches of inflammation on its villous membrane. The small intestines contained thousands of the folded tapeworm (*tænia plicata*), and about twenty-five of the

large round worms (*ascaris lumbricoides*,) with a large quantity—several ounces—of sand. I regret much not having weighed it. The villous membrane was in a stage approaching to *sphacelus* (mortification). Is this produced as follows? The vermis causing irritation of the stomach and intestines, induced by sympathy a depraved appetite (*pica*), sand is licked up, and the effect of this foreign body on the intestines is inflammation and its sequelæ. This, however, is a mere conjecture of mine. The rectum contained chyme and mucus of a grassy green hue. The other contents of the abdomen and pelvis were perfectly healthy, as were those of the thoracic cavity. I next examined the living animals, and found about fifty of them in a sad pickle about and under the tails, from frequently passing mucous fæces. The fæces were of a grass-green colour, and not in the least fetid or bloody. The animals ate but little food, and were usually found lying, evidently suffering much abdominal pain, and all of them reduced to mere skin and bone.

“My first advice was to make a total change in the diet. The following medicine was first tried: Castor oil, 1 oz.; powdered opium, 3 grs.; starch, 1 oz.; boiling water sufficient to make a draught. Thin starch, night and morning, was also ordered to be given.

“7th. The lambs are certainly better: continue the medicine.

“11th. The irritation of the stomach and intestines being to a certain extent removed, I ventured to give the following stimulant, for the purpose of

destroying, if possible, some of the parasites:—Linseed oil, 2 oz.; oil of turpentine, 4 drs. One dose only was given to some of them, others required two, and a few had three or four in the course of the following month, and then all were well."

The sheep, before Mr. Copeman saw them, were pastured on salt-marshes by the sea-shore. Might not the sand have been washed or blown up from the sea-shore, and deposited on the grass, and thus taken with the food?

Pining.

Though a dry state of the fæces is natural to sheep, and they are enabled by nature to subsist on arid and comparatively indigestible food, yet in some localities they suffer much from an excess of dryness in the pasture, and many die in consequence. In the southern districts of England the disease is not much known, but in North Britain, and particularly in the Cheviot Mountains, it is very prevalent; and it is a curious fact that the very land which formerly produced the rot, on being drained now produces this disease, which is there termed *pining*. It would be well if some botanist were to examine thoroughly the various grasses that are found in these disease-producing spots; for Dr. Playfair relates, that on a recent visit into Somersetshire with Dr. Daubeny, they were told by a farmer that he had two fields, one of which invariably purged his cattle, and the other bound them. On examining the pastures, Dr. Daubeny soon discovered that the former abounded in purging flax (*Linum Catharticum*), and the latter with the common tormentil or

septfoil (*Potentilla Tormentilla*), a very astringent plant.

The disease is thus described by a recent writer: "In certain parts of Scotland there is a most destructive and ruinous disease among sheep, called *Pining*, a very descriptive word, derived from the verb to pine, or languish; 'for no creature,' says the Ettrick Shepherd, 'can have a more languishing and miserable look than a sheep affected by this malignant distemper.' In the course of nine years Mr. Hogg lost upwards of 900 sheep by its ravages.

"The principal districts of this disease are, the green pastures of the Cheviot Mountains, the chains of hills running through the south-west parts of Roxburghshire, the pastoral districts of Selkirk and Peebles-shire, Galloway, and some other districts in Scotland. Mr. Hogg says that pining is quite a new disease on the border, but that in some of the districts just enumerated it has been known for ages under the name of the *Vinquish*.

"The distemper is a strange one; it may affect a whole flock at once. The first symptoms to a practised eye are lassitude of motion, and a heaviness about the pupil of the eye, indicating febrile action. On attempting to bleed the animal, the blood is thick and dark coloured, and cannot be made to spring; and when dead, there is found but little blood in the carcase, and even the ventricles of the heart become as dry and pale as its skin. On the genuine pining farms, the disease is more fatal in dry than in wet seasons; and most so at that season when, by the influence of the sun, the

plants are less juicy, or early in autumn, when the grasses which have pushed to seed become less succulent. Consequently, June and September are the most deadly months. If ever a farmer perceives a flock on such a farm, having a flushed appearance of more than ordinarily rapid thriving, he is gone. By that day eight days, when he goes out to look at them again, he will find them all lying, hanging their ears, running at the eyes, and looking at him like so many condemned criminals. As the disease proceeds, the hair on the animal's face becomes dry, the wool assumes a bluish cast; and if the shepherd has not the means of changing the pasture, all those affected will fall in the course of a month. But even this remedy is not always wholly successful; for on one occasion, on the first symptoms of the disease, Mr. Hogg changed the pasture of the hills for two fields of young clover, and changed the stock on these every fortnight. This probably saved a portion of the sheep, but, in spite of all efforts, fourteen score died. Pining proceeds from an enervated and costive habit, producible by want of proper exercise, and eating astringent food. The only effective cure, therefore, seems to be change of pasture to one of more succulent herbage. Mr. Hogg mentions this as a certain remedy, when resorted to in time; and if the sheep are laid on clover, the cure is quicker. The shepherd will notice whether the change of food has the usual effects of medicine on the sheep. When such is the case, the animal is safe. Nevertheless, these sheep will always be liable to take the disease again, either

that year or the next, so that a farm cannot be subject to a more ruinous distemper. The farms most liable to this disease are those dry grassy farms, abounding in flats and ridges of white and flying bent. These are the bane of the flocks, especially when the surrounding bogs do not yield herbage sufficiently rich and succulent to counteract the astringent effects of the former; for it is found that exactly in proportion as the succulent and laxative herbage prevails over the dry and benty, the effects of pining are less felt. On steep and rocky lands, where the herbage is sweet and short, the disease does not exist; and on hard heathy lands, which are generally intermixed with little green stripes called gairs, it is scarcely known. But there are few of those strong, deep, grassy farms, which prevail so generally over the southern districts of Scotland, on which there are not some parts which require to be constantly watched, and the sheep driven from them once or twice a day, otherwise the pining is sure to appear. Thus, in dripping seasons, shepherds by strict attention in changing the sheep's pasture every day, may in great measure prevent its ravages; but in a dry season, without in-field land sown with succulent grasses or limed, it is impossible to prevent it.

Although the amazing rapidity with which this disease becomes diffused might lead to the conclusion that it is as contagious as fire, yet such does not seem to be the case. It proceeds wholly from the nature of the food, as is proved by the fact that on inlands where it is but partially known and

little regarded, a straggling sheep will take it, and cling to its dry spot of astringent herbage till it dies, and yet none of the rest be affected by it.

The lands which are now most subject to this disease were once, in the same manner, liable to the rot. As the draining of the sheep pastures proceeded, the rot gradually became extinct, and was ultimately superseded by the pining. In the one case the land was too wet, and in the other too dry. An intermediate state is required, to attain which, as soon as the land has been fairly drained, a little subterranean agriculturist industriously plies his trade, notwithstanding he is persecuted and hunted to death as a ruinous enemy by the very farmer whose land he so much improves. This little subsoil ploughman is the mole. According to Mr. Laidlaw, before draining was begun in his district moles were seldom to be found except in dry loamy soils, the finer parts of which were termed green gairs, from the darker shades they assumed in consequence of their superior fertility. The boggy soils were too wet and adhesive to suit the subterranean habits of the mole; but these being drained, were immediately frequented by the animal, which was supposed to do considerable damage by letting out the water with its cross-roads; spoiling the sides and filling up the drains. The moles were therefore diligently pursued and exterminated. But with what result? The green gairs disappeared, soft succulent plants were found to languish and die; herbage became coarse, harsh, unpalatable. Mr. Laidlaw says:—"In the place of the mountain-

daisy, the sweet-scented vernal grass, the healthy sheep's fescue, the rich native clovers, the aromatic yarrow, the spreading rib-grass, which with their kindred plants delighted the sight, a quite different and inferior set of plants frequently possessed the soil, such as moss and lichens, tufty hair-grass and the like. This had been produced by want of that constant supply of fresh earth which the mole brings to the surface, and which, whether spread regularly by the farmer, or casually by the sheep and lambs in the active exercise of playful instinct, or even allowed to remain as thrown up, covers annually a considerable portion of the surface of such farms, and must tend to produce greater variety and better herbage." The farmer will therefore do well to consider whether in destroying the moles he is not depriving himself of a set of most useful labourers, who, without wages of any kind, are constantly working to bring his lands into cultivation. In his search after food, the mole turns up and brings into activity those portions of the soil beneath, which but for his labours would have remained useless. Mr. Hogg is of opinion that the extirpation of moles is the primary cause of the pining of sheep; and Mr. Laidlaw gives a number of cases in support of the fact, and mentions that of a farm, on which during ten years there was little draining and no mole-catching, and the sheep were free from the disease, which, however, appeared during the ensuing ten years, when the land was drained and the moles partially destroyed, and greatly increased afterwards when the moles were nearly eradicated;

but afterwards gradually lessened when the moles were suffered to increase and extend their labours unobserved.

It cannot be doubted that the effects of this severe disease can be best counteracted by taking care to change the sheep from time to time to more succulent pasture, which should therefore be cultivated assiduously, and employed as it were medicinally; and it is worthy of suggestion whether the culture of plants having laxative qualities, such as the purging flax, would not be highly useful in the way of prevention.

With regard to medicine, the Epsom and Glauber salts offer themselves as the most suitable, and the employment of common salt will also be found of much service.

Redwater.

The disease understood by this term consists of effusion of reddish-coloured serum or water in the abdomen, outside the bowels, and is the effect of increased action of the membrane called the peritoneum, which forms the outer coat of the bowels, and also lines the abdominal cavity. It is the natural office of this membrane to secrete a watery fluid, in order that the bowels should glide readily on each other, but when diseased action is set up in this membrane its secretion becomes excessive, and the serous portion of the blood, mingled with some of the red portion, becomes effused in this cavity, where it cannot escape.

The disease is extremely common to lambs, both during the time they are with their dams, and after

they have been weaned ; and in them, as well as in sheep, it is very fatal, destroying the latter in twenty-four hours, and the former in less time.

The nature of the fluid effused is similar to the serum or watery portion of the blood, and as there is no active pain manifested, we are not justified in considering that it is the effect of inflammation, but one rather of debility of the vessels, and the existence of too much moisture in the system. It usually attacks both sheep and lambs when feeding on turnips, and particularly when there is a hoar-frost, and the sheep are folded on them during the night. From this circumstance it has been attributed to the effect of lying on the cold damp ground, thus chilling the system, and particularly the abdomen. But the sheep is an animal covered with wool, which can readily bear this exposure, and it is more likely to be produced by an excess of this cold watery frost taken into the system, though perhaps assisted by cold lair.

This view of the matter, too, is borne out by the fact, that where ewes in lamb are kept too much or too long on turnips, they often cast their lambs, which are found dead and *water-bellied*, as it is termed, that is, the abdomen is found distended with the same description of watery fluid as we find in redwater. Now, in this case, the ewe generally escapes disease, therefore it cannot be from external cold, but from the nature of the food ; so likewise it is most probable that such is the case with redwater.

The *symptoms* usually observed in sheep are re-

fusal to feed or ruminate, a dull heavy appearance, often attended with giddiness, a staring eye, obstinate costiveness, and sometimes the head is carried on one side. In lambs these symptoms are less decidedly marked, but the little animal lags behind its fellows, is unwilling to move, and is very dull, and dies in a shorter time than the sheep. Acute pain is rarely manifested in either sheep or lamb, but they are generally carried off in a short time. It is not at all uncommon for the shepherd to leave them apparently well overnight, and to find one or more dead in the morning.

The *treatment* of the cases where the symptoms have fully manifested themselves will generally be unsuccessful; but in the earliest stage, and before the disease has actually been manifested, much can be done. The sheep should be removed to a drier situation, and pasture or seeds or stubble should be substituted for the turnips, and the following medicine administered:—

Sulphate of magnesia		1 lb.
Gentian, powdered		1 oz.
Ginger, dissolved in warm water		1 oz.

This is sufficient for eight or ten sheep, or double or treble the number of lambs.

Above all, it is desirable, by way of prevention, to remove the healthy sheep to some dry pasture, giving them good sound hay, a little corn, and turnips only in moderation. Such, however, is the fatality of the disease, that it is a question whether it will not be more prudent to kill the sheep or lambs affected; that is, if they are in any condition

for the table, or unless from any particular reason it is very desirable to preserve them. Bleeding in these cases will not be prudent unless we are sure that inflammation is present, which we may expect if active pain is manifested.

Mr. W. Greaves advises the employment of tar as a preventative, and adduces the following instance of its successful employment. He says, "This disease is very prevalent in this part of Derbyshire, and a friend of mine, Mr. Cooper, of Ashford, for many years lost one-fifth of his hoggets from redwater. Three or four years ago, he was advised to bring them into a yard, and give each hogget a table-spoonful of common tar every fortnight, and the consequence has been, that although they are kept in every respect in the same way as before, and on the same ground, he has not lost one sheep since the adoption of this treatment."

We give the above on the responsibility of the adviser, in case any farmer may be desirous of trying it, but we can give no opinion in favour of its efficacy.

SECTION XXVII.

DISEASES OF THE CHEST.

THOUGH diseases of the organs of respiration are less frequent than those of digestion, yet they often occur either in the milder forms of catarrh and influenza, or the more severe visitations of inflam-

mation of the chest, or substance of the lungs ; and, indeed, many sheep are annually lost by these diseases.

Catarrh.

Catarrh, or *Cold*, is very common at the fall of the year, and particularly if the season is unduly wet, or the flock has been much exposed, or driven about from place to place. It is very common at the autumnal fairs to find great numbers of sheep coughing continually, and having a considerable discharge of mucus from the nostrils. The disease consists of inflammation of the membrane lining the chest, nostrils, and throat, and windpipe. From the changes of the weather, and exposure to wet, particularly after being heated by travelling, and often before the fleece has grown sufficiently after shearing to afford proper protection, the membrane before spoken of becomes inflamed, a considerable increase of its natural discharge takes place, and a cough is produced, either as a consequence of the inflammation of the membrane at its most irritable part, or from the irritation excited by the presence of mucus. The disease will sometimes continue in this state for several weeks, and gradually get well of itself. It is well if it does not lead to anything worse, for sometimes the inflammation will extend itself to the lungs, and prove fatal. The effect of a cold is, at least, to retard the improvement of the animal, and every severe case should be met with attention, and, if possible, more shelter and good nursing. This alone, in mild cases, with the assistance of a

little gruel, will effect a cure ; but if the symptoms are more severe, half an ounce of Epsom salts, a drachm each of nitre and of ginger, and half a drachm of tartarized antimony, may be given, dissolved in gruel. In still more severe cases, where any of the sheep have been lost, or inflammation of the lungs is threatened, bleeding from the neck should be practised.

Bronchitis

Is often the sequel of catarrh, or it may co-exist with it, or be produced by the same causes. It is, in fact, an inflammation of the mucous membrane lining the air passages of the lungs, and is much more dangerous than catarrh.

The *symptoms* are, besides those of catarrh, such as cough and discharge from the nostrils, a greater diminution of appetite, and accelerated pulse and respiration.

Sometimes, though rarely, it is produced by the presence of small worms in the windpipe, and then the cough is more frequent and distressing. This form of bronchitis is much more common with young cattle, probably from their being more exposed to wet and woody pastures ; and when sheep are affected it is confined to young animals.

Treatment.—Bleeding may be employed in the early stages with advantage, but with some degree of moderation ; and if the weakness is great, and the discharge from the nose considerable, it had better be avoided. The same dose may be administered as advised for catarrh, and should be repeated the

second day; and, with the exception of the salts, it may be continued several times, diminishing, however, the quantity of nitre, and adding a drachm of gentian. It is not desirable to purge in this disease, nor to diminish the strength much, but only to relax the bowels mildly: good nursing, shelter, and care, are particularly called for.

Bronchitis, when produced by the presence of small worms in the windpipe, requires a somewhat different treatment, the object being to destroy these irritating parasites. The same means should, therefore, be resorted to as are employed with success in young cattle, and for which we are indebted to Mr. Mayer, of Newcastle-under-Lyne. Lime-water, half a pint for a sheep, and a quarter for a lamb, should be given in the morning; and in the evening one or two large tea-spoonfuls of salt, dissolved in a quarter to half a pint of water. This treatment should be continued for the space of a week, or until the improvement becomes very decided.

Inflammation of the Lungs (Pneumonia).

This disease, though we cannot consider it very common, yet occurs more frequently than sheepmasters imagine. It consists of inflammation of the substance of the lungs, and thus differs from two other diseases of the chest, for which it may be mistaken, and with which, indeed, it may co-exist—that is, pleurisy and bronchitis; the former being inflammation of the membrane covering the lungs and lining the chest, and the latter inflammation of the membrane lining the bronchial tubes. *Pleurisy*

is a disease of a serous membrane, and will be benefited by copious bleeding; and *bronchitis* that of mucous membrane, and can only endure bleeding in moderation.

Inflammation of the Lungs, or Pneumonia, may either exist together with one or the other of these diseases, or without them. It may be produced by a common catarrh, or the same cause that produces it, such as undue exposure to wet and cold; and thus it is apt to occur after sheep-washing.

The *symptoms* are those of fever, with quickened and laborious breathing, and hard and quick pulse. High-bred animals are more liable to this, as well as to other inflammatory diseases; and the Leicester breed is probably more disposed to it than any others, and imparts, together with its superior fattening qualities, a greater liability to inflammatory disease to those breeds with which it may be crossed. To illustrate this, we may subjoin the following cases. They are related by Mr. Guttridge in the thirteenth volume of the 'Veterinarian,' and are full of useful information.

He says: "Jan. 21st, 1840.—I was requested to see a very valuable two-year-old tup of the Leicester and Cotswold breed, the property of J. Powell, Esq., of Fanley Court. The sheep had been taken up, and put into the barn previous to my arrival. I found him standing leaning against the wall, his pulse hard and quick, refusing his food, having ceased to ruminate, heaving of the flanks, most painful cough, an insatiable thirst, grinding of the teeth, and constipation of the bowels."

"I immediately bled him freely from the neck, and gave a brisk purge. I also administered injections of thin gruel every two hours, giving also a small quantity by the mouth.

"22nd. The cough not so violent, but the medicine has not acted. The respiration is more disturbed, the mouth hot, and a total disgust of food. We determined to abstract more blood, but before we could take two ounces he suddenly fell. Two hours afterwards I gave him more salts, with a little powdered digitalis in some gruel. In three hours after this I found him much relieved, the pulse not so quick, respiration not so much disturbed, and the bowels acted on. I ordered gruel every three hours, and injections as before.

"23rd. Better, but no appetite: not so much unwillingness to move; has laid down in the night and this morning for some time. Treatment as before.

"24th. The medicine has taken the desired effect; the pulse is more regular; he moves about more; very little discharge from the nose; rumination has returned; he lies down very composedly; the eye not at all clouded. Medicine as before.

"25th. Very much better; feeds; ruminates; lies down; walks about, but very weak. I ordered small doses of gentian and ginger in chamomile tea, every morning and evening.

"I did not hear of him for three weeks after this, when I was informed that he had perfectly recovered, and that Mr. Powell would not sell him for a hundred pounds. I saw him a few weeks ago in perfect health, and in most beautiful condition."

Mr. Gutteridge relates a second case, in which, though to a certain extent successful, yet, in consequence of organic disease, it was found necessary to kill the animal. "The sheep was of the same breed as the other, and the symptoms still more severe and distressing. The countenance was expressive of great suffering; an oppressed pulse; great and most offensive discharge from the nose; violent cough; cessation of rumination; great heaving of the flanks; a staggering walk; respiration much disturbed. I bled most freely, and gave a brisk purge, with injections, gruel, &c. Three hours afterwards I found his breathing much worse; I opened the vein, and abstracted three ounces more blood, and gave half an ounce of salts with powdered digitalis, in warm gruel. I also inserted setons in the chest, and left him for the night. In the morning I found him a little improved, but still in a most dangerous state. The medicine had acted very slightly. I gave half an ounce of salts with the sedative. Continue the injections and gruel for three days.

"14th. I was informed that the tup was better, but his breathing continued very short. On my entering the barn I saw him attempt to lie down, but he started up again. He then suddenly rested himself on his knees, then sprung up once more, with his feet as wide apart as possible: then he stood heaving and panting, as if he had been driven for a long distance.

"On examination I found that he had purged a little; the pulse was still very quick; the mouth

very hot; a mucous discharge from the nose; a clouded eye; the greatest unwillingness to move; the setons discharging well. I gave more salts, with the digitalis, &c., and left him, ordering the same medicine to be given morning and evening.

"17th. I found him better, but still with difficulty of breathing, and a short and staggering walk; stopping and looking round at his sides, as if to tell us the seat of disease. I kept the discharge of the setons up by a very strong stimulating ointment, and continued the aperient and sedative medicine morning and evening, giving green meat in small quantities three times a day.

