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DR. NATH. BELLS

A
COURSE
OF
MEDICAL STUDIES:

CONTAINING
A COMPARATIVE VIEW
OF
THE ANATOMICAL STRUCTURE
OF MAN AND OF ANIMALS;

A HISTORY OF DISEASES;
AND
AN ACCOUNT OF THE KNOWLEDGE HITHERTO ACQUIRED WITH
REGARD TO THE REGULAR ACTION OF THE
DIFFERENT ORGANS.

*A WORK CHIEFLY DESIGNED FOR THE USE OF
MEDICAL STUDENTS.*

BY J. BURDIN, M. D.

TRANSLATED FROM THE FRENCH.

IN THREE VOLUMES.

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PRELIMINARY DISCOURSE.

IN this work I have endeavoured to exhibit a general view of the knowledge acquired in regard to the organization of man.

My principal object in undertaking this labour was to unite different branches of science, designed to illustrate each other, in such a manner as to enable every intelligent person to become acquainted with subjects, which, considering their importance, ought to be more generally cultivated. It is indeed astonishing, at a period when attempts are made to comprehend in public instruction all the useful sciences, that we do not find among them one which gives to man a knowledge of his organic structure; which makes known to him the phænomena exhibited by the regular action of his different parts; and which points out to him the general causes and natural progress of his numerous derangements.

A methodical study of the phænomena of the organization is alone capable of enabling man to avoid what may be hurtful to him, and to acquire those habits which are most conducive to his preservation. For want of this knowledge some abandon themselves with security to irregularities, the dangerous consequences of which they cannot foresee; others, with a view to ameliorate or to preserve their health, subject themselves to an austere regimen; deprive themselves of those varied and agreeable enjoyments which are necessary to com-

plete life ; and at length, by mistaken care, weaken that good constitution which they are desirous to maintain. Those who remain ignorant in regard to the nature of their organization expose themselves also, when it experiences any derangements, to the mercy of every thing around them ; and it is not uncommon to find persons of great talents, who in such cases believe in the greatest absurdities, and thus give importance to the most dangerous errors.

To this may be added, that the only means of banishing quackery, against which mankind declaim so much, is to propagate the knowledge acquired in regard to the physical nature of man. Those, indeed, who have correct ideas of the phænomena of their organization will not readily become dupes to advice dictated by ignorant zeal or by forward selfishness ; whereas the rich and the ill-informed are always more exposed to deception, as the honest and enlightened physician has too little influence to be able to convince them of their danger, and to protect them against the ignorance and effrontery of those who endeavour to mislead them.

If the study of the organization, notwithstanding so many motives of interest, is not so generally cultivated as it ought to be, and if it has not yet been made a part of the usual course of education, this deficiency must be ascribed to the detached manner in which the different branches it embraces have been treated ; as they have not yet been united into a proper system, worthy of being classed among works on the exact sciences.

But other causes also have contributed to retard the progress of this useful science. It may be observed, in the first place, that a study which is so difficult, and which,

which, besides great talents, requires a mind entirely divested of prejudice, could not make a conspicuous figure among the objects of human knowledge, till at a very advanced period of its improvement. It may be remarked, also, that few cultivate this science merely with a view of searching for new discoveries; and this, perhaps, is owing to the disgust which must be overcome before people can acquire sufficient resolution to extend the field of their observation to the sick and the dying. It is well known, also, that young men, who devote themselves to the study of medicine, are in general obliged to apply too soon to practice; which does not allow them sufficient leisure for difficult researches and profound meditations.

In the last place, those who have divided among themselves the different branches which relate to the physical nature of man, do not sufficiently communicate to each other the result of their experience and of their observations.

A physician who begins practice with a certain degree of knowledge, is always struck with the confusion exhibited to him by the science of medicine. At first, he ascribes it to the difficulty of the study; but if he continues to be a calm observer, and to believe nothing implicitly, he soon perceives that those who cultivate the different branches of which it is composed have so little intercourse, that, though very extensive knowledge has been obtained, the result of their individual labours is, for the most part, lost to the science in general; and that a great number even, without knowing it, are divided in their opinions in regard to the principal points on which it is founded. Hence it happens, that the distinct study of the different parts of the history of the

organization, instead of promoting, serves rather to retard its progress; because those by whom it is cultivated do not set out from common and fundamental principles, to which all their particular observations might be referred.

When a physician, therefore, begins to practise, he is necessarily struck with the number of popular errors which he every where finds among persons who are always desirous to explain, in their own manner, the different phenomena of health and disease; which indicates, at least, how anxious they are to obtain information respecting every thing that relates to the organization. Unfortunately, most physicians seem, at first, to participate in these false notions, that they may not too openly attack received opinions: by these means they gradually become familiarized with them; and at length adopt them entirely as incontestable truths. Thus, men who in consequence of their situation ought to contribute most towards the diffusion of useful knowledge, only give importance to fatal errors, which being established by time and the force of habit, must be difficult to be eradicated, and can be destroyed only by their united efforts.

Before I enter into any detail in regard to the plan of the work, the motives of which I have here explained, it will be proper to make a few general observations on organized bodies.

Organized bodies have been divided into vegetables and animals; but they are far from being all naturally susceptible of arrangement under these two divisions. There is a very numerous series of beings evidently organized, with the intimate structure of which we are absolutely unacquainted, either on account of their extreme

extreme minuteness, or because their transparency deprives us of the means of observing their organs, by making them appear to us under the form of a homogeneous viscosity.

When these beings develop themselves without changing their place, or by exhibiting a sort of ramification, they are classed among vegetables: of this kind are the byssi, lichens, fuci, ulvæ, confervæ, and tremellæ. On the other hand, when they move, or seem to have a distinct alimentary canal, like the volvox, monades, sponges, lithophites, alcyons, &c., they form a part of the class of animals. There are also several species which are placed alternately in these two classes, according to the different observations which have been made.

It appears, that it is among these beings, so little known, that the division between animals and vegetables takes its origin, or where the two classes are confounded.

The numerous class of animals exhibit a natural division by the existence or non-existence of the vertebral column. The difference between vertebral and invertebral animals is so great, that Daubenton was of opinion that the former ought not to retain the name of animals, if it be given to the latter.

Vertebral animals comprehend fishes, reptiles, birds, and the order of the mammalia, at the head of which man is placed.

The knowledge acquired in regard to the organization of man, which I have endeavoured to unite in this work, comprehends:—1st. Anatomical researches; 2d. A history of diseases; 3d. An examination of the vital functions.

functions. These three branches of knowledge, which compose the philosophy of man, naturally divide the work into three parts.

First Part. The anatomical description of man, as well as that of a great number of animals, which forms the subject of the first part, has been given with great minuteness, and scrupulous exactness, by celebrated anatomists: but as a complete and connected view of the different systems of organs in man, compared with the same systems of organs in other animals, is not to be found in any work, the result was, that only one part of the picture was exhibited; and therefore it was impossible to form a proper idea of the whole. The lectures of Cuvier, from which I have endeavoured to derive as much advantage as possible, and which were collected and in part published by Dumeril, will form in this new line a complete work, the conclusion of which is looked for with impatience.

The first difficulty which occurs, in describing the systems of organs, arises from the choice of the order proper to be adopted. As all the systems of organs discharge their functions almost simultaneously, a successive description of them is always attended with this disadvantage, that it separates objects which ought to remain united. It was therefore necessary that the order adopted should, as far as possible, remedy this inconvenience.

The whole of the parts of the body is composed of six principal systems:

- 1st. The system of the bones and muscles.
- 2d. The cerebral and nervous system.
- 3d. The system of the senses.

4th.

4th. The system of digestion.

5th. The system of circulation and respiration.

6th. The system of generation.

The description of each of these systems, in man, is preceded by a cursory view of the corresponding organs in the different classes of animals.

In the system of the bones will be seen the variety of forms exhibited by the skeleton, from that consisting of one series of similar vertebræ, of which the head seems to be only one more complex, to that which is composed of a vertebral column, a head, a thorax, and limbs.

The disposition of the muscles varies according to the parts to which they are attached.

The description of the bones, and of the muscles, is followed by tables, the arrangement of which is such, that, while they present a nomenclature of the different parts, they exhibit their position and their use.

The system of the bones, and that of the muscles, constitute the foundation of the human body. They comprehend the greater part of its material substance; and the other organs exhibit a disposition which is necessarily subordinate to them.

The cerebral system is composed; 1st. Of the encephalic organ, united to its rachidian prolongation. 2d. Of the ganglions of the trisplanchnic. These two principal organs, analogous ones to which are found in all vertebral animals, give rise to the nerves that distribute the principle of motion and sensation to the different parts. It is observed, that the nerves proceeding from the trisplanchnic are distributed, in particular, to the vessels which form the different tissues, and to the organs not subject to the empire of the will; and that

they thus maintain that animal life only which each point of the organization enjoys; while those which proceed from the encephalon and its prolongation furnish to the principal systems of organs secondary nerves, which communicate to them relative life, by causing them to perform the function for which they are proper. It is to be remarked, that in all animals the organs distributed to the organs of the senses, and to some other determinate parts, are always furnished by analogous pairs.

The description of the cerebral and nervous systems in man is followed by a synoptic table of the nerves, and an analytical view of the cerebral organ, with a recapitulation of the various parts which compose it, and of which the use is unknown.

The organs of the senses are merely particular terminations of some nerves, disposed in such a manner as to perceive the slightest impressions, and to vary the forms of touching. An examination of these organs in the different classes of animals, beginning at the simplest, and proceeding to the most complex, affords the only mean of discovering the use of the different parts which enter into their composition. Thus, it is seen that among the numerous pieces of which the ear is formed, the one most important and indispensably necessary for that organ is the membranous capsule, containing a viscous fluid, amidst which the auditory nerve expands; because this capsule is found in all animals, and in some it exists alone.

In the description of the digestive system, either in animals in general, or in man in particular, the progress of the aliments has been followed. It is curious to examine the gastric system in different animals, from those

those in which it consists of a single bag with one aperture, to those in which it is composed of a mouth armed with teeth, with a tongue, with salivary glands, &c.; of an œsophagus, which leads to one, two, three, and even four stomachs; of intestines of different lengths and sizes, provided with cœcal appendices, more or less numerous, and receiving fluids from a liver and a pancreas.

The result of digestion is the chyle: this fluid, absorbed by particular vessels, proceeds into the veins; which affords a natural transition from digestion to circulation.

In the system of circulation, the course of the blood has been followed, by giving a successive description of the organs which it traverses. This system, in animals, exhibits a still more astonishing variety of forms than the digestive system. How many particular arrangements are observed between the mammalia, whose blood is warm and red, and the worm, which seems to have only one dorsal vessel, with branches ramified to every part of the organization, and a few external apertures which afford an entrance to the atmospheric air!

In man, the arterial blood, which is of a bright red colour, and which has the temperature of 40 degrees of the centigrade thermometer (104° Fahr.), when it proceeds from the aorta is distributed by an order of vessels (the arteries) to every part of the organization. During its progress, it is continually freeing itself from the excess of its heat by the excretion of the cutaneous organ; and from its excess of aqueous, saline, &c. parts, by urinary secretion. The blood, after supplying every part with the materials of nutrition, returns by two
orders

orders of vessels (the veins and the lymphatics), and traverses organs which tend to make it resume the qualities of arterial blood. For the lymph, these organs are: the numerous lymphatic glands; and for a part of the venous blood, the hepatic system.

The lymph mixes with the venous blood, and the veins unite into two large trunks, which pour the blood into the right side of the heart; whence the whole of it passes into the pulmonary organ: it is distributed to every part of that organ, and during the act of respiration resumes its former qualities of arterial blood: it then proceeds to the left side of the heart, whence it passes into the aorta, to serve for a new circulation.

In the description of the different parts of the system of circulation, by thus following the progress of the fluids, the reader is better enabled to comprehend the organic phenomena, and in some measure to divine the laws by which life is maintained.

Having described the organs which the blood traverses, and shown the results of the chemical analysis of that fluid, an accurate description is given of the distribution of the arteries, followed by a synoptical table of these vessels. This article is terminated by the veins and lymphatics; and in explaining them the progress of the fluids is still followed, as far as possible, by taking the vessels at their capillary origin, and tracing out their union into ramusculi, rami, branches, and trunks.

In explaining the lymphatics, the glands are described in the order in which these vessels proceed thither. This method seems to be the most convenient.

In the last place, this first part is terminated by a description of the system of generation, with a curious detail of the parts of which it is composed in different animals.

It is there seen that if all organized beings are connected by some relations, it is in particular by the organs of generation; for an analogous structure of parts is found in all those the generating organs of which are known.

This first division concludes with a cursory examination of the general structure of the tissues, of which the different systems of organs are composed. It is observed that all these systems (anatomical systems of organs) consist of a certain number of similar parts. It is of very great importance to examine carefully their general disposition, as these parts perform analogous functions, and as they experience derangements of the same nature. This last circumstance tends to throw great light on the history of diseases, which is treated of in the second part.

In describing the different derangements to which the higher orders of society are at present subject, it appears on the first view impossible to class, in a proper manner, all these disorders so exceedingly various: however, by the help of a few general considerations, respecting the whole of their most important phenomena, it will soon be found that they may all be arranged under a few principal heads, from which the particular cases may be naturally deduced.

Diseases consist in an alteration of the parts, or in a derangement of their regular action. Those which exhibit a manifest alteration in the intimate structure of the organs compose the *phlegmasiæ*: those which consist in a general or particular derangement in the exercise of the functions, without any essential alteration of the parts, establish the series of *fevers*, or the different orders of *affections*, which in some measure are merely *nervous*.

Any irritation whatever, excited in a part, produces
a new

a new mode of action, the result of which is a series of phænomena that may vary, according to the structure and uses of the affected part. Thus, phlegmasiæ exhibit peculiar characters, according to the parts where they are developed. All these diseases of the same order, when considered in succession in the different anatomical systems of organs, furnish very natural marks of separation. This distinction, for which we are indebted to the moderns, but which has not yet received all the extent of which it is susceptible, has thrown great light on the phænomena of these affections. Thus, in the history of phlegmasiæ, these affections are distinguished into the following classes: 1st, Those of the cellular and parenchymatous tissue; 2d, Those of the serous membranes; 3d, Those of the mucous membranes; 4th, Those of the white fibrous parts; 5th, Those of the bones; 6th, Some special organic affections; 7th, Phlegmasiæ of the skin.

The phlegmasiæ comprehended in each of these sections exhibit very important differences, according as their progress is rapid or slow (acute or chronic phlegmasiæ), and under various other points of view.

It is to be observed that in these orders of phlegmasiæ almost all the diseases called *chirurgical* or *external* are united and confounded, with a great part of those called *internal*. A comparison of these derangements, of the same nature, which reciprocally illustrate each other, is sufficient to show how absurd it was to keep them always separate.

In the history of phlegmasiæ it is seen that those of the cellular tissue and mucous membranes have given rise to the popular errors in regard to *humours*. In these diseases, the regular action of the cellular tissue, or of the

mucous

mucous membranes, is deranged; and these parts, instead of furnishing the liquid by which they are habitually lubricated, secrete a more abundant humour often highly irritating, which has been considered as the cause of the disease, while it is merely the effect. It was therefore imagined that this humoral cause might exist in all other cases of disease, though not apparent. This unfounded supposition produced, in the course of time, a very seducing theory, which by the concurrence of a thousand particular circumstances was afterwards adopted.

When phlegmasiæ have a rapid progress, the local alteration is sometimes so great as to produce in the whole of the different functions that general derangement which constitutes *fever*.

Phlegmasiæ then naturally lead to the history of *fevers*, by an account of those called *eruptive*. In these fevers, the febrile derangement, instead of being produced by a local affection, as in phlegmasiæ, gives rise to an eruption of the skin, which appears about the third or fourth day of the disease. In describing the eruptive fevers, I have dwelt more particularly on the natural or inoculated small-pox, and on the vaccine: this article will enable the reader to appreciate easily what has been said for or against this discovery.

The chapter of fevers has always been one of the most obscure in all works on nosology, because the nature of the derangement which constitutes this order of diseases has never been considered under its real point of view. There is only one sort of derangement, characterized by a general perturbation of the functions, which constitutes *FEVER*; but this disease afterwards assumes a thousand particular forms, according to the causes which produce
it,

it, and the disposition of the individuals: it conducts back to health or terminates in death, by a series of phænomena which succeed each other with a sort of regularity.

Of fevers some have a *continued* progress, with striking exacerbations; others come on regularly by paroxysms, which leave between them a *remission*, more or less complete, and which in this manner seem to be so many distinct diseases. This circumstance, of so much importance in the progress of the disease, and which renders so great a difference necessary in the treatment, furnishes the first division of *fevers* into *intermittent* and *remittent*. There are no sufficient reasons for uniting affections which exhibit characters so essential and so distinct.

Continued fever exhibits forms highly varied, from the slight paroxysm, which terminates spontaneously at the end of twenty-four hours, to the form which continues for a longer or shorter time, with a succession of phænomena more or less violent, and which, for the most part, proves fatal.

In this long series of affections it is observed that some of them have a regular progress, which brings back health at the end of a limited period (*simple fever*); and that others, exceedingly severe and frequently fatal, are susceptible of becoming epidemic, and even contagious. (*Pernicious fever.*)

PERNICIOUS FEVER is characterized by a state of extreme prostration (*adynamic or putrid fever*); sometimes it exhibits in its symptoms abrupt changes and different anomalies (*malignant or ataxic fever*): in a word, this pernicious form presents very remarkable varieties in the hospital or jail fever, the yellow fever and the plague, which

which are only the same disease with comparative degrees of intensity.

Intermittent like *continued* fever exhibits a *simple* and a *pernicious* form. The simple form varies according to the time which elapses between two accessions, and furnishes the *tertian*, *quartan*, *quotidian*, &c. types.

The pernicious form may take place under the different types above mentioned: it is characterized by the exacerbation of any symptom, which frequently brings on death at the end of the third or fourth accession. It often exhibits the epidemic character.

This simple and natural arrangement of febrile diseases, while it renders the study of them easier, tends to throw some light on the nature of the phænomena which constitute them, and to furnish hints for the mode of treatment which ought to be employed.

The diseases not classed among the phlegmasiæ and fevers are all those which arise from particular derangements in the *exercise* of some of the organs, whether the nervous action of their parts be diminished, increased, or deranged. These numerous affections may be naturally classed under the four following heads: *comatose*, *asthenic*, *spasmodic*, and *vesanic* affections.

Comatose affections, characterized by a suspension of the principal external signs of life, comprehend: *apoplexy*, the various kinds of *asphyxia*, *catalepsy*, and *syncope*.

Asthenic and spasmodic affections are taken into consideration successively, according as they are observed in the different systems of organs.