"I saw the tup a fortnight afterwards; he fed as well as the other sheep, but did not get into condition. He was rather losing ground. It was now evident that there was a chronic disorganization in the lungs, which left no chance of recovery. He was allowed the most nutritive food that could be got for him, with common salt, one ounce daily, and four ounces of lime-water; the salt being given in the morning, and the lime-water in the evening. In this way he remained until last week, when, having occasion to go to Fanley, I was informed they had killed him, he carrying a fair quantity of good meat, and there being no chance of his ever getting well. The respiration had still continued at some times sadly disturbed. I inquired respecting the state of the lungs, &c. They told me that these organs were in a most diseased state; full of tubercles, and great adhesion of the left lung to the pleura; the liver was very soft, and much enlarged.

The kidneys, and the whole of the intestinal canal, were perfectly healthy."

The foregoing treatment requires but little remark; the latter was undoubtedly complicated with pleurisy, and this would account not only for the greater severity of the symptoms, but the degree of pain manifested. It must be evident, in acute inflammation of the lungs, the sheet anchor in our treatment must be early and copious bleeding, repeated if necessary in a few hours. To this must follow aperient medicine, such as two ounces of Epsom salts, which may be repeated in smaller doses, if the bowels are not sufficiently relaxed. Although it is not desirable to produce very active purging, there is not that danger of doing so that there is in the horse. The following sedative may also be given with gruel twice a day:—

Nitrate of potash	1 drachm.
Digitalis powdered	1 scruple.
Tartarized antimony	1 „

And so continued for several days.

Setons in the brisket will also be useful, not perhaps as a relief for the acute attack, but to counteract the chronic symptoms so frequently left behind.

If the disease is of a sub-acute character the bleeding must be less active, but the other treatment the same.

Inflammation of the lungs will sometimes appear almost as an *epidemic*, attacking great numbers at the same time; or it may with greater propriety be termed *endemic*, being more frequently confined to

particular localities. In France it appears to have prevailed more extensively, and with greater fatality, than in this country, and is in great measure attributed to the custom of keeping sheep in close unventilated sheds. In the report of the annual meeting of the Royal and Central Agricultural Society in France, there is an account of this disease by M. Roche Lubin, which destroyed a great many sheep in the winter of 1836, in Saint Afrique. "This malady, the nature and treatment of which cannot be too clearly explained to the sheep-farmer, is produced by the long continuance of the sheep during the winter, in small and ill ventilated sheep-houses, where the floor is covered by a thick dung-heap, seldom removed, and highly infectious; and also by a sudden change from the heated air of these sheep-houses to the cold air without, in order to drink of the half frozen water, which the thirst under which they labour induces them to take with avidity, and in a great quantity. Too many sheep become diseased from this cause. The difficulty of submitting them separately to a methodical treatment, the measures adopted before the arrival of the veterinarian, in consequence of the advice of empirics and charlatans, and the ignorance and the superstition of the farmers themselves, are circumstances that have induced a mortality discouraging to the medical attendant, and too often inducing the proprietor to abandon the breeding of sheep.

"Out of 1100 sheep submitted to an anti-inflammatory, and yet slightly tonic, mode of treatment, a third only was saved; and they were animals that

were attended at the very commencement of the disease. The others were speedily carried off, exhibiting after death hepatization (*condensation*) of the lungs, with a complication of hydro-pericarditis (*dropsy of the heart-bag*) and diarrhoea."

The following is also an account of its appearance in France, and is written by M. Seron, a French veterinary surgeon. He says:—

"I was called on the 30th of January, 1836, to a sheep-fold on which some unknown disease had been committing dreadful ravages. On my arrival, one of the sheep was dying. I stayed and opened him, and thought that I perceived the cause of death. Of all the maladies of the sheep, inflammation of the lungs is least understood, and yet very common. It usually appears in the months of January and February. The proprietors and cultivators of this country buy in lean sheep, in October, November, and December, in order to fatten and resell them in the course of the succeeding year. They had previously been much neglected and badly fed, and they had been driven from market to market, exposed to the intemperature of the weather. They are now suddenly placed in comfortable sheep-cotes, and have as much as they will eat, and that of stimulating food. Is it astonishing that inflammatory complaints should break out among them?

"The cause of the complaint, then, is the state of poverty in which they are brought, and the improvement of condition, rapidly, and to a great extent, acquired by means of food too abundant and too succulent, and administered without discern-

ment, their confinement in sheep-cotes hot and ill ventilated, and the emanations from the dung and urine too long left in them.

"The symptoms are red and injected conjunctiva, hot mouth, accelerated pulse, and laborious breathing, the muzzle of the sheep rests on the side, and the animal makes frequent attempts to get rid of a yellow mucus with which the nostrils are clogged. One symptom is remarkable and always present, namely, great tenderness of the loins. If the animal is pressed on that part, he will often fall suddenly to the ground. The duration of the malady is from twenty-four to thirty hours, and its termination is always fatal, if medical assistance is not had recourse to without delay.

"The lungs are the chief or only seat of disease. The exterior lobes are those which are ordinarily or alone affected. If they are cut into they are found to be hard, and the knife creaks as it passes through them; and if they are thrown into water they sink immediately to the bottom. Sometimes it is found in the left lobe alone, but then the whole extent of that lobe is diseased, and the other lobe is perfectly sound.

"*Treatment.*—This must be of an antiphlogistic character. Venesection should be immediately resorted to, and repeated two or three times if necessary in the course of twenty-four hours. I have bled as often as three times, and in neither instance did I stop the bleeding until the animal began to stagger. I have always succeeded when I have been consulted in an early stage of the disease, and

adopted this course. To this were added, after the bleedings were ended, warm drinks in which a little nitre, honey, and gum arabic were dissolved—acidulated injections into the nose, in order to get rid of the adhesive mucus—emollient injections, and the sparest diet.

“The emetic tartar was given in doses of a drachm, in the second stage, and I had always reason to be satisfied with it, if I abstained from bleeding afterwards.”

Pleurisy, Pleuritis.

This disease consists of inflammation of the pleura, or membrane lining the chest. It is produced by the same causes as inflammation of the lungs, with which it may be accompanied, and particularly by any sudden changes that may chill the whole system. It often occurs from this cause after sheep-washing, when it is very common to find a few sheep failing and in proportion to the want of care exercised. It is not unusual, in examining the bodies of sheep, to find the lungs in part adhering to the sides of the chest, and the animal thus affected generally loses flesh. This adhesion is the effect of pleurisy, and another and still more dangerous result is water in the chest.

The *symptoms* of this disease are in many respects like those of inflammation of the lungs, but it is attended occasionally by severe pain, and by a variation of the symptoms generally, such as a harder and more defined pulse and more warmth of the body.

The *treatment* must consist of active bleeding in the first instance; and in this disease the sheep can bear blood-letting to a greater extent than in most diseases. The bleeding may be repeated if necessary, setons may be inserted in the brisket, the bowels moderately relaxed, and in other respects the same treatment observed as advised for inflamed lungs.

The pure Leicesters are more subject to this disease than other breeds, as the following communication, addressed to the Editor of the 'Veterinarian,' in the 10th volume, will show:—

"A very extensive farmer and grazier, residing on the banks of the Ouse, a low and marshy district, has had the misfortune to lose many of his sheep for some years past, in the spring and autumn, from some fatal disease. By examining two or three after death, I found it to be pleuritis. There was nearly a quarter of an inch thickness of coagulable lymph on the whole surface of the pleura, and between its layers more or less serous fluid. The substance of the lungs was free from disease, as were all the other viscera. This disease has been confined to the well-bred sheep, and Mr. — never saw it in his coarse-skinned sheep. So fatal, however, has it been in the pure Leicester, that he cannot any longer breed them pure; he mixes them with half-Lincoln. These do not escape; within the past week many have died. Mr. — has observed, that the malady has been more prevalent when the sheep have been placed on rich food, such as cabbages and turnips: it is seldom seen when they are kept on grass or dry food. The treatment that

has been adopted from time to time has been attended with no good effect; in fact, it has been directed by no very defined indication, except that of bleeding the whole flock when any case has been suspected; and when the animal is actually seized, bleeding again. Only one sheep ever recovered, and that was kept in an almost constant state of faintness for two or three days by repeated bleedings. The symptoms observed by Mr. — are pulse very quick and hard; breathing difficult; countenance dull; the head in a declining position, with the nose forced against the ground; bowels more than usually constipated; the membranes of the eyes and nose red; low and short cough; almost always lying down; when moved indicating much pain, and making a grunting noise. In one of the sheep there was a discharge streaked with blood from the nose."

Mr. Youatt, in his reply to this communication, attributes the disease to the luxuriant pasture, the high condition of the animals, and the predisposition of the high-bred sheep; and he advises more moderate feeding, and less mixture of Leicester blood.

This is undoubtedly good advice, for the attack is so rapid and sudden that treatment will probably be rarely successful. The same means, however, should be adopted as advised for inflamed lungs, the first bleeding, if possible, being still more copious. As soon as the disease appears, the whole of the flock should be removed to poorer pasture, for some time only allowing the rich food for a short period of the day. It may be observed, as a

general rule, that when a particular disease makes its appearance regularly amongst a flock of sheep, it is to be attributed to some faults in the feeding or management, which should be carefully searched into and discovered, as a preventive is of more importance than a remedy.

SECTION XXVIII.

DISEASES OF THE URINARY ORGANS.

Inflammation of the Bladder (Cystitis).

INFLAMMATION of the bladder, sometimes called *watery braxy*, is a rather rare disease with sheep, and is chiefly confined to such as are kept on artificial food, such as oil-cake, beans, &c., though clover that has been mown, it is said, will produce it. There are more losses from this cause than farmers are aware of, it being generally this disease when a sheep is said to drop with water. It is mostly confined to the male sex, and principally to rams, and such as are highly fed. The state of the bladder appears to be that of fulness, which shows that its neck is involved in inflammation, and thus becomes contracted, and closes the cavity. In horses cystitis is generally attended with constant staling the bladder, being so irritable as scarcely to retain a drop of urine. In sheep there is the same disposition to stale, but an incapability of performing the act. Two cases are related in the 15th vol. of the 'Veterinarian,' by Mr. Tindal, which proved fatal, and on examination the bladder was found not

only highly inflamed, but also ruptured in both instances; the penis was also both inflamed and ulcerated. The symptoms were uneasiness, constantly shifting the hind legs, and frequently straining, as if to void the urine. He was stiff and unwilling to move, and appeared to breathe with difficulty, and the action of the heart was quick and faltering. The abdomen was enlarged and tender, and there was costiveness.

Mr. Dickens, in the same volume, also relates two interesting cases, closely resembling the former in the symptoms. The first sheep was slaughtered, and the bladder was found full and highly inflamed, and there was also a lesser degree of inflammation of the kidneys and intestines. The other case exhibited the same symptoms, and the sheep being a tup, and highly fed, Mr. Dickens at once abstracted three pints of blood from the neck, which produced fainting; he soon rallied, and an oleaginous draught, accompanied by an opiate, was given twice during the day. Towards night he appeared much better, ate a little, and was seen to void some very highly coloured urine. His medicine acted well during the night, but on the next day his straining came on at times. He again bled him from the other side of his neck to the amount of two pints. From this time he continued mending, and Mr. D. had the pleasure of seeing his patient obtain a prize as extra stock from the Huntingdonshire Agricultural Society in October.

These sheep had been highly fed on peas, cabbages, and oil-cake, and Mr. Dickens is inclined to attribute the disease to the grit or extraneous matter

with which foreign oil-cake too frequently abounds. However prejudicial this dross may be, yet we must not forget the fact, that when an animal is very highly fed his urine becomes far more stimulating, and more abounding in nitrogenized elements..

Calculi in the Urinary Organs.

Stones are very seldom found in the urinary organs of sheep, unless they have been kept on dry food, and then they are generally found in the urethra of rams, where they sometimes cause fatal obstruction and inflammation, unless relieved by operation. The following instructive cases are related by Mr. Stevens of Newmarket, in the 13th volume of the 'Veterinarian.'

"Case I.," he says, "was a fifteen months' ram, of the pure Down breed, preparing for the late agricultural show at Cambridge. I met the shepherd on his road to ask my assistance. He informed me that he had a sheep with a stoppage in the water, that the present case was the fifteenth animal that had laboured under apparently the same disease, and all of whom had either died or been destroyed.

"I found the animal down, and on his getting up observed a great anxiety of countenance, and a peculiarly sudden curvature of the spinal column; after which he passed a drop or two of urine. These symptoms had been observed continually for six hours, whenever he stood up: his respiration was also hurried.

"On casting him, and drawing out the penis, I found a small calculus forced a short distance into the

appendix vermiformis, by the pressure of the urine from behind. I cut down on and removed the calculus, when the animal immediately voided it more freely than he was accustomed to do (as it flowed through the incision which I had made). I next administered in the course of twenty-four hours five ounces of sulphate of soda, and a pint of castor oil; (the animal weighed about 125 lbs.) by which means his bowels were freely acted upon. In a week he went back to his pen perfectly recovered in health, and afterwards did quite as well as the others. On turning him up, however, on the following week, I found that the appendix had rotted off, incapacitating the animal as a ram. Indeed, this vermiform process appears to be of so very delicate a texture that it will scarcely bear touching.

“Case II. This was of a similar character. It occurred to a fellow-sheep, also fifteen months old, but a much finer animal. I found the symptoms exactly the same, and the obstructions in much the same situation. The shepherd had removed the stone before I arrived; but, much to his own disappointment, the urine flowed but a drop at a time, and these drops very slowly after each other. The same remedial means were had recourse to, but without success, for the animal became gradually worse, and it was thought advisable to kill him.

“*Post Mortem Examination.*—The whole extent of the urethral canal was in a state of excessive inflammation, and the lining membrane so much thickened as to prevent the passing of the urine; the bladder was much distended, and it is very probable, if the

animal had been suffered to live, that the disease would have terminated in rupture of that organ. The bladder was also nearly covered internally with patches of vivid inflammation, but no earthy matter was observed. On slitting the ureters two or three small calculi were found in each, not much larger than a pin's point. I am sorry to say that I had no opportunity of examining the kidneys. I am of opinion that if this last case had been subjected to earlier treatment, the life of the animal might have been saved. I should have observed that in every case that has occurred, concretions were found adhering to the hairs round the prepuce, like small beads, of the same character as the calculi taken from the urethra.

“On analyzing the stone and concretions, they were found to consist of phosphate of lime. Sheep at grass do not appear to be subject to this complaint. Would not sorrel, or some acid, given them with their food, counteract the direful effects of the forcing system? Or would it not be wise for sheepmasters to give a dose of physic previous to their sheep being put on high keep?”

SECTION XXIX.

PARTURITION, AND THE DISEASES CONNECTED WITH IT.

Parturition.

THE usual period for lambing with the greater number of sheep in this country is in the months

of March and April : sometimes an earlier period is attained, in order that the lambs should be sooner fattened for the market, and with the Dorset and Somersetshire sheep the lambs are generally dropped before Christmas. It often happens that during the lambing season we have cold inclement weather; either the rain or snow of February, or the bleak winds of March prevail, and both ewes and lambs suffer much in consequence, and many are destroyed. There is no economy so thriftless in the whole range of agriculture, as that which denies the ewe proper shelter at this period. They should either be driven nightly into yards or cots properly protected, or this protection should be afforded in the field by means of double rows of hurdles lined with straw, with a still more protected pound or inclosure. The shepherd or lamher should be perpetually on the watch, and the eye of the master should superintend the whole. A little manual assistance opportunely afforded, the extrication of an ewe from a dangerous position or very exposed situation, these and similar means will save a great number; and it is well observed by Mr. Price, in his work on sheep, that "many lambs may be lost without it being possible to charge the lamher with neglect or ignorance, although greater attention on his part might have saved many that otherwise perish. The practice of lambing is at times very intricate, and is apt to exhaust the patience of a lamher. Sheep are obstinate, and lambing presents a scene of confusion, disorder, and trouble which it is the lamher's business to rectify, and for which he

ought always to be prepared. Some of the ewes perhaps leave their lambs, or the lambs get intermixed; and the ewes that have lost their lambs run about bleating, while others want assistance. These are only a few of the various occurrences which call for the immediate attention of the lamher, and which render it necessary that the owner of the sheep should be on the spot, and should superintend the whole concern. In the year 1805, I mentioned this to one of the greatest sheep-owners on the Romney Marsh, and who said that he would watch the lamher more attentively than ever; and the consequence was, that in the following spring he was more successful than he had been in any one of the preceding twenty-five years. Another master, pursuing the same plan, saved 200 pair of twins out of 800 ewes, whereas he had never before saved more than 100, and in some years not more than one lamb to each ewe."

When ewes are heavy in lamb, they should by all means be kept quiet and undisturbed by dogs. The fences, too, should be kept in good order; for if chased with dogs, or from any other cause they break their pasture, there is very great danger of abortion taking place; and this evil once commenced in a flock of sheep, it is difficult to say where it will stop. At the same time they should not be too closely confined, for exercise is very essential to breeding ewes. They should be in fair condition, but not too fat; and their best place will be some good sound pasture, on which they may have a moderate proportion of turnips. If, how-

ever, the farm will not admit of this, and other feed is so short that turnips must form a main portion of their food, they should then be folded on them after the fat and young sheep, so that the greens and most succulent part of the turnips have been already eaten, leaving only the driest but most wholesome part. It is preferable that the ewes should be somewhat deficient in condition, rather than this condition should be procured by means of turnips. It is a very useful plan, adopted by many breeders, to drive the ewes into a straw-yard every night, which, if it is at some distance from the turnip-field, will be of no consequence if they are not driven hastily. Where sheep-breeding is systematically and judiciously followed, the owner or the shepherd will be able to tell, with a tolerable degree of correctness, which ewes first took the ram, and consequently which may be expected to year first. This will save trouble, and in many cases prevent loss, by selecting these ewes, and separating them from the others. When the important and anxious time of lambing commences, the utmost vigilance should be exercised; but, at the same time, the operations of nature must not be hastily interfered with.

The following very useful observations, from an essay by Mr. Cleeve, in the first volume of the 'Journal of the Royal Agricultural Society of England,' are worthy of much consideration:—"The shepherd must not be led, by the appearance of uneasiness and pain, to interfere prematurely: he must watch the ewe closely, and so long as she

rises at his approach, he may be assured that whatever uneasiness she may exhibit, all is well. Much uneasiness is generally apparent; she will repeatedly lie down, and rise again with seeming distress. If this occurs when driving her to fold, he must be very cautious and gentle in urging her. These symptoms ought to be continued for two or three hours, or even more, before he feels imperatively called on to interfere, except the lamb is in such a position as to warrant fears of losing it. In cold weather particularly, the labour is likely to be protracted. Should the ewe appear exhausted, and gradually sinking under her labour, it will be right to give her some oatmeal gruel, with a little linseed, in the proportion of a spoonful of the latter to two of the former. When the ewe feels that she is unable of herself to expel the lamb, she will quietly submit to the shepherd's assistance. In giving her this assistance, his first duty is to ascertain whether the presentation is natural. The natural presentation is with the muzzle foremost, and a foot on each side of it. Should all be right in this respect, he must proceed to disengage the lamb, first very gently drawing down the legs, and with all possible tenderness smoothing and facilitating the passing of the head with his fingers, rather than forcibly extricating it, the particular attention of the shepherd being given to these points. This may be effected by passing the finger up the rectum, until he feels the back of the lamb's head, and then urging it forwards at the same time that he gently pulls the legs. Sometimes the head is sufficiently ad-

vanced, but the legs are too backward. In this case the head must be gently pushed back, and the hand being well oiled must be introduced into the vagina, and applied to the legs so as to place them in their natural position, equal with the head. Should the fore feet, on the other hand, protrude, they must in like manner be returned, and the same assistance given to advance the head. If the hinder quarters present themselves first, the hand must be applied to get hold of both the hind legs together, and draw them gently but firmly; the lamb may often be easily removed in this position. It is no uncommon occurrence to find the head of the lamb protruding, and much swollen; but still, by patience and gentle manipulation, it may often be gradually brought forward; or even nature, not unduly interfered with, will complete her work, if the pelvis is not very much deformed. Should, however, the strength of the mother be rapidly wasting, the head may be taken away; and then, the operator pushing back the lamb, may introduce his hand, and laying hold of the fore legs, effect the delivery. It also often happens that the legs are thrust out to the shoulder, and from the throes of the ewe, it is not possible to replace them so as to get up the head of the lamb. By partially skinning the legs, you may disunite them from the shoulder-joint; there will then be room for the introduction of the hand, and by laying hold of the head you can deliver the ewe. A single season of practice will do more than volumes of writing, to prepare the farmer for the preceding and some other cases of difficult labour.

But let him bear in mind that, as a general rule, the fœtus should, if possible, be placed in its natural position previously to any attempt to extricate it by force. When force must be used, it should be as gentle as is consistent with the object of delivery. I need scarcely observe that the ewe must be the object of careful nursing and care, until she is completely restored."

Abortion.