The vesanic affections, which exhibit a derangement more or less striking of the intellectual functions, are: *hysterics*, *nymphomania*, *satyriasis*, *hypochondriasis*, *melancholy*, and *mania*.

In

In the long recapitulation by which the history of diseases is terminated, an attempt is made to prove that man is not subject to more diseases than animals; and to show in what manner the different affections to which he is exposed may have been developed at different periods of civilization, and under different circumstances of climate, food, habits, &c. It is there seen that animals, collected into herds and flocks, are subject, under analogous circumstances, to affections of the like kind.

The treatment most proper for the different diseases is deduced from general considerations on the nature of their development, on the general progress of their symptoms, and the regular action of the vital phenomena. The effects daily produced by a blind adherence to the common medical routine furnish also a series of proofs, which has not been neglected.

When medicine was a science merely hypothetical, it proved of great utility in the hands of the physician who formed the best conjectures; but at present, when anatomical knowledge has been carried to the highest degree of perfection, when the history of diseases is complete, and physiological researches begin to be very extensive, it can no longer be said that the medical art is destitute of a proper foundation.

When anatomy was little cultivated, in consequence of the study of it being fettered by religious prejudices, surgery also was often an art merely conjectural, the precepts of which were mixed with the grossest errors: but for half a century past, during which anatomy was more generally cultivated, surgery in France made a rapid progress, and has now attained to a degree of superiority which makes it to be held in high estimation. Men, indeed, who have a thorough knowledge of the arrangement

rangement of the parts, and of the disorders which alterations in them produce, ought to be the most proper for applying the necessary remedies. For the same reason, those who with a correct knowledge of anatomy have carefully observed the regular action of the different organs, and the natural progress of the derangements to which this action is liable, must alone be capable of giving salutary advice in regard to those diseases which essentially belong to the province of medicine.

The knowledge acquired in regard to the comparative structure of man, which forms the subject of the *first part*, and the numerous diseases, the history of which is given in the *second*, furnish a fund of information, by the help of which the regular action of the different vital functions is examined in the *third*.

In examining the *functions* of the different systems of organs, the order adopted in the *description* of these systems has been followed; beginning, however, with the action of the nervous and cerebral system, without which there can be no life.

The cerebral system is first considered as an organ of secretion. The large quantity of blood which the heart sends to the brain by a very short passage; the peculiar disposition of the arteries, which distribute it to the surface of that organ; the state of extreme divisibility which it soon assumes by penetrating into its interior parts; the slow and tortuous progress which it affects in its return, all announce that this common principle of nutrition serves for a very important secretion, and the cerebral organ seems to assimilate a fluid of great tenuity, which is distributed by means of the nerves to all the parts of the body, where it maintains, by its presence, the action peculiar to them.

is, in the first place, observed that strong and unusual impressions, capable of disturbing the regular action of the organs, produce a change of state, which constitutes the *sensation of uneasiness*; and, on the other hand, that those which contribute to complete life by maintaining the natural motion of the functions, produce another change of state, which is the *sensation of ease*. In the last place, it is to be observed that every living being is irresistibly excited to *act*, in order to withdraw itself from the causes of destruction, and to place itself under circumstances favourable to its preservation.

The habit of thus receiving alternately painful and agreeable sensations, soon renders living beings capable of appreciating very slight changes of state, in some measure indifferent to the organic order, and which constitute simple *sensations*.

The faculty of perceiving simple sensations becomes an organic function, which, like all the rest, is improved by proper exercise, and by the force of habit. It results from this disposition, that the simple sensations already experienced may be completely renewed without the presence of the objects by which they were first communicated; but merely by circumstances which have a greater or less relation with them.

The faculty which man has of experiencing *recalled sensations*, in consequence of new *direct sensations*, and the necessity of *acting* to avoid pain, to satisfy his wants, and to obtain ease, makes it necessary for him to *combine* these different sensations, and to act agreeably to the result of that combination.

The faculty of combining sensations gradually increases with the slow progress of civilization; and this function, which at first seemed to be a blind kind of instinct,

sinct, gives rise to the noblest operations of the human mind.

These ideas on the development of sensations, and the origin of the intellectual faculties, which are deduced from the knowledge acquired in regard to the structure of the organs and the phænomena they produce in the different circumstances of health and disease, may give to metaphysics that solid base which has hitherto been wanting.

An examination of the vital action in the bones gives rise to some important considerations.

The function of the gastric system exhibits a series of very remarkable phænomena. It is observed, that the digestive power does not belong exclusively to the gastric apparatus, but that it is peculiar to all the organs. Hence foreign substances, brought into contact with parts of the body, either in the ærian passages, in the interior or at the surface of all the tissues, and even of the skin, may be digested. The nutritive parts susceptible of entering into the composition of the animal fluids are taken up by the absorbing vessels, and the residuum is thrown out.

Digestion, properly so called, that which is effected in the stomach and intestines, is the result of the whole influence of the vital power. The aliments of whatever kind are transformed into a chymous pulp, which always contains chyle of the same nature; this assimilation is produced by the action of the digestive juices, favoured by the pressure of the sides of the intestines on the alimentary substances, but in particular by their long stay in a living organ, where that assimilating power, which is observed only within the sphere of the activity of organized bodies, is exercised in its full extent.

In the function of the gastric system are distinguished:

the digestive action of the organs on the alimentary substances; the stimulating action of the aliments on these organs, and the results of this reciprocal influence.

This article is terminated by pretty extensive considerations on the general mode of action of medicines.

In the system of circulation, after considering the force by which the blood is propelled from the heart, and that which continues to make it circulate in the vessels, the changes which this fluid undergoes in traversing different organs is examined.

The continual loss which the blood experiences, in consequence of the different excretions, is repaired by the products of digestion and of respiration. In this uninterrupted assimilation, it is of great importance to observe, that the substances which issue from the body exhibit altogether more density than those which enter it, the result of which must necessarily be an habitual elevation of temperature.

The excess of the heat of the blood is carried off by the evaporation of the sweat, which even produces that excess of heat; and the habitual temperature remains nearly at 40 degrees of the centigrade thermometer, (104° of Fahren.)

In arterial circulation, the blood, by means of the kidneys, is still freed from its excess of aqueous parts, and from different saline substances.

The arteries, in distributing themselves to all parts, are subdivided indefinitely, and reduce the arterial blood to a state of rarefaction proper for effecting the different changes which take place in every part of the organization. This repairing fluid afterwards returns by the veins and the lymphatics, the degree of the capillary minuteness of which is equal to that of the arteries.

ries. During its return, the venous blood undergoes different assimilations, which tend to make it resume its qualities of arterial blood. The lymph and the chyle acquire new characters of animalization, in passing through the numerous lymphatic glands. The venous blood, in its partial passage through the liver, frees itself from oily and albuminous substances; but it is in the pulmonary organ, in particular, that this fluid experiences the most important changes, and completely resumes the qualities of arterial blood: it there frees itself from the materials of carbonic acid gas, as it abandoned in the liver the constituent principles of the bile. Neither carbonic acid gas, however, nor bile are found ready formed in the blood; they are the result of a special secretion; and some have been inclined to believe that in the act of respiration the carbonic acid does not arise from a particular combination of the oxygen of the air with the carbon of the blood, since animals exposed in azotic and hydrogen gas throw out carbonic acid gas, as they do in atmospheric air.

The air in issuing from the lungs, with more or less force, can discharge another important function: the moveable cartilage which covers the aperture of the glottis, like the mouth of a wind instrument, causes the air to vibrate in its passage, and gives rise to the production of sound. Thus, every thing in the organization is fitted for being useful; the expired air serves for the production of melody and of speech, as the excretion of the bile becomes one of the powerful instruments of digestion.

Generation, considered in regard to the general reproduction of organized beings, exhibits a remarkable uniformity. All living beings produce, in some of their

parts, small bodies; which, by their further increase, form beings similar to those from which they arise. In some classes these beings in miniature (*buds, gems, &c.*) require only, for their expansion, to be separated from their mother, and to be placed under certain favourable circumstances (*slips*). In others, these small bodies (*seeds, ova, germs*) are not completely developed until some specific irritant has impressed on them, by its contact, the first movement of individual life. Reproduction, considered in this general manner, becomes a phænomenon which can be reconciled much better with the principles of philosophy, than that of the transformation of the aliments into a chymous pulp.

The last part concludes with a view of the knowledge acquired in regard to the vital functions. In this part, particular attention is paid to the development of the intellectual faculties. By observing the slow progress of this faculty, during the first years of life, and at the different periods of civilization, the successive connection of these different phænomena can be followed. But if we neglect to examine the earliest exertions of this function; if we attempt to account for the phænomena exhibited by the human mind when it has attained to the highest degree of intellectual vigour, without having previously observed, with care and attention, the development of the different sensations, and the origin of the rational faculties, we shall find nothing but an immense abyss, into which it will appear impossible to penetrate, and man will seem condemned to remain a stranger to the nature of that faculty which he daily employs for making new discoveries.

When it is considered that men who had no knowledge of the organic structure were the first who attempted

to

to explain the phænomena of the most astonishing function of the organization, the capital errors which occur in their works will not excite so much surprize as the great discoveries which they made.

It may readily be conceived that the only proper method to be pursued in order to explain, in a satisfactory manner, the function which gives rise to the intellectual faculties, is to acquire a thorough knowledge of the organic structure, and of the natural progress of the functions under the different circumstances of health and of disease.

If in the search after truth we ought to proceed from things known to those which are unknown, it will be necessary to study the *physical* nature of man before we attempt to make researches in regard to *what is beyond* the province of natural philosophy, and which forms the object of *metaphysics*.

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OF
MEDICAL STUDIES.

SYSTEM OF THE BONES.

OF THE TRUNK.

1. THE organs of small animals are not supported by osseous parts; bones in general are found only in the large animals; and the skeleton which they afford seems always to have been formed according to an uniform plan.

The skeleton determines the general form of the animal; it contains some organs, and supports others; it affords points to which a great many are attached, and serves for various kinds of motion.

Animals which have a skeleton are called *vertebral animals*; because in the skeleton the vertebral column is a constant and central part, little subject to variation.

The skeleton of some animals consists only of the vertebral column and the head; but in the greater number there are also limbs.

2. VERTEBRAL COLUMN IN ANIMALS. The vertebral column, *rachis*, or spine, is constituted of a series of longer or shorter bones, variable in extent, called *vertebræ*.

The number of the *vertebræ* varies between 16 or 20 to more than 200 in fishes, and in some serpents it exceeds 300.

The *vertebræ* are each composed of one essential part, which is *the body* of the bone; the *vertebræ* are placed one above the other, and in this manner form a column, which serves to support the trunk, and as a stay to the head.

Vertebræ, of the simplest kind, consist sometimes merely of the body. The more complex have also a groove or an arch, and protuberances on four faces. Each *vertebra* therefore has two faces for joining to the two contiguous *vertebræ*; the rest of its surface, whatever be its form, always presents four faces: a spinal face, *spina dorsæ*; a præspinal or antispinal; and two lateral ones.

The spinal face has sometimes a notch like that in the spine of osseous fishes; but for the most part it is furnished with a cavity which forms a hole.

The

The junction of the notches produces a groove, that of the cavities a *canal*.

The spinal face exhibits also, in general, a protuberance called the *spinal apophysis*: it is placed above the cavity; and when there is a groove the latter is cut out on the apophysis.

The spinal apophysis of the vertebræ varies both in its form and its direction; it is more or less elongated, round or flattened; terminates in a point or edge, and stands at right angles, or proceeds in an oblique direction.

The præspinal face is seldom furnished with apophyses; they are observed however in the vertebræ of the rattle-snake, and in the tails of fishes.

The lateral faces sometimes have only apophyses, called transverse, which support the ribs, as is the case in fishes; but other animals have two other articular or *lateral apophyses*, one above, the other below the transverse apophysis, and articulated with the adjacent vertebræ corresponding to them.

On the sides of the vertebral canal there are holes or *foramina*, which penetrate to its cavity.

Striking differences are observed in the vertebræ in regard to their connection. In fishes they join only by their substance; in other animals they are articulated not only by their substance, but by their articular apophyses.

The articular faces of the bodies of the vertebræ have sometimes conical cavities, as in fishes : the junction then takes place by the edges of these cones ; and the *rachis* or spine forms a series of elliptical cavities, filled with a white firm and elastic or *cartilaginous* substance ; but for the most part the vertebræ are articulated by their plain surfaces. The surfaces of the articular apophyses exhibit the same disposition.

The disposition of the articular faces of the vertebræ, and that of their apophyses, always determine the quantity of motion they can perform by the means of muscles ; this motion may be exceedingly free when the vertebræ are articulated only by their bodies, and when their apophyses do not mutually confine each other, as is the case in fishes : by a contrary disposition they may be reduced to perfect immobility.

The rachis or spine of some fishes consists of a long series of vertebræ, which exhibit no difference ; in serpents, a great part of the vertebræ are joined to ribs, but those towards the tail are not : the former are called *dorsal*, the latter *caudal vertebræ*.

The greater part of fishes have also vertebræ united to ribs, and which are called dorsal ; but the caudal vertebræ, towards the belly, are all furnished with apophyses : fishes have some likewise without ribs, and which exhibit no ventral apophyses :

apophyses : these vertebræ, when they are above those of the tail, are called *lumbar*, and when immediately below the head, *cervical*.

In animals provided with limbs a part of the vertebræ receive the ribs ; another part are sustained by the *pelvis*, and the rest remain free above and below the *thorax* and the *pelvis* : this disposition allows us to distinguish the vertebræ into *cervical*, *dorsal*, *lumbar*, *pelvian*, and *caudal*.

The *cervical* vertebræ are between the head and the thorax ; the *dorsal* sustain the ribs ; the *lumbar* lie between the thorax and the *pelvis* ; the *pelvian* are affixed to the pelvis, and the *caudal* come after the pelvis.

The cervical vertebræ, in the *mammalia* *, are in number always seven : in the other classes they vary.

3. VERTEBRAL COLUMN IN MAN. Man has seven cervical vertebræ, twelve dorsal, five lumbar, five pelvian united and forming a bone called the *os sacrum*, and three or four caudal also united, and forming a small bone called the *coccyx*.

4. *Vertebræ*. In general, each vertebra presents a body, on the spinal face of which is a ring ;

* Except the three-toed sloth, which has nine.

the whole of these rings forms the *vertebral canal*. Before the spinal arch of each ring is a *spinal apophysis*; on each side of the body or ring of the vertebræ is a *transverse apophysis*, and above and below this apophysis there is another *articular* one.

The articular apophyses unite with the corresponding ones of the neighbouring vertebræ. In the cervical and dorsal vertebræ the facets of the superior articular apophyses are turned backwards; those of the inferior forwards; while in the lumbar vertebræ the superior facets are turned inwards, and the inferior ones outwards.

Between the articular apophyses of one vertebra and that adjoining to it is a hole which communicates with the vertebral canal (24 *vertebral foramina*).

In the cervical region the upper part of the bodies of the vertebræ is indented and inclined forwards: in the rest this part is plane and horizontal.

The first cervical vertebra, called the *atlas*, is a simple ring, which on its upper part and both sides presents two facets for its articulation with the head, and two others below unite it with the second. The internal part of the arch of this first vertebra exhibits also an articular facet, which supports a round and elongated tubercle (*processus odontoides*) which rises above the body of the second

cond vertebra. The latter is distinguished by the name of *axoides*.

The free motion of the head on the neck arises from the peculiar disposition of these first two vertebræ.

The cervical vertebræ are the smallest: their bifid or forked spinal apophyses are turned a little downwards, and their transverse apophyses are perforated.

In the dorsal vertebræ the spinal apophyses, which are longer, are turned downwards; the transverse apophyses, inclined backwards, exhibit demi-facets, which when united form complete facets destined to receive the ends of the ribs; the 1st, the 11th, and the 12th, exhibit a complete facet. These facets are turned downwards in the upper vertebræ, and upwards in the lower.

The lumbar vertebræ are the largest; their spinal apophyses are exceedingly strong, and turned backwards.

The different regions of the spinal and præspinal face of the rachis or spine are also distinguished by peculiar names.

Thus the region of the neck behind is called the *cervical*, and before the *trachelian*; that of the back behind, the *dorsal*, and before, the *prædorsal*; that of the loins behind, the *lumbar*, and before, the *prælumbar*.

The five pelvian vertebræ united into one piece

form the *os sacrum*; this bone is flat, triangular, and concave before; its broad and thick summit is united by its body and articular apophyses to the last vertebræ of the back; it is articulated on the sides with the bone of the pelvis, and on the lower part it receives the *coccyx*.

The *os sacrum* exhibits on the fore part the bodies of the vertebræ of which it is formed, and behind and on the sides confused tubercles, which correspond to the spinal, transverse and articular apophyses. This bone contains also the vertebral canal; the foramina which terminate there are placed before and behind.

The last three or four vertebræ, united into one, form a small bone called the *coccyx*, which terminates in a point, and is articulated with the *os sacrum*, on which it can be bent backwards. In this bone the form of the vertebræ which compose it can scarcely be distinguished.

Between the articular surfaces of the bodies of the vertebræ is found a white, thick, firm and elastic substance, the consistence of which decreases from the circumference to the centre; this substance, which is of a fibrous structure, adheres strongly to the two contiguous vertebræ, and is called *the ligamento-cartilaginous*.

The bodies of the vertebræ are covered, both before and behind, with a tissue of white compact fibres, exceedingly solid, which proceeds along the whole

whole rachis or spine, and which is called the *common vertebral ligament, posterior and anterior*.

On the posterior part of the spinal canal, and between the articular apophyses, there are exceedingly strong ligaments called the *intermellar (yellow ligaments)*.

The vertebræ are fastened also behind by a ligament (the *superspinal*), which proceeds along the spinal apophyses, and by ligaments (*inter-spinal*) which extend from one spinal apophysis to the other. Each articular apophysis has also a strong *capsular ligament*, which is united to the neighbouring vertebra*.

The means by which the last lumbar vertebra is united to the os sacrum are the same as those by which the vertebræ are united; and the coccyx is fixed to the os sacrum by an articular capsule and ligaments placed before and behind.

The vertebral column is slightly bent, in such a manner that the region of the neck before is convex, that of the back concave, the region of the loins convex, and that of the *os sacrum* concave.

Though each vertebra can perform on the other

* All the articular surfaces of these bones, which form moveable articulations, are covered with a strong, smooth, and moist cartilage, and the portions of the bone articulated are always wrapped up in a sort of membrane which surrounds the articulated surfaces in the form of a *capsule*, and keeps them firm. This arrangement being always the same, we shall distinguish it in future by the name of the *articular capsule*.

only very confined movements, the whole of these movements is complete in the whole of the spine; and it is well known how far those who exhibit feats of tumbling can carry the pliability of this part. It is by means of the lumbar vertebræ in particular, that the greatest movements of the trunk are performed, because they are not impeded in their motion, like that of the back, by being united to ribs.

The body of the vertebræ consists of a spongy substance; that of the apophyses is of a more compact texture.

5. THE RIBS AND STERNUM IN ANIMALS. In almost all animals the ribs are sustained by a greater or less number of vertebræ. These bones, however, are wanting in many cartilaginous fishes; in some of the osseous, and in frogs.

The number of the ribs, which varies from 12 to 23 on each side in the *mammalia*, is considerably increased in serpents and some fishes, which have almost as many as they have vertebræ.

In the salamander, and several genera of fishes, the ribs are very short; in some of the *mammalia* they are exceedingly long. In the herring they are as small as needles; and in the two-toed ant-eater (*myrmecophaga didactyla*) so long that they cover each other like tiles.

In general they are single; in several fishes however they are forked, so that two proceed sometimes from the same vertebra.

The

The ribs are seldom straight, being for the most part bent almost in a semicircular form; in the mammalia their configuration determines the form of the thorax, and in fishes and serpents that of the belly and *abdomen*.

One of the extremities of the ribs always rests on the vertebræ; the other either remains suspended in the soft parts, or is united with a cartilage, or rests on a bone called the *sternum**.

The name of *sternal* vertebræ is given to those which on one side adhere to the vertebræ, and on the other to the sternum; and that of *asternal* to those which do not reach the sternum.

In mammalia the ribs which end at the sternum are towards the head: birds, in general, exhibit a contrary disposition; sometimes, however, they have asternal ribs towards the head, and towards the pelvis. In animals which have no ribs† the sternum is wanting; serpents and almost all fishes have ribs, without having a sternum.

In mammalia the sternum is long, of considerable thickness, broader or narrower, ossæous, sometimes cartilaginous, and, for the most part, consists of several pieces. In birds it is exceedingly broad as well as thin, and presents a very salient ridge, particularly in those of a rapid flight. In some reptiles it assumes very singular forms, is extremely small, and in fishes is always wanting.

* In the crocodile the ventral ribs rest on the *os pubis*.

† Frogs excepted.

6. RIBS IN MAN. In man the ribs are in number 12 on each side; these bones are long, bent irregularly in a semicircular form; are flat, and, as it were, twisted backwards.

At the posterior extremity they present a double facet, separated by a salient line; this facet is articulated between the lateral parts of two vertebræ. At the distance of an inch from this extremity, the ribs have behind another facet, which is applied to the transverse apophysis of the lowest vertebra. These two articular facets are separated by a narrow part or stricture called the *neck* of the rib.

The ribs then proceed backwards and outwards, after which they seem to bend in order to proceed forwards, and exhibit there a salient line nearer the vertebræ in the upper ribs: *angle of the ribs*.

The anterior extremity is terminated by a cartilage which unites with the sternum; the first seven ribs (*sternal ribs*) proceed in this manner to the sternum, by means of an intermediate cartilage; but the cartilages which terminate the last five (*asternal ribs*), rest one upon the other, and are supported by the cartilage of the seventh rib.

The first rib, which is shorter as well as broader, has its external face turned upwards; the following ones become longer, and their external faces are directed forwards: in the last place, the lower ones become shorter, and observe the same direction.

The

The articulation of the ribs with the bodies of the vertebræ is secured by an articular capsule, an *anterior ligament*, a *costo-transverse ligament*, and an *interior ligament*. The tuberosities of the first ten ribs are fastened to the transverse apophyses of the corresponding vertebræ, by a *capsule* and a *transverse ligament*.

7. *The sternum.* The sternum in man is a flat bone, broad at the top, and terminating at the bottom in a thin cartilage of greater or less extent. This bone often consists of two pieces, which in the course of time coalesce and adhere together; on the sides it has facets proper for receiving the cartilages, which terminate the ribs; these cartilages are retained on the sides of the sternum by an *articular capsule*, an *anterior* and a *posterior ligament*.

The sternum is exceedingly spongy; it is covered both without and within by a very strong *periosteum*.

The sternum, the ribs, and the dorsal vertebræ, form the capacity of the thorax.

The thorax has the form of a very irregular cone, with its base truncated downwards and its summit upwards; it is flat before, broad and rounded on the sides; flat and concave behind.

OF THE HEAD.

THE head, with respect to its form, is that part of animals most liable to variation. It consists of the cranium and face.

8. CRANIUM OF ANIMALS. The cranium, or *cephalic cavity*, contains the brain.

The differences observed in the form of the head of various animals consist chiefly in the greater or less contraction of the size of the cranium, and the greater or less elongation of the face.

The extent of the cranium, in regard to the elongation of the face, may be determined on the surface presented by a vertical section of the head : it is observed, in the different classes of the mammalia, that the cranium occupies on this surface an extent either greater or smaller than or equal to that of the face, without including the lower jaw. Among the Europeans the extent of the cranium is nearly quadruple that of the face ; in the Negro, the extent of the cranium remaining the same, that of the face is increased by a fifth.

In the different species of apes, the area of the face goes on increasing ; in the mandril (*simia maimon*), and the greater part of carnivorous animals, it is nearly equal to that of the skull ; in various species of graminivorous animals it continues to increase to such a degree, that in the horse it is almost four times as large as that of the cranium.

The cranium affects different forms ; but for the most part the summit of it is oval or rounded, and its base an irregular plane.

The bones of the cranium do not seem to be numerous in fishes ; in these animals they are united by plane surfaces, coalesce at an early period, and leave few traces of their junction. In birds these bones, which are fitted into each other by sutures, coalesce also at an early period, and the traces of their articulations disappear with age. But in the greater part of the mammalia, and in man, these osseous pieces are very distinct, and at most are eight in number, viz. before, the *frontal* bone ; on the summit and at the sides, the two *parietal* bones ; lower, and on the sides, the two *temporal* bones ; behind, the *occipital* ; and at the base, the *sphenoid*, and the *ethmoid*. Of these bones the frontal, sphenoid, and ethmoid, are common to the cranium and face.

These bones, in the various genera of animals, differ both in regard to their form and relative size ; and it may thence be easily conceived in
how

how many ways the configuration of the cranium may be varied.

The cavity of the cranium in the mammalia is filled with the brain; but in reptiles and fishes this organ occupies only a very small part of it.

9. CRANIUM IN MAN. In man the cranium is round, well expanded, and presents a cephalic cavity comparatively larger than that of other animals: it consists of eight bones.

10. The *sphenoid*, or *sphenoides*. The sphenoid is a bone of a very singular form; it is long, and passes through the middle of the base of the cranium and the breadth of the face; it exhibits a great number of prolongations, by means of which it is articulated with all the bones of the cranium, and a great part of those of the face*.

On account of its position and numerous connections, it has been considered as the key of the

* This bone has on each of its sides two unequal prolongations, called the *greater* and *less ala*, or wings; at the bottom two apophyses, called the *pterygoides*, which form behind a *fossa*, called the *pterygoid*. The middle of this bone is the body of it, the upper part of which, transversally depressed, is known under the name of the *sella turcica*, and is surrounded by the *anterior* and *posterior clinoid apophyses*. This bone is perforated with holes, which afford a passage to the vessels and nerves; viz. the optic foramina, the sphenoidal fissures or *rimæ*, the upper and lower maxillary foramina, and two spinous foramina. In the thickness of the body the sphenoid fissures are contained.

bones of the head. This bone is seen at the base and on the sides of the cranium; it concurs to form the cavities of the eyes (*orbits*) and those of the nostrils.

11. *Frontal bone, Os frontis.* The anterior part of the cranium, or the forehead, is formed by the *os frontis*. This bone forms also the upper part of the face; it is curved and rounded at the summit, and before and on the sides it is furnished with two processes called the *frontal*, and in the middle, lower down, with two other processes called the *nasal*. The lower part of it is bent back in a horizontal direction: it is indented in the middle to receive the *os ethmoides*, and its sides are arched to form the upper part of the cavities that contain the eyes.

This bone is articulated below with a part of the bones of the face; behind and at the bottom with the *os sphenoides*, and behind and at the top with the two following bones.

12. *Parietal bones.* The summit and sides of the cranium are formed by the junction of the two parietal bones. These bones are convex on the outside, quadrilateral and serrated at the edges; they articulate with each other above, with the frontal bone before, with the occipital behind, and at the bottom with the temporal bones and the sphenoid.

13. *Occipital bone, Os basilare.* The back of the
VOL. I. C head

head and a part of the base of the cranium are formed by the occipital bone. This bone is convex on the outside, and is shaped somewhat like a lozenge; two of its edges are fitted by a suture into those of the parietal bones; it presents on the outside behind a protuberance called the *occipital*; on the sides two salient lines called the *occipital arch*, and within two grooves, corresponding to these two lines. Below is the large *occipital foramen*, which forms a continuation with the vertebral canal; on the sides and within this hole there are two *tuberosities*, with which the head is articulated on the vertebral column: in the last place, that part of the bone before this hole is called the *sub-occipital*.

This bone has several holes also for the passage of the nerves and vessels: it is articulated before with the sphenoid; at the bottom with the *rachis* or spine, and on the sides with the following bones.

14. *Temporal bones, Offa temporalia.* Below and on the sides the cranium is formed by the two *temporal bones*. These bones are of a very irregular figure; they present on the outside a flat, rounded, and very thin part, which may be compared to the shell of an oyster. This part gives birth on the outside to an *apophysis*, called the *zygomatic*: it is long and thin; proceeds forwards, receding from the bone, and unites with the *apophysis* of another bone to form an arch.

Below the root of this apophysis is the *glenoid cavity*, which receives the condyle of the jaw-bone: beyond this cavity is the external orifice of the *meatus auditorius*; and still further back is a large tuberosity called the *apophysis mastoideus*. Below the auricular foramen is the apophysis *styloides*, behind which is observed the *jugular fossa*.

The temporal bone presents, in the inside, a thick part, very unequal and exceedingly hard, called the petreous (*petrea*). It is in the thickness of this part that the organs of hearing are contained. The temporal bone exhibits a great number of holes, the principal of which are: below, the *stylo-mastoid*; the carotid canal, and the guttural conduit of the ear; in the inside, the interior auditory foramen.

This bone is articulated before with the sphenoid; at the top with the parietal bones, and behind with the occipital.

15. All these bones of the cranium are fitted into each other by futures, or are united by smooth surfaces. Their edges are generally cut obliquely in different directions: the same bone, therefore, has a part of its edge cut into a bevel on its external face, while in another part it is cut into a bevel on the internal face. This peculiar disposition exhibits a method of articulation as strong as it is wonderful.

Those serrated marks produced by the junction of the bones of the cranium, and which are called *sutures*, become effaced sometimes with age.

The bones of the cranium exhibit, on the outside, particularly behind and on the sides, depressions or asperities, that indicate the insertion of the muscles by which these parts were covered.

In different points of the bone of the cranium there are holes of greater or less size, which penetrate to the inside of it, and which afford a passage to the vessels and nerves.

The upper part of the cavity of the cranium exhibits furrows of greater or less depth, which extend in a ramified form: these furrows correspond to vessels which rested directly against the sides of this cavity.

The base of the cranium presents, in the inside, eminences and excavations very distinct: the cavities serve to lodge portions of the cerebral organ.

The lower part of the cephalic cavity, the base of the cranium and the sides of the head contain holes, fissures, and indentations, which afford a passage to the nerves, arteries, and veins*.

The

* The inferior side of the cavity of the cranium, proceeding from the fore part backwards, presents the *foramen cecum*, the holes with which the cribriform plate of the *os ethmoides* is perforated, the optic foramina, the sphenoid fissures, the upper maxillary or large round foramina, the lower or oval maxillary foramina,

The bones of the cranium are covered throughout their whole extent, both internally and externally, by a membrane which strongly adheres to them, and is called the *pericranium*.

16. THE FACE IN ANIMALS. It is of importance to examine the face in the different classes of animals, in regard to its greater or less elongation.

The form and elongation of the face are always determined by the greater or less prolongation of the jaw-bones.

It is observed, in general, that the perfectibility of the organization of animals is in the inverse

foramina, the spinous or small round foramina, the internal orifice of the carotid canal, the posterior foramina lacera, the anterior foramina lacera, the interior auditory foramina, the posterior foramina lacera, the anterior condyloid foramina, (the posterior condyloid, and the mastoid foramina when they exist,) the grand occipital foramen.

The base of the cranium presents: the anterior palatine foramina, the posterior palatine foramina, the posterior aperture of the nasal fossæ, the posterior aperture of the palatine and pterygoid conduits, the anterior foramina lacera, the carotid canal, the posterior foramina lacera, the anterior and posterior condyloid foramina, and the grand occipital foramen.

The lateral parts of the head present: the external orifice of the auricular conduit, the stylo-mastoid foramina, the spinous foramen, the foramen ovale or lower maxillary foramen, and the zygomatic fossa, in which are found: the spheno-maxillary rima or fissure, the orifice of the sub-orbital, palatine, pterygoid, spheno-palatine, and pterygo-palatine conduits.

ratio of the small size of the cranium, and of the great elongation of the jaw-bones.

Man, of all animals, has the largest cranium and the shortest face.

To determine the size of the facial angle, Camper raises above the plane of the base of the cranium a line, which, proceeding from the bottom of the upper incisive teeth, is continued in an inclined direction to the most prominent part of the forehead. The plane of the base of the cranium passes through the anterior edge of the upper part of the nostrils, and through the auditory foramina. The facial angle, therefore, in European heads, in general, is equal to eighty degrees; in those of the Moguls to seventy-five; in those of the negroes to seventy; in the orang-outang to sixty-five; and in carnivorous and graminivorous animals it decreases so much, that in the horse it does not exceed twenty-three degrees.

This measurement, however, can be applied with any degree of exactness only to the human species and the *quadruman* *. Other animals often present such singular configurations of the head, and such projections of the forehead, that it is not possible to measure their facial angle: besides, it is of little importance to observe the size of the

* *Quadruman*—animals with four hands: a name given to the second order of the *mammalia* in Blumenbach's *Handbuch der Naturgeschichte*. The species included under this denomination are: Simia, Papio, Cercopithecus, Lemur. In the older works this order were called *Pithecii*. TRANS.

head, except in regard to the volume of brain it is supposed to contain : in reptiles and fishes the brain occupies only a small portion of the cavity of the head.

The Greeks seem to have been sensible that the beauty of the head consists, in an essential manner, in a straight direction of the face. In the statues of the gods or heroes whom they were desirous of ranking among their deities, it is seen that they increased beyond the limits of nature this angle, which they sometimes carried to nearly a hundred degrees, as if they wished by these means to give them a form of countenance as far distant as possible from that of the common race of men.

It is observed, indeed, that the straight form of the face generally pleases even in animals ; and, on the other hand, that elongation of the muzzle and depression of the cranium give them always a stupid and ferocious air.

17. FACE IN MAN. In man the face has such a direction that the eyes and mouth look directly forwards : the bones which compose it are in number fifteen, besides the thirty-two teeth.

18. BONES OF THE NOSE. The bones of the nose are small, oblong, and quadrilateral ; they coalesce, and thus form the upper part of the nose ; they rest laterally on two prolongations of the upper jaw-bone ; at the top they are indented

into the frontal bone and the *os ethmoides*; their lower edges being free are united with the cartilage of the nose.

19. *Lachrymal bones*. On the interior sides of the orbits there are two small thin bones, called the lachrymal bones. Their exterior face exhibits a portion of the *fossa lachrymalis*, which has a communication with the nostrils.

These bones are articulated: at the top, with the frontal bone; before and below with the upper jaw-bone, and behind with the *os ethmoides* and the lower cornets.

20. *Zygomatic bones*. On the external and lower side of the orbits there are two small bones, called *Zygomatic bones*, of a very irregular form, flat, and somewhat convex on the outside. Their circumference consists of four indented sides, terminated by pretty long angles, called *apophyses*.

These bones are articulated: by the upper apophysis, with the *os frontis* and *os sphenoides*; before and at the bottom with the upper jaw-bone. The posterior apophysis, being longer, is united with that which, as already said, rises above the temporal bone, and forms with it an *arch*, called the *zygomatic*.

21. *Super-maxillary bones*. At the middle and anterior part of the face are the two bones of the upper jaw, or the *super-maxillary bones*: these bones are each very irregular, and present, in their thickness,

thickness, a cavity called the *sinus maxillaris*, which has a communication with the nostrils.

The super-maxillary bone is connected with all the bones of the face, and with a part of those of the cranium. It is articulated : in the inside and at the bottom with its fellow, and two other bones ; before and at the top it has an ascending apophysis, called the orbito-frontal, which rests on the frontal, the lachrymal and the ethmoid bone, and which supports the bones of the nose : at the bottom and on the outside of this apophysis is the anterior orifice of the sub-orbital conduit : on the outside it is united to the *zygoma* and the *os sphenoides* : before and below it receives the teeth.

These bones constitute a great part of the face and palate ; they contribute to form the arch of the nose, the sides of the nostrils and those of the orbits ; they receive the upper teeth, and serve for mastication.

22. *Bones of the palate.* Behind the super-maxillary bones, and at the bottom of the nostrils, are the palatine bones, which extend as far as the orbits. These bones are of a very singular form, which is necessary that they may adapt themselves, in a great part, to the still more singular form of the *os sphenoides*.

These two bones unite behind the super-maxillary bones : they are articulated with the *os sphenoides*, the *os ethmoides*, and the lower cornets (turbinated bones), and with an osseous plate.

23. The

23. The *os ethmoides*. In the inside, and at the summit of the nostrils, under the indentation of the frontal bone, is the *os ethmoides*, of a cubic and elongated form, exceedingly light, and consisting in the inside of very thin plates, pierced with holes, which assume different directions, and form a great many cells communicating with each other.

The upper face of this bone, which is of a more compact nature than its interior plates, is pierced with about forty holes : it corresponds on the inside to the basis of the cranium, and in the middle presents a *ridge*. Its compact lateral faces concur to form the internal sides of the orbits. The other faces of this bone are open, and correspond to the summit of the nostrils.

This bone is articulated : at the top with the frontal bone ; before, with those of the nose, the super-maxillary bones and the lachrymal ; behind, with the *os sphenoides* and the palatine bones ; at the bottom and in the middle with an ossæous plate.

24. *Lower cornets. Turbinated bones.* Beneath, and on the sides of the *os ethmoides*, are two bones, formed of plates twisted into the form of cornets : these bones seem to be an appendix of the *os ethmoides*, and are united to it. These cornets are articulated also with the super-maxillary bones, the lachrymals, and the palatine bones.