Though not so common as in cows, this disease, as it may be termed, sometimes occurs very extensively, and becomes of serious consequence to the sheep-owner, disarranging all his plans, as well as occasioning a severe pecuniary loss. It may occur at all periods of pregnancy, but is most frequent when the ewe is about half gone. The causes of abortion are various—sudden fright, jumping over hedges or ditches, being worried with dogs, and the too free use of salt, have all been known to produce it; but that which causes it more than anything else is the unlimited use of turnips and succulent food. Many farmers may have, doubtless, been in the habit of permitting this with impunity, and would therefore be disposed to doubt the evil consequences of the practice; but it is not in every season that it is attended with the danger: but when vegetation has been abundant in the autumn, and the winter has been unusually wet, there is considerable probability of the ewes casting their lambs. Such was the case during the past spring in numerous instances in this locality, and several

of which came under my own particular attention. One farmer had nearly a hundred aborted, and lost a good many of the ewes. They had been turned on a fine field of turnips, and subsisted entirely on them and water-meadow hay for some time previous to the commencement of the mischief, which began soon after Christmas and continued for several weeks. Though the greater number of ewes recovered, yet they suffered much, and some died from inflammation of the womb, and others became paralysed.

The *symptoms* first manifested are dulness and refusal to feed: the ewe will be seen moping at a corner of the fold, and will be heard to bleat more than usual. To these succeed restlessness, and often trembling, with slight labour pains; and in the course of twelve hours abortion will have taken place. Sometimes the parts will be so relaxed, that the uterus or vagina will become inverted, and the expulsion of the placenta will precede that of the fœtus. In the flock before alluded to the lamb was almost universally dead, and often exceedingly offensive, and the abdomen was distended with a bloody, watery fluid, pointing out pretty clearly the nature and source of the disease.

The *treatment* to be adopted is of two kinds, preventive and curative; the former however is the most important. In the first place it is imprudent to turn ewes in lamb into turnips; they should have instead some dry pasture, and be well supplied with hay. If feed is short, the turnips may be drawn and given them on the ground in moderate quantities, or what is better, cut up and mixed with chaff

or bruised corn in troughs. It is better that the condition of the ewes be in some degree impaired, than that so great a danger as abortion should be incurred. If this precaution has not been observed, and abortion should appear, what then is to be done? The flock should be removed from the turnips to a dry pasture, and supplied with the best hay on the farm; the aborted parts should be carefully buried, and the ewe removed from the rest; and, if possible, the same man that attends the flock should not touch or go near the abortion, for there is very considerable danger from infection. The ewe should be placed in a sheltered situation, but allowed plenty of fresh air, and the following medicine may be given with some nourishing gruel:—

Epsom salts	$\frac{1}{2}$ ounce.
Tincture of opium	1 drachm.
Powdered camphor	$\frac{1}{2}$ „

The two latter medicines may be repeated the following day, but not the salts, unless the bowels are confined.

The immediate cause of death in fatal cases is inflammation of the uterus or womb.

Dropsy of the Abdomen.

Another bad effect arising from the too free use of turnips and succulent food is dropsy of the abdomen of the ewe, which gradually increases in size, and at length, about a few weeks before parturition, produces death from weakness and exhaustion.

In other cases the lamb is born alive, but soon pines away, refuses to suck, and dies in a few days

with the abdomen distended with serum, *water-bellied*, as it is commonly termed.

The only thing that can be advised in the latter cases is prevention, by the avoidance of the exciting causes; but dropsy in the ewe has been relieved by the operation of tapping, and though in such cases our prognosis must be extremely doubtful, yet the following case appears to sanction favourable hopes:—

This singular and, we believe, original operation was performed at Laxton, by Mr. Esam, butcher of that village. “A ewe sheep was almost dying from the effects of dropsy, when Mr. Esam proposed that he should be permitted to try the effects of tapping. His suggestion being approved of, he made an incision in the side of the animal, into which he introduced a piece of elder as a tube, and took from the sheep not less than eight gallons of water. It soon began to revive, and is now apparently in perfect health. The ewe was four years old; the pasturage on which she had been fed consisted of low ground; the incision was made on the right side, about four inches down the flank. The ewe has done well since the operation, and there does not appear to be any return of the disease.”

A Disease previous to Lambing.

Although the ewe throughout the greater portion of the period during which she is with lamb is in a good state of health, and often enjoys an immunity from diseases, such as the rot, &c., to which other sheep are liable, yet as the period draws near, she becomes susceptible to various diseases, some an-

terior, though more subsequent to parturition. .Of the former, the following communication to the 14th vol. of the 'Veterinarian,' affords rather a singular instance:—

"A nobleman, a very extensive agriculturist and grazier, has within a few days lost several of his best true Down ewes just ready to drop their lambs. There are several hundreds of the true Leicester and Down Leicester breeds in the same flock, but they are all doing well at present. They are pastured on a fine rich elevated park, the feed short, folded at night, and allowed good hay. The best of them are generally the first and the most severely attacked.

"*Symptoms.*—They stray from the rest of the flock, lie down, toss their heads, and grind their teeth. If suddenly disturbed, they jump up, and then frequently topple heels over head. They at length, however, rise, or lie and look dull, sleepy, and stupid. They walk stiffly, and with their bellies tucked up; and after going a little way they lie down and are unable to rise. The appetite is lost, and rumination ceases. These are the principal symptoms, varying much in degree. The pulse and respiration are little affected, except when the animals are excited. The legs and ears are generally warm, and the mucous membranes of their natural colour. The disease generally terminates fatally about the fifth day from the first attack. A few that have been bled seem to rally a little, and are certainly better. They were all bled when the disease first appeared.

"*Post-mortem Examination.*—The liver very pale, of a light yellow clay colour, and containing but little blood.

"*The Lungs.*—The parenchymatous substance filled with thousands of minute, round, red, or yellow spots, from the size of a pin's point to that of a pin's head. When cut into, they contain either blood or yellow serum, in some few pus: but from their minute size it is difficult for me to describe them.

"*The Brain.*—In that part of the dura mater opposite to and just below the frontal sinuses, there was a black and soft effusion, easily wiped off. The substance of the brain was a little softened, but otherwise healthy.

"Every other part of the animal was minutely examined, and was perfectly healthy. The sheep were rather fat for breeding-sheep, and two fine lambs in each of them. The stomachs and intestines were healthy and contained but little food."

The most singular part of this account is that the disease was confined to the true Downs, whilst the Leicesters and the half-breds escaped. Now this is precisely a different result from what we should expect with regard to inflammatory diseases, the Leicesters being more disposed to disease of this nature. The Downs are also considered to be better mothers and nurses. We can scarcely suppose that the richness of the feed could have been the cause, as the sheep were folded at night (unless they were allowed the hay then as well as by day, which the writer does not mention), and the herbage in the month of March not being particularly nutritious.

The symptoms denote cerebral disease, or affection of the brain from sympathy with the digestive organs, and the examination after death supports the former supposition. The true Downs being alone affected might be an accidental circumstance, and possibly they might have had previously chronic disease of the lungs and liver. In the absence of a favourable solution of the cause of this disease, we should recommend a change of pasture, less hay and a few turnips instead, as precautionary measures, if a similar disease should make its appearance; and with regard to remedial treatment blood-letting, and a dose of salts, with a seton at the back of the head.

Inversion of the Uterus.

Though this occasionally takes place in the ewe at any period, from sudden severe exertion or straining hard, yet it is most frequent immediately or very shortly after parturition. In this case it arises from the violent spasmodic action of the womb, which turns inside out, and protrudes out of the sheep.

No time should be lost in replacing it. The ewe must be placed on her back, with her hind parts somewhat elevated; and the hands being lubricated with oil or lard, the uterus should be gently forced back into its natural situation. A stick of metallic wire or leather should then be passed through the bearing, so as to prevent a second protrusion, and yet to admit the urine coming away. Twenty to thirty drops of the tincture of opium should be

given in a pint of gruel, and the ewe kept perfectly quiet for several days.

Heaving, or After-Pains.

This disease is often a severe loss to sheep-breeders, not unfrequently carrying off the pride of their flocks, even when the labour has been natural, and the lamb yeaned without difficulty. Lord Braybrooke states, that on some farms near Saffron Walden the mortality from this disease is $4\frac{1}{2}$ per cent. The spasmodic pains arise from the violent contraction of the womb, and the effort of nature to restore it to its natural size. It is much more severe with the second or third lamb than the first, because each time the womb becomes more dilated, and requires more contraction; and though, to a certain extent, it is a healthy operation of nature, it often passes beyond the bounds of health, and becomes disease. It usually appears about the third day after parturition, and the first symptom is generally a frequent and painful disposition to expel her urine, which is high coloured, or bloody. She breathes quick, lies down, and appears to have spasmodic pains; her ears droop, and she takes no notice of her lamb. On pressing her hind parts she yields, and almost sinks to the ground; and if she moves, it is with pain and difficulty. The hind parts often swell, and mortification follows, when the pain in a great measure ceases, but is soon followed by death. When the pains are not inordinate, it is better not to interfere with nature; but when otherwise, the *treatment* must consist principally in the adminis-

tration of sedative medicine, the best combination of which will be the following:—

Take

Camphor	$\frac{1}{2}$ drachm.
Tincture of opium	$\frac{1}{2}$ ounce.

Mix. To be given with gruel; repeating the dose, somewhat diminished, in a few hours.

The spasm often continues in spite of treatment, and inflammation of the womb supervenes, and it occasionally prevails almost as an epidemic, destroying sometimes a good portion of the flock, as the following communication to the twelfth volume of the 'Veterinarian' will show. The writer, after stating that he had tried bleeding and Epsom salts ineffectually, observes, "We are losing at this time 20 per cent. The attack commences from six to thirty hours after parturition, and including those who have experienced a difficult labour, and others who have given birth to their lambs without any assistance.

"The *symptoms*, when first noticed, are,—continually shifting their posture, lying down and getting up again immediately, the ears hanging down, the eyes looking dull. Sometimes partial or almost universal palsy ensues, and mortification of the womb terminates the poor animal's sufferings.

"I have tried bleeding a few days previous to their lambing, and immediately after parturition, but neither did any good. The sheep are not in high or low condition: some of them have been living on Swedes, and some on white turnips, but they have never had a great quantity. The turnips

are very good for the season, without much green top. They have also at times had salted hay.

"When we first began to lose them, we attributed it to the north-east winds, and the quantity of snow that fell at the time; but we were wrong in this, for we are losing them now that the wind is south-west."

A similar mortality has prevailed with many other flocks, and mostly on farms where it is customary to keep the ewes pretty much upon turnips. In the above instance we are inclined to think that the disease must be connected with the turnip diet, assisted perhaps by the salted hay. Though both are excellent for fattening sheep, they are neither to be recommended for ewes in lamb: to them hay should be given without salt, and a dry pasture is more suitable than the turnip field, where a moderate quantity of turnips may be given that have been drawn a day or two, by which means much of the watery portion will have been evaporated. If no pasture of this sort is available, the ewes in lamb should follow after the fatting sheep have been folded on the turnips, so as to have the driest portion of the roots.

Garget.

This disease, which is an inflammatory affection of the udder, is less frequent in the sheep than in the cow. It may be produced by cold and wet lair, and, it is stated, from the dryness and hardness of the ground, or from constitutional derangement. It will first be denoted by disinclination or refusal

to allow the lamb to suck, and one or more of the teats will be found red and tender and swollen, and sometimes the udder itself will, even at this stage, be found wholly or partially enlarged, and hard knots or tumors will be felt.

An ounce or two of Epsom salts, with a drachm of ginger, should be given the ewe, dissolved in warm gruel or water, and the udder should then be fomented with water as hot as she can well bear it for some time together, and the lamb may afterwards be allowed to suck her. The fomentation, if necessary, should be repeated, and then the camphor ointment may be rubbed in twice a day. If the swelling continues, and matter forms, it should at once be opened by a free incision, and the escape of the pus assisted by pressure and renewed fomentation. If the wound smells in the least degree unpleasant, it should be syringed with a weak solution of chloride of lime for several days.

The garget sometimes makes its appearance suddenly, and in so formidable a manner, that it becomes fatal in the course of twenty-four hours from the supervention of mortification. It should be met by the most active treatment, and the *constant* application of a hot fomentation.

A not unfrequent cause of inflammation of the udder is from a ewe having twins, and one of them having been taken from her, and the other lamb allowed to suck from the same side as before, as it generally will; the consequence of which is, the milk accumulates on one side, and inflammation follows. This effect can of course be obviated by the shep-

herd obliging the remaining lamb to suck from both teats. The udder of every ewe should be examined by the shepherd immediately after yeanning, in order to ascertain whether milk can be drawn readily from both teats. It should also be observed afterwards from time to time, as early attention will in many cases save the ewe from this troublesome and dangerous disease.

Sometimes, from the effects of garget, some portion of the udder becomes hard, schirrous, as it is termed, and of course no longer secretes milk. Such a ewe should invariably be drafted and fatted.

In more favourable cases, or perhaps simply from soreness of the teats, their openings become closed, and the passage impervious, and this is only discovered after the ewe has had another lamb, and it attempts to suck.

An endeavour should first be made to insinuate a small probe into the entrance, but if this fails, a knitting-needle should be made red hot, and with this an opening should be made, taking care not to carry it deeper than necessary, nor to deviate from a straight line. After this the lamb, by frequent sucking, will keep the passage clear.

The following account of a disease appearing amongst ewes is rather of an unusual kind. It appears in a communication from the owner, Mr. Buckley, in the *Journal of the Royal Agricultural Society of England*. He says: "Several ewes have been attacked with a disease which turns out, after death, to be an affection of the liver. This organ appears as if it had been parboiled, and is in the

first stage of decomposition; the gall-bladder is unnaturally full; but the rest of the intestines are in an apparently healthy state. Sometimes a violent purging comes on; and the complaint throughout is accompanied with great debility. Condition seems to have nothing to do with it, as those in high, as well as those in low, have alike been attacked with it: it is confined entirely to ewes at different periods after parturition, varying from fourteen days to a month, or longer. Not a fluke has been discovered in their livers, or any other symptom of 'rot' whatsoever. I think in some cases the disease fixed itself on the udder, with less affection of the liver; but it has terminated fatally in every instance: some have died in forty-eight hours, others have lingered a fortnight. Calomel and other purgatives have been tried; in cases where great debility existed, stimulants of different kinds have been tried; but all to no purpose." The above account having been submitted to Professor Sewell, he observes: "It appears to be a chronic disease of the liver, produced by continued wet weather, and leaving the constitution so much debilitated, that the secretion of milk required to nourish the lamb as its growth advances increases the debility, until exhaustion ensues, under which the animal sinks. Both the depleting and stimulating treatment having failed, I think mild tonics should have a trial. Dissolve half an ounce of sulphate of iron in a quart of hot water, and give half a pint twice a day. To check purging, give one ounce of finely-powdered common chalk in half a pint of water daily, if required.

Keep under shelter, and give dry food, and a lump of rock-salt to lick."

SECTION XXX.

DISEASES OF THE SKIN.

Scab.

THIS troublesome and loathsome disease is analogous to the mange in horses, and the itch in man. It is decidedly contagious, and when it extends considerably amongst a flock, it is occasioned by infection, although filth and poverty will also produce it. It is not so much, however, the actual contact of the sheep, as the rubbing on the same post, or other object, which produces it, and thus it has been communicated to a sound flock after the affected sheep had been all removed.

The first symptom which calls attention to an affected sheep is the itching, the animal rubbing itself against any object; and it has been ascertained that the sheep begins to rub about twelve days after having received the affection. It will then be found that, on the part affected, pustules will be visible, and the skin feel rough and the pimples hard. In a few days the pustules are broken by the rubbing, and a fluid escapes, which soon becomes dry, and forms the scab, which gives the designation to the disease. This scab, if rubbed off, exposes a sore which may thus increase, and spread over a good portion of the body, the wool being denuded; and

in the summer the fly will attack the sore, and the maggots eat into the flesh, and form deep sinuses, which bid defiance to every remedy.

It has now been pretty clearly shown that the scab, like the itch in man, and the mange in horses, is caused and propagated by means of minute insects called *acari*. These insects are of both sexes, and though no larger than the hole formed by a pin or needle of medium size, they burrow under the skin, producing great irritation, and when the pustule dries they leave it for another part, and thus extend the disease over the body, or propagate it by contact with another animal. The mode in which this is accomplished has been pointed out by M. Walz, a German, who observes: "If one or more female *acari* are placed on the wool of a sound sheep they quickly travel to the root of it, and bury themselves in the skin, the place at which they penetrated being scarcely visible, or only distinguished by a minute red point. On the tenth or twelfth day a little swelling may be detected with the finger, and the skin changes its colour, and has a greenish blue tint. The pustule is now rapidly formed, and about the sixteenth day breaks, and the mothers again appear, with their little ones attached to their feet, and covered by a portion of the shell of the egg from which they have just escaped. These little ones immediately set to work, and penetrate the neighbouring skin, and bury themselves beneath it, and find their proper nourishment, and grow and propagate, until the poor animal has myriads of them to prey on him and to torment him, and it is not

wonderful that he should speedily sink. Some of the male acari were placed on the sound skin of a sheep, and they, too, burrowed their way, and disappeared for a while, and the pustule in due time arose; but the itching and the scab soon disappeared without the employment of any remedy." It therefore appears necessary that both sexes of the acari should be present in order to propagate the disease to any extent, and then such are the prolific qualities of the female (from eight to fifteen being produced in a litter), that we cannot wonder that the disease should spread so extensively. It is stated by M. Walz that the insect will even retain its life throughout the winter, although the greater number perish previously, and this agrees with the fact which we occasionally find that the disease breaks out in the spring in animals that were thought to be cured. We also find that the disease is generally more rife at this period of the year, and the irritation produced is greater than in cold weather.

The theory which the German writer unfolds explains readily one of the fertile causes of this disease, but there is greater difficulty in accounting for the manner in which it is frequently engendered. We well know that poverty is a most fertile predisposing cause, whether the disease be engendered or taken by contagion. But in the former instance this appears to be in obedience to a law which obtains throughout nature, that when the powers of vitality in an animal are materially diminished, it becomes the habitation of other beings possessing life; thus we find flukes in rotten sheep, worms in

the intestines and windpipe, and the acari in the itch and mange. We can ascertain these facts, but are still in the dark as to the real origin of this and similar diseases.

The *treatment* of this disease consists in destroying the obnoxious insects, and therefore requires a local application. There are many that have been found successful, but all demand much trouble in their employment. Perhaps one of the most simple, as well as the most effectual, is that of dipping the sheep in an infusion of arsenic, half a pound of which will be sufficient for twelve gallons of water. The infusion must be thoroughly applied to the skin, which it should reach, as well as saturate the wool; and this will be greatly facilitated if the sheep is previously washed with soap and water. Care must, however, be taken that the head is not dipped, otherwise great danger will be incurred from the mixture entering the lungs. Convenient apparatus is now sold for the purpose, together with a prepared mixture for a solution, and it has met with the approbation of many agriculturists, and been exhibited at agricultural societies.

Another mode of cure, but attended with more trouble, is the application of mercurial ointment. One part of strong mercurial ointment being mixed with from three to five parts of lard, should be applied by parting the wool and rubbing it into the furrows from the head to the tail, and about four inches apart.

The following ointment, applied in the same manner, will generally be effectual:—

Take

Lard, or palm oil	2 lb.
Oil of tar	$\frac{1}{2}$ "
Sulphur	1 "

The two latter ingredients being gradually mixed together, the former should then be rubbed down with it.

The following has also been successfully employed, but being very powerful, should not be applied too freely:—

Corrosive sublimate, powdered .	$\frac{1}{2}$ lb.
White hellebore, powdered . .	$\frac{3}{4}$ "
Whale, or other oil	6 gallons.
Rosin	2 lb.
Tallow	2 "

The two first ingredients to be mixed with a little of the oil, and the rest being melted together, the whole to be gradually mixed.

Tobacco water is another remedy which has been found effectual, but the high duty it is subject to limits its application. A pound of common tobacco may be infused or boiled in about eight gallons of water, and thoroughly applied, the skin being first well cleaned with soap and water.

Sheep are liable to another disease of the skin, which often puts on an erysipelatous character. It is attended with much itching, but occurs more suddenly, and consists of an inflammatory affection of the skin, which causes small blisters full of a red and watery fluid. These, of course, break, and a scab forms of a black colour. This disease has in some places received the term of Red Water, which is very ob-

jectionable, inasmuch as two other diseases have in different spots received the same designation.

The *treatment* consists in a cooling purgative, and, if necessary, some blood may be also taken, and a little oil or lard applied to the scabs.

Cutaneous inflammation is occasionally more severe than that above described, or appears in other forms, and even as an epidemic: it has been denominated the Wild Fire (*Ignis sacer*).

Black Muzzle

Is a local term given to a cutaneous eruption of the nose, which extends up the face. It is probably produced by the acrid nature of some of the plants which form the pasture in particular localities. It may be cured by means of mild mercurial ointment, or the following:—Take

Sulphate of zinc, finely powdered	. 1 ounce.
Hog's lard	1 lb.

To be rubbed up together.

Sheep Pox.

Though this disease is not met with in this country, it appears to have existed to a considerable extent on the continent, and particularly in France, where it is denominated *La Clavelée*. It consisted of a pustular eruption, principally on the inside of the thighs and arms, but extending to all parts where the skin is thinnest. The pustules contained a highly infectious matter, and on breaking a scab formed. It was thus propagated by infection, and

spared neither young nor old, though lambs were most susceptible to its attack. It often destroyed a half, and sometimes the greater portion of a flock.