25. The *vomer*. Between these two cornets,
below

below the *os ethmoides*, and in the middle of it, is an osseous plate, which divides the nasal fossæ into two nostrils, and is called the *vomer*. This thin and long bone receives in a groove, on its anterior and superior edge, a cartilage, which completes with it the partition of the nostrils. It rests at the bottom, between the two super-maxillary and the palatine bones, and is joined at the upper part, in the bottom of the nostrils, to the middle of the *os sphenoides*, by a large furrow.

26. JAW-BONE. The lower jaw-bone, *os maxillare*, is formed of a bone turned round on its plane face, in the form of a horse-shoe : the upper edge of the arc contains sixteen cavities for receiving the teeth ; the lower edge has a projection towards the *chin*.

Behind and in the middle of this bone is a small ridge, called the *genian* ; on the sides of which are two salient lines, known by the name of the *mylean*, which terminate at the orifice of the dental canal.

The extremities of the maxillary bone are bent up and backwards, so as to make an angle of forty-five degrees, and terminate in a flattened transverse tuberosity, called the *condyle*, which is received in the articular cavities of the temporal bones. Before this tuberosity is a large apophysis, called the *coronoid*, separated from the condyle by a deep indentation.

The

The articulation of this bone with the temporal is secured by a lateral external ligament, a lateral internal, a tylo-maxillary ligament, and an articular capsule.

Mammalia, fishes, and many reptiles, have jaw-bones armed with teeth. (*See that part of the article on Digestion.*)

27. The bones of the face, as well as those of the cranium, are connected by means of smooth surfaces or indentations, and exhibit the same peculiarities. These bones have also depressions or asperities in those places to which the muscles were attached, and holes through which the vessels and nerves were conveyed to the interior parts.

The aggregate of the bones of the face, together with those of the cranium, seem fitted in a special manner, by the formation of the cavities of the ear, the orbital fossæ, the nasal fossæ, and those of the mouth, for receiving the organs of hearing, of smell, and of taste.

The aggregate of the bones of the cranium and face exhibit also externally some remarkable parts, to which it is of importance that particular names should be assigned, in order that they may be distinguished with greater facility. Thus the cranium has on each side a large depression called the *temporal fossa*, the lower end of which terminates near the zygomatic arch; below this arch is
another

another cavity of less breadth, but much deeper, known by the name of the *zygomatic fossa* *.

28. ARTICULATION OF THE HEAD. The head, in different animals, is articulated on the vertebral column by one or two condyles.

In birds, it is articulated behind by a single condyle, which allows it to perform such extensive motion, that these animals can turn their beaks directly behind them : it is well known that they often sleep with their heads resting in this manner between their wings. A part of the oviparous quadrupeds have only one occipital condyle. Serpents have a condyle with three facets, disposed in the form of a trefoil leaf, which admits of few movements. Most fishes have only one condyle,

* If the face be examined from the top downwards, we observe the holes of the eye-brows and the orbital fossæ. In the orbital fossæ are found the ocular holes, the sphenoidal and sphenomaxillary fissures, the internal orbital foramina, and the orifice of the nasal canal. Below and between the orbital fossæ the face presents the aperture of the nasal fossæ. In these fossæ are seen the holes of the cribriform plate of the os ethmoides, the apertures of the sphenoidal sinuses and of the posterior ethmoidal cellules ; the aperture common to the anterior ethmoidal cellules and the frontal sinuses ; those of the maxillary sinuses ; the sphenopalatine foramina ; the orifices of the anterior palatine conduit. On the sides of the nose, the face exhibits also a fossa called the *canine*, in which is seen the sub-orbital foramen ; and below, the face exhibits the dental arches and the orifices of the dental canals.

articulated

articulated by means of cartilages, and which possess very little mobility. The ray and shark have two condyles, the movements of which are very confined. In the last place, the mammalia are furnished with two condyles, more or less moveable.

In man, the head is articulated on the vertebral column, by means of two tubercles or *condyles*, placed on the sides of the large occipital foramen. These condyles are fitted into two articular cavities situated on the interior sides of the arch of the first vertebra.

This disposition of the articular faces permits the head to perform, with ease, every motion of flexion and extension, backwards and forwards; and easy movements of flexion and rotation on the sides.

But the movements of rotation performed by the head are owing, in a great measure, to those performed in the same direction by the first vertebra on the second; and the different motions which the vertebræ perform on each other contribute greatly also to those of the head.

The articulation of the head is secured by an *anterior ligament*, a *posterior ligament*, and an *articular capsule*.

The peculiar articulation of the second vertebra on the first, by means of the odontoid apophysis of the latter on the anterior arch of the former, is
secured

secured by a *transverse ligament*, two *lateral ligaments*, an *accessory ligament*, and a *capsule*.

The middle of the head is not placed exactly on the vertebral column, and Camper has observed that the part which is before the large occipital foramen is to that behind in the ratio of eight to seven; so that the head, when not kept back, has a slight tendency to fall forwards.

In the vertical position of the head, man alone has the mouth and eyes looking directly forwards.

We have already seen that the trunk and head consist of bones, some of which have always their fellow, while others are constantly single. The single bones are always symmetric, that is to say, can be divided into two similar parts: these are necessarily placed in the centre. Bones which have fellows are always placed one on the right and the other on the left, and never have a symmetric form; so that in the skeleton one side has a perfect resemblance to the other.

OF THE LIMBS.

29. LIMBS IN ANIMALS. The skeleton of serpents and fishes consists of the trunk and the head only; but that of oviparous quadrupeds, birds, and the mammalia, is provided with four limbs, which seem always to be formed according to an uniform plan.

The fins of fishes, properly so called, are parts which supply the place of limbs; but they cannot be considered as such, because their structure has nothing in common with that of limbs.

Cetaceous animals, which are not fishes but amphibious mammalia, have no fins: their place is supplied by limbs, which discharge the same functions.

The limbs of all animals are constantly fixed, some to the breast or *thorax*, and others to the *pelvis*; on which account they are distinguished into *thoracic* and *pelvian*.

Thoracic Limbs.

30. THORACIC LIMBS OF ANIMALS. The thoracic limbs of animals are the shoulder, the arm, the fore-arm and the hand; the pelvian are the haunch, the thigh, the leg, and the foot.

The

The other limbs vary in the different orders of animals, with respect to their form, their length, their covering, and in particular their termination. This variety determines the use for which they are proper.

31. SHOULDER IN ANIMALS. The shoulder consists sometimes of one bone called the *scapula* (*omoplata*), as is the case in the mammalia with solid hoofs. It is often formed of two bones, the *scapula* and the *clavicle*; as in the quadrumana, some carnivorous animals, and the greater part of oviparous quadrupeds. In birds it consists of three bones, viz. the *scapula*, the *clavicle*, and the fork.

The shoulder has always a cavity which receives the head of the bone of the arm. This cavity, for the most part, is contained in the *scapula*; sometimes it is formed both in the *scapula* and *clavicle*; and in birds the three bones of the shoulder concur towards its formation.

The *scapula* is generally a broad, flat bone, situated at the dorsal part of the ribs; but its figure greatly varies in different animals: in the mole it is exceedingly long; in the frog and the toad it consists of two pieces.

The *clavicle*, for the most part, is a long thick bone, resting on one side on the top of the sternum, and on the other against the *scapula*, which it

fixes and keeps back. All animals provided with this bone can extend their thoracic limbs forwards, with more or less facility to perform great motions.

Animals which have no clavicle employ their thoracic limbs only for walking. Some carnivorous animals, such as dogs and cats, &c. have the clavicular bones suspended in the flesh, and altogether useless.

The forked bone in birds has the form of the letter V; it serves, together with the clavicle, to keep the scapula firm, and to prevent it from advancing too far forwards: birds which have this bone exceedingly strong fly, in general, with great rapidity.

The shoulder of the tortoise consists of three bones, analogous to those of birds: these bones coalesce, and form only one osseous piece.

The shoulder, in man, consists of the scapula and the clavicle.

32. The *scapula*. The scapula is a flat, thin, triangular bone, placed at the top of the back behind, having one of its angles elongated and directed downwards.

Its external face has, at the upper part, a projecting apophysis, running across it, which is prolonged outwards by a large tuberosity flattened from the top downwards, and on the side of which the clavicle rests. This apophysis is called the

acromion :

acromion: its upper edge is distinguished by the name of *super-acromian*, and the lower by that of *sub-acromian*.

The external angle of the scapula, which is truncated and swelled up, presents a facet, to receive the head of the bone of the arm: above and within this facet is a very strong apophysis bent forwards, and known by the name of the *coracoid*.

The scapula is secured by muscles.

33. The *clavicle* is a long, round bone, bent into the form of an *f*: it is articulated on one part into the top and sides of the sternum, and on the other with the side of the acromion apophysis. The acromian extremity is united to the acromion by an *articular capsule*, and two *ligaments* (the *rhomboid* and *conoid*) which proceed from the coracoid apophysis.

The sternal extremity is fixed to the sternum and the cartilage of the first rib, by an articular capsule, a *costo-clavicular*, and a strong *inter-clavicular* ligament. This articulation has also an *inter-articular* ligament.

It is seen by this disposition that the shoulder is articulated with the trunk only by the extremity of the clavicle, which is united to the sternum; and that the scapula can perform great movements by gliding on the thorax.

34. THE ARM. The arm, in all animals, consists

sists of only one bone, called the *humerus*: this bone varies with respect to its proportion; it is exceedingly short in cetaceous animals, and very long in bats.

35. THE HUMERUS. The humerus of man has at its upper extremity a smooth hemisphere, turned inwards and upwards *, by means of which it is articulated with the scapula.

Around this hemisphere is a slight depression, which forms its neck; and on the back part of it there are two *tuberosities*, one larger than the other: the largest is distinguished by the name of the *trochiter*, and the smaller by that of the *trochin*: they are separated by a *groove*. The articular facet of the scapula, which is narrow and almost plane, is incrusted in a thick cartilage turned up at the edges, so as to form a cavity proper for receiving the hemispheric facet of the humerus: these bones are maintained in their proper positions by an articular capsule, which embraces the neck of the humerus, from the osseous and cartilaginous edge of the cavity of the scapula.

The arm can perform on the shoulder very free movements, in every direction.

* In describing the bones of the thoracic limbs of man, it is supposed, in regard to the respective position of the different parts, that the limbs are extended along the body with the palm of the hand turned forwards.

The humerus becomes broader at the lower part: it is plane behind, convex before, and turned a little outwards: it is terminated on the sides by two tuberosities: the *interior*, which is larger and does not descend so low, is called the *epitrochlea*; the other is known by the name of the *epicondyle*. At the extremity of the bone there are two smooth round surfaces, slightly hollowed into two grooves, separated from each other by a projecting line: the interior moves around the bone, from the fore-part backwards, in the form of a pulley, *trochlea*; and is terminated before and behind by a cavity: the exterior is placed at the lower part before, and is called the *condyle*.

36. THE FORE-ARM. The fore-arm in some animals, such as the bat, consists of only one bone; in ruminating animals it appears to be formed of two bones which have coalesced: in the greater part of animals, and in man, it consists of two distinct bones, called the *cubitus* or *ulna* and the *radius*.

37. *Cubitus*. The bone of the elbow, which is slender and of a triangular shape, becomes larger at the upper part, where it has a deep articular indentation of a semi-circular form, turned forwards and inwards, called the *sygmoid* cavity. The humeral extremity of this bone has on the back part an eminence, which forms the elbow or *ole-*

cranon: before, it has a larger one called the *coronoid*, and within a small articular *facet* called the small *sygmoid cavity*: this articulation is secured by an *anterior ligament*, a *posterior ligament*, two *lateral ones*, and a *capsule*.

The bone of the elbow is terminated below by a small plane articular facet, on the interior side of which is an *apophysis* called the *styloid*.

38. *The radius*. The radius at the upper end has a small articular facet, somewhat concave, the smooth internal edge of which is articulated with the small *sygmoid cavity* of the cubitus. Below the head it is much smaller, so that this part forms its neck. This bone becomes broader towards the lower end, and is terminated by an articular facet, lengthened in a cross direction, and somewhat concave. On the exterior side of this bone is a *styloid apophysis*, and on the interior a small articular facet, which corresponds with that of the *cubitus*.

The fore-arm is articulated on the arm by its two bones, which are articulated also with each other above and below.

The *sygmoid cavity* of the cubitus embraces the articular facet of the humerus, which is shaped like a pulley, and gliding on it causes the fore-arm to execute great movements on the arm as if by a hinge. The olecranon placing itself in the cavity which is behind the pulley of the humerus,
limits

limits the motion of extension; and the coronoid eminence by resting against the cavity, which is before this pulley, fixes the movements of flexion.

The articular facet of the radius rests against the rounded surface on the exterior side of the pulley of the humerus, and glides on that surface, accompanying the cubitus in its motions.

In its articulation with the humerus, the radius can turn on itself. This rotary motion takes place at the top against the external edge of the cubitus, and at the inferior end around that bone.

The bones which form the articulation of the cubitus are secured by an articular capsule, and two lateral ligaments.

The interstice between the two bones of the fore-arm is filled up by a very strong *interosseous* ligament. The two bones of the fore-arm are kept together also above by an *annular* ligament, and below by a capsule or *triangular* ligament.

39. The last part of the thoracic limb has received different names*, according to its particular disposition; but in all animals it consists of the *carpus*, the *metacarpus*, and the *phalanges*.

40. CARPUS. The carpus is composed of small short bones of an irregular figure, the number of which is variable. In birds it is formed of two bones in a row. The number of the bones of the

* It has been called hand, paw, hoof, pastern, bastard wing, fin, &c.

carpus varies in the mammalia from 5 to 10, which are always disposed in two rows.

In oviparous quadrupeds, most of the batrachians have the carpus formed of eight bones in three rows.

41. METACARPUS. The metacarpus consists of longish bones, the number of which varies from 1 to 5; but in general it is equal to that of the fingers.

In ruminating animals and the *solipeda* the metacarpus consists of a very long bone, which constitutes the cannon bone. This bone seems to add to the limbs of these animals one part more, which in them is generally taken for the fore-leg.

The metacarpus of birds is formed of a bone with two branches united. In cetaceous animals the bones of the metacarpus are united and flattened.

42. THE PHALANGES. The phalanges are those longish bones which form the fingers. Sometimes they have the appearance only of imperfect rudiments; the perfect phalanges form fingers, which remain concealed under the skin, or are covered by lax membranes, or are enveloped in a carneous matter, or form externally separate and distinct fingers.

Animals have never more than five fingers, each of which consists, at most, of three phalanges; and the thumb has never more than two. The *solipeda* have only one perfect finger, which is known by the name of the pastern, coronet or
coffin-

coffin-bone. Ruminating animals have two fingers, supported by the bone of their metacarpus which forms the cannon bone. The three-toed sloth has three fingers. Several animals with solid hoofs have four fingers, as the swine, the tapir, and the hippopotamos. In the last place, five fingers are observed in most carnivorous animals, in apes, and in man.

In bats, the extremity of the last phalanges, which are very long, terminates in points without claws*: it is sometimes enveloped in a corneous substance, as in ruminating animals and the solipeda: it terminates in *fixed* claws in dogs, and *retractile* claws in cats: in apes and in man it is enveloped by the skin, and covered with a flat nail.

Birds have a large finger with two phalanges, and a pointed bone which supplies the place of a thumb: these two fingers, as well as the bone of the metacarpus which supports them, serve for bearing feathers†.

The thumb is formed of one or two phalanges; compared with the other fingers it is generally shorter: in carnivorous animals it is of the same length, and in the phocæ longer: in apes, and in man, the thumb is free, and can be opposed to

* Except the thumb, which remains short and nail-like.

† The thumb bears the bastard feathers, and the large finger as well as the metacarpus bears the primary feathers.

the other fingers ; this disposition forms the character of the hand.

These different constitutions of the extremity of the thoracic limb enable animals to employ it differently ; and their habits, in this respect, are always the result of the peculiarities observed in the organization of this part.

43. **THE HAND OF MAN.** In man the hand is composed of the carpus, the metacarpus, and the fingers.

44. *The Carpus.* The carpus of man is formed of eight bones*, disposed in two rows : the two of the first row towards the thumb are received in the articular facet of the bone of the radius ; the third is united to the bone of the cubitus ; and the fourth rests on the interior side of the third. The bones of the second row are articulated above with those of the first, viz. the two towards the thumb with that which is above ; the third with the second and third ; and the fourth with the third : all the bones of the carpus are articulated also with each other on the sides.

The bones of the carpus being articulated on

* Each of these bones is distinguished by a particular name. Those of the first row counting from the thumb are : 1st, os scaphoides ; 2d, os semi-lunare ; 3d, os cuneiforme ; 4th, os pisiforme. Those of the second row, taken in the same direction, are ; 1st, os trapezium ; 2d, os trapezoides ; 3d, os magnum ; 4th, os unciforme.

those of the fore-arm, must follow the movements which the latter perform on each other. Thus the bone of the radius is articulated above with the humerus, and can turn on itself by gliding on the side of the sygmoid cavity: below, this bone of the radius is articulated on the exterior side of the small head of the os cubitus, around which it turns by moving forwards, and the radius crosses before the bone of the cubitus, in the form of a saltire, describing below an arc, the size of which is determined by the breadth of the bone in that place.

In this motion of the radius the carpus, which on the one side is articulated with it by its first two bones, and which on the other is united to the bone of the cubitus by its third, is carried forwards and inwards by the radius; and in this movement it turns on the extremity of the os cubitus as on a pivot. It is thus that the movements of *pronation* and *supination* are performed.

The articulation of the three bones of the carpus with the two bones of the fore-arm is enveloped by an *articular capsule*; this articulation contains a triangular cartilage, and is fixed by an *anterior ligament*, a *posterior* and two *lateral ligaments*.

The second row of bones of the carpus is also fixed to those of the second by an articular capsule; and the bones of the carpus are connected
by

by ligamentous fibres exceedingly varied, which extend from the one to the other.

45. *Metacarpus*. The five bones of the metacarpus in man are long, and somewhat convex behind; on the upper extremity they have a facet for their articulation with the bones of the carpus; and on the sides there are other small facets for uniting them to each other: their inferior extremity is terminated by a round head, which is received by the phalanges.

The three first bones of the metacarpus are articulated with the three first of the second row of the carpus; the last two are articulated with the fourth.

The articulation of the bones of the metacarpus with the bones of the carpus is secured by an articular capsule; and by ligaments which proceeding from the second row of the bones of the carpus are fixed at the base of the bones of the metacarpus: these ligaments are numerous, exceedingly varied, and placed before, behind, and on the sides.

46. *Fingers*. The five fingers of man are each formed of three phalanges, except the thumb, which has only two.

The first *phalanges* are longer, and at the upper end have articular facets which receive the heads of the bones of the metacarpus; and at the lower end round processes which are received by the facets of the following phalanges (*phalangines*). In
the

the last place, those which terminate the fingers (*phalangettes*) are very small; they have also at the superior end articular facets, which receive the heads of the phalanges, and are terminated by a tubercle which supports the nail.

The metacarpal articulation of the thumb has always, towards its palmary face, two small round bones called *ossa sesamoidea*. Others are sometimes found towards the articulations of the other phalanges. The articulation of each phalanx is secured by an articular capsule and lateral ligaments.

Independently of the movements which the hand is susceptible of performing by following those of the radius, it can also bend forwards, backwards, and towards the sides. The bones of the carpus, as well as those of the metacarpus, perform on each other only very light and gentle movements; but the aggregate of these movements produces a very striking effect, and greatly contributes to give the hand pliability and mobility. The four fingers, being separated and free, can perform separate movements of flexion, in the articulation of the phalanges, and lateral movements on the bones of the metacarpus.

The two phalanges of the thumb, and the corresponding bone of the metacarpus, form a separate finger, which is articulated directly on the
carpus;

carpus; moves freely in every direction, and can be opposed to the other fingers.

The thumb of man is freer, and proportionally larger, than that of apes; its metacarpal bones are also less concave than those of these animals; so that man, with respect to the bones of the hand, exhibits an arrangement more advantageous than any other animal.

47. The thoracic limbs are inferior in strength to the pelvian; they are also shorter: their great mobility on the shoulder and with the shoulder; their easy flexibility in the articulation of the cubitus, but in particular that variety and pliability of motion of which the fore-arm and the hand are susceptible, form one of the great advantages which man enjoys over other animals.

Some relation seems to have been remarked between the increase of the thoracic limbs and the expansion of the bones of the cranium. It has been observed that children, in whom the bones of the cranium do not assume their usual development, because the brain is in part wanting (*acephali*), have their arms exceedingly long, while those in whom the bones of the cranium, in consequence of water collected in the inside of it, assume a great expansion, (*hydrocephali*), have the arms very short.

It may be remarked also that, of all the *manumalia*,

lia, man has the largest head and the shortest limbs. This structure would be very unfavourable for walking on all four.

Of the Pelvian Limbs.

48. PELVIAN LIMBS OF ANIMALS. All animals which have thoracic limbs are furnished also with pelvian limbs : we must however except cetaceous animals, in which these parts are wanting.

The pelvian limbs, in general, have a structure analogous to that of the thoracic limbs : thus a bone has a cavity proper for receiving the bone of the thigh, as the scapula receives the humerus : the thigh is formed of only one bone, in the same manner as the arm ; the leg like the fore-arm consists of two bones ; and the foot, in the same manner as the hand, is formed of three analogous bones. Notwithstanding this great similarity between the thoracic and the pelvian limbs, each of their parts exhibits differences so striking, that it is hardly possible to confound them ; and therefore it is of importance that they should be examined separately.

49. THE HIP. The upper part of the pelvian limb is formed of a broad bone placed at the bottom, and on the side of the vertebral column : it is called the coxal bone, and forms the hip.

The hip bones are directed in the portion of
a curve

a curve towards the belly, and unite at a certain distance from the vertebral column.

The excavation formed by the two coxal bones, and that part of the vertebral column to which they are attached, has been distinguished by the appellation of *pelvis*.

The hip bones are generally articulated without motion on the vertebral column: in tortoises, however, they are moveable. In birds the lumbar vertebræ, the os sacrum, and the coxal bones form only one.

Animals with pouches, such as the *didelphis*, have before the pelvis (*pubis*), two articulated and moveable bones, called the *marsupial bones*: to these bones are attached particular muscles, which support a bag or pouch containing the teats.

The coxal bones vary much in their form in different animals; which gives to the pelvis various configurations, and produces striking changes in the mode in which the thigh is articulated on these bones.

50. THE HIP IN MAN. The hip bone in man, which is very irregular, forms chiefly the haunch: it is broad behind, and at the top; but becomes narrower, excavated, and indented at the bottom and before.

At an early age this bone consists of three parts, which have been distinguished by names according to their position. The broad portion,

which is behind and on the sides, is called the *ilium*; that part below the first is named the *ischium*; and that entirely before is the *pubis*.

The *iliac* portion of the coxal bone exhibits behind and within a large articular surface, with which this bone is united to the *sacrum*; it then advances by a large plane portion which juts out at the top and on the sides; the upper edge of this bone is broad and rounded; it descends behind, and at the end has a large tuberosity: before, this edge terminates in a right angle, at the bottom of which is a tuberosity.

The *ischial* portion is below and before the ilial; in the middle and on the exterior side it has a deep cavity called the *cotylloid*, which receives the head of the thigh-bone; this cavity, which turns outwards, downwards and a little forwards, is not completely formed by this part of the hip bone: the other two contribute also to its formation. At the bottom of this cavity is a small fossa, and on its interior edge a deep indentation.

The ischial portion has behind two *notches* separated by a tubercle; it is terminated below by a large *tuberosity*, on which the human figure rests when it sits; in the inside and before it has a notch, which being united to another belonging to the pubis forms the *sub-pubian* hole, which in the male is oval, and in the female triangular.

The *pubic* portion of the hip bone is entirely

before ; it is terminated by a narrow edge furnished with a cartilage, by means of which this bone is applied to the cartilage of the corresponding part.

This articulation is called the *symphysis* of the *pubis*. Above their junction, these portions of bone have a prominence, and below an *arch* (of the *pubis*).

The space circumscribed by the broad hollow part of the ilium constitutes the *large pelvis* ; the other formed below by the ischium, the pubis, the os sacrum, and the coccyx, and which is narrower, constitutes the *lesser pelvis* : the name of *upper strait* has been given to the somewhat narrow edge which separates these two cavities, and that of *lower strait* to the space comprehended between the tuberosities of the ischium, the arch of the pubis and the coccyx.

These cavities behind have notches filled up in part by exceedingly strong ligaments, which serve to fix these bones to the os sacrum, and to the last of the lumbar vertebræ : they are called the *ileo-lumbar*, the *large* and *small sacro-sciatic* ligaments, and the *sacro-iliac* ligaments.

The articular portions of the hip bones, which form the symphysis of the pubis, are covered before with a cartilage of greater or less thickness.

They are kept together before by a bunch of ligamentous fibres, and below by a triangular ligament.

In consequence of the vertical position of man, the pelvian cavity is turned upwards; and it can receive and support a part of his abdominal viscera: this advantageous disposition cannot take place in animals, and particularly quadrupeds, the aperture of whose pelvis is turned directly forwards; but the region of the pubis, which in these is very narrow and forwards, is lower, and often very broad in man, and supports a part of the viscera.

51. THE THIGH. The thigh always consists of one bone, named the *femur*; which, in general, has nearly the same shape, but varies a great deal in its proportion. In ruminating animals and the solipeda it is so short, that the limb which it forms, being in part concealed by the flesh, is not commonly taken for the thigh: this bone is still shorter in the phocæ.

52. *Femur*. In man, the thigh, the length of which determines that of the limb, is nearly cylindrical: it has, however, behind a rough line called the *femoral*, which indicates the place where the muscles are attached, and is continued along two thirds of the bone at the upper part.

This bone has at its summit an articular head, which is turned inwards, and a little upwards, and which is supported by a *neck*: this head has a small depression in the middle. The femur directly above, is terminated by a large tuberosity,

which projects a little outwards, and which is distinguished by the name of *trochanter*. On its interior side behind it has a *cavity*. Behind these parts, but lower down, and a little within, is another smaller tuberosity, called the *trochantin*.

The femur is terminated below by two large articular facets, rounded from the fore part backwards in the form of the portion of a wheel, and called *condyles*: of these condyles the exterior is smaller, and does not descend so low as the interior: they are separated by a groove, which terminates behind at a depression called the *fossa poplitea*: from behind the condyles proceed two lines, which ascend obliquely, and unite at the femoral line: before these condyles the rotula is placed.

The femur is articulated by its *head* with the *cotylloid cavity* of the hip bone, and can perform on it motions in every direction. These bones are retained in their position by a strong articular capsule, and an inter-articular (*round*) ligament.

53. LEG. The leg sometimes is formed of only one bone, called the *tibia*, as in ruminating animals. In others, such as the dog, rat, swine, and birds, it is composed of the tibia and another bone or portion of a bone, which coalesces with it for a greater or less extent. In a great many of the mammalia the leg is formed of two distinct and separate bones, viz. the *tibia*, and another
much

much slenderer called the *perone* or *fibula* : these two bones are articulated below with those of the foot ; above, the tibia only is joined to the bone of the thigh, and the perone remains united on the side of the tibia. In the last place, in the greater part of oviparous quadrupeds, the two bones of the leg are articulated at the top with the bone of the thigh, and below with those of the foot.

Before the articulation of the thigh with the leg there is generally a small flat bone called the *rotula*.

In man, the thigh is formed of the *tibia* and a distinct *perone*, which is articulated above only with the tibia : the knee is furnished also with a *rotula*.

54. *Tibia*. The tibia, throughout almost its whole length, affects a triangular form : the anterior edge (*prætibial*) is very salient ; it is terminated at the top by a tubercle, to which a strong ligament is attached. This portion of the tibia becomes much larger in that part, and is distinguished by the name of the head : below this head is a plane surface, on which there are two articular faces, slightly excavated, which receive the condyles of the femur, and are separated from before backwards by a double elongated tubercle. The sides of the head of the tibia are distinguished by the name of *condyles*. A little behind the head of the tibia, under the exterior condyle, is a small articular facet, which receives the *perone*,

The tibia is smaller below, and terminates in a concave articular surface of greater extent in a cross direction, and which rests on a bone of the foot. On the interior side of this surface is a large tuberosity, prolonged below, and which forms the interior malleolus: its exterior side, slightly notched, has an articular facet, which receives the perone. The posterior face of the tibia is distinguished by the name of the poplitean.

55. *Perone*. The perone, which is very slender, is situated at the exterior side of the tibia, and a little behind it. At the upper extremity it has a head, on the side of which is an articular facet resting against that bone. At the lower end the perone descends below the tibia: it makes a projection outwards, which forms the exterior malleolus, and on the inside has an articular facet for its junction with the tibia, and the bone of the foot which receives it.

56. *Rotula*. The rotula is a small flat round bone, having behind it a double facet, which corresponds before the femur.

The articulation of the knee is secured by an *articular capsule* and two *lateral* ligaments; before by a strong ligament, which belongs to the rotula, and behind by two *cross* ligaments: this articulation has also two inter-articular cartilages of a *semilunar* form.

The

The perone is fixed to the tibia by an articular capsule, and an anterior and posterior ligament.

The space left between the two bones of the leg, which is larger above, is filled by a ligament attached on the edges of these bones.

The leg can perform only very extensive movements of flexion backwards.

57. LAST PART OF THE PELVIAN LIMB.

The last part of the pelvian limb, like that of the thoracic limb, has received different names according to its mode of termination; but it is always formed of a *tarsus*, a *metatarsus*, and *toes*.

The bones of the tarsus vary very much both with respect to their form and number. The tarsus in birds consists of only one bone; in the three-toed floth it consists of three; in ruminating animals, of from five to six, and very often of seven. The bones of the tarsus are in general thick and short: in some animals, however, they are very long.

The bones of the leg are articulated, in general, with only one bone of the tarsus; but in reptiles they rest on two bones of that part*.

The bones of the metatarsus, in animals, have the same general arrangement as those of the metacarpus; and the toes, which are articulated to one or the other of these parts, exhibit also the same mode of termination.

* The tibia rests on the astragalus, and the perone on the calcaneum.

The pelvian limb has only five toes * ; each toe consists at most of four phalanges †, and the large toe has only two ‡. The folipeda have only one toe on the hind-foot, and one finger to the fore-foot. Ruminating animals have two on each foot, articulated on their cannon bone. Some animals, such as the tapir and the rhinoceros, have three toes, and the swine has four. The greater part have five. The frog has six. The toes are often parallel, as in carnivorous animals: in the quadrumana and pedimana the great toe is a *thumb*, which can be opposed to the other toes. In birds which have three toes they are parallel: those furnished with four have one or two turned backwards, or all the four turned forwards. The number of the phalanges in these animals is increased by one for each toe, proceeding from the great toe. The large toe is shorter than the rest in the quadrumana and pedimana, all the toes of which are very long: in some of the carnivorous animals it is nearly equal to the rest: in man it is the largest of all the toes,

58. FOOT OF MAN. The foot of man is formed of the tarsus, the metatarsus, and the toes.

Tarsus. The tarsus of man consists of seven bones. That on which the two bones of the leg

* The frog has six.

† In the toe before the last of the lizard there are five.

‡ In that of the chameleon there are three.

are articulated is called the *astragalus*; it is placed on another larger bone which forms the heel, and which is called the *calcaneum*: a third, situated before the *astragalus*, is distinguished by the name of the scaphoid bone (*os scaphoides*) or navicular bone (*os naviculare*). The other four, placed in a row, receive the bones of the metatarsus: the first three, counting from the great toe, are known by the name of the *cuneiform* bones, and the fourth by that of the cuboid.

59. *Astragalus*. The astragalus has at the top an articular facet, rounded from before backwards, in the form of the portion of a pulley; it is received by the articular cavity of the tibia. On the sides of this facet, the astragalus receives without, the extremity of the perone, which forms the exterior malleolus, and within the tuberosity of the tibia, which produces the interior malleolus. The astragalus has also articular facets for its union below with the calcaneum, and before with the scaphoid and even the cuboid bones.

60. *Calcaneum*. The calcaneum, which is larger than the preceding bone, is lengthened from the fore part backwards; and has above and before a deep indentation or notch which receives the astragalus, and directly before another facet for its junction with the cuboid bone. This bone is lengthened behind by a large tuberosity, which
forms

forms the projection of the heel, and below it there are two tubercles.

61. *Scaphoid bone.* The scaphoid bone is articulated behind with the astragalus; on the outside with the cuboid bone, and before with the three cuneiform bones.

62. *Cuboid bone.* The cuboid is united behind to the calcaneum and the astragalus; in the inside to the scaphoid bone and the third cuneiform bone; before it is articulated with the two last bones of the metatarsus.

63. *Cuneiform bones.* The three cuneiform bones are articulated behind with the scaphoid bone; on the outside with the cuboid, and before with the four first of the metatarsus; so that the first cuneiform bone touches the two first bones of the metatarsus; the second touches only the second; the third touches the second, the third, and the fourth. These bones are articulated with each other on the sides. It is to be observed that the three cuneiform bones have really the form of a wedge; that their disposition with the other bones of the tarsus is such, that this part forms a moveable arch marked by the instep, and that, in progression, all the bones of the tarsus do not rest on the ground.

64. The articulation of the leg with the foot is secured by a *capsule*, an *interior lateral ligament*, and three *exterior lateral ligaments*.

The

The five bones of the metatarsus, which are nearly of the same length, have behind articular facets for their union with the *cuboid* and the three cuneiform bones; and before small heads, which are received by the excavated facets of the first phalanges: these bones are articulated also with each other on the sides by their posterior extremity.

The articulation of the bones of the tarsus with those of the metatarsus, and that of all these bones with each other, is secured by ligaments analogous to those which fix the bones of the carpus and metacarpus; except the first bone of the metatarsus, which is not separated like the first of the metacarpus.

The phalanges of the toes have the same mode of articulation and the same means of junction as those of the fingers, and are equal to them in number.

The five toes are parallel; and the large toe is longer than the rest, which go on decreasing in size to the last.

65. The structure and arrangement of the bones of the foot are such, that they constitute an arch more elevated and more extensive in the inside than without: the foot rests behind on the extremity of the calcaneum, which is directed a little outwards; it rests before on the anterior extremity of the bones of the metatarsus, and on the toes; and in the middle of its exterior edge the foot rests

on the posterior head of the last bone of the metatarsus. It is to be remarked, that the astragalus forms in the inside the summit of the arch, and that the leg, supported by this bone, corresponds with this arch in the place where the bones by which it is formed do not touch the ground.

66. Besides the bones already mentioned, there are always two small round bones below the metatarsian articulation of the large toe: there are small bones also sometimes at the articulations of the phalanges: these bones are called the *sesamoid* (*ossa sesamoidea*).

67. The bones of the limbs have also some peculiarities common to the bones of the trunk and the head: thus, for example, they are all covered with a periosteum; frequent asperities, which mark the places where the muscles adhered, are also observed in them, and they have holes by which they are pierced throughout their whole thickness. The long bones have also in the inside a cavity, larger in the middle, which goes on increasing to the extremities, where it terminates in osseous fibres that cross each other in different directions, and form a kind of *net-work*.

The cavities of the long bones are lined also with an interior periosteum.

68. The skeleton, examined in general, ex-

hibits an assemblage of pieces equally pliable and strong.

The vertebral column consists of 24 very short bones, light, exceedingly strong, articulated in several points, and their articular surfaces are covered with a thick cartilage highly elastic, and susceptible of yielding to every purpose. All these bones are retained in their position by ligaments sufficiently strong and numerous to give that column the requisite degree of strength. The aggregate of the vertebræ affects different curves, which can be increased or diminished according to circumstances.

The head rests on the vertebral column almost by its centre; and the two first vertebræ have a peculiar disposition, which allows the greatest movements.

The disposition of the bones of the cranium, in the form of an arch, is exceedingly well calculated to secure the brain from the action of all external bodies; and the vertebral canal protects the prolongation of the brain which it receives.

The vertebral column serves also to support the ribs, the aggregate of which, together with the sternum, forms a conical cavity strong and exceedingly flexible, which envelops the heart and the lungs.

The vertebral column rests on the os sacrum: this bone with the two hip bones forms a cavity,
the

the different pieces of which, united strongly by cartilages * and ligaments, are however susceptible, when necessary, of very striking movements.

The cotyloid cavity is situated in an oblique direction on the exterior side of the hip bones: the femur is bent forwards; its head and neck have an oblique direction, and its interior condyle is longer: the knee is slightly inclined inwards, and the thigh is always ready to bend upon the leg: the tibia is somewhat curved, and the foot inclines outwards, and forms an arch.

This general construction, which every where exhibits curves, angles, and folding levers, unites agility to strength, and seems to be well adapted for performing, without any shock, those movements communicated to the trunk by stamping the feet against the ground.

69. When a man walks fast, stamps with his foot, or falls in an upright posture, there is produced, in this action, a quantity of motion which must necessarily be employed, and produce an effect; and if by habit this effect occasions no disorder, the motion must be distributed by a peculiar disposition to every part, without producing any shock.