The *symptoms* of this disease are given with much minuteness by the French writers; and in the translation by Mr. Youatt, it is observed that in this disease, there were four distinct periods; first, the symptoms which preceded the eruption, as dulness, loss of appetite and strength, and debility marked by a peculiar staggering gait, the suspension of animation, and slight symptoms of fever. This continued during about four days, when commenced the second period, or that of eruption. Little spots of a violet colour appeared in various parts, and from their centre sprung pustules accompanied by more or less inflammation, isolated or confluent, and with a white head. Their base was well marked and distinct, they were surrounded by a red areola, and their centre was flattened; they were larger than an ordinary lentil. In some animals they were confined to a few spots; in others, they spread over the whole body. They were scattered here and there, or disposed in the form of beads, or congregated together in a mass.

When the disease was not of an acute character, and the eruption was not considerable, and the febrile symptoms were mitigated as soon as the pustule was developed, there was not much to fear. The eruption ran through its several stages, and no serious disorganization remained; but in too many cases the whole of the integument became reddened and inflamed, the flanks heaved, the pulse, whether

strong or obscure, increased in frequency, the mouth was hot, the conjunctiva red, the breath foetid, the head swelled, the eyelids almost closed, rumination had ceased, the muscular power was exhausted, the pustules died away with little apparent fluid secretion, a foetid diarrhoea ensued, and death speedily took place.

The progress of the eruptive stage of the disease was frequently, however, a very unsatisfactory one. When the pustule had risen, and the suppuration had commenced, a new state of febrile excitement ensued, accompanied with more than usual debility. It lasted from three to four days, and during its continuance the pustules became whiter at their summit, and the fluid which they contained was of a serous character, yellow or red, transparent or viscid, and by degrees it thickened and became opaque, and then puriform; and at this period, when danger was to be apprehended, a defluxion from the nose ensued, and swellings about the head as already described.

This was the contagious stage of the disease, and when it was too easily and fatally transmissible by accidental contact or by inoculation. Then came the last stage, that of desiccation; and about the twelfth day from the commencement of the disease, the pustules subsided, or the integument gave way, and the fluid which they contained escaped, and a scab was formed of greater or less size and density, yellow or black, and which detached itself bodily, or crumbled away in minute particles or powder. The contagion was now at an end, and the animal

recovered his appetite, and spirits, and strength. This stage of desquamation frequently lasted three weeks or a month. A secondary eruption occasionally followed of an erysipelatous character. There were no distinct suppurating pustules, but there was a more serous or watery secretion, which soon died. This was the regular and the fortunate course of the disease, but too frequently there was a fatal irregularity about it. Almost at the commencement there was excessive fever, and prostration of strength, and fœtid breath, and detachment of large patches of the wool, and more rapid and bounding or inappreciable pulse, and strange swellings about the throat and head, and difficult deglutition. There was also a discharge of adhesive spumy fluid from the mouth, and if ichorous or thick, and yellow or bloody, and fœtid discharge from the nostrils, often completely occupying and obstructing them. The respiration became not only laborious, but every act of it could be heard at a considerable distance. There was a distressing cough; the lips, the nostrils, the eyelids, the head, and every limb became swelled. The pustules ran together, and formed large masses over the face and the articulations. Diarrhœa, that bade defiance to every medicine, ensued, and the end was not far off.

It was thought that this disease was identical with the small-pox of the human being; but though in some points it appeared so, in others the distinction was marked in several important characteristics.

The *treatment* of this disease consisted first in

separating the sound sheep from the diseased, being careful that, having been thus separated, they were not subjected to the influence of cold or wet, or insufficient food. The diseased sheep were supplied with wholesome food; during the febrile stage aperients of Epsom salts were administered. The state of fever having passed, mild tonics, as gentian and ginger, were administered, the Epsom salts being still retained, but in smaller doses. Common salt was a favourite, and a very useful medicine, on account of its antiseptic and tonic properties.

The practice of inoculation, so as to produce the disease artificially in a milder form, and thus prevent a more severe and dangerous attack, was introduced about the middle of the last century, and was so far attended with success, that whereas, when the disease appeared naturally, one-half of a flock or upwards fell victims to its attack, in the artificial disease this mortality was limited to about one in a hundred, and it secured the sheep from future attacks. The practice has been in consequence pretty generally adopted; and it is considered the duty of flock-masters on the continent, when the disease appears in the neighbourhood, to submit their sheep immediately to inoculation.

Vaccination has also been tried, and it was found in a large experiment, that out of 1523 sheep vaccinated, only 308 became secure from the sheep-pox, with the virus of which all were inoculated. It answered, therefore, to a certain extent, but in consequence of its partial failure it has been generally abandoned.

The Tick, Fly, &c.

Sheep are much exposed to the attack, and suffer much from the effects, of various insects and vermin. One of the most common and well-known is the *tick*, which, though commonly about the size of a pea, is sometimes much larger. This is a very active insect possessing six legs, and running with much speed; it attaches itself to the skin by means of sharp claws at the extremity of the legs, and pierces the skin with sharp instruments attached to the head. The tick propagates rapidly, and is often found in great numbers on a single sheep, selecting the neck and shoulders in preference to other parts.

It may be destroyed by the application of turpentine, linseed oil, or mercurial ointment, or dipping in a solution of arsenic. Lice are sometimes a source of much annoyance, but may be destroyed by mercurial ointment, solution of arsenic, or tobacco-water.

The *fly* is a still more formidable enemy, causing more irritation, and leaving behind more severe effects. It abounds mostly in woody localities, and in the month of May deposits its eggs on the sheep, selecting a sore, if there is any to be found, which is often the case, particularly about the head. The maggots being hatched burrow under the skin, causing severe irritation, and producing frequently extensive and troublesome wounds. The sheep exhibits much uneasiness soon after being struck, often stamping, biting themselves, and running about the field with much violence. The wounds, if neglected,

soon spread, and I have known the most severe and complicated fistulous wounds produced thereby,—extending between the shoulders and becoming incurable.

The most simple preventive to the attack of the fly is the application of coarse whale oil to the parts most likely to be attacked. The fly has such dislike to even the strong *smell* of the oil, that it acts as a safe protection, and is much more simple than the application of a plaster, as sometimes practised. A striking instance of the effect of the oil is mentioned by Mr. Hogg in his ‘Shepherd’s Guide.’ As a local application, immediately after the sheep have been struck by the fly, white lead is one of the best, and it will also act as a preventive. It is rendered still more effectual when mixed, as in the following recipe, and on being scattered over the parts will speedily destroy the maggots:—

White lead	4 ounces.
White arsenic	1 “
Sulphur	6 “
Cinnabar of antimony	2 “

Each to be finely powdered, and the whole then well mixed. It may be rendered weaker, and perhaps more suitable, when employed as a preventive, by diminishing considerably the proportion of arsenic.

The following is the application used at Holkham successfully in the flocks of the Earl of Leicester:—

White arsenic	1½ ounce to 1 gallon of water.
Soap	3 “ “
Tobacco	2 “ “

The arsenic is boiled in a bag, and kept stirred

at the time of boiling. The tobacco is also boiled in the same manner, and put into the water when cold. The soap is cut in thin slices, and the whole of the mixture boiled for half an hour. One pint and a half to be applied to each sheep.

Earl Spencer observes—"It is better to dip the lambs immediately after the ewes are shorn than after weaning. The shearing the ewes destroys or removes the ticks which were upon them, and the dipping destroys those which were upon the lambs; whereas, if it is postponed till the lambs are weaned, the wool on the ewes will have then grown long enough to shelter ticks, which have come upon them from the lambs after the time of shearing."

If the sore, from inattention or neglect, has spread, the application of the following astringent powder will be desirable:—

Prepared chalk	6 ounces.
Alum	1 "
Armenian bole	1 "
White lead	1 "
Chloride of lime	1 drachm.

Each to be finely powdered, and the whole then well mixed together.

The Gad-Fly (Æstrus Ovis).

One of the most annoying insects (at least temporarily so) by which sheep are attacked is the *æstrus ovis*, or gad-fly, which in the summer months abounds in woody places. These insects have two wings, and somewhat exceed half an inch in length and near a quarter of an inch in width when full

grown. They deposit their eggs on the inside of the nostrils, which the sheep endeavour to prevent by holding down their heads and flocking together. When the fly succeeds, the sheep becomes half frantic, and often races about the field with extreme violence. The eggs thus deposited are soon hatched, and the little maggots crawl up the nostrils, in doing which they produce great irritation to the poor sheep, and enter the frontal or other sinuses, where they remain increasing in size until the following spring. They are supposed to live on the mucus secreted by the membrane which lines these cavities; and whilst in these abodes they do not appear to give any inconvenience; but after remaining till the following April they make their exit from these sinuses, and crawl down the nostrils, in doing which they again prove a source of great irritation, causing the sheep to sneeze, toss their heads, and stamp with their feet. The insect then burrows in the ground, and its skin becoming hard and of a dark brown colour, it appears as a chrysalis. In from six to nine weeks it again assumes the form of a fly, and has sexual connection with a fly of the opposite sex. The male soon afterwards dies, sometimes, however, impregnating several females; and these, after depositing their eggs in the manner before described, soon terminate their existence.

Little can be recommended either as a preventive or a remedy. Some whale oil smeared on and round the nostrils is, however, the most likely method of keeping off the attack of the fly.

Sore heads is a term used to express the injury

inflicted in part by the irritation of the fly causing the sheep to scratch its head with the hind feet, and in part by the fly itself afterwards attacking the wound and causing it to spread sometimes to a great extent. The fly is of a different species, and smaller than that we have before spoken of, but may be also kept off by means of the whale oil. When, however, the sore is very extensive, the best plan is to apply some common sticking-plaster to the wound, and cover the whole with a canvas cap, having loops to admit the ears, and tape to tie under the chin and throat.

SECTION XXXI.

THE ROT.

THIS disease is one of the most ancient, as well as one of the most destructive, with which sheep are attacked. For centuries past we have accounts of its formidable ravages, arising unquestionably in all ages from keeping these animals on soils not intended for them by nature, unless improved by means of drainage. The sheep, for the most part, is naturally an inhabitant of high and dry situations, and it is only by art, and attention, and skill, that he has been made to thrive and increase in rich and lowland pastures. For the last few years, however, our flocks have been in great measure exempt from the visitations of this disease; it has, as it were, given place to other epidemics still more extensive, though less fatal.

Though a million of sheep or lambs have frequently been destroyed annually by this disease, in the winter of 1830-31 this number, it is supposed, was more than doubled—some farmers lost their whole flocks, others a moiety, and many were ruined in consequence. These facts were proved before a committee of the House of Lords in 1833, and it was there stated by one farmer that he lost 3000*l.* worth of sheep on his farm, in Kent, in the course of three months. Even at this time there were 5000 less sheep taken to Smithfield every market-day in consequence of the mortality two years previously, so extensive and general had it been. On the Continent, and in America, the mortality has been as great in proportion as in Britain, and even in the settlements of Australia its ravages have been felt. In Egypt, on the borders of the Nile, it rages with a degree of virulence to which Europe affords no parallel. MM. Hamont and Fischer, in an Essay on the subject, translated in the seventh volume of the 'Veterinarian,' inform us that "It assumes its most serious character after heavy rains and extensive floods, and in wet countries covered with aquatic plants. It affects animals of different ages, and in all seasons. It appears every year in Egypt after the fall of the Nile, and it follows and keeps pace with the subsidence of the waters. In the superior parts of Upper Egypt it commences about the end of July; nearer Cairo, in August; in the environs of the capital in October and November; and during the months of December, January, and February, in the Delta. It is most obstinate, and

continues longest, in the neighbourhood of the confluence of the waters : in Lower Egypt it lasts about 120 or 130 days, and it disappears soonest, and is least fatal, when the rise of the Nile has not been considerable. Desolation and death accompany it wherever it passes. The Arabs say that this pest annually destroys 16,000 sheep in Egypt. Its victims usually perish on the twenty-fifth, thirtieth, thirty-fifth, or fortieth day after the apparent attack."

The first *symptoms* attending this disease are by no means strongly marked ; there is no loss of condition, but rather apparently the contrary ; indeed, sheep intended for the butcher have been purposely cothed or rotted in order to increase their fattening properties for a few weeks, a practice which was adopted by the celebrated Bakeley. A want of liveliness and paleness of the membranes generally may be considered as the first symptoms of the disease, to which may be added a yellowness of the caruncle at the corner of the eye. Dr. Harrison observes, "when in warm sultry and rainy weather, sheep that are grazing on low and moist lands feed rapidly, and some of them die suddenly, there is fear that they have contracted the rot." This suspicion will be further increased if a few weeks afterwards the sheep begin to shrink, and become flaccid about the loins. By pressure about the hips at this time a crackling is perceptible now or soon afterwards, the countenance looks pale, and upon parting the fleece the skin is found to have changed its vermillion

tint for a pale red, and the wool is easily separated from the pelt; and as the disorder advances the skin becomes dappled with yellow or black spots. To these symptoms succeed increased dulness, loss of condition, greater paleness of the mucous membranes, the eyelids becoming almost white, and afterwards yellow. This yellowness extends to other parts of the body, and a watery fluid appears under the skin, which becomes loose and flabby, the wool coming off readily. The symptoms of dropsy often extend over the body, and sometimes the sheep becomes *chockered*, as it is termed—a large swelling forms under the jaw—which, from the appearance of the fluid it contains, is in some places called the watery poke. The duration of the disease is uncertain; the animal occasionally dies shortly after becoming affected, but more frequently it extends to from three to six months, the sheep gradually losing flesh and pining away, particularly if, as is frequently the case, an obstinate purging supervenes. In Egypt, where the disease is more virulent and rapid, the symptoms are more marked, and the swelling under the throat is more uniformly present. “If an Arab shepherd,” observes M. Hamont, “is asked how he distinguishes this disease from all others, he replies that they have under the jaw a bag full of water; that they walk with difficulty; have diarrhœa; their wool falls off; they are dull, disinclined to move, and are almost constantly lying down; sometimes a foetid matter of a variable colour, yellow, grey, or green, runs from the nose. The head, and neck, and belly, and limbs, swell; the eyes are red; they

become thin; they eat and drink little when the disease is in an advanced state, but rumination continues for a considerable period."

The appearance after death depends much on the stage in which the sheep is destroyed. In five or six days after contracting the rot, the thin edge of the small lobe of the liver becomes of a transparent white, or bluish colour, and this spreads along the upper and lower sides, according to the severity of the complaint; sometimes it does not extend more than an inch above the margin. If not in an early period of the disease the flesh is found very pale, and a yellow serous fluid infiltrated in various parts of the body, and the abdomen often contains a similar fluid. In the latter stages there are few parts of the body free from disease; the lungs are often studded with tubercles, and the heart is soft and pale; but in all cases we find the liver extensively affected, sometimes pale and easily broken down, in others mottled like the back of a toad, containing hard scirrhus spots, and sometimes a fluid like jelly is deposited in different parts of its surface, but particularly round the bile duct and hepatic vessels, and upon boiling the liver loses its firmness, and separates into pieces, and continues soft and flaccid.

These are appearances that may vary in different subjects, and many of them may be considered to be owing to the progress of the disease itself; but the appearance which we find in almost all cases, either more or less, is the presence of *flukes* in the ducts of the liver. These flukes have been considered to constitute the essence of the disease, al-

though it must be observed that there are some respectable writers who consider them to be an effect and not a cause, and this doctrine would seem to be borne out by the opinions and observation of MM. Hamont and Fischer, who, in their *post-mortem* examinations, do not mention the presence of flukes, and who believe the disease to be owing to the superabundance of water taken into the system with the food.* The liver appears to be the only, or the principal locality, for these parasites, and sometimes its ducts are entirely full of them, upwards of seven hundred having been counted, whilst in other livers a few only could be found. They resemble in shape the fish called *plaice*, or sole, and are from half an inch to upwards of an inch in length, and rather less than half this in breadth in the middle, from which they taper to the head and

* "Examination after death," observe these writers, "presented œdema of the whole body, or of the head and neck only, wasting generally, and of the hind limbs particularly; warmth disappeared the moment life had fled. The skin was pale; the cellular tissue exhibited a transparent or pale yellow infiltration; the muscles were softened and infiltrated; layers of fat covered the parietes of the abdomen, which was filled with a colourless fluid; the stomach and intestines were remarkably pale; the liver was sound or tuberculous, or filled with hydatids; the bile was thin and oily; the kidneys were soft, and contained a very small quantity of blood; the bladder was sometimes full and sometimes empty. The mucous membrane of the digestive passages, with a few exceptions, was pale and humid. The blood in the large vessels was fluid; it did not coagulate; it contained a great quantity of serum, and very little fibrine; there was a sensible diminution of the colouring matter, and the general aspect of the blood was watery. The thoracic cavity was filled with transparent fluid; there was also water in the pericardium (*heart bag*); the lungs were sound, but pale and collapsed; they were rarely tuberculous, and in two cases contained hydatids. The heart was soft and pale.

the tail. The following description, with the engraving, is supplied by Mr. Morton, to the twelfth volume of the 'Veterinarian,' and by him and the editor of that journal obligingly offered for the use of the present work:—

“At the extremity of the head will be perceived an orbicular opening, which I suppose must be designated the mouth of the fluke. This Mr. Sowerby, however, has not been able to trace beyond the representation here given of the animal, nor have I been more successful. It is possible that the parasite possesses the power of projecting this tube-like body, which now is in a state of retraction. In a dried specimen it resembles a small slit. It is certainly a circular opening, inclining somewhat to the inferior surface, both in the recent animal and in those preserved in spirits. Just below this is seen a small projection. In some flukes this is very indistinct, and, at first, induced me to think it marked the difference of the sexes; farther investigation convinced me of my error, for it may be found in all in a greater or less degree of develop-

ment. Sometimes it is coiled upon itself; and within its opening two minute globular bodies may be seen, seemingly attached by filaments. Is this the ova-duct? There can be no doubt of its connexion with the ovaria; and it seems to make up part of the complex genital organs which render the animal hermaphroditic. The eggs themselves, whether within or without the animal, are interesting microscopic objects. As the latter, they may be obtained in abundance from the liver of a rotten sheep, by diluting the bile with water, and then separating them by means of a filter. There can therefore be no doubt of the truth of your (the editor's) statement that the eggs are frequently received in the food. Having been discharged with the dung, they remain on the grass or damp spot on which they may fall, retaining their vital principle for an indefinite period of time.

"Immediately beyond this prolongation may be observed another opening, called by some the *ventral opening*, but which, in reality, is a sucking disc; and consequently some entomologists have given the name of *distoma hepaticum* to the parasite. It is composed of strong muscular fibres, and is imperforate, or, at least, it has no traccable communication with the internal parts of the animal. The question naturally arises, Does this parasite, receiving this aliment by one tube, after having absorbed the nutritious particles from it, return it by the same, as do the polypi, and other animals even still lower in the scale of organization, even the monads?"

Mr. Morton was unable to discover any traces of eyes; and it is not at all probable that these residents of a locality never penetrated by light actually possess any.

It is important to ascertain to what these parasites owe their origin, and in what manner they enter the liver, where they are almost invariably found.

There are several theories on the subject, some attributing them to the miasma of marshy situations, believing that the mischief is inhaled by the lungs; others consider that the eggs are taken with the food alone, and that these eggs are only found on the dung of rotten sheep, and that the combined action of the sun and moisture preserve their vitality, and in this state they are swallowed with the grass by other sheep, and are hatched in the stomachs and intestines, and crawl up the ducts of the liver. It is unquestionably the fact that the rot is produced by stagnant water being exposed to the influence of the sun; and that neither a running stream, nor land entirely under water, or quite dry, will produce it. It is equally true that the eggs in countless numbers may be found in the dung. Thus it is seen, that though all agree as to the agency of moisture in producing the disease, there is much difference of opinion as to the particular mode in which it acts: and of the several theories that have been offered in explanation, it will be proper and convenient here to give a summary:—

1st. We have the theory that the rot is produced by marsh miasma—by emanations proceeding from

the soil and entering the system by means of the lungs.

2nd. The theory which we have mentioned of the eggs of the fluke being deposited with the dung, and preserved from destruction by warmth and moisture, and swallowed by other sheep. Mr. King, in an essay on the subject, considers that the eggs are hatched in the stomach and intestines, and the flukes there hatched crawl up the gall-duct to the liver. This view of the case induces the belief that the symptoms of the disease are to be entirely attributed to the presence of flukes, and is therefore altogether opposed to another theory—

The 3rd, which asserts that the disease is solely to be attributed to the taking into the system a superabundance of watery food, surcharging the body with aqueous matter, thus diluting the blood, and producing the train of symptoms that are met with. Such is the opinion of MM. Hamont and Fischer, from whose essay we have quoted; and, indeed, they do not even mention the existence of flukes in the liver, though they appear to have made careful examination of the bodies of Egyptian sheep.

4th. We must not omit to mention another theory, which is advanced with much confidence as a cause of rot:—"I would beg to say," observes Mr. E. May, of Berkshire, "that I do not think sheep become rotted from every kind of wet land, whether drained or not, but from a particular character of the soil and sub-soil, such as is inclined to bog or quagmire, although it may not have that appear-

ance on the surface of the land, but may lie eight or twelve feet deep. Between this subterraneous bog and the surface there is generally a hard stratum of blue clay or sand, tainted with the bog-water lying underneath at that depth; and this infectious water is brought up from the bog to the surface of the earth by means of small pipes, which are always found to form the communication between them, and called by experienced land-drainers bog-pipes. In consequence of this infectious water thus arising to the surface, a plant is produced not of the grass-tribe, but called by some old experienced shepherds the *sheep-rot weed*; and, if sheep are allowed to feed on this land, particularly if in a hungry state, although the weed does not grow more than an inch or two above the surface, and is of a nauseous taste, they will in this state of hunger indiscriminately eat it up along with the grass, and it will, I believe, more or less infect them with the rot. When a hole is made in the land of this description, so as to allow water to collect and stand in it, the surface of the water will in twenty-four hours become covered with a scum, having the metallic lustre of quicksilver tinged with red, and, therefore, probably of an injurious nature.

“Having paid great attention for many years to these points, it is my humble opinion that one great cause of sheep being rotted may be traced to the circumstance of their eating the noxious weed and scum in question.”

With so many conflicting opinions on the subject, it is very difficult to come to a sound conclusion;

and, therefore, our own ideas are offered with some doubt and hesitation.

From the first supposition that the disease is produced by the inhalation of miasma we entirely dissent. We observe none of the symptoms of intermittent or low fever, which in the human subject are attributed to such cause, but, on the contrary, at first an improvement in the animal's appearance. There are clearly no symptoms of fever or of inflammation, as supposed by M. Hurtrel D'Arboval.

For reasons before stated, we must also withhold our entire assent from the doctrine which teaches that the disease is entirely produced by swallowing the eggs of flukes, deposited by other diseased sheep.

And though we believe that the disease is introduced through the medium of the digestive organs, yet we cannot give in our adhesion to the theory that would at once assign it to the large quantity of water imbibed with the food; for, large and detrimental as it may be, it is yet less than is often taken with impunity by sheep living entirely on turnips, in which there is no less than 90 per cent. of water, and yet, although such food is sometimes productive of disease, it is never the cause of rot.

It appears to me that in addition to the consumption of food in which water greatly abounds, it is essential that this food should be in a state of decomposition (partially rotten), in order to produce this fatal disease. And this view of the case corresponds with the fact that heat as well as moisture is necessary to cause rot, that it is not produced while the land is entirely under water, nor until the rays

of the sun have acted on the grass previously saturated with moisture. The disease, of course, may be rendered more or less rapid and virulent in proportion to the amount of water imbibed in the system with the food, and though in all probability the eggs of the flukes are swallowed at the same time, yet it is possible that in the Egyptian cases the disease was too rapid in its progress to admit the development of the flukes in the liver, which we usually find in this country. I believe that the digestive organs is the medium through which they enter the system; but I cannot consider that this is the only source; as if so, land deprived of sheep for some years would cease to cothe, whereas it is known that particular soils will give the rot whenever heat and moisture are in operation at the same time. Though we incline to this view of the case, yet we do not urge it with perfect confidence, for it is not improbable that most of the causes which have been assigned combine in producing the various symptoms of the disease, *i. e.* the eggs of flukes, the superabundant moisture, and vegetation in a state of decay; and, though we cannot limit the cause of rot to eating the *sheep-rot weed*, or imbibing impure water, we believe that the rot is principally produced on springy, boggy, and uncertain land far more than on land simply retentive of wet. In support of this opinion, I may mention that on a farm now in my occupation, of a very retentive nature, with a clay sub-soil, sheep have never been known to take the rot, though often kept there throughout the year. Such a soil we well know is unfavourable to vegetable

decay. Whatever difference of opinion there may be as to the mode by which the deleterious matters are introduced into the system, there is, and can be none as to the fact of the combined operation of heat and moisture producing it. Numberless facts have sufficiently proved that the rot does not occur on a sandy, chalky, or porous soil, or on land altogether under water, nor if completely dry. But on land retentive of moisture, or having pools of stagnant water, rot is very likely to appear. It occurs in wet summers to a much greater extent than in dry, and it has therefore been much less prevalent during the last few years.

With regard to our remedial measures, little satisfactory matter can be offered. There are few drugs which the laboratory can supply but what have been tried and found wanting; and though salt has appeared to have had more effect on it than anything else, it must be confessed that hitherto medicine has offered no remedy for this formidable and destructive disease. Prevention must be our chief aim, and it is satisfactory to know that much can be done by means of extensive and general draining; and it is hoped that before long, by the aid of the legislature and the conjoint energy and capital of both owners and occupiers of land, the system will be adopted almost universally, by which alone this disease is likely to be controlled or eradicated; and at the same time increased labour employed on the land, and more abundant crops obtained from the bounty of nature.

M. Hamont observes, "When the first symptoms

appear, the vigilant Bedouins lose not a moment; they reassemble their flocks, and drive them back to the desert. In the midst of the sands their principal food is the salt-wort or kali. After some days the symptoms of the rot gradually disappear, and the sheep regain their former health. Such is the preservative and curative treatment of the Bedouin shepherds, and they know not any other. If the disease is more advanced, this simple mode of treatment probably is not sufficient. The Bedouins themselves acknowledge it, and immediately destroy the animal."

M. H. also mentions that "the administration of soup, as recommended by Professor Dupuy, was successful in the Delta on a dozen sheep that had been ill eight days. All these animals had diarrhœa, the belly distended, and a little œdematous enlargement under the throat. The proprietor, who had long been known to us, wished us, for his satisfaction, to follow his directions. A soup was made with the carcasses of dead sheep, and each of those that had the rot drank from a pound to two pounds of it every four and twenty hours. In ten days the cure was complete. We were far from being always so successful; on the contrary, we failed in the majority of cases; but we had then as our patients sheep which the fellahs were about to slaughter."

It thus appears from this and every other authority, that, whether as a preventive or as a cure, salt has a more powerful influence over this disease than any other remedy. Its presence preserves even wet pastures from the disposition to give the

rot, for it is well known that salt marshes are free from danger. In what manner salt thus operates it is difficult to explain. The blood in this disease is in a state of unnatural dilution—it is deficient in its fibrous and colouring principles: now, whether salt, which is a combination of chlorine and soda, acts by restoring some portion of those salts of which the blood is deficient, or whether it is prejudicial to the vitality of the flukes and the eggs, or whether it acts by the antiseptic power which belongs to chlorine, we cannot tell, though its influence over the disease is generally acknowledged.

Our own advice as to remedial treatment may be summed up in a small compass. The sheep should be removed from the unsound pasture as soon as possible, either to a salt marsh or the driest pasture that can be found; as much salt may be given as the animals will take with their food; to this the sulphate of iron may be joined. Half a drachm daily for each sheep, with the same quantity of ginger, may be given in nourishing gruel. An aperient should be given once or twice during the treatment, and may consist of one or two ounces of sulphate of magnesia, or a large table-spoonful of common salt dissolved in warm gruel or water. Food should be given in as nutritious a form as possible; and a pint of beans daily will be an excellent diet with good hay on sound pasture.

Though turnips cannot be considered as a cause of rot, yet from the superabundance of water they contain, they are highly prejudicial to sheep that

are affected with the disease, particularly if taken whilst a hoar-frost is on them.

Calomel has been strongly advised, but the recommendation, as far as I am aware, has not been backed by any successful cases. If tried by way of experiment, about five grains daily, with four of opium, suspended in thick gruel, may be repeated once a day for the space of a week at a time.

SECTION XXXII.

EPIZOOTIC DISEASES.

Influenza.

THIS disease is, in the sheep as well as the horse, of a peculiar kind; it is not simple catarrh, or even epidemic catarrh, but an affection of the mucous membranes generally, and is attended with much prostration of strength. It is probably infectious, and its attack usually extends to a considerable number. It is perhaps most common amongst the marshes, but appears likewise on the hills, and young sheep are most subject to its visitation.

We are indebted to Messrs. Darby, Evison, and Spilsby for several valuable communications on this disease.

Mr. Darby observes: "The symptoms in acute cases I have generally found to be a closed eye, disturbed respiration, discharge from the nose, with extreme prostration of strength; pulse from 80 to 100. In this stage you may expect quickly to lose

your patient. The *post-mortem* appearances are engorged lungs, and frequently the vessels of the brain are in a state of turgescence, with more or less disease of the whole of the mucous surfaces. The manyplus is very much distended with food, which appears as if it had been in a press.

In the chronic stage there is the dull vacant eye—extreme debility—the animal generally leaning against the fence with his back up. Sometimes he feeds moderately, at other times not at all; and so goes on, until ultimately he is worn out with organic disease. The examination after death exhibits sad mischief. The lungs are often adhering to the sides—an effusion of serum, in an enormous quantity, has taken place into the chest—the liver is very much diseased, and, in some cases, I have found engorgement of the spleen, with—in both stages of the disease—much frothy mucus in the windpipe.

Mr. Darby also furnishes us with the following account:—"On the 8th ult. I was called to attend a flock of sheep, consisting of 250 lamb-hogs. I was informed they had lost, and were losing, four or five sheep daily. The shepherd brought three dead ones from the fold that morning, and on closely examining the flock, I found the greater part to be more or less affected with influenza. The eyes were closed, or partially; the head very much affected; a purulent discharge issued from the nostrils, and some hours previous to death, a thick ropy discharge took place from the mouth, the stench from which was abominable; a glaring eye, with an inclination to keep forming a circle, was the last symptom; and

then death soon closed the scene. On examining those that had died that morning, the following appearances presented themselves:—the membrane of the windpipe of a purple colour, and the tube contained much frothy mucus; the lungs were highly congested, as were the vessels of the brain, and inflammatory patches existed throughout the whole length of the intestinal canal. The symptoms were described next day to Dr. Banks, a physician of this place, and he pronounced them to be the most decided symptoms of influenza he ever heard of in sheep.

“I commenced my *treatment* by giving the whole flock four drachms each of Epsom salts, combined with vegetable tonics, and calculating the proper quantity of warm water, we brewed the medicine in the gross, giving each sheep a quarter of a pint of the mixture. I afterwards gave to those that required it small doses of digitalis, opium, tartarised antimony, and vegetable tonics. I am happy in being enabled to add that, after having given this medicine, I never lost a single sheep, and they are at this moment as fine a flock of hogs as any on the walks. I should have said, when I first saw them, that they were on turnips, and having two ounces each of linseed cake, with barley chaff. I had them removed from the turnips to old seeds for some days, but they are now on their usual keep. Several of them went blind, but by applying a solution of sulphate of zinc, and tincture of opium, they had recovered their sight.”

We have in this account the low fever, and the

affection of the head and mucous membranes, which characterise the influenza in the horse, and which justifies us in giving it the same denomination in the sheep; and the same moderate system of treatment was also found successful.

In the following description by Mr. Clayworth, we observe the same character in the principal symptoms, but attended with some modifications, probably arising from the nature of the locality.

Mr. Clayworth in his communication observes "that he has found the disease most prevalent in the marshes near the sea, where the land is good, but much exposed. It prevails mostly in March and April, and generally attacks young sheep." He then proceeds to give an account of a flock which he attended in 1838. "It was on the 19th that I was first desired to attend them. On my arrival I found seven or eight dead. They were observed to be ill on the day previous to my seeing them. There were eight more that could not stand, and when lifted up they had entirely lost all power of motion. On examining the remainder of the flock, I found some scarcely affected at all, while others were gradually going on in the same way as those that had died.

"The first symptoms exhibited were dulness of countenance, and a disinclination to join the rest of their companions, or look out for food. They soon became more dull; a thin mucous discharge made its appearance from the nose and eyes, the tissues being highly injected; the ears drooped, a grating of the teeth was heard, and a staggering gait evinced in

walking. As the disease advanced, all the above-named symptoms became more manifest.

"The animals were able to walk at a slow pace, but if urged into a quicker one they would fall down on their knees, and then on their sides, throw their heads back, and grate their teeth as if in pain. After lying a few minutes they would get up again, although with difficulty; and their manner of walking in this stage of the disease very much resembled a horse labouring under inflamed laminæ. When the disease had been allowed to run on to this height, the sheep often became affected with spontaneous diarrhœa, the fæces appearing to come away involuntarily. Those that did not purge usually voided much mucus coating the dung. After this they quickly became worse; they would lie perfectly still, as far as the limbs were concerned, but they continued to grate their teeth, and a rattling noise was heard in the windpipe, accompanied with a frothy discharge from the mouth and nose, and an occasional cough. To this death succeeded in a few hours.

"The *treatment* I pursued with those that could not stand was, first, to place them under a shed, with plenty of dry straw to lie upon: to those affected with diarrhœa, astringents were administered, such as catechu, chalk, &c., combining them with an aromatic tonic, and the *spiritus ætheris nitrici*; while to others that were constipated in the bowels, I gave a gentle laxative, following it up with a vegetable tonic. This course of procedure appeared to be attended with benefit; for out of the number, eight that could not stand recovered, and

were able to provide for themselves in two or three days. After the exhibition of the medicine to the diseased, the remainder of the flock were removed into as sheltered a situation as could be found, or sheds were erected for them, with plenty of dry straw to lie upon. A liberal diet of oats and hay was allowed, while their general comfort was as much attended to as possible. To many that gave indications of the approach of an attack of the malady, a laxative and a tonic were combined and given.

"On April 21st the sheep were not only looking better, but had very materially improved. The above-mentioned treatment was continued, with occasional variations, according to the circumstances of each case, and in five or six days they were all out of danger. I am happy to be enabled to say, that after this there were not more than two or three sheep out of the flock in which the prostration of strength became so great as to render them unable to stand; and I would add, that I never knew one case recover without the aid of medicine, after the disease had lasted so long as to produce the loss of power."

We have given these accounts in full, as they are useful, not only as giving clear and satisfactory accounts of this epidemic, but also as affording a convincing proof of how much can be done in the cure of the diseases of sheep by rational and scientific treatment.

The Epidemic of 1840, &c.

In the winter of 1839 and 1840, and throughout

the greater portion of the latter, and extending even to the following year, and again making its appearance at the period I am writing, this country has been visited by an epizootic, to which, for the almost universality of its attack, a parallel can scarcely be found even in the virulent epidemics of former times. Horned cattle and sheep are equally susceptible to its influence; even pigs are not exempt. That it is decidedly contagious no one can doubt, for proofs have been adduced both numerous and positive; and yet its attack is frequently very erratic, attacking perhaps the cows at one period and the sheep at another, and in other places visiting both at the same time. The mouth and the feet were the chief parts locally affected, and in cattle the former generally manifested the disease first; but in sheep the feet were earliest and most severely affected, and in the majority of cases the mouth altogether escaped. The constitutional symptoms, too, were less severe in the sheep, but the affection of the feet was generally more virulent and obstinate than with cattle. In the latter an indisposition to feed, from soreness of the mouth, was generally the first symptom perceived; the saliva would drivel from it, and soon large bladders would be observed on and under the tongue, and in other parts of the mouth, which in a few days would burst, when the soreness would become still more severe. These symptoms were also observed in sheep when the mouth was affected, but the feet were, in these animals, usually first attacked; and attention was first directed to a flock by observing some of the

sheep lame; and on inspecting them, either a sore would be observed between the clees, or the foot would feel very hot. The disease appears to be essentially a fever of a contagious and peculiar nature, affecting and disturbing the whole system, and manifesting itself externally by this affection of the feet and mouth, just as in the human subject small-pox or measles exhibits itself externally by forming eruptions and ulcers on particular parts of the skin. In many instances the disease appears, in sheep, to have been confined to this one local affection of the feet, and sometimes without any treatment the animals have soon got well. Not so, however, in the majority of cases: the sore would spread, the foot feel hot, matter would form beneath it at the back of the foot and between its divisions, and this spreading forwards, the hoofs, in many instances, would slough off, and sometimes fungus, in large quantities, would be thrown out, particularly if the animals were exposed to much moisture. The sheep for a long time would crawl about on their knees, and from this and the pain combined lose flesh considerably. I have lately seen in a flock of sheep severely affected some cases in which it was supposed to have extended to the knee-joints, which were in so sad a state of internal inflammation as to threaten loss of the joint, and externally were covered with extensive sores. I am of opinion, however, that this diseased appearance is of a local character, produced by the sheep travelling so much on their knees, or standing so much on one leg, in order to favour the other. In one instance abscesses

had formed, and I fear the knife of the shepherd had, in opening them, extended the incision into the joint, and thus added greatly to the inflammation in the joint and the general fever in the system.

Sheep were, generally speaking, much longer in getting well than cattle, which may be attributed to their being more exposed to dirt and moisture, and having from their numbers less personal attention bestowed on them individually. If the animals were attentively examined, symptoms of fever would be discovered, such as a hot mouth and increased circulation, but the affection of the feet was generally the most formidable and most troublesome attendant.

This disease appears to have spread throughout every description of land, and during every variety of weather; in some instances, however, it disappeared during a frost, and was generally more prevalent and more severe in wet weather than in dry. In sheep this was more particularly observable, and in them the disease was very considerably protracted by wet lair, and to this and the less attention they received, I attribute the fact of their being longer in getting well than cattle.

With regard to the *cause* of this disease, it is, I imagine, beyond the power of man to discover. Some mysterious principle, some invisible gas escaping from the laboratory of nature, and imbibed by the systems of animals susceptible of its influence, and receiving probably from the emanations of diseased animals a large accession of deleterious and infectious atoms, and thus travelling onwards, and

widely extending its ravages, is all that we can offer towards an hypothesis as explanatory of the cause of this very serious and troublesome malady. Sheep that travel much, and are driven about from fair to fair, have the disease much more frequently than others that remain stationary, and it is in this manner, in many instances, that it appears to be brought on a farm, or into a district. Whether it is that sheep thus driven about are more likely to meet with the invisible cause of the epidemic, whatever it be, or whether their systems become more excited by travelling, and thus more susceptible to disease;—which of these reasons it is, or whether both are in operation, we cannot tell; the fact, however, is indisputable, that migratory sheep are more frequently affected than others.

There cannot be a doubt as to the infectious nature of this disease; numerous instances have been related which go far towards establishing the fact, but the following experiments, by a German veterinary surgeon, put it altogether beyond doubt. He says, "My first experiment was on a flock of 900 sheep, 160 of which were already lame. I had those selected in which the horn had not quite come off from the foot, but where it was so loose that a slight pressure of the finger would be enough to separate it. With the matter found in the hoof I inoculated 500 animals on that side of the ear which is most free from wool. In the course of twenty-four hours considerable fever had arisen: in forty-eight hours the inoculated places exhibited symptoms of intense inflammation; and in seventy-two hours I

found in many of them small blisters full of serum. On the sixth day I examined them all separately, and found that nearly every bladder had burst, and that purulent matter, of an unpleasant smell, was escaping from them. During the first ten days after the inoculation, sixty of them became lame, although in each the blister, or pock, had risen on the spot inoculated. That lameness, however, was not very great, and in general lasted only about two days. All the other inoculated animals remained free from the disease, though in some not inoculated it raged as much as before. I can only explain the circumstance of sixty becoming lame after the inoculation by the supposition that they must previously have been infected. Other experiments have been attended with similar results."

The *treatment* of this disease consists of both local and constitutional measures, though in slight cases the former may be altogether dispensed with.

Take

Sulphate of magnesia . . .	1 ounce.
Nitrate of potash . . .	2 drachms.
Powdered ginger . . .	1 drachm.
Spirit of nitrous ether . . .	2 drachms.

The powders to be gradually mixed with the ether, and a quarter of a pint of warm water then slowly added.

This may be given to each sheep that exhibits appearance of fever. It will of course be the simplest method to prepare this medicine in much larger quantities, but in the same proportion. The sores in the feet may be simply dressed with a so-

lution of sulphate of copper, if confined to the upper parts; but if the lower parts should be affected, and matter should be present under the horn, a sufficient quantity should be removed to give exit to the matter, but the too free and indiscriminate employment of the knife should be avoided, as it is likely to increase the growth of fungus. One of the following applications should then be used:—

Take

Oil of tar	$\frac{1}{2}$ pint.
Creosote	$\frac{1}{2}$ ounce.
Olive oil	1 „

Or,

Barbadoes or Stockholm tar	1 pound.
Melted lard	2 ounces.
Sulphuric acid	1 ounce.

To be carefully mixed.

After one or two applications of the above, the following powder may then be scattered over the sores daily:—

Powdered chalk	4 ounces.
Armenian bole	1 ounce.
Powdered charcoal	1 „
„ alum	$\frac{1}{2}$ „
Sulphate of zinc	$\frac{1}{2}$ „

Mix.

When fungous flesh is present, a caustic, such as either muriate of antimony or hydrochloric acid (the latter being the strongest), should be applied with a feather, but should not be often repeated.

An object of equal, if not superior, importance to even medical treatment, is to secure for the sheep a dry surface for their feet. The troublesome and

protracted cases which have too frequently occurred, may be attributed in a great measure to the constant dirt and moisture to which the sheep have been exposed: whilst this continues it is vain to expect a cure. The sheep should either be kept in the driest pasture on the farm, or in littered yards or houses.

After the first symptoms of fever have disappeared, the sheep should be kept pretty well to counteract the debility and loss of flesh that often supervene. If they are being fattened, plenty of corn and oil-cake should be allowed with the hay and turnips; and if they are ewes in lamb, or with lambs by their side, corn even then, particularly oats, will not be injudicious. This nutritious food should not, however, be given till all symptoms of fever have disappeared.