When the foot indeed strikes the ground, the

* These cartilages swell up during the last months of pregnancy; which gives more amplitude to the pelvis, and disposes the bones of which it is formed to move with greater facility.

motion produced is communicated to the places which begin to bear : thus the heel, the anterior extremity of the bones of the metatarsus, and the exterior edge of the foot, receive the first impression. The arch formed by the foot on the interior side gradually sinks down ; the inter-articular cartilages yield, and the motion then propagated along the tibia immediately increases its curvature.

The motion, when it reaches the knee, is not communicated in a straight line to the thigh : it divides itself on the sides, passes from the condyles of the tibia to those of the femur, and the femilunar cartilages, interposed between these parts, immediately yield : on the other hand, the direction of the knee inwards and somewhat forwards disposes it to give way, and it then bends.

The motion being then continued along the femur immediately increases its curvature, and when it reaches its neck forces it to bend. The head of the femur does not bear directly under the pelvis, but rests obliquely in the cotyloid cavity ; so that it acts upwards and backwards on the edge of that cavity, compressing the articular cartilages ; and at that moment the pelvis bends on the thigh as the thigh bent on the leg.

It is to be observed, that, in this action of the parts, the articular capsules, the ligaments and the muscles,

muscles, which surround the articulations, easily give way, and recover their former state.

The motion communicated to the bottom of the cotyloid cavities tends to carry the hip bones upwards and inwards. To obey this impression, the curvature of these bones decreases momentarily ; they move before in the articulation of the symphysis, and behind they glide on the sacrum. This bone, shaped like a wedge, penetrates between the hip bones, tends to separate them, and opposes the first impulse that tended to bring them together : in this action the inter-articular cartilages and the ligaments yield more or less.

In the last place, if any motion remains, it is communicated obliquely to the vertebral column by the top of the sacrum, and continuing along that part it increases its different curvatures ; depresses its inter-articular cartilages ; and causes the vertebræ to glide on their different surfaces. The motion, when it reaches the cervical region, communicates itself to the head, which is there suspended, and as it were in equilibrium ; and as it has a tendency to fall forwards it bends on the neck.

From this arrangement, it may be seen that the sum of the motion communicated to the feet must be very great before there can reach the vertebral column

column and the head a quantity capable of producing derangement in the parts it contains; which indeed happens very rarely.

70. *Female skeleton.* The female skeleton is in general shorter than the male; but the trunk is comparatively lengthened, so that the half of the body, which in man corresponds to the pubis, is above that part in the female. The bones which compose the female skeleton are slenderer, weaker, smoother, rounder and whiter: the eminences, asperities, cavities, and holes, are neither so strong nor so striking.

The female skeleton, compared to that of the male, exhibits also very apparent local differences.

The vertebral column is comparatively longer, and the capacity of the breast shorter; so that the lumbar region is the most extensive. The greater elongation of the trunk seems to be connected with a greater thickness of the bodies of the lumbar vertebræ, and particularly of their inter-articular cartilages.

The alternate curvatures of the vertebral column seem a little less striking in the female; but the whole trunk affects a sort of obliquity; the sacral region is thrown backwards; the breast is carried more forwards, and the head requires to be kept more erect. This disposition, which is owing to the greater capacity of the pelvis, and the more

forward position of the cotyloid cavities, is still increased in the state of pregnancy, when the projection of the abdomen forces the breast and head to be thrown backwards, in order that the equilibrium may be preserved.

The transverse apophyses of the dorsal vertebræ are thrown more backwards; the posterior arch of the ribs is more convex, and the vertebral grooves are more excavated.

The ribs are slenderer as well as smoother; their convexity behind is much greater, and the cartilages of the false ribs are more elongated.

Of the two pieces which compose the sternum, the superior is generally thicker and longer. The inferior is much shorter in the female, but in such a proportion that the whole sternum is shorter: the point of it is thrown a little forwards, while in man it is turned directly downwards.

In consequence of the peculiar structure of the dorsal vertebræ, of the ribs and the sternum, the thorax, in the female, has less transverse breadth; is less flattened before, and is more convex behind; it is also wider below, and more rounded in its circumference.

The clavicle, in the female, is longer, and almost straight, so that the shoulders are thrown more backwards, and project less on the sides of the thorax. To this peculiar disposition of the
scapula,

scapula, thrown farther back, is ascribed the difficulty which women experience in performing great movements with the arms, and in projecting bodies, which they cannot do with the same force and ease as men.

The head, in the female, is smoother and more rounded; and the face is shorter.

The pelvis, in general, is broader and shallower in the female; the iliac portions of the hip bones are thrown more back; the pubis is transversely broader, and has less height: the pubian arch is wider, and the sub pubian hole is triangular. The aperture of the pelvis is turned more upwards; the distance of the tuberosities of the ischium is greater, and the curvature of the os sacrum is more apparent.

The cotyloid cavities are more forward, less oblique, and of less depth.

The neck of the femur has a more horizontal direction; the interior condyle of that bone is larger, more convex, and descends lower.

It follows from the peculiar conformation of the pelvis, and that of the femur in women, that the haunches are broader; that the sacral region projects more posteriorly; which determines the inclination of the trunk, and the projection forwards of the thorax. The cotyloid cavities are at a greater distance, and the knees are larger, and ap-

proach each other more ; which forces the feet to turn outwards.

This peculiar disposition determines the grand lateral movements of the pelvis, which women perform in walking to transport alternately the weight of the body to the two femora, and thus preserve the centre of gravity.

Dupuytren has observed, that till the age of puberty the female pelvis differs very little from that of the male ; that both have the same triangular form, and the antero-posterior diameters nearly equal : but at that period the female pelvis acquires a rapid expansion ; it becomes oval ; its transverse diameter has less extent, and it soon assumes all its distinguishing characters.

The general disposition of the breast and pelvis, in the male and female, is such, that if two parallel lines be continued upwards and downwards, from the sides of the thorax, it is observed in the male that a part of the shoulders is cut by these lines ; while in the female these lines intersect a part of the bones of the pelvis. The breast in the male is in some measure square ; in the female it is conical.

71. During the first days of conception, the germ is a gelatino-albuminous fluid, in the middle of which fibres or filaments gradually appear.

This

This state continues till the 20th day, at which period there is developed in different points of the embryo a concrete, white, elastic substance, called cartilage; and towards the 30th or 40th day the foetus begins to exhibit in various parts of the cartilages some specks of more consistence, which are the first development of the bones.

It is remarked that one cartilage only is formed for the whole of the bones that are to remain united; such as the cranium, the vertebral column, and the pelvis; and that a particular one is formed for each of the bones which are to remain separate and moveable. The part which at that period forms the cavity of the cranium is a sort of membrane.

The bones continue to expand during the time of gestation: the first points of ossification appear in the bones of the shoulder and those of the cranium; they next appear in the ribs, the bones of the arm and fore-arm; then in the vertebræ and the pelvis: in the last place, they are seen in the bones of the thigh and leg, in those of the metacarpus, the metatarsus, the fingers and the toes.

The bones of the carpus, those of the tarsus, the calcaneum excepted, and the rotula, remain cartilaginous till after birth.

The long bones expand by three points of ossification; one for the centre, and two for the extremities: the large flat bones have their point of

ossification in the centre. This point furnishes longitudinal or radiated fibres, which advance, meet, and cross each other to form one solid piece.

At the period of birth the skeleton of the foetus exhibits very remarkable peculiarities; the whole of it is still, in a great measure, cartilaginous.

The vertebral column is quite straight, and its apophyses scarcely appear.

The breast is very small, and the head is comparatively very large.

The bones of the face are not much expanded, and the face itself is exceedingly short; for the want of teeth exhibits a facial angle very large. The sinuses of the head, as well as its different prominences, are scarcely marked; while the cavities of the eyes, and particularly the auditory canals, seem at that period, to have acquired their full expansion.

The thoracic limbs are comparatively very long. The pelvis is very small, and its axis is almost directed straight upwards.

The thighs and the legs are also very slender and short; so that in the foetus, at that period, the half of the body corresponds nearly to the navel.

The bones, which are flexible and slender in infancy, increase by degrees, and their complete expansion makes the skeleton assume the form which it is observed to have in adults. When the body
has

has attained to its full growth, the bones are firmer as well as more elastic, and assume a grayish colour ; but with age they become dried and more brittle, and their colour is a dirty yellow.

72. In old age all the prominences, cavities, asperities and holes are more apparent ; the curvatures of the bones are greater ; the articulations are less moveable in consequence of the ossification of a part of the cartilages, ligaments, tendons, capsules, &c. by which the articulations are surrounded.

The face becomes shortened by the loss of the teeth ; the chin stands more forward, and the alveolar edges become sharper.

73. The various parts of the bones exhibit striking differences in regard to their density ; some are formed of a closer and more *compact* tissue, and have a white and smooth appearance ; others exhibit a cellular, polyedral tissue, lax, and as it were spongy ; they are lighter, and not so white ; some of these bones exhibit only a few fibres, which cross each other, and form an open or *reticular* tissue : in a word, they compose solid bodies more or less elastic, which seem to consist of laminæ laid above each other.

74. If a bone be placed in an acid, such as the muriatic, diluted with water, it becomes soft, and

loses about the half of its weight. Carbonic acid gas is disengaged from the liquor, and there is deposited at the bottom a sediment, the weight of which is equal to that lost by the bone: this deposit is muriate and phosphate of lime: what remains of the bone exhibits a fibrous, vascular and gelatinous character.

If a bone be placed in a solution of caustic alkali (potash or soda), it loses half its weight in the same manner; it remains solid, but becomes brittle and friable: the residuum is found to be a sort of soap, and the earthy part is phosphate and carbonate of lime.

In the last place, if a bone be calcined in an open fire, it still loses half its weight, and what remains is phosphate and carbonate of lime.

If it be required to ascertain, by a more accurate analysis, the quantity of solid matters which enter into the composition of bones, the following method may be employed: calcine the bones till they are white, and, having pulverized them, subject them to the action of the nitric acid. This acid will dissolve the lime and the phosphate of lime: then pour ammonia into the solution, and the phosphate of lime will be precipitated: separate this salt by filtration, and weigh it after it has been thoroughly dried. The filtrated liquor still contains lime, which must be precipitated by common potash: this lime is united to carbonic

TABLE OF THE BONES WHICH FORM THE SKELETON.

THE SKELETON IS COMPOSED

1st. OF THE TRUNK, <i>which comprehends,</i>	1st. THE VERTEBRAL COLUMN, <i>formed by</i>	24 VERTEBRA, viz. 7 cervical (the 1st Atloid, the 2d Axoid), 12 dorsal, 5 lumbar, the sacrum and the coccyx.	
	2d. THE THORAX, <i>formed by</i>	12 RIBS on each side (7 sternal, 5 asternal), the sternum and the 12 dorsal vertebræ.	
2d. OF THE HEAD, <i>which comprehends,</i>	1st. THE CRANIUM, <i>formed by</i>	The sphenoid, the frontal, the parietals, the occipital, the temporals, and the ethmoid.	
	2d. THE FACE, <i>formed by</i>	The frontal, the sphenoid, the bones of the nose, the lachrymals, the zygomas, the super-maxillary, the palatine bones, the ethmoid, and its turbinated bones, the maxillary; 32 teeth, 8 of which are incisors, 4 angular, and 20 molar.	
3d. OF THE LIMBS	1st. THE THORACIC, <i>formed by</i>	1st. THE SHOULDER, <i>formed by</i>	1st. The clavicle;
		2d. THE ARM, <i>composed of</i>	2d. The scapula.
		3d. THE FORE-ARM, <i>composed of</i>	The humerus.
			1st. The cubitus.
	4th. THE HAND, <i>formed by</i>		2d. The radius.
			8 bones in two rows, which are <i>counted</i> from the thumb, and which are called:
			1st Row. { 1st. The scaphoid, 2d. the similinear, 3d. the cuneiform, 4th. the pisiform.
			2d Row. { 1st. The trapezium, 2d. the trapezoid, 3d. os magnum, 4th. the unciform.
	1st. THE HAUNCH, <i>composed of</i>	2d. THE METACARPUS, <i>composed of</i>	5 bones of the metacarpus.
		3d. THE FINGERS, <i>each composed of</i>	3 phalanges (2 in the thumb), which are <i>counted</i> from the metacarpus; and which are called Phalanges, Phalangines, Phalangettes.
			The two hip-bones, with the sacrum and coccyx, form the pelvis.
			The hip-bone.
	2d. THE PELVIAN, <i>formed by</i>		The Femur.
			1st. The Tibia.
			2d. The Perone.
			3d. The Rotula.
4th. THE FOOT, <i>formed by</i>	1st. THE TARSUS, <i>composed of</i>	7 bones: the astragulus, the calcaneum, the scaphoid, the 3 cuneiform bones, and the cuboid.	
	2d. THE METATARSUS, <i>composed of</i>	5 bones of the metatarsus.	
	3d. THE TOES, <i>each composed of</i>	3 phalanges (2 in the great toe), which are <i>counted</i> from the metacarpus, and which are called Phalanges, Phalangines, Phalangettes.	

MUSCULAR SYSTEM.

76. OUR organs are moved by means of muscles. The greater part of the carneous mass, the meagre and fibrous portion of the flesh of animals, constitutes the muscles. They are composed of fibres in bundles.

The fibres of the muscles are subdivided in an indefinite manner. Each fibre, and each bundle of fibres, is enveloped by a cellular membrane, which is a tissue of vessels. Each muscle also is surrounded by a cellular membrane of greater thickness.

The muscles are continued, and generally terminate in a smooth, white, shining substance, of a very compact fibrous texture, round or flat, and always of less size than the body of the muscle. That portion of a muscle which terminates in a cord is called a *tendon*; and that which spreads itself into a broad flat surface is distinguished by the name of *aponeurosis*. It is generally by these tendinous or aponeurotic parts that the muscles are fixed to the bones.

The gelatinous, albuminous, and fat substance, contained in the *cells* of this *tissue*, produces fullness of the muscles.

The cellular tissue, interposed between the fibres
of

of the muscles, varies both in regard to its nature and quantity in different animals, in their different parts, and according to the different circumstances of health or disease.

In the mammalia the muscles are of a darker or lighter red colour; in the gallinaceous they are paler, and in reptiles and fishes almost white.

The muscular fibres have the property of contracting, of becoming shorter, of carrying with them the moveable points to which they are fixed, and of producing, in this manner, various movements.

The muscles of reptiles and of fishes, which have white fibres, contract with much greater force and velocity than those with red fibres of other animals.

Muscles are never found but in parts which perform very striking movements; and they are stronger and of greater length, according as these movements are greater and more energetic.

The movements performed by our different parts are always a result of the form of the bones, of the peculiar disposition of their articular surfaces, of the different points by which the muscles are affixed to these bones, and of the direction of the muscular fibres. Consequently a knowledge of the ratio of the articular surfaces of the bones of any part, and of the nature of the motions which it performs, may always serve to determine, in a
general

general manner, the size, form, and direction of the muscles of that part. But as the muscles do not always produce their action in a straight line; as they often act by points of reflection; to have a sufficiently correct idea of them, it is necessary to know minutely their peculiar disposition in man.

77. In the different animals the position of the muscles, which are fixed to the vertebral column, varies according to the motions which are performed by that part. Thus the muscles are opposite to the spinal and præspinal face of the vertebræ, when the vertebral column bends forwards or is thrown back, as in the mammalia, birds, and reptiles. In animals which perform only lateral movements with the spine, such as fishes, these muscles are situated on the sides of the rachis or spine. In animals which make the vertebral column, or one of its parts, move in all directions, as is the case with the bodies of serpents, the neck and tail of many of the mammalia, muscles are found on the four faces of that part. In those parts of the vertebral column which perform no motion, muscles are wanting: this is the case with the spinal face of fishes, the dorsal region of birds, and the præspinal face of the dorsal and lumbar vertebræ of most animals.

78. MUSCLES IN MAN. In man, the muscles
affixed

affixed to the vertebral column, in order to make it move, are placed chiefly on the spinal face.

79. *Muscles which produce motion in the vertebral column.* A very thick muscle, which extends from the os sacrum to the atloid vertebra, runs along the spinal face of the rachis. This muscle is single inferiorly, and is fixed to the posterior part of the os sacrum, and the edges of the os ileum. When it reaches the lumbar region, it divides itself into three parts: the first is inserted in the transverse apophyses of the lumbar vertebræ, at the angle of the ribs, and in the transverse apophyses of the last cervical vertebræ: THE DORSO-TRACHELIAN or *sacro-lumbar* portion; the second part adheres to the transverse apophyses of the lumbar and dorsal vertebræ, as well as to the inferior edge of the last eight ribs: THE COSTO-TRACHELIAN or *long dorsal part*; this portion comprehends another, which extends from the transverse apophyses of the last five vertebræ of the neck to the first four or five of the back: *accessory of the long dorsal* or *great transverse muscle of the neck*; the third portion is inserted in the transverse articular and spinal apophyses of all the vertebræ: the LUMBO-CERVICAL PORTION OF *transverse spinal* *.

* The particular name of *axoido-atloidian* has been given to that which proceeds from the transverse apophysis of the axoid to the spinal apophysis of the atloid.

This

This muscle, in contracting, bends the vertebral column backwards, or keeps it in a state of rectitude: THE SACRO-SPINIAN*.

80. The spaces comprehended between the spinal apophyses of the vertebræ of the neck are filled by muscles which are fixed to these apophyses. They keep the neck straight, and draw it backwards. INTERSPINIAN OF THE NECK, *small spinal of the neck*.

81. In the cervical and lumbar regions, the muscles are fixed from one transverse apophysis to the other. When those on one side act by themselves, they bend the vertebral column towards the same side; when they act simultaneously they keep it in a state of rectitude. INTER-TRANSVERSARIAN OF THE NECK AND LOINS.

82. A muscle which proceeds before the bodies of the first three dorsal vertebræ, along the cervical vertebræ, is inserted in the anterior tubercle of

* In describing the muscles we shall retain the nomenclature of Chaussier. This methodical nomenclature of the muscles is founded on the points to which they are attached. Thus the name of every muscle is composed in general of two words, which indicate these two points: the first indicates the point which is the most fixed, and the second that which is most moveable; so that the name is a sort of concise description. We shall adopt also, for the names of the muscles, the uniform termination in *ien*, which Dumeril has given to them. [The English translator has changed these terminations into *ian*.]

the atlas: it bends the neck forwards. **PRÆ-DORSO-ATLOIDIAN**; *long muscle of the neck*.

83. To the body of the last vertebra of the neck is fixed a thin muscle which is frequently wanting. This muscle descends in an oblique direction on the side of the lumbar vertebræ, passes before the ilium, and is inserted by a flat tendon in the ilio-pubic eminence. It tends to bend the spine on the pelvis. **PUBIO-PRÆLUMBIAN**, *the small psoas*.

84. From above the upper and posterior edge of the ilium rises a muscle, which is fixed to the transverse apophyses of the first four vertebræ of the loins, and to the last rib. It serves to bend the vertebral column on the pelvis. **ILIO-TRANS-VERSIAN**, *square of the loins*.

85. Two small muscles extend from the spine of the ischium to the sides of the coccyx: these muscles tend to carry that small bone backwards. **ISCHIO-COCCYGIAN**, *idem*.

86. *Muscles which give motion to the breast.* The breast is moved by means of numerous muscles fixed between the ribs, or which extend from the ribs to the vertebræ; from the ribs to the sternum, and even from the ribs and the sternum to the bones of the pelvis.

The muscles which extend from the breast to the pelvis form in a great part the sides of the lower belly.

In

In some classes of animals the breast and lower belly form only one cavity, as is the case in birds; but in the greater number, these two cavities are separated by a broad, thin muscle called the *diaphragm*.

In the different animals, all these muscles experience variations analogous to the different configurations of the skeleton; they are in a great measure wanting in those which have no breast properly called.

87. *In man*, the interval between the ribs is filled up by two layers of muscular fibres, which adhere to the edges of the ribs, and are directed obliquely in a contrary direction. THE INTERCOSTIAN, *inter-costal*, *exterior* and *interior*.

88. To the transverse apophyses of the last five vertebræ of the neck is fixed a muscle, which is inserted in the middle posterior part of the three first ribs, by as many digitations. THE TRACHELO-COSTIAN, *scalene*.

89. Twelve muscles proceed from the transverse apophyses of the last vertebra of the neck, and from the first eleven of the back, to the angle of the ribs. TRANSVERSO-COSTIAN, *elevators of the ribs*.

90. A muscle extends from the spinal apophyses of the last two vertebræ of the neck, and the first two of the back, to the angle of the first five ribs (the first excepted). DORSO-COSTIAN, *small indented posterior, superior*. All these muscles tend, in an essential manner, to elevate the ribs.

91. To

91. To the spinal apophyses of the last two vertebræ of the back, and the first three of the loins, is fixed a muscle which extends to the last four ribs, and tends to depress them. LUMBO-COSTIAN, *small indented posterior inferior*.

92. A muscle of a triangular form proceeds from the interior surface of the sternum, and extends to the last five sternal ribs: it contributes also to depress the ribs. STERNO-COSTIAN, *triangular of the sternum*.

93. The thorax is separated from the abdomen by a large *odd* muscle, which forms its *diaphragm*.

This broad, thin muscle, tendinous in the middle and fleshy on the edges, is fixed to the lower part of the sternum, the cartilaginous contour of the ribs, the transverse apophyses of the last vertebra of the back, the first of the loins; and to the lateral parts of the bodies of the first two or three lumbar vertebræ, by two fleshy pillars. This muscle, convex on the side towards the breast, is pierced with three holes: the one on the right affords a passage to a large vein (*vena cava*); the other enters the pillars, and gives passage to a large artery (*the ventral aorta*), to the canal of the chyle and lymph, and to the *azygos* vein; the third receives the alimentary canal and a nerve (eighth pair). It retains the name of DIAPHRAGM. This muscle, becoming flat, by its continued and successive contractions,

tractions, increases the capacity of the thorax, and thus contributes to inspiration.

The muscles here described produce the movements performed by the thorax during respiration.

94. From the ilium and the pubis proceeds a large muscle which rises in an oblique direction, and is fixed to the last eight ribs by as many digitations. This muscle unites and is confounded with that of the opposite side by a very strong aponeurotic expansion, which forms longitudinally on the middle of the abdomen a line called the *median*. These muscles in contracting tend to lower the breast, and to diminish the capacity of the lower belly. ILIO-PUBIO-COSTIAN, *exterior oblique* or *large oblique*.

95. These muscles cover two others which proceed also from the ridges of the ilium to the cartilages of the sternal ribs; they are fixed behind to the spinal apophyses of the last two vertebræ of the loins, and to the os sacrum; they are united before by a double aponeurotic expansion along the median line, and have the same action as the preceding. ILIO-COSTIAN, *interior oblique* or *small oblique*.

96. Between the aponeurotic leaves of the two preceding muscles, there are two muscular bands which extend from above the pubis to the sternum; to its appendix, and to the cartilages of the last sternal ribs.

The aponeurotic leaves which receive these

muscles adhere to them in some points, and produce on them three or four transversal tendinous lines. They bend the breast on the pelvis. **PUBIO-STERNIAN**, *straight of the lower belly*.

97. A muscle, fixed by a long aponeurotic expansion to the transverse apophyses of the first three lumbar vertebræ, proceeds, in a cross direction, to the median line. It adheres also to the cartilaginous edge of the thorax, the ridge of the os ileum, the crural arch, and the pubis. These muscles compress the sides of the abdomen. **LUMBO-ABDOMINIAN**, *transverse of the lower belly*.

98. From above the pubis rise also two small muscles, which terminate in a point below the navel. **PUBIO-SUB-UMBILIAN**, *pyramidal*.

99. *Muscles which move the head.* The disposition of the muscles, which serve to move the head, varies according to the manner in which the head is articulated with the neck.

These muscles, in animals which have the neck long, such as the most part of birds, or those which have no thorax, as serpents, are fixed to a point in the neck: in the mammalia they are fixed to the neck, the breast, and the shoulders.

In quadrupeds, whose head being often very large is suspended before the vertebral column,

and has need of being continually supported, these muscles must be very strong *.

100. *In man*, the muscles which move the head have their fixed points of adhesion in the neck, the breast, and shoulders : they are situated before, behind, and on the sides.

The muscles which have a lateral position move the head when they act singly ; when they act simultaneously they direct it forwards or backwards, or keep it fixed : the latter are the most numerous.

101. To the summit of the sternum and a part of the clavicle are fixed two portions of a muscle, which unite, and ascend obliquely outwards and backwards, in order to be inserted by a broad flat tendon at the base of the mastoid apophysis. The action of one of these muscles makes the head turn on one side : when they act together they bend it forwards. STERNO-MASTOIDIAN, *idem*.

102. A muscle is fixed before to the tubercles of the transverse apophyses of the last five vertebræ of the neck, by the same number of small bands, which unite in ascending. This muscle is joined to its fellow before the first vertebra, and

* The head of these animals is retained chiefly by a very broad and thick ligament, which is attached to the spinal apophyses of the back and neck, and is fixed to the occiput ; it is known by the name of the cervical ligament.

both are inserted before the large occipital foramen. They raise the head when inclined backwards, and bend it forwards. **THE LARGE TRACHELO-SUB-OCCIPITIAN**, *anterior large straight*.

103. Behind this muscle is another very small one, fixed before and to the side of the atloid, which ascends within and is inserted before the large occipital foramen. It has the same action as the preceding. **SMALL TRACHELO-SUB-OCCIPITIAN**, *anterior small straight*.

104. Another small muscle, fixed before the transverse apophyses of the atloid, is inserted near the mastoid apophysis. It acts like the preceding. **ATLOIDO-MASTOIDIAN**, *lateral small straight*.

105. A muscle is fixed behind along the spinal apophyses of the first five vertebræ of the back, the last vertebra of the neck, and to the cervical ligament; it then rises, becomes broader, and is inserted in the transverse apophyses of the last two vertebræ of the neck (*cervical portion*), and the mastoid apophyses (*mastoidian portion*); it carries the head backwards. **CERVICO-MASTOIDIAN**, *splenius of the head*.

106. To the first four vertebræ of the back and those of the neck, the first excepted, are fixed the same number of small tendinous bands, which unite in ascending. This muscle proceeds backwards, and is inserted by a flat tendon towards the middle of the occipital arch close to its neighbour,

from which it is separated only by the cervical ligament. It keeps up the head, and pulls it backwards. TRACHELO-OCCIPITIAN, *large complexus* and *digastric of the neck*.

107. To the transverse apophyses of the first vertebra of the back, and the last four of the neck, are fixed the same number of small tendinous and fleshy bands, which unite in ascending. The muscle which they form is inserted by a flat tendon behind the mastoid apophysis. It has the same action as the preceding. TRACHELO-MASTOIDIAN, *small complexus* or *lateral mastoidian*.

108. To the transverse apophysis of the first vertebra of the neck, is fixed behind, by a thick tendon, a muscle which becomes much broader, ascends obliquely behind and on the side, and is inserted in the lower part of the occipital arch near the mastoid apophysis. These muscles elevate the head. ATLIDO-SUB-MASTOIDIAN, *superior oblique* or *small oblique*.

109. A muscle, which grows broader as it rises, and is inserted on the sides of the occipital arch, below the preceding muscle, is fixed to the spinal apophysis of the second vertebra of the neck: it elevates the head. AXOIDO-OCCIPITIAN, *posterior large straight*.

110. In the space comprehended between the preceding muscles is a smaller one, which proceeds from the posterior tubercle of the atloid, expands

as

as it rises, and is inserted on the sides of the occipital arch, behind the preceding: it has the same action. *ATLOIDO-OCCIPITIAN, posterior small straight.*

111. There are some muscles also which proceed from the head to the scapula; but, as they act more powerfully on the shoulder, we shall introduce them in another place.

All the muscles here described scarcely ever act singly, but always in concurrence with a greater or less number of others; and it is the indefinitely varied combination which may take place between all these portions of force, that gives rise to the pliability and variety of motion of which the parts of our bodies are susceptible.

112. *Muscles which move the face.* In all animals the face is overspread with muscles which surround the eyes, the nose, and the mouth; and these muscles, covered by a fleshy panicle, have no other action than that of enlarging, contracting, or shutting the apertures of these different organs.

But in man, these muscles compose a moveable physiognomy, the features of which become the living expression of the various sensations he experiences.

113. The head of man is covered in the middle by a thin aponeurotic muscle, which is fixed along

the occipital arch, and, proceeding towards the forehead, extends to the eye brows and the convexity of the nose. This muscle corrugates the skin of the forehead, and elevates the eye-brows. OCCIPITO-FRONTIAN, *epicranius* and *pyramidal of the nose*.

114. Two small muscles, inserted in the nasal projections of the os frontis, lose themselves in the substance of the eye-brow. They elevate and corrugate the eye-brows. FRONTO-SUPERCILIAN, *superciliar*.

115. A small muscle issues from the bottom of the arch of the orbit, and expands over the upper edge of the tarsal cartilage of the upper eye-lid. It raises it when shut. ORBITO-PALPEBRALIAN, *elevator of the upper eye-lid*.

116. The eyes are surrounded by a muscle, the semi-elliptical fibres of which seem to issue from the interior angle of the orbits where they adhere, in order to proceed to the exterior angle: by contracting they shut the eye-lids. PALPEBRALIAN, *orbicular of the eye-lids*.

117. A small muscle, fixed to the maxillary bone, proceeds in a transverse direction on the cartilage of the nose: it serves to dilate the nostrils. SUPER-MAXILLO-NASIAN, *transverse of the nose*.

118. Below the alveoli of the upper incisive teeth is a small muscle, fixed to the alæ of the
nose,

nose, which it tends to depress. **ALVEOLO-NA-SIAN**, *myrtiform*.

119. From the zygomatic arch arise two muscles, which descend obliquely towards the angle of the lips: by contracting they carry the lips upwards and backwards.

The smaller of these two muscles is placed above the other. **ZYGOMATIC-LABIAN**, **GREATER** and **LESS**, *great and small zygomatic*.

120. Three small muscles are fixed to different points of the sub-maxillary bone: the *largest* arises on that bone towards the interior angle of the eyes; proceeds to the upper lip, and leaves some fibres on the sides of the nose: the *middle* one is inserted on that bone, below the orbital cavity, and expands equally over the upper lip: the *lesser* is fixed above the alveolar edge near the angular tooth, and proceeds to the angle of the lips. These muscles serve to elevate different points of the upper lip, and even the nostrils. **SUPER-MAXILLO-LABIAN**, **GREATER**, **MEAN**, and **LESS**; 1st, Elevator of the *ala nasi and of the upper lip*; 2d, *Incisive or proper elevator of the upper lip*; 3d, *Canine, or elevator of the angle of the lips*.

121. From the part of the maxillary bone which corresponds to the chin, arises an *odd* muscle of a square form, which proceeds through the substance of the lower lip. It depresses that part. **MENTO-LABIAN**, *square of the chin*.

122. At

122. At the bottom of the lower jaw, and on the sides, arises a muscle, which expands as it ascends, and proceeds to the angle of the lips. It depresses that part. MAXILLO-LABIAN, *triangular, or depressor of the angle of the lips.*

123. At each side of the mouth is a thick muscle, which is fixed at the top and bottom to the alveolar sides of the two jaws, and behind to the inter-maxillary ligament: all the fibres of this muscle take a cross direction, and expand towards the angle of the lips: by contracting, these muscles swell out the cheeks. They were called *buccinators*, because they are those principally put in action when a trumpet is sounded. BUCCO-LABIAN.

124. Around the lips is an *odd* muscle, the semi-oval fibres of which cross each other towards the angles; they concur to form the thickness of the lips: by contracting they lessen the aperture of the mouth. LABIAN, *orbicular of the lips, or small incisive of the upper and lower lip.*

125. All these muscles of the face are covered, and their intervals are filled up with a greasy tissue, exceedingly fine, and of a nature altogether peculiar: the fibres of these muscles cross each other in many points; and this disposition increases the relation of these parts, and gives them a great degree of mobility.

126. A broad thick muscle occupies the whole
temporal

temporal fossa and a part of the zygomatic. This muscle, which is covered within by a strong aponeurosis, is formed interiorly of two layers of fibres which unite below in a thick tendon: this tendon embraces the coronoid apophysis of the maxillary bone, below the zygomatic arch. This muscle tends strongly to elevate the lower jaw.

TEMPORO-MAXILLIAN, *crotophite* or *temporal*.

127. At the bottom, and on the sides of the cheek, is a thick muscle, which is fixed below the zygomatic arch, to the os zygoma, and to that part of the super-maxillary bone united to it. This muscle descends along the branch of the maxillary bone, and is inserted in the exterior and inferior side of the angle of the jaw. It has the same action as the preceding. ZYGOMATO-MAXILLIAN, *masseter*.

128. In the cavity of the pterygoid apophysis of the sphenoid is fixed a muscle which descends outwardly, becomes thick, and is inserted in the interior side of the angle of the maxillary bone. It elevates the jaw, and tends to draw it backwards. GREAT PTERYGO-MAXILLIAN, *great* or *interior pterygoidian*.

129. The pterygoid apophysis receives also on its exterior side a small muscle, which proceeds horizontally before the condyle of the maxillary bone, to which it is fixed as well as to the articular capsule. This muscle tends to draw the condyle of the

the

the jaw forwards. SMALL PTERYGO-MAXILLIAN, *small* or *exterior pterygoidian*.

130. A muscle extends from the mastoid apophysis to the middle of the interior face of the jaw ; it descends by a fleshy portion towards the angle of that bone, where it presents a tendon, which continues with another fleshy portion inserted in the genian apophyses.

This digastric muscle tends to depress the jaw. MASTOIDO-GENIAN, *digastric*.

131. Beneath the skin, between the breast and the chin, is a thin muscle which originates below by a few fibres under the clavicle, and the acromion : these fibres approach each other, and rise nearly to the chin, where they cross the fibres of the opposite muscle : the action of this muscle is not sensible.

This muscle is much stronger and more extended in animals ; it spreads itself over the face, and forms the carneous panicle, which, as already said, covers the muscles of that part. It strongly corrugates the skin of the neck, THORACOFACIAN, *cutaneus*.

132. MUSCLES OF THE LIMBS. The limbs of animals have different uses, and perform various motions ; the result not only of the configuration of the bones which form them, but of the peculiar disposition also of the muscles fixed to them.

Thus, in apes, it is not the peculiar structure
of

of their bones that prevents them from standing perfectly erect, with the leg extended, and the sole of the foot entirely resting on the ground, but the peculiar disposition of the muscles, which keep the thighs half bent on the pelvis, and the heel raised up. The case is the same with other animals; they all perform movements, which are the result of the peculiar structure of the bones and muscles of which their limbs are formed.

The thoracic limbs of birds, covered with feathers, form wings proper for flying; their pelvian limbs serve them for walking; and in some they are furnished with membranes, and answer the purpose of fins.

Those of oviparous quadrupeds serve for progression.

Those of amphibious and cetaceous animals, being short and flat, are fitted for natation. Those of bats, covered with broad membranes, perform the same office as wings. In the greater part of quadrupeds, however, they serve only for walking. In the quadrumana, the thoracic limbs serve for walking and grasping.

In some genera of animals the limbs have also peculiar uses: by carnivorous animals they are employed for catching and tearing their prey; by others they are employed for climbing trees, digging in the earth, &c.

In man the thoracic limbs serve for apprehension,

sion, and the pelvian for walking erect: he is the only animal who does so.

Thoracic Limbs.

133. *Muscles which move the shoulder on the breast.* In man, the muscles which give motion to the shoulder are six on each side.

A muscle of a trapezoidal form proceeds on the one hand along the spinal apophyses of the vertebræ of the back, from the seventh of the neck to the cervical ligament, and as far as the occiput; and on the other extends along the upper edge of the spine of the scapula, and is fixed to its acromion apophysis, and the humeral extremity of the clavicle. The superior part of this muscle, the fibres of which descend obliquely before, elevates the shoulder; the middle portion, which has transverse fibres, draws it backwards; the lower part, the fibres of which ascend by proceeding forwards, tend to lower the shoulder. The total action of this muscle is to pull the shoulder backwards; and when it remains fixed it moves the head in the same direction, by being connected with the occiput. This muscle is united to its fellow along the vertebræ, and both together represent a sort of lozenge. DORSO-SUPER-ACROMIAN, *trapezius*.

134. Below this muscle is a smaller one, nearly of a rhomboidal form, which descends obliquely from

from the spinal apophyses of the last two or three cervical vertebræ, and the first three or four of the lumbar, and proceeds along the posterior edge of the scapula below the spine of that bone.

This muscle elevates the base of the scapula by drawing it backwards; and thus lowers the anterior angle of the shoulder. **DORSO-SCAPULIAN**, *rhomboid*.

135. Higher up than the preceding muscle is another, which is inserted in the transverse apophyses of the first four vertebræ of the neck, and descends obliquely towards the posterior angle of the scapula to which it is fixed, as well as to the portion of the posterior edge which is above the spine of that bone. This muscle raises the shoulder, as the preceding one does, by causing it to make a kind of movement like that of a lever, which depresses the humeral angle. **TRACHELO-SCAPULIAN**, *angular*.