Epidemic Diseases in Australia.

It will be proper in this place to mention a formidable epizootic which prevailed extensively in New South Wales, in the years 1834 and 1835, and was so fatal in that colony, that some sheep-masters lost half their flocks. An inquiry was instituted by the Governor, under the direction of Mr. Bennett, a surgeon in the colony, and the following is an abstract of their report, as quoted by Mr. Youatt, in his work on sheep:—

“ The character of the runs on which the sheep fed was that of lofty ranges abounding in excellent pasture and good water. They had been placed in this locality five or six years, and had remained per-

fectly healthy. The winter months had been dry with severe frosts, but the rain setting in during the latter part of the spring, the epidemic began to appear. The animal separates from his companions, and appears depressed and listless; the eyes are watery, the membrane of the nose red, and the sheep sneezes frequently. A watery discharge, but soon becoming glairy and clammy, is observed from one nostril, and there is a collection of adhesive mucus encrusting the eyelids: the animal ceases to ruminate, and droops his head, but is evidently uneasy, and continually shifting his posture or his place. This first stage lasts from four to twelve hours. The eyes and nose become redder, the discharge increases, it is thicker and of a yellowish hue, and it hardens about the orifices of the nose, and obstructs respiration. The orifice of the nostrils is swelled, the breathing is evidently hurried, and the animal is in great pain; the head is heavy, and is rested on the hurdles of the fold; and a cough, troublesome and painful, is observed.

“ The third and last stage now advances. The membrane of the nose assumes a leaden or dark purple hue; the discharge is lessened, but it is very thick and streaked with blood; the breathing is more laborious, and the cough more painful. The lips, and particularly the upper lip, the nostrils, and sometimes the whole face and head, are swollen; and, presently, a general trembling comes over the animal; he appears stupid; he runs against everything in his way; he kneels down, or falls down; becomes comatose, and, after a few struggles, ex-

pires. In some of the sheep death occurred in six hours after the first attack—oftener twelve hours elapsed, and sometimes the animal lingered on to the third day. If he lived beyond that time, he usually recovered. In those that did recover, general debility remained for a long while, and in almost all of them the wool fell off, leaving the poor animals perfectly naked. The surface of the body, after death, appeared to be of a dark purple or livid hue, and the carcass very speedily became putrid.

"*Post-mortem* examination presented, in most cases, inflammation of all the sinuses of the skull, a strong affection of the membranes of the brain, but not the slightest disease of the substance of the brain. The membrane of the nose was highly inflamed and thickened, and a tough viscid matter was effused over it, which could be scraped away with a knife. In many cases the disease was confined to those membranes, except that the heart was gorged with black blood. In other animals the disease was confined to the pulmonary organs; the inflammation extended down the larynx, the trachea, and all the bronchial passages; the membrane was thickened, and the air-tubes obstructed with viscid mucus. The stomachs were usually healthy, and filled with food in a healthy state: the whole of the intestinal canal was perfectly sound, except that the fæces had accumulated in hard lumps, and produced some abrasion of the mucous membrane. The liver was usually free from disease, as were also the kidneys and the bladder.

"The *treatment* was simple, but decisive. The

animal was bled almost to fainting, and an ounce of Epsom salts administered, with a drachm of nitre, in warm gruel. The infected sheep were separated from the sound ones, without, however, fatiguing or distressing the animals by long harassing journeys or otherwise. If the patient was not relieved in four or six hours, the bleeding was repeated, and the quantity regulated by the effect which it produced on the pulse. The administration of the salts was also persevered in until the bowels were well opened. The chance of success was greater in proportion as these remedial means were early applied. Even in the second stage of the disease they had occasionally good effect, but in the third stage they were of no avail. Relapses on change of weather were frequent: the convalescents being for a long period extremely weak. There did not seem to be any preventive; and those who bled all their sheep, on the appearance of the disease in a few, had reason to repent it, on account of the greater number that were eventually attacked, and in the increased proportion of deaths. It was difficult to ascertain the number of sheep that were affected, and died, or recovered; because this epidemic, like almost every other, was very capricious as to the farms that it attacked, and the proportion of its victims. The greater part of the flocks escaped altogether. Where a flock of sheep, consisting of about 300, was attacked, the average number of patients would be 100, of which about 55 would recover, and 45 be lost. The whole number of deaths was more than 7000. It was plainly an infectious disease, but only commu-

nicable when the animals were brought into actual contact."

In Sydney, it appears that many sheep die from disease originating in the astringency of the water, produced by decayed leaves. The following brief account was communicated to the 'Veterinarian' by the late Mr. Cheetham:—

"In consequence of the ruinous effects of a very prevalent complaint among sheep, his Excellency has appointed commissioners to investigate thoroughly the nature of the disease, with a view to its cure, and prevention in future. We have lately had a conversation with an extensive sheep-holder on the subject; and as it is one of a most important nature, I will endeavour to give, for the benefit of the community, the substance of his experience—at least in some diseases which were until then unknown, and whose immediate causes are still little understood.

"The first, then, to which we beg to call the attention of your readers, is the water to which the sheep have general access. The water-holes are usually surrounded with trees, which, during a continued drought, shed their leaves into the water. Now, while any large body of water remains in the holes, the effects arising from the infusion will not be perceptible on the animal; but when, during the excessive heats of summer, the quantity becomes reduced, its powerful astringent effects will be discovered in the disease, and consequent death, of many of the flock. This latter circumstance more frequently

occurs than in cases of scab or rot; because in the latter the nature of the complaint is known immediately, and proper remedies can be applied in the first stage of the disorder; whereas in the former it is unknown until after death (and then only discoverable by a thorough anatomical process), while a remedy or cure is entirely out of the question.

"The only chance which suggests itself to save a flock thus attacked, is instant removal to a situation where water may be obtained without containing that strong principle of tannin which all our trees possess in a greater or less degree.

"There is another disease, not unlike the above, to which sheep are liable, arising from a somewhat similar cause, and to which the same remedy only can be effectually applied. This arises from drinking water impregnated with alum. The gentleman to whom I have formerly alluded informed me that on one occasion a very large proportion of a flock died off, a circumstance for which he could in nowise account. There was no external sign of illness, yet they died. This induced him to subject the carcass of one of them to a regular anatomical process, which pointed out the stomach as the seat of the disease; and, from other appearances, he came to the conclusion that the evil was caused by the water. He accordingly tested the water from holes on the run, and discovered one strongly impregnated with alum. The mystery was elucidated; the flock was removed, and the mortality ceased. We may, however, expect more information upon this subject when a proper investigation shall have taken place."

The writer does not mention the symptoms of the disease ; but, from its cause, I should imagine it must bear some analogy to the disease termed Pining, described at page 328, which proceeds from the astringency of the food. Epsom salts and other aperients would seem to be proper remedies ; but little good can be expected unless the cause also is removed by changing the pasture. In a country like this, where labour is so scarce and dear, the flocks of sheep are of course kept entirely on natural pastures ; but if a few succulent roots, such as white turnips, could be cultivated, or the root called the purging flax (*Linum catharticum*), in situations where the disease is apt to prevail, it would materially conduce towards preventing and curing it.

SECTION XXXIII.

SPECIFIC DISEASES.

Scrofula.

SHEEP are liable to a scrofulous disease which is almost uniformly fatal. It is called the *evil* in some places, and elsewhere receives other denominations. A hard swelling of the glands under the jaws is first observed ; after a time small pustules appear about the head and neck, which break, discharging a white matter, then heal, and are followed by others more numerous. This gradually robs the animal of flesh, and slowly pining away, it becomes at length quite useless, and in this state

is destroyed. It seldom attacks a great number at a time, but selects generally a few individuals from a flock.

The writer, though he cannot say that he has perfectly succeeded in effecting a cure, has done so to a certain extent, so that the tumors disappeared and the animals improved in flesh and health, but afterwards relapsed. This he has accomplished by administering 4 or 5 grains of hydriodate of potash daily in gruel, and rubbing the parts likewise with ointment of iodide of mercury. As soon as the animal is considerably better, it should be sent to the butcher.

Somewhat analogous to this disease is the following account, which appears in the tenth volume of the 'Veterinarian.' It is introduced by the editor, who does not mention the country in which the disease appears and the writer now resides:—

"This spring my South Down sheep looked somewhat ragged in their fleeces, but were in good condition until about six weeks before their lambing, when, notwithstanding their excellent feed, they seemed to lose their flesh, as pregnant animals are apt to do. On the 20th of April I was enabled to turn them on a little grass.

"On the 25th my little flock (our correspondent is a farmer on a very large scale, but this was the first time that he had been enabled to try the South Downs: they had been drawn from the flock of Mr. Ellman, and exported by him) commenced lambing, and every lamb was deformed by an enlargement of the neck. It gasped once or twice, struggled a little,

and then died, although perfectly and excellently developed in every other respect. In this way I lost twenty-three lambs, two only living a miserable existence.

"The enlargement varies a little in position up and down the neck, and embraces the thorax more or less closely, and varies in size from that of a walnut to a hen's egg. The lungs had evidently never passed any blood through them.

"I first thought that it was goitre; but it did not correspond with the situation or appearance of that disease. I attributed it to something peculiar in the water; but, on communicating with other breeders, I found that flocks drinking the same water had, in two successive seasons, produced lambs with and without this defect; and I also found that it had appeared where well-water, and also where springs, and brooks, and swampy water had been used: but, with one exception only, I found that, in all cases in which this enlargement of the neck had taken place, the ewes had been grained (had corn given them), and that, too, pretty highly. What to do with this one exception I do not know. One of my ewes seemed to me to be consumptive, and I kept her in a stable, and fed her with whatever she would eat; oats, oil-cake, hay, turnips, or tea-leaves—no very scientific feeding, you will say. She retained her strength until the lambing time came, and then she brought me a lamb with an enlarged neck. The tutor in my family amused himself with feeding, in a small yard close by mine, half-a-dozen nice ewes. He fed them with poor hay, but the best oats; and

they had nothing but snow-water to drink until late in March, when they drank of the same swamp-water as my sheep. All their lambs came perfect.

"I sold six full-bred Merino sheep, and six grade (half-bred) sheep that were fed with a quart of oats per day, and drank at a spring. All their lambs came with enlarged glands.

"I will only remark, that of the lambs that did well the swellings seemed loose, and almost pendulous; yet the breathing was difficult and spasmodic, and there was mucous discharge from the nostrils. One lamb with these swellings died very fat, and in another the swellings have much decreased.

"Within the last twelve months I find that no less than six of my ewes have enlarged necks, which does not seem to inconvenience them in the least: they, however, are not ewes that carry much flesh. The old sheep showing this enlargement has a little puzzled me."

The *treatment* I should be inclined to adopt in such cases as the above is the exhibition of iodine, in the forms before recommended. The disease may be considered as endemic; and it is to be regretted that the writer makes no observations on the nature of the climate or the soil. The fact of the lambs escaping that were produced by the ewes that had had snow-water (which is exceedingly pure) to drink till near the time of lambing, would induce the belief that the water must, from some mineral taint or other impurity, have been an active cause in producing the disease.

In such case, where an endemical disease makes its appearance, a discovery of the cause is better than that of the cure; and, in the instance in question, no pains should have been spared in eliciting it. Numerous experiments should be instituted, by keeping various ewes on different food and water, and by such means the real cause of the mischief would have been brought to light.

Dropsy.

Various parts of the body may become affected with anasarca or dropsical swellings, although by no means so frequently as in the horse. The following brief account of such disease is communicated by Mr. J. Tombs, in the fourteenth volume of the 'Veterinarian':—

"There has been a disease very prevalent among sheep in this county (Worcestershire): it made its appearance about a week after they were shorn. A swelling came on near the udder, and extended along on both sides of the abdomen to the anterior extremities. After it had existed for some time, a swelling on the inside of the thighs came on. The pulse was quick and feeble; the eyes had a peculiarly watery appearance; the animals were very soon emaciated. The shepherds very improperly called it murrain, as it was to all intents and purposes *anasarca*, the swellings, when punctured, discharging a watery fluid. The causes of the disease were, cold and wet weather when shorn, and eating wet grass. Many shepherds, thinking it was murrain, dressed the sheep with liquid caustics,

which killed them outright. The cases that came under my notice yielded to repelling lotions, and the exhibition of diuretics and vegetable tonics."

This disease, or one very similar to it, prevails in some of the midland counties, and is denominated *Black-leg*. It is best treated by mild aperients, and diuretics combined with tonics.

In all dropsical affections it will be prudent to change the food from wet to dry, giving good hay cut into chaff, with a little corn and oatmeal gruel. When water collects within the cavity of the abdomen, as it sometimes does, and generally in old sheep, it is usually preceded by some degree of inflammation of the peritoneum, the membrane by which the water is secreted.

SECTION XXXIV.

LOCAL DISEASES.

Injuries of the Feet.

WE have noticed the peculiar structure of the feet in sheep in a previous part of the work, p. 135, and we have mentioned that the principal part of the weight is supported by the heel or back part of the foot. The front part is, from its pointed nature, well adapted to preserve the foot-hold and prevent slipping, particularly in ascending rocky declivities; and in such situations, and particularly if the animal has to travel, the wear of the horn at the toe is equal to its growth. But in wet pastures, or on soft soil, the growth of the toe is much greater

than the wear, and consequently this part often grows extremely long and irregular, so that it separates from the quick, and dirt insinuates, and lameness and a troublesome wound are the consequences, sometimes leading to foot-rot. This might be prevented by cutting off the superfluous horn with the knife.

The foot of the sheep often becomes sore from travelling, particularly on sandy roads. In this case it is the heels and the skin between them that suffer; but timely rest will set the matter right, and a little oil of tar may be applied to the wound.

Sometimes the biflex canal becomes the seat of disease and the cause of lameness; sand may penetrate, or the part may be chafed by much walking in the dirt, and inflammation and ulceration are the consequence. The part should be cleaned and dressed with a little tincture of myrrh, or the astringent powder recommended at p. 416 for the epidemic. If proud flesh forms, it should be kept down with the muriate of antimony.

These various injuries often prove very troublesome, from the circumstance of the sheep being exposed to dirt and moisture and the vicissitudes of the weather, and sometimes prove the forerunner of a still more troublesome malady.

The Foot-Rot.

This disease is a sadly troublesome affair both to the sheep-owner and the shepherd; and though seldom fatal, yet often, by the irritation and lameness it produces, robs the animal of its flesh, to the

great injury of the owner. It consists of inflammation and suppuration, and often ulceration of the sensible and secreting parts of the foot, and occurs either during or immediately after a long continuance of wet weather, and is most prevalent on land retentive of wet. There is much difference of opinion as to its being contagious or not. Mr. Read, in an excellent essay on the subject, in the 13th volume of the 'Veterinarian,' inclines to the opinion that it is not so, but believes that the sheep are all infected from the same cause; but we will let him speak for himself presently. Many writers consider it infectious, and some carry this opinion so far as to believe that the infection may remain in the ground for years; this, however, is absurd. A shepherd, in a communication in the 12th volume of the 'Veterinarian,' after stating his belief that it is decidedly infectious, mentions an instance of a large flock, half-bred, between the Leicester and the Down, though occupying a sound pasture, yet becoming affected in consequence of a neighbouring plantation being thrown open, which plantation was almost constantly in a wet state; the effect of which was to give the foot-rot to every sheep or lamb that entered it, though after a time the sheep that were used to it enjoyed a comparative immunity from it; but if any strangers were turned in, they were sure to become affected.

We are inclined to the opinion that the disease is produced by the decomposition of decaying vegetables, produced by the combined operation of warmth and moisture. The roots and leaves of the

grasses are in the winter often in a state of rottenness, and the horn of the sheep's feet, being blanched and weakened by the continual moisture, is exposed to the contact with vegetable bodies in a state of putrefaction. If this be the case, we can no longer doubt that the diseased matter from the feet of the affected sheep must materially assist in producing the disease when assisted by the agency of moisture. But as for the disease being always or even generally produced by contagion, such opinion is undoubtedly erroneous. Whether this theory be correct or otherwise, there cannot be a doubt of the close connection which moisture has with the disease, and the disposition which land retentive of wet has to produce it. We are aware that many whose opinions are deserving of great weight, express a positive opinion against the foot-rot being contagious, and this opinion is grounded chiefly on the fact which has come before their notice, that diseased sheep have failed to produce the foot-rot in sound animals on dry lands. This, however, is not sufficient to establish its non-contagiousness; for when the horn is dry and strong, and free from cracks and fissures, and the skin above also sound and properly lubricated with the unctuous secretion which is here particularly supplied, there is no disposition to absorb foreign matters, but, on the contrary, a power of resisting their influence, and thus we cannot be surprised that the foot-rot matter has no effect under such circumstances. When, however, the oily secretion is washed off, the skin in an irritable and probably sore state from the friction of

the wet and dirt between the clees, the horn long at the toe and ragged underneath, and particularly the upper or coronary portion which unites with the skin, and consequently is very thin,—when this part is blanched, weakened, and probably in some degree separated from the skin above, we cannot be surprised that such a state of the parts must greatly expose them to the action of any infectious matter from without. We therefore regard the disease as infectious, and yet do not imagine that it is propagated so much by this means as by the various causes that we have just mentioned, and more particularly by the reaction which follows on a change of weather, or even without it.

The progressive *symptoms* developed by this disease are so well described by Mr. W. Hogg in a prize essay communicated to the Highland Society, that we cannot do better than give it a place here. He observes:—"The first indication of the foot-rot is a slight halt in the animal. It gradually increases, and in two or three days the animal assumes a lank appearance, lags behind the rest, lies much, and, when roused, appears anxious, and confused at finding itself alone. It becomes more and more lame. Frequently the hoof is swelled; and in the course of five, eight, or ten days, the insensible lamina which lines it is dissolved, and the hoof hangs loose round the exterior of the foot, entirely separated from it, except at the upper edge. The disease also eats through the hoof, generally at its lower edges, after which the horny part comes away in fragments. The insensible part of the sole also peels off, leaving the

insensible incrustation which invests the bone quite bare. The animal is then obliged to gather its food on its knees. It remains in a single spot all day, and turns very lean, and, if the summer be soft and sultry, is unable to preserve itself from the intrusion of the flesh-fly, so that, at length, maggots swarm over its whole body. If it lingers on till about Martinmas, when long exposure to the air and sharp nights of frost kills the contagion, a new hoof grows from its upper edge, and the foot is again sheathed in a horny case; but if winter sets in with severity, the animal, already disfigured by pain and disease, generally falls a victim. Such are the consequences of foot-rot when the disease is not interrupted in its progress.

“On examining the foot, in the first stage of the disease, the coronary edge, though no external injury can be traced, is sometimes found a little swollen and inflamed; at other times the hoof is eroded; but whether it be shattered or entire, an intense heat is always perceptible in the foot, with a strong pulsation in the arteries, where they are inserted into the coronary edges of the hoof; and, however sound the hoof may appear externally, the connexion between it and the interior of the foot is always dissolved, though the separation is not evident till the hoof is pared away. A peculiar smell is perceptible, especially in the advanced stages, or when the ulcerous part is newly opened; yet, even in the worst cases, a large quantity of ichor is never discharged, there being little more than will wet the finger, and that only when pressed among it.”

Mr. Read, veterinary surgeon of Crediton, Devon, has written in the 'Veterinarian' a very excellent essay on this disease, and as it is at once both practical and scientific, and accords for the most part very nearly with our own views, and we have witnessed the ravages of the disease to a great extent, we prefer quoting largely from it. Mr. Read observes that the disease is of extensive prevalence in his neighbourhood, "and, on some farms, scarcely, if ever, absent, particularly if they consist of rich meadow old pasturage park lands, or meadows situated near towns, so as to receive the contents of drains and cesspools. Low situations, conjoined with moisture, are the fruitful and primary causes of foot-rot. Sheep in these situations have their hoofs and the integument above to which they are united, and the highly elastic tissue situated between the claws, constantly in a wet and humid state. Go into any of these pastures after sheep have been placed there for only a short period, and look at their feet—will there not be an increased growth of hoof? will not the skin round the coronet, and the highly sensitive membranous tissue between the claws, be blanched? will not the vascularity of the parts be weakened from its circulation being enfeebled? Now this is all produced by wet. In a few days, perhaps, we have a change of temperature; evaporation is produced from the surface of the land, and from animal bodies as well, and the ground becomes drier. A re-action takes place, the circulation is quickened; the hoof swells, or rather is pushed from the parts beneath; the skin between the claws

inflames; the heels bulge; the coronet enlarges; abscesses form: matter penetrates between the horn and the substance beneath, and disunites the sensitive from the horny laminæ; and in the worst forms of the disease the hoof falls off. The joints, tendons, and ligaments are soon implicated. Sometimes, from the overshooting of the toe of the hoof, it turns back or upwards, and breaks the horny sole from the crust: gravel then gets in; inflammation is set up; a separation of the foot from its horny covering is produced; and from every part of the foot thus denuded fungus quickly sprouts. The true foot-rot does not, as is generally thought, so often begin from below as from above.

"Hundreds of sheep on sharp sandy farms wear away their hoofs and soles, and expose the sensitive parts. A little heat and tenderness ensue, and matter forms, which is soon replaced by fungus. This might be got rid of in a short time. It is only a spurious kind of rot; and is again produced by the injudicious paring of the horny parts by the farmers and shepherds.

"If a little gravel happens to have insinuated itself between the junction of the crust and sole, the knife cuts away without any ceremony too much of the crust, exposing the laminæ, and the sole is so thinned as to afford no protection in walking. The animal limps at every step from the want of the horny crust; whereas, by only properly paring the foot, all might have been prevented.

"It is, now-a-day, too much the fashion for the farmer or shepherd to have his sheep-foot knife

always in his pocket, and every poor animal that happens to halt is caught, and but too often unmercifully pared. I have myself been an eye-witness to this. I have reasoned on its impropriety. The knife has been spared, and lameness has diminished. These two last causes are mechanical productions of the disease. Yet, on the other hand, if the foot is improperly managed, and a fair vent not given for the escape of the matter, it rises upward and breaks out at the coronet, and makes the cure more tedious.

“ Sometimes one foot, either the fore or hinder, is affected ; at other times both fore feet ; now and then all four ; sometimes only a single claw on one foot, and both on another. Such are the symptoms which I have been accustomed to observe during fifteen years’ practice among these useful animals. As to the question of its contagiousness, I have never been able to make up my mind decidedly on this point, although the strong leaning of my opinion is against its contagiousness. For the last three or four years I have made every inquiry of men accustomed to sheep. Some say, on my asking their opinion, that it is as infectious as the plague ; for if they put a lot of sound ones with some that were lame, they all become so. But I have then said, ‘ Perhaps the sheep with whom yours were put were in a soil favourable to the production of the foot-rot, and yours were taken from a healthy soil.’ Such was generally the case, and such is the proof which farmers and others pretend to give us of its infectious nature. Little do they imagine what is the operating cause on a soil disposed to it. That which

gives it to one will give it to a hundred, if there is a predisposition to take it on.

"Again, we hear of farmers that never had it on their estates, their farms being on healthy sites; but happening to take for a season, or buy at an auction, a ram that had the disease, and put him with the ewes, in from four to six weeks nearly the whole flock had been lamed. Scores of histories of this kind have been told me by different people; but, from what I could gather, they were solitary cases, and confined to the experience of the individual narrator. It might have been a wet season; for, during a wet or rainy summer (which has this year (1839) been the case), many farms that were free from, and others that rarely had it, have this season been pestered with it. Such a season might have occurred when conclusions were made to establish its contagiousness.

"My opinion is, that you may put lame sheep with sound ones on a healthy farm, and they will soon get well, and the others not become infected. As a proof of this, I will relate the experience of a near relative of mine that has a very healthy sheep estate, but who also rents an extraordinary rich flat piece of meadow land watered by the town sewers. His sheep are put there occasionally; but before a fortnight has expired they are nearly all lame. He drives them home again, and in a very short time they are all sound, and not one of the others infected; but if the lame sheep had been driven back to a farm disposed to the foot-rot (although none lame thereon at the time), it would have been ascribed to infection had they also become lame after some lapse

of time, instead of the soil, which is the grand operating cause, in conjunction with moisture.

"If this disease is infectious, how is it induced? Many experiments have been tried by the French and others, by a direct application of the matter to the feet of sheep, on abraded and non-abraded surfaces; but the results have not been satisfactory. Now, if a direct manual application of the discharge to the feet of sheep scarcely, if ever, produces the malady, how can sheep acquire the foot-rot from one another by walking or treading about while feeding, when it is with so much difficulty produced by the actual contact of matter discharged from feet having the disease? The discharge issuing from feet in any stage of the disorder is not in a very considerable quantity, and must be lost on the land on which they are roving about. Neither are they infected while being folded so close in contact as to render it almost impossible that they should avoid inoculating themselves.

"Shepherds and sheep-breeders, however, cannot be dissuaded, that if a piece of land or an enclosure, which gave their flock the foot-rot seven years since, should at the end of that period have some sheep turned upon it; and again, although none had been pastured there during those years, contract the lameness, they cannot, I say, be dissuaded from the belief that it must have remained in the ground with all its virulence the whole time, not thinking that the same soil which produced it seven years ago is capable of producing, for ages to come, under favourable circumstances, the same disease.

"There are, however, many stubborn facts recorded as to its infectious nature. Should these happen to be true, can there be given off from the feet of sheep labouring under the disease an animal effluvium, which, on a soil predisposed to it, is still rendered more contagious by uniting with any exhalation from the earth? Then, on the other hand, sheep with the foot-rot, put on a sound farm, oftentimes cure themselves, and do not infect the others. Such may be the case, as exhalations vary on different soils in their constituent parts as the land does in quality. Now, if empoisoned effluvia from the feet, or any malaria from the soil, uniting, become the cause, the effect must be produced on the local part by means of respiration whilst depasturing. We all know that there are many local diseases produced through atmospheric agency, and of a specific nature, capable of being again produced by inoculation."

With reference to *treatment*, Mr. Read observes—"When a sheep halts, let your attendant cast him. Then, if the hoof is too long, pare it on a level with the sole; shorten the toe; and be particular in examining the foot between the claws. If it is swollen, looks red, or has any discharge of bloody serum oozing from any fissure or fissures, let the solution of the bichloride of mercury or hydrochloric acid be well applied to the part by means of a little tow twisted, or a small flat piece of whalebone, and, in this stage of the complaint, one dressing is usually sufficient. There is nothing so much desired by the farmer as an application which will at once put

a stop to this complaint. The trouble it would save is incalculable when we consider the time it takes to dress the feet every day of from thirty to fifty or one hundred sheep. If abscesses have formed around the coronet, and burst, they usually have two or three fistulous openings, which, with your silver probe, you will soon discover. Arm the eye of the probe with a little tow dipped in the solution, and draw it through the sinus or sinuses. If they extend into the joint, the same thing must be done. Twice is most commonly sufficient to apply the solution in these cases; and oftentimes, when you attempt to pass the probe the second time, you will not be able, from its being filled with coagulated lymph. If any of the discharge is between the crust, pare the sole, and with a feather or syringe apply it to the part. Fungus is sure to sprout from any part where the sole or crust is lost, and rapidly will it sprout. Agriculturists and shepherds are at a loss in curing these morbid growths, as they resist nearly all the caustic applications in use, both empirical and those contained in the *Materia Medica*. Butyr of antimony, quicksilver and aquafortis, and numerous other applications, are of no avail, especially if the disease is of long standing. There is but one quick and effectual remedy, that is the hot iron, which will do more good in five minutes than all the caustics in our pharmacy.

"About four months ago, I was called in to look at two very valuable rams, that had been lame for four months with a fungous sole, belonging to a celebrated

breeder who had tried all his usual remedies to no purpose. I applied the hot iron with a keen edge, so as to cut off the fungus. All fungus that sprouts from a denuded sole when of long standing becomes hard and contracted at its base, which a hot iron will soon remove, and the lameness also in a few days, as it did in the case just recited. The fungus that grows from any part of the foot, from between the claws, from the laminæ, and from the junction of the crust at the heel, may all be removed in the like manner by a keen hot iron."

There are many specifics which are recommended for this disease, and all with the boast of being entirely successful. Some rely with confidence on the muriate of antimony, which is a very good application; others on a mixture which is supposed to acquire much of its virtue from the presence of gunpowder. Mr. Hogg, whom we have before quoted, advises the following mixture, having found it very successful, first removing the horn from the part having matter underneath:—

Turpentine	2 ounces
Sulphuric acid	2 drachms

to be well mixed before it is used, and then to be applied freely to the diseased part.

An ounce of olive oil and double the quantity of the sulphuric acid would, I take it, be an improvement. The acid must be mixed carefully with the turpentine, as considerable inflammation immediately takes place. In our own experience we have used all the powerful acids with success; and it is, I imagine, of but little consequence which caustic is

employed, provided it be of sufficient strength. The beneficial agency of a caustic may be thus explained: it first destroys the parts to which it is applied, thus arresting the progress of the disease by substituting a more destructive though more limited action for a milder but more progressive one; the caustic not only burns the diseased part but that in contact with it, or, as Shakspeare says, "One fire puts out another burning," on the same principle as we pull down a single house to preserve a whole street from the flames. The diseased action being thus arrested, an eschar is formed which protects the parts beneath, whilst a new and healthy action on a level surface is set up. The treatment pursued by Mr. Read is as good as can be employed; and in cases progressing favourably, but still possessing sores, we have used with much benefit the astringent powder recommended in the chapter on the Epidemic. It will also greatly assist the cure if the diseased sheep are put in a shed with a clean floor, on which some quicklime is spread every day.

Diseases of the Eye.

Sheep are subject to inflammation of the eye far more frequently than is generally imagined, and the number of instances of total or partial blindness of one or both eyes that are to be met with in the slaughter-house are very numerous. It is unnecessary to draw those distinctions which, though they probably exist in the sheep as well as other animals, are of little practical importance; but there are two varieties of inflammation which it will be proper to mention: one is of a superficial description, and is

produced either by a cold or external injury, and is attended with dulness and weakness of the eyes, and a discharge of tears at first, and afterwards of mucus from the corners of the eyes. One effect of this attack, which not unfrequently occurs, is adhesion of the lids to the eye at first, with mucus, and afterwards with lymph, which if neglected produces blindness by covering the sight. This effect is more likely to be produced if the lids participate in the inflammation, and more particularly if there is any scab about the animal at the same time, so as to cause rubbing. It is necessary in such case to separate the lid from the eye by means of the handle of a spoon, or a bit of smooth wood, and to apply some cooling ointment or oil to the part, to prevent adhesion again.

The more severe kind of *ophthalmia* frequently occurs without apparent cause, and the sheep is said to be lark-spurred, from the supposition that the injury has been produced by the spurs of a lark. The idea, of course, is ridiculous. The disease sometimes quickly disorganizes the eye, and at other times is much slower in its progress. It may terminate in blindness either by rendering the cornea opaque, the humours of the eye cloudy, or the crystalline lens opaque, which is, in fact, a cataract; or there may be general disorganization throughout the whole of the eye.

The *treatment* of these cases must consist in bleeding from the vein under the eye, lancing the eyelids, and fomenting the eye with warm water; and if the animal is of sufficient value, such, for in-

stance, as a choice ram or ewe, following up the treatment by a dose of salts and the frequent application to the eye of a lotion consisting of tincture of opium an ounce in a pint of cold water.

Besides these diseases, the eye is sometimes torn and lacerated from injuries received from fighting with other sheep, and when the substance of the eye is broken through, blindness always follows. When less severe, the treatment before advised will be found effectual.

Gutta-serena, or *amaurosis*, or paralysis of the optic nerve, sometimes occurs from injury of the brain, and it not unfrequently accompanies giddiness. It is generally incurable.

Diseases of the Mouth.

Sheep are liable to several diseases of the mouth, the most frequent of which is *Blain* or *Gloss-Anthrax*. In this the tongue, or rather its connections, are mostly affected: a number of vesicles or bladders appear on its side, attended with inability to feed, and a discharge of saliva from the mouth, which sometimes becomes bloody and offensive. These bladders burst, and leave behind large sores, which sometimes become troublesome ulcers; and these symptoms are occasionally attended with swellings of the head and throat. There is little doubt but that the disease is infectious, whether it appears as an epidemic or not; and, therefore, the affected sheep should be immediately separated from the rest of the flock. The vesicles should be freely lanced, and after being well cleaned with warm

water, may be washed with half an ounce of alum dissolved in water; but if the discharge is anyways offensive, the mouth should be washed with a lotion, composed of one drachm of chloride of lime dissolved in a pint of warm water. The sheep should be drenched with gruel, in which should be mixed, if the animal is weak, a drachm of ginger, and two of gentian.

Aphthæ, or Thrush,

Is another disease of the mouth, with which sheep are affected. It somewhat resembles that last described, but is less severe. It is attended with vesicles, but of a slighter description, and the sheep is often unable to feed.

The following cases are related by Mr. Rawlins, of Bristol, in the tenth volume of the 'Veterinarian.' He says, "In the month of May, 1836, I was requested to examine the flock of Mr. Charles Marshal, Snowhill, near Broadway, Worcestershire, who had lost several ewes and lambs previous to my seeing them. I found seventy lambs in a most emaciated state, scarcely able to move, their mouths presenting a mass of disease, being one complete ulcer. On examination, I found a large fungus issuing from all around the lower gum, enveloping the teeth, and protruding over the lip to a very considerable extent. There were about thirty still more or less affected. The disease clearly originated in the lower gum, and when it was matured to any extent, the ewes refused to allow the lamb to suck, and it gradually pined away. At this

stage of the disease, the lamb communicates it to the ewe's udder. As soon as she is affected, she begins to lose flesh most rapidly; the udder becomes tumefied. In some of the extreme cases the udder suppurated, and parts of it, with one or both teats, sloughed; and the ewe was rendered useless for a stock ewe. My first object was to get the flock separated—those severely affected, both ewes and lambs, from those less so; and to keep the sound ones in a distant field, the disease being contagious. By carefully attending to this plan and examining the flock, and removing those that became affected, and using the following detergent dressing, I succeeded in curing the whole. Take of

Simple oxymel	$\frac{1}{2}$ lb.
Burnt alum	6 ounces.
Sulphate of copper	2 drachms.

Mix, and apply it every morning to the affected part.

"Mr. Hyatt, at the adjoining farm, had his flock also affected, but by using the same means his sheep soon got well."

The above treatment is as good as can be employed.

SECTION XXXV.

INJURIES AND OPERATIONS.

Wounds, Bruises, Abscess, Strains, and Fractures.

SHEEP are not very liable to external injuries, but occasionally we find them either in the form of wounds, bruises, strains, or fractures.

Wounds are of various kinds, either simply incised, lacerated, superficial, or deep-seated.

A simple incised wound should, if possible, be united by the first intention; the edges of the skin should be brought together, and joined by means of stitches, over which a bandage may be placed, and by this means a cure is frequently effected in a short time. If the injury is considerable, metallic wire will be the best material for these stitches.

If the wound is lacerated and irregular, and extending amongst the flesh or muscles, this plan cannot be adopted, and should not be attempted. The parts should be fomented and kept clean, and a mild stimulant, such as the tincture of myrrh, may be applied, and the astringent powder, recommended at page 416, may then be scattered over the wound every day. Flesh generally heals very rapidly, but skin is far more tedious, as it grows only from the borders of the old skin. Thus the time which an extensive wound may take in getting well may be nearly ascertained, by the quantity of skin that may be lost. In horses new skin is generally weaker than the old, and does not carry any hair, the bulbs of the hairs having been lost with the old, and not replaced with the new skin; but in sheep there is very frequently a horny excrescence that grows on the surface of the new skin, in the place of the wool. When the granulations are too luxuriant, rising above the level of the neighbouring skin, as will generally be the case with extensive wounds, they should be touched by means of a feather, with a little muriate of anti-

mony or other caustic, every day till sufficiently reduced.

Bruises are not very common with sheep, the wool forming generally a secure protection from such injury. When, however, they occur, hot fomentations are the best means of reducing the attending inflammation.

Abscess, which is a collection of pus or matter under the skin, may be produced by a bruise, or by some constitutional cause. Whilst collecting, the surface of the skin is usually very tender, and sometimes there is also much constitutional irritation present. A collection of matter may be known by the heat, swelling, and pain of the part. On pressing it, the contained fluid is felt to fluctuate; and the pressure being removed, the part immediately assumes its former shape, whilst a watery or dropsical swelling, on being pressed, leaves for some time the marks of the fingers. After some time the abscess points; that is, the matter can be more distinctly felt at one particular part, at which, if permitted, the abscess would soon burst. This, however, should not be permitted; but at this stage the abscess should be opened at the lowest part, or that which would admit most readily of its discharging itself. The opening should be large, and no dressing will be required except the continuance of the fomentation, which should previously be used. It should be observed, that if the abscess is languid and slow in forming, a stimulant, such as hartshorn and oil, rubbed in occasionally, will be useful.

Strains are very rare with sheep, locomotion in

these animals being slow and careful. When, however, they do occur, the fetlock joint is the part most frequently so injured. The *treatment* should be rest, fomentations, and poultices; and if any swelling afterwards continues, a strong stimulant or mild blister may be rubbed in.

Fractures

Are sometimes the consequence of falls; the bones below the knee are those most frequently so injured. If the skin is cut through by the broken bones, it is called a *compound* fracture; whilst, if the skin is not thus penetrated, the injury is denominated a *simple* fracture. In the former case, if the carcass is of any value, the wisest plan will generally be to destroy the animal, unless, indeed, it should be a ram of value.

The *treatment* of a fracture will be, in the first place, to reduce it; that is, to restore the bones to their proper situation, which should be accomplished with much care. The wool having been cut from the limb, some slips of coarse brown paper, smeared on one side with gum or paste, should be wound round the part a great many times, and over this some fine tow should be placed in the greatest abundance where the limb is smallest, so as to render it of a uniform size, by which means the bandages will be prevented from shifting. Two bandages of linen or cotton, about three or four inches wide, and four feet long, should then be carefully put on, a little paste or gum being likewise smeared on one side. This mode of treatment

will be better than using wooden splints, and less likely to injure the skin. The animal should be kept perfectly quiet, and the bandages should remain on for a month.

Castration.

The earlier this operation is performed, the less likely is it to be followed by injurious effects. A favourable day should be selected, dry, but neither hot nor cold; and if the flock is considerable, it will be better to operate upon the lambs at different periods, by which they can all be operated on at pretty nearly the same age, than to wait and perform the whole at the same time: a fortnight is a very good age. It will also save trouble, and be quite as well, to dock them at the same time. There are different methods of performing the operation; but the following, which we have generally practised, is as expeditious, convenient, little painful, and satisfactory as any.

The operator sits astride on a long stool, with one of the lamb's hind legs under each thigh, the fore legs and head being held by an assistant. With the finger and thumb of the left hand, he draws up the lower part of the scrotum or bag, and cuts off a portion of the skin with a sharp scalpel or knife. He then grasps the upper part of the scrotum, which forces the testicles forwards, and with one incision separates the part which divides the testicles, sufficiently to cause them both to escape from the bag. He then places the iron clams on the cords above the testicles, and with a

hot iron divides the cords, and the operation is completed. By removing a portion of the skin, though the wound is rather longer healing, there is less likelihood of matter collecting within the bag. A little lard may be smeared on the parts afterwards, to keep off the fleas, &c. Before the operation is performed the bag should be examined, in order to find whether any rupture exists, in which case some of the intestines will have escaped into the scrotum. In such case, the operation must be performed in a more careful and difficult manner. Four small slips of wood, about four inches in length, must first be provided. Two sticks of elder cut in half will be most suitable; and it will be better if the pith is removed, and the vacancy filled with some caustic. One end of each pair must be fastened together with waxed thread. The intestines should be gently forced up into the abdomen, at any rate as high as possible. An incision should then be carefully made over each testicle, and through the skin alone: the testicle, with its coverings, should then be pressed through the opening in the skin, which being held back, the elder-sticks should be placed on the cord above the testicle; and one end having been previously united, the other should be brought together, and firmly tied by an assistant with waxed thread. The other testicle may then be operated on in a similar manner. Care must be taken that neither the skin, nor any portion of the intestine, be included in the wooden clams, and they must be pressed together as closely as possible.

In the course of three or four days the lamb should be examined, and if the testicle has fallen off, or can be removed by the hand, the thread may be cut and the clams removed.

In castrating full-grown rams, it is better to take out each testicle separately, through an incision made into each compartment of the scrotum, and the same method may be adopted as is practised with the horse.

Docking.

This simple operation is performed on most lambs at an early age, generally, and very properly, at the period of castration. In the Dorset and Somerset horned sheep, and a few others, it is, however, customary to leave the tails; but if diarrhœa should attack the lamb, as it is likely to do in some degree, the long tails harbour filth, and sometimes cause sores, on which the fly will deposit its eggs.

The best method of performing the operation is to place the tail on a block of wood, and excise it with a sharp iron, red hot, about four inches from the root. It may, however, be cut off without any bad effect.

A LIST OF MEDICINES

EMPLOYED IN THE TREATMENT OF THE DISEASES OF SHEEP.

Aloes, though a valuable purgative in the horse, is rarely if ever employed in the sheep internally, being uncertain and attended with danger; as a tincture, however, it becomes a useful stimulant to wounds.

Alum. An astringent. Dose, half a drachm with gruel; but is inferior to other astringents. As an external application it is useful as a wash or lotion applied to the mouth in several of its diseases, and also mixed with chalk it makes a good external application to sores.

Antimony, Butyr or Chloride of. An excellent caustic for foot-rot and other diseases. It may be applied with a feather.

Arsenic is sometimes used as an infusion for the purpose of dipping sheep, to destroy ticks and other insects. It should be employed with caution, and the vessels in which it is used carefully cleaned afterwards. Too much caution can scarcely be used in the application of arsenic or corrosive sublimate to the skin. Whilst writing I am informed that a gentleman in Dorsetshire having some fine sheep preparing for the approaching meeting of the Royal Agricultural Society of England at Southampton, had them sheared and then anointed with oil, and afterwards Courtney's fly-powders rubbed in, the consequence of which has been a dozen died very shortly afterwards. The previous application of the oil, no doubt, assisted the absorption of the poison, and the danger is therefore much greater than if used as a powder or even as a lotion.

Camphor is both a narcotic, sedative, and anti-spasmodic. Dose, one scruple to a drachm. It is also used with oil or spirits of wine as an external stimulant.

Cantharides (Spanish Flies). The principal ingredient in blisters, but otherwise rarely employed in the sheep.

Caraway-seeds. Stomachic. Dose, two to four drachms.

Catechu. A useful astringent, and as such employed with opium and chalk in diarrhœa. Dose, half a drachm to a drachm.

Chalk, prepared. An anti-acid and mild astringent, excellent in diarrhœa. Dose, half an ounce to an ounce. Also a useful external application to wounds and sores.

Copper, Sulphate of (Blue Vitriol). Externally a mild caustic; internally a tonic. Dose, half a drachm.

Corrosive Sublimate (Bichloride of Mercury). A strong caustic and poison, sometimes employed for the scab and to destroy vermin. It requires much caution.

Croton Seeds or Oil. A very powerful purgative, rarely used in sheep, but useful in obstinate constipation. Doses 5 to 15 drops of the oil.

Digitalis (Fox-glove). A sedative, lowering and diminishing the action of the heart. Dose, one scruple.

Epsom Salts (Sulphate of Magnesia). An excellent purgative in doses from one to two ounces or more dissolved in warm water or gruel.

Gentian. A useful vegetable tonic. Dose, from one to three drachms.

Ginger. A valuable cordial and stomachic. Dose, from half a drachm to two drachms. It is very commonly given with aperient medicine, which it secures from griping.

Hartshorn, Spirit of. A stimulant and anti-spasmodic useful in hoove. Dose, two drachms in six ounces of warm gruel or water.

Iodine. A powerful stimulant to the absorbent vessels, whether administered externally by friction or internally. It has peculiar influence over glandular swellings, but is generally administered in the form of Iodide of Potassium internally in doses from four to six grains, or in such form, or in that of Iodide of Mercury, with eight parts of lard as an external application. For enlargement of the udder or other glands, the ointment of Iodide of Potassium will be found useful.

Laudanum, see Opium.

Lead, Acetate or Sugar of Lead, or in the form of Goulard's extract, is a common ingredient in cooling lotions.

Lead, White, is a useful application for the prevention of the fly.

Lime, Chloride of. A valuable antiseptic, and an excellent application to foul and offensive wounds and ulcers. Also useful as a means of preventing infection.

Linseed Oil. A safe and useful purgative, though less suitable than the sulphate of magnesia. Dose, two ounces.

Magnesia, Sulphate of. See Epsom Salts.

Muriatic Acid (Spirit of Salt). A powerful caustic, valuable in foot-rot.

Nitrate of Potash (Nitre or Saltpetre). A cooling diuretic. Dose, two drachms.

Olive Oil (Sweet Oil). A laxative, though not so good as linseed oil; useful as an external application in cases of burns or bites from venomous insects.

Opium. A valuable anti-spasmodic and sedative. It may be used either in the form of a gum or powder. Dose, ten grains. It is more usually given in the form of tincture of opium or laudanum. Dose, one to two drachms.

Pimento (Allspice). A useful cordial and stomachic. Dose, one to two drachms.

Rye, Spurred (Ergot of Rye). A powerful stimulant to the uterus, and may with this view be given in cases of very protracted lambing. Dose, a scruple infused in hot water, and repeated if required in the course of one or two hours.

Salt (Muriate of Soda). In large doses a purgative, in smaller ones a stomachic and tonic. Sheep are very fond of it; and, in moderate quantities, given with the food, it has a useful effect on the health. It is a good plan to put rock salt in the troughs, so as to admit the sheep licking it when they choose. It has been found to have more effect in counteracting if not curing the rot than any other medicine. As a purgative the dose is about an ounce.

Saltpetre, see Nitre.

Spirit of Nitrous Ether (Sweet Spirit of Nitre). A diffusible stimulant and anti-spasmodic. Dose, two drachms.

Sulphate of Iron (Green Vitriol). A tonic. Dose, a drachm combined with ginger.

Sulphate of Copper (Blue Vitriol). A strong tonic, though seldom used in the sheep. Dose, one scruple. Infused in hot water, it makes an excellent astringent lotion.

Sulphuric Ether. A powerful stimulant and anti-spasmodic. Dose, one drachm with warm water.

Sulphuric Acid (Oil of Vitriol). A very powerful caustic, useful in foot-rot, alone or combined with tar.

Sulphur, Sublimed (Flower of Sulphur). An aperient given in com-

hination with Epsom salts. Dose, one to two ounces. Flower of sulphur is also sometimes used as an external application for the scab in the form of an ointment.

Sulphur, Vivum, is less pure than the yellow sulphur and cheaper; its colour is grey, whilst the former is yellow, and it is only used as an external application.

Sweet Spirit of Nitre, see *Spirit of Nitrous Ether*.

Tar. A useful application to the feet in cases simulating or bordering on foot-rot, particularly when combined with sulphuric acid or other caustics. *Oil or Spirit of Tar* is also sometimes employed for the same purpose, but it should not be mixed with powerful acids. It is also a good stimulant to wounds, and is commonly applied to the wounds in the skin made in sheep-shearing, and likewise for the fly.

Turpentine. There are several varieties of turpentine. *Common or Horse Turpentine* is an ingredient in digestive ointments, but is not administered internally in the sheep. *Venice Turpentine* is a pure and more expensive kind. *Oil or Spirit of Turpentine* is a powerful stimulant and anti-spasmodic. Dose, one drachm.

Vitriol, Blue, see *Sulphate of Copper*.

Vitriolic Acid, see *Sulphuric Acid*.

FINIS.

I N D E X.

- Abomasum, the, or fourth stomach, 161. 112
 Abortion, 862. 255
 Abscess, 418. 512
 Acari, the, 876. 267
 After-pains, 869. 259
 Age, the method of judging, 748. 102
 Albumen, 841. 725
 Amaurosis, 441. 309
 Anasarca, 427. 299
 Ancient history of the sheep, 1.
 Ancient Upland breeds, 88. 25
 Animal heat, production of, 800. 136
 Aphthæ, or Thrush, 445. 310
 Apoplexy, 881. 197
 Archenfield, the sheep, 51. 50
 Argali, the, 1.
 Arteries, the, 190. 128
 Atmospheric air, its composition, 195. 138
 Australia, sheep introduced into, 43. 168
 ———, exports and imports, 70. 76
 ———, epidemic diseases in, 417. 294
 ———, disease from astringency of the water, 421. 296
 Back, bones of, 132. 92
 Bakewell, the founder of the New/Leicester sheep, 100. 62
 ———, his objects and system, 101. 63
 ———, his mode of letting rams, 104. 65
 ———, the little reward he received for some years, 105. 65
 ———, the large sums he afterwards realized, 105. 66
 ——— establishes the Dishley Society, 106. 66
 Bampton, the Nott, 96, 230. 20
 Bennett, Mr., on Australian Epidemics, 447. 294
 Berkshire, 82, 87. 32
 Bezoars, 847. 277
 Biflex canal, 108. 96
 Black-faced heath sheep, 85. 15
 Black-leg, 426. 300
 Bladder, description of, 172. 119
 ———, inflammation of, 852. 243
 Blain, or Gloss-Anthrax, 444. 310
 Blasting, 804. 210
 Blood, and its circulation, 101. 125
 ———, its analysis, 200. 174

- Boiling sheep in Australia, for the tallow, 68. *79*
 Bones, structure and composition of, 120. *86*
 Bowels, inflammation of the, 325. *223*
 Brain, its description, 148. *99*
 —, inflammation of, 282. *99*
 —, water on the (Hydrocephalus), 280. *197, 137*
 Breeding, its principles and practice, 224. *312*
 Bruises, 443. *265*
 Buckley, Mr., on a Disease amongst Ewes, 378. *265*

 Carbonic acid gas, 195.
 Casein, 212. *313*
 Castration, 450. *111*
 Cells of the reticulum, 159. *99*
 Cerebrum and cerebellum, 143. *99*
 Cheetham, Mr., on a Disease in Australia, 421. *121*
 Chest, the, and its contents, 175. *123*
 —, the form of, most suited for fattening, 204. *180*
 Cheviot sheep, 31, 228. *2*
 Childers, Mr., his experiment on feeding sheep, 219. *180*
 Circulation of the blood, 186.
 Clayworth, Mr., on the Influenza, 408.
 Cleeve, Mr., on Palsy, 299.
 —, on Parturition, 359.
 Coates, Mr., on the poisonous effects of soot, 313.
 Colic, spasmodic, 324.
 Concretions in the stomachs, 315.
 Copeman, Mr., on Worms, 326.
 Corn, feeding with, 221.
 Cotswold sheep, 97, 241.
 Cranial cavity, 123.
 — nerves, 144.
 Crossing, on, 239.
 Cystitis, 352. *Calling an improver of Leicester sheep 67*
 Darby, Mr., on the Influenza, 406.
 Dartmoor sheep, 24.
 Daubeny, Dr., on the Purging Flax and Septfoil, 328.
 —, his table of the constituents of certain crops, 213.
 Diarrhoea, 317.
 Dickens, Mr., on Inflammation of the Bladder, 352.
 Digestive organs, diseases of, 301.
 Dipping, on, 387.
 Disease previous to lambing, 365.
 Dishley, the, or New Leicester sheep, 100.
 — Society, rules of, 106.
 Dorset, the, sheep, 42, 229.
 Dropsy, 427.
 — of the abdomen, 365. *257*
 Ducie, Lord, his experiment on feeding in sheds, 218.
 Dura Mater, the, 143.
 Dysentery, 317.

- Early lambs, 45.
 Ellman, Mr., the improver of the South Down sheep, 73.
 ———, his description of ditto, 74.
 Epidemic, the, of 1840, &c., 410.
 ——— diseases in Australia, 417.
 Epilepsy, 296.
 Epizootic diseases, 405.
 Esam, Mr., his operation for dropsy, 365.
 Eustachian cavities, 152.
 Exmoor sheep, 24.
 Experiments, Lord Ducie's, on sheep-feeding, 218.
 ———, Mr. Childers's, 219.
 Face, the bones of, 127.
 Fair, Mr., on Louping-ill, 283.
 Fat-tailed sheep, 9.
 Feeding and fattening, 202.
 Feet, injuries of the, 428.
 Felting property of wool, 255.
 Flesh, the, 140.
 ——— its analysis, 209.
 Fluke, description of, 394.
 ——— engraving of, 395.
 ——— theories respecting, &c., 397.
 Flux, the, 317.
 Fly, the, 385.
 Fly powders, fatal effects of, 453.
 Foot, description of, 135.
 Foot-rot, 429.
 Fore-extremities, bones of, 132.
 Forest breeds, 24.
 Fractures, 449.
 France, Merino sheep in, 56.
 Gad-fly, the (*Oestrus Ovis*), 387.
 Garget, the, 371.
 Gasparin, M., on epilepsy, 297.
 Gastric juice, the, 161.
 George III. imports Merino sheep, 61.
 Germany, introduction of Merino sheep into, in 1765, 57.
 Giddiness, goggles, &c., 275.
 Grantham, Mr. S., prize South Downs, 76.
 Grass lambs, 48.
 Greaves, Mr., on giddiness, 280.
 Gullet, obstruction in the, 302.
 Gutta-serena, 444.
 Gutteridge, Mr., on concretions in the stomachs, 315.
 Hamont, MM., and Fisher on the rot, 390.
 Hampshire, the, Down sheep, 85, 241.
 ———, old sheep, 42.
 Harrison, Dr., on the rot, 391.

Hawes, Mr., on the fatal effects of new wheat, 312.

Hay, its analysis, 210.

——, its nutritious qualities, 213.

Heart, the, 185.

Heaving, or after-pains, 369.

Hereford, the, sheep, 50.

Hind-extremities, the bones of, 139.

Hogg, Mr., on giddy sheep, 279.

—— foot-rot, 432.

—— thwartil-ill, &c., 283.

—— pining, 329.

Hoove, hoven, 304.

House-lambs, 45.

Hydatids, 276.

Hydrocephalus, 280.

In and in breeding considered, 242.

Influenza, 405.

Injuries of the feet, 428.

Injuries, 446.

Intestines, diseases of the, 324.

Irish sheep, 21.

Kerry sheep, 23.

La Clevelée, 380.

Lambing, difficult, 259.

Larynx, the, 151, 177.

Leicester, the new, 100, 225.

—— the old, 101.

—— the fleece of, 109.

—— the improvers of other breeds, 110.

—— their management in Scotland, 110.

—— Lord, on Norfolk sheep, 39.

—— on dipping, 386.

Lemster, the, wool, 51.

Lincoln, the, sheep, 90.

Local diseases, 428.

Loins, the bones of, 132.

Long-woolled, the, breeds, 89.

—— sheep of Ireland, 97.

Low, Professor, on the Argali, 1.

—— Black-faced heath sheep, 26.

—— Cheviot sheep, 34.

—— Penistone sheep, 40.

—— his account of the sheep of Europe, 8.

Louping-ill, the, 283.

Lubbock and Hubbard's tables, 265.

Lungs, description of, 180.

—— inflamed, 340.

Mackenzie, Sir G., on dysentery, 319.

- McArthur, Capt., cultivates Merino sheep in Australia, 63.
 McCulloch on woollen manufactures, 265.
 Madness, canine, 290.
 Maniplus, the, or manifolds, or third stomach, 160.
 Marrow, the, 120.
 Mastication, the organs of, 147.
 Mayer, Mr., on bronchitis, 340.
 Medicines, a list of employed in the diseases of sheep, 453.
 Medulla oblongata, 141.
 Merino, the, sheep, 52. — 70
 Middleton, Mr., on rearing house lambs, 45.
 Milk, its analysis, 212.
 Moors, the, 52.
 Morton, Mr., his description and engraving of the fluke, 395.
 Mountain breeds, 25.
 Mouth, diseases of the, 444.
 Muscles, the, or flesh, 140.
 Musmon, 1.

 Neck, the bones of, 130.
 Negretti sheep, 57.
 Nerves of the head, 144.
 ——— spine, their double origin, 145.
 Nippers, the, or incisor teeth, 147.
 Nitrogen, or azote, 195.
 Norfolk sheep, 38.
 Nostrils, the, 175.
 Nutriment in different specimens of food, 213.

 Oil-cake, feeding with, 221.
 Orkney sheep, 16.
 Os hyoides, 151.
 Oxygen, 196.

 Palsy, paralysis, 298.
 Parotid glands, the, 149.
 Penistone, the, sheep, 40.
 Pharynx, the, 151.
 Pia mater, the, 143.
 Pining, 328.
 Pleurisy, pleuritis, 349.
 Pliny, an ancient writer on sheep, 4, 12.
 Pneumonia, 340.
 Portland, the, sheep, 49.
 Price, Mr., on parturition, 356.

 Rabies, or madness, 290.
 Radnor, the, sheep, 21.
 Rawlins, Mr., on aphthæ, or thrush, 445.
 Read, Mr., on the foot-rot, 430, 434.
 Redwater, on, 334.
 Respiration and its effects, 194.

- Reticulum, the, or second stomach, 159.
 Rham, Rev. W., on the constituents of food, 214.
 Rheumatism, on, 300.
 Ribs, the, 131.
 Roche Lubin, M., on inflammation of the lungs, 345.
 Romney Marsh, the, sheep, 93, 230.
 Ross, the, sheep, 50.
 Rot, the, 389.
 Royal Agricultural Society of England, Journal of the, 280, 299, 359.
 Rumen, the, or first stomach, description of, 157.
 — mechanical distension of, 310.
 Ryeland, the, sheep, 50.

 Saliva, the, 149.
 Saxony sheep, 57.
 Sayer, Mr., on diarrhoea and dysentery, 321.
 Scab, the, 375.
 Scouring, 317.
 Scriptural account of the sheep, 5.
 Scrofula, 423.
 Selection in breeding, 236.
 Seron, M., on inflammation of the lungs, 347.
 Sewell, Professor, advice on a disease amongst ewes, 374.
 Short-tailed sheep, 16.
 Skeleton of the sheep, 120.
 Skin, diseases of, 375.
 Simonds, Mr., on rabies, 292.
 Snow storm, 36.
 Soft palate, 115.
 Smearing, 36.
 Somerset, the, sheep, 49.
 Sore heads, 388.
 Soot, fatal effects of, 313.
 South Down sheep, 72, 227.
 Southey, on wool, 258.
 Spain, the sheep of, 53.
 Spasmodic colic, 324.
 Spencer, Earl, on dipping, 387.
 — on Norfolk sheep, 39.
 Spinal marrow, 144.
 Stephens, Mr., on hydatids, 277.
 Stevens, Mr., on calculi in the urinary organs, 354.
 Stevenson, Mr., on dysentery, 320.
 Strains, 448.
 Structure of the sheep, general view of, 114.
 Sussex sheep, 72.
 Sweden, introduction of Merino sheep into, in 1723, 56.

 Tait, Mr., on apoplexy, 282.
 Teeswater, the, sheep, 95.
 Tetanus (locked jaw), 295.
 Tbrush, 445.

Thwartil-ill, or trembling, 283.

Tick, the, or fly, 385.

Tindal, Mr., on inflammation of the bladder, 352.

Tochenlin, M., on inflammation of the bowels, 325

Tombs, Mr., on dropsy, 427.

Tongue, the, description of, 150.

Transhumantes, or migratory sheep, 55.

Turnsieck, the, 275.

Twynham, Mr., his breed of sheep, 87.

Umbri, 4.

Urinary organs, 171.

_____ diseases of, 352.

Urine of sheep, 172.

Van Diemen's Land, sheep introduced into, 64.

Veins, the, 191.

Velum palati, the, 151.

Veterinarian, the, monthly journal of veterinary science, edited by Messrs. Youatt and Percivall, extracts from, 282, 312, 313, 315, 326, 341, 350, 352, 354, 366, 370, 405, 424, 427, 434.

Vinquish, the, 329.

Walz, M., account of the acari, 376.

Warwickshire, the, sheep, 96.

Washing, sheep, 34.

Water, astringency of, producing disease, 421.

Webb, Mr. Jonas, his pure South Downs, 76.

Welsh sheep, 18.

Western's, Lord, sheep, 62.

Wicklow, the, sheep, 22.

Wild fire (Ignis sacer), 380.

Wiltshire, the old, sheep, 41.

Windpipe, the, 177.

Worms, 326.

Wounds, 446.

Wool trade 167

Youatt, Mr., discovers the serrated edge of wool, 256.

_____ on epilepsy, 297.

_____ on sheep-pox, 381.

_____ on Australian epidemics, 417.

_____ his work on sheep, 276.

_____ on concretions in the stomachs, 315.

_____ on pleuritis, &c., 351.

_____ translation from the French, 381.

_____ on scrofula, 424.

Zetland sheep, 16.

NEW EDITIONS OF IMPORTANT AGRICULTURAL WORKS.

Now ready, much enlarged, and reduced to 12s., cloth,

THE COMPLETE GRAZIER, AND FARMER'S AND CATTLE BREEDER'S ASSISTANT.

A Compendium of Husbandry, containing full Instructions relative to the Breeding, Rearing, General Management, and Medical Treatment of every Kind of Stock, the Management of the Dairy, and the Arrangement of the Farm Offices, &c., &c. Also a Description of the Newest and Best Agricultural Implements; Directions for the Culture and Management of Grass Land, and the Raising of Grain and Root Crops, as well as an Account of the Nutritive Value of these, and of the various Natural and Artificial Grasses; Draining, Irrigation, Warping, &c.; and a detailed Account of the Preparation, Application, and Relative Value of Manures.

By WILLIAM YOUATT, Esq., V.S.,

Member of the Royal Agricultural Society of England; Author of
"The Horse," "Cattle," &c.

Tenth Edition. Revised by M. A. YOUATT, and able Assistants.
Illustrated with numerous Engravings.

The whole forming a **COMPLETE BODY OF HUSBANDRY**,
in one large Volume, 8vo, 12s., cloth.

MOST USEFUL WORK FOR COUNTRY GENTLEMEN, FARMERS, LAND AGENTS, ETC.

Now ready, New Edition, with Additions and Corrections, price 4s.,
strongly bound, The

LAND VALUER'S BEST ASSISTANT.

Being Tables, on a very much improved plan, for Calculating the Value of Estates. To which are added, Tables for reducing Scotch, Irish, and Provincial Customary Acres to Statute Measure; also, Tables of Square Measure, and of the various Dimensions of an Acre in Perches and Yards, by which the contents of any Plot of Ground may be ascertained without the expense of a regular Survey; Miscellaneous Information on English and Foreign Measures, Specific Gravities, &c.

By R. HUDSON, Civil Engineer.

"This new edition includes tables for reducing Irish, Scotch, and provincial customary acres to statute measure; table for ascertaining the value of leases for any term of years; a table showing how to lay out plots of ground of certain acres in furlms, square, round, &c., with valuable rules for ascertaining the probable worth of standing timber to any amount; and is of incalculable value to the country gentleman and professional man."—*Farmer's Journal*.

London: SIMPKIN, MARSHALL, and Co., Stationers' Hall Court.

THE
SHEEP

SPOONER

SE
375

PERKINS