136. To the anterior part of the four ribs which follow the first, are fixed, near to their cartilages, the same number of muscular digitations, which ascend obliquely behind, and unite in a flat tendon inserted in the coracoid apophysis.

This muscle carries the shoulder forwards, by depressing its humeral angle. **COSTO-CORACOIDIAN**, *anterior serrated* or *small pectoral*.

137. Above and between the first eight or nine ribs is fixed, by the same number of digitations, a
large

large muscle, which becomes narrower, proceeds backwards, passing under the scapula, and is inserted in the posterior edge of that bone.

All the portions of this muscle tend to draw the shoulder strongly forwards, at the same time that its upper part raises and its lower depresses it.

COSTO-SCAPULIAN, *large serrated*.

138. A small muscle extends obliquely from the anterior edge of the first rib to the middle of the clavicle : situated between these two bones, it appears that it ought to fix the clavicle. **COSTO-CLAVIAN**, *sub-claviar*.

139. A simple indication of these different muscular forces, and of the combinations which can be formed of them, serves to account for the variety of motions of which the shoulder is susceptible. It is to be remarked that the shoulder has this peculiarity, that the bone of which it is essentially formed is in a manner free, and suspended amidst muscles which sustain it, and give it motion ; and that it is on this bone that the arm is articulated. In the different actions of the muscles of the shoulder we must always keep in mind that the scapula is confined by the clavicle, which regulates its progress, and often occasions very compound motions on the principle of the lever.

140. *Muscles which move the arm on the shoulder.*

der. The muscles which move the arm on the shoulder are fixed to the bones of the shoulder, and of the breast; to those of the vertebral column, and even to those of the pelvis.

141. To the sternal portion of the clavicle, the sternum, the first seven or eight ribs and their cartilages, is fixed a broad muscle, the digitated portions of which extend in a transverse direction over the breast.

This muscle, while it proceeds towards the arm, becomes narrower; the inferior fibres are folded back behind, and at the top on the superior ones, and terminate in a broad, flat tendon which is inserted on the superior quarter of the humerus, along the exterior edge and groove of that bone. This muscle, which forms the anterior edge of the cavity of the arm-pit, serves to pull the arm strongly forwards, and towards the sides of the breast, by making it turn on itself from without inwards. STERNO-HUMERIAN, *great pectoral*.

142. Above the shoulder is a thick muscle, fixed before the humeral extremity of the clavicle, to the acromion, and along a part of the lower border of the ridge of the scapulum. The fibres of this muscle pass above the articulation of the arm with the shoulder; the anterior and posterior fibres are folded back under the middle fibres, and they all terminate in a tendon which is

inserted in the rough line at the bottom of the groove of the humerus. This muscle elevates strongly the arm. SUB-ACROMIO-HUMERIAN, *deltoid*.

143. From the coracoid apophysis arises a small muscle, which is fixed within the humerus towards its middle part. It tends to pull the arm forwards, by bringing it near to the trunk. CORACO-HUMERIAN, *coraco-brachial*.

144. The face of the scapula, which is above its ridge, serves to lodge a muscle, the carneous fibres of which terminate anteriorly in a tendon, which passes above the junction of the acromion with the clavicle, and descends to fix itself to the trochiter. This muscle, situated below the *sub-acromio-humerian*, concurs towards the same action. SUPERIOR SUPER-SCAPULO-TROCHITERIAN, *super-spinal*.

145. Another very broad muscle, fixed to the ridge of the hip bone and the os sacrum, ascends along the spinal apophyses of the lumbar vertebræ and the last seven of the back: it extends over the last four ribs by as many digitations. All the fibres of this muscle approach each other, and proceed towards the arm, where they terminate in a flat tendon, which is turned round on itself, and inserted at the bottom of the trochin, on the interior edge of the groove. This muscle envelops the trunk behind: it forms at the top the posterior

posterior edge of the cavity of the arm-pit: by contracting it tends to pull the arm downwards and backwards, making it turn inwardly on its axis. **LUMBO-HUMERIAN**, *great dorsal* or *very large of the back*.

146. To the inferior angle of the scapula is fixed a muscle, which ascends obliquely before, and terminates in a flat tendon: this tendon passes behind that of the preceding muscle, around which it turns, and is inserted on the interior edge of the humerus below its head. The action of this muscle is analogous to that of the preceding. **SCAPULO-HUMERIAN**, *large round*.

147. To the face of the scapula, situated below its ridge, is fixed another muscle, the fibres of which terminate before and at the top in a tendon that passes over the exterior side of the head of the humerus, and proceeds to insert itself in the trochiter. This muscle tends to make the head of the bone turn outwards. **INFERIOR SUPER-SCAPULO-TROCHITERIAN**, *subspinal*, and *small round*.

148. The interior or costal face of the scapula receives, in its whole extent, a thick muscle, which produces before a large tendon that passes over the interior side of the head of the humerus, and is fixed to the trochin. This muscle tends to make the head of the humerus turn inwards. **SUB-SCAPULO-TROCHINIAN**, *sub-scapular*.

149. *Muscles which move the fore-arm on the*
H 2
arm.

arm. The fore-arm is moved on the arm backwards and forwards : two muscles bend it, and one extends it.

150. One of the bending muscles is composed of two carneous portions united below. At the top, the interior portion of this muscle is fixed by a tendon to the coracoid apophysis ; it then descends to about the lower third of the humerus. The exterior portion exhibits a larger tendon, which furrounds, at the top and within, the edge of the glenoidal cavity of the scapula : it passes above the head of the humerus in the inside of the articulation, and, after contracting itself, issues from it to lodge in the groove of that bone, along which it descends. These two portions unite into one muscle, which soon becomes narrower, and gives birth to a round tendon : this tendon passes before the articulation, and is inserted in a tubercle, which is below the neck, and at the interior part of the radius. This muscle bends the fore-arm on the arm, and by making the radius turn inwards and outwards it contributes to the motion of *supination*. SCAPULO-RADIAN, *biceps*.

151. Before the bone of the arm, at its middle and exterior part, is another thick muscle which descends towards the bending of the arm, passing below the preceding muscle : it terminates below in a tendon, which is inserted in the coronoid apophysis of the cubitus : it bends the fore-arm on the arm. HUMERO-CUBITIAN, *interior brachial*.

These two flexor muscles are covered with a very thin aponeurotic membrane.

152. Behind the humerus is a broad, thick muscle, which adheres at the top by three separate portions: one exterior and somewhat anterior is fixed below the trochiter: the middle one, which is larger, is fixed by a flat tendon to the anterior edge of the scapula, below its glenoidal cavity: the interior and posterior, which is shorter, is inserted behind, below the head of the humerus. These three portions unite towards the middle of that bone, embrace it, and adhere to it nearly as far as the articulation, where this muscle changes into a tendon, which passes behind the articulation, and is fixed to the olecranon. This muscle alone extends the fore-arm on the arm. SCAPULO-OLECRANIAN, *brachial triceps*.

153. On the exterior side of the olecranon is a very small muscle, which is fixed to the epicondyle, and proceeds obliquely over the exterior side of the os cubitus, in a small part of its extent. The action of this muscle is very weak. EPICONDYLO-CUBITIAN, *small anconeus*.

154. *Muscles which make the radius turn on the os cubitus.* Four muscles make the radius turn on the os cubitus; two of them by pulling it inwards, and two by drawing it outwards.

155. Before, and at the bottom of the epitrochlea,

trochlea, is fixed a muscle, which descends obliquely without, to insert itself before in the middle of the radius. EPITROCHLEO-RADIAN, *round pronator*.

156. Before the two bones of the fore-arm and below, is placed, in a deep situation, a thin broad and carneous muscle, which extends transversely from the interior edge of the cubitus to the exterior edge of the radius. CUBITO-RADIAN, *square pronator*.

These two muscles make the radius bone turn before the cubitus, and thus produce the motion of *pronation*.

157. The bottom of the epicondyle gives birth to a muscle which adheres also to the neighbouring articular ligaments: it proceeds outwards and inwards, around the head and neck of the radius, which it embraces, and descends to insert itself along the interior edge of the superior quarter of that bone: it draws the radius outwards. EPI-CONDYLO-RADIAN, *short supinator*.

158. To the exterior and inferior edge of the humerus, and before its epicondyle, is fixed a slender muscle, which descends along the convexity of the radius, and is inserted on the outside, in the inferior extremity of that bone. This muscle, which evidently tends to pull the radius outwards when it is before the os cubitus, can also draw it inwards when these two bones
are

are parallel. HUMERO-SUPER-RADIAN, *long supinator*.

These two muscles pull the radius outwards when it has been drawn before the cubitus : they thus produce the motion of *supination*.

The movements of pronation and supination are produced, in an essential manner, by the action of the radius ; but the os cubitus, and even the humerus, yield to these motions in a sensible manner.

159. *Muscles which move the wrist on the fore-arm.* Four muscles move the wrist on the fore-arm ; two by bending, and two by extending it. On the interior side of the fore-arm is a long slender muscle, which is fixed at the top to the humerus behind the epitrochlea, close to the olecranon : it descends along the os cubitus, and terminates below in a tendon inserted before the last bone of the first row of the carpus (*pisiforme*). EPITROCHLO-CARPIAN, *interior cubital*.

160. Before the epitrochlea is fixed another muscle, which descends obliquely on the fore-part of the arm ; rejoins the radius, and accompanies that bone two thirds towards its lower part. This muscle is terminated by a long tendon, which glides in the groove of the first bone of the carpus (*unciforme*), and is inserted in the second bone of the metacarpus. EPITROCHLO-METACARPIAN, *interior radial*.

The action of these two muscles tends, in an essential manner, to bend the wrist on the forearm.

161. On the exterior side of the arm is a thick muscle, which proceeds above from the epicondyle; descends a little inwards, and is fixed along the exterior edge of the cubitus, to which it strongly adheres. This muscle terminates in a tendon which passes inferiorly behind the cubitus, and is inserted on the exterior side of the superior extremity of the last bone of the metacarpus. The action of this muscle tends to pull the wrist backwards, by inclining it on the cubitus. CUBITO-SUPER-METACARPIAN, *exterior cubital*.

162. On the exterior side of the arm there are also two muscles, fixed superiorly to the epicondyle, which descend together along the exterior edge of the radius, and become tendinous towards the middle of that bone. These two tendons proceed together towards the lower part of the radius, and in that place separate: one of them is inserted without on the summit of the second bone of the metacarpus, and the other on the summit of the third. This double muscle extends the wrist backwards, by inclining it on the radius. EPICONDYLO-SUPER-METACARPIAN, *first and second exterior radial*.

When these three muscles act together they extend the wrist directly backwards.

163. Of the four muscles here described (the
last

last two being considered as one), it is seen that the two situated before have a tendency to bend the wrist on the fore-arm, and that the two situated behind have a tendency to pull it back : but when the one before, and that behind, situated on the exterior edge, act together, they bend the wrist towards that side : the case is the same with the other two, situated on the interior edge. The varied action of these four muscles is still combined with that of the muscles which serve for pronation and supination. The variety of the motions that can result from the combination of these different forces may give some idea of the great mobility of which the wrist is susceptible.

164. The muscles of the arm are covered with a thin aponeurosis, which envelops the arm beneath the skin : it is confounded above with the tendons of the muscles, and terminates below towards the articulation of the elbow.

The muscles of the fore-arm are also covered with an aponeurosis, which is fixed superiorly around the articulation of the elbow, and chiefly to the epitrochlea. This aponeurosis is very strong on the interior side of the fore-arm, where it furnishes the membranous prolongations which penetrate between the scapulo-radial and the humero-cubital muscles, and supplies them with points of adhesion. It is thin on the exterior side of the fore-arm, as well as towards the wrist, where it entirely disappears. This
aponeurosis,

aponeurosis, by enveloping the muscles, confines them, supports them, and thus favours their action.

The muscles, which serve for the motion of the fingers, and which extend from the arm and forearm to the hand, have tendons which pass over the circumference of the wrist. These tendons are strongly retained in that place by an aponeurotic *annular ligament*, broad, and in the form of a bracelet, which prevents them from separating.

The tendons of these muscles are also received in that place in sheaths, or tendinous grooves, along which they glide as far as the lower point, by which they are fixed: of these sheaths some are common to several tendons, and others are peculiar to particular ones.

The muscles of the inside of the hand are covered with a very strong *aponeurosis*, which lies immediately beneath the skin. It seems to arise from the interior part of the annular ligament, and expands on the inside of the hand as far as the fingers.

The interior face of this *palmar aponeurosis* seems also to give birth to membranous prolongations, which form partitions along the bones of the metacarpus, and thus separate the tendons that pass over these parts.

165. The palmar aponeurosis seems to continue itself superiorly along with the tendon of a

long and slender muscle, which still remains to be described. It is fixed above to the epitrochlea: it is carneous for a small space, but soon becomes tendinous: the slender and flat tendon of this muscle descends along the interior edge of the fore-arm, and passes over the interior face of the annular ligament, where it adheres by some tendinous fibres: it then expands, and seems to lose itself, and to be confounded with the palmar aponeurosis. This muscle can contribute to the flexion of the wrist, and seems to be capable of stretching the palmar aponeurosis. EPITROCHLO-PALMIAN, *palmaris longus*, *slender cubital*.

166. Beneath the skin of the palm of the hand is observed also a small muscle, exceedingly thin, the transverse fibres of which seem to lose themselves under the palmar aponeurosis, and in the thickness of the skin: its action must be very weak. PALMO-CUTIAN, *palmaris cutaneus*.

167. *Muscles which produce motion in the fingers.* The muscles which make the fingers move are very numerous: some of them serve for bending, and others for extending them; and there are some which make them move on all sides. Some of these muscles are common to several fingers; others are peculiar to one: some of them also are very long, and fixed to the fore-arm; while others, much shorter, are fixed to the carpus and metacarpus.

168. Along

168. Along the interior part of the fore-arm is a muscle fixed superiorly, by a very thick carneous part, to the epitrochlea, the interior side of the cubitus, and the fore-part of the radius. This muscle descends till towards the middle of that bone, where it separates into four distinct portions, which terminate inferiorly in the same number of thin, flat tendons. These four tendons pass together before the wrist, and then separate to proceed to the last four fingers. They glide before the bones of the metacarpus and the first phalanges, where these small tendons are perforated; they then unite, and are fixed along the interior face of the second phalanges. This muscle serves to bend the second phalanges on the first, the fingers on the hand, and the wrist on the fore-arm. COMMON EPITROCHLO-PHALANGIAN, *sublime* or *perforated flexor*.

169. Below this muscle is another analogous to it, thin above and thick in the middle. It is fixed along the interior edge of the cubitus, and divides itself into four portions, which terminate in as many tendons. These tendons proceed below those of the preceding muscle, as far as the place where the latter are perforated, traverse the fissures of them, and are connected to the interior edge of the last phalanges. This muscle, which has the same action as the preceding, can bend also the third phalanges, to which it is fixed.

COMMON

COMMON CUBITO-PHALANGETTIAN, *profound or perforating flexor.*

170. Towards the superior extremities of the bones of the metacarpus, between the two common flexors of the fingers, are fixed four small muscles, which proceeding from the tendons of the profound flexor, are inserted along the interior edge of the first phalanges of the fingers. They are auxiliaries to the two muscles between which they are placed. PALMO-PHALANGIAN, *lumbricales.*

171. The interval comprehended between the bones of the metacarpus is filled, in the inside, by three small muscles, which proceed from the carpus to the first phalanges. They contribute to bend the fingers. INTERIOR METACARPO-SUPER-PHALANGIAN, *inferior or interior inter-osseous.*

172. Along the exterior face of the fore-arm is a muscle fixed to the epicondyle: it grows larger below the point where it is fixed; and when it reaches the middle of the radius, it divides itself into four portions, each of which covers its neighbour, and becomes tendinous. These four tendons pass behind the carpus, and separate from it to proceed to the convex face of the third phalanges of the fingers. This muscle extends the four fingers which follow the thumb. COMMON EPICONDYLO-SUPER-PHALANGETTIAN, *common extensor.*

173. The

173. The interval between the bones of the metacarpus is filled up without, by four small muscles, which proceed from the carpus to the phalanges. They contribute to the extension of the fingers. EXTERIOR METACARPO-SUPER-PHALANGIAN, *superior or exterior inter-osseous*.

174. Before the upper third of the radius, and along the interior edge of that bone, is fixed a thin muscle, which terminates below in a flat tendon. This tendon passes to the exterior edge of the carpus, and proceeds to the last phalanx of the thumb. This muscle bends the two phalanges of the thumb on the bone of the metacarpus, and even that bone on the carpus. RADIO-PHALANGETTIAN OF THE THUMB, *long flexor of the thumb*.

175. A thick muscle is fixed to the base of the first bones of the carpus, passes before the first, and even the second bone of the metacarpus, and envelops the first phalanx of the thumb. It tends to bend the thumb. CARPO-PHALANGIAN OF THE THUMB, *short flexor of the thumb*.

176. To the top of the cubitus, on the outside and for a part of its length, is fixed a muscle, the tendon of which passes behind the first bone of the metacarpus, and is inserted in the first phalanx of the thumb. The action of this muscle is to extend the thumb. CUBITO-SUPER-PHALANGIAN, *long extensor of the thumb*.

177. Another

177. Another muscle, much shorter and thinner, proceeds in the same direction, and has the same action as the preceding: its tendon terminates at the second phalanx of the thumb. **CUBITO-SUPER-PHALANGIAN OF THE THUMB**, *short extensor of the thumb*.

178. Along the interior side of the third bone of the metacarpus is inserted a muscle, which proceeds in a transverse direction, and is fixed to the cubital edge of the first phalanx of the thumb. It brings the thumb towards the other fingers, by pulling it forwards. **METACARPO-PHALANGIAN**, *adductor of the thumb*.

179. To the exterior face of the cubitus is fixed superiorly a muscle, which extends between the two bones of the fore-arm, and terminates inferiorly in a tendon, often divided, which is implanted in the summit of the first bone of the metacarpus, towards its radial side. This muscle removes the thumb from the other fingers. **CUBITO-SUPER-METACARPIAN OF THE THUMB**, *long abductor of the thumb*.

180. A small muscle is inserted before the two first bones of the two rows of the carpus, and proceeds outwards on the radial edge of the first phalanx of the thumb, which it embraces. This muscle removes the thumb from the other fingers. **CARPO-SUPER-PHALANGIAN**, *short abductor*.

181. Before

181. Before the first two bones of the two rows of the carpus is fixed a muscle, which is inserted on the radial edge of the metacarpian bone of the thumb. This muscle makes the bone of the metacarpus turn on its axis, and pulls the thumb towards the hollow of the hand, in order to oppose it to the other fingers. CARPO-METACARP-
PIAN OF THE THUMB, *metacarpian of the thumb, or opposer.*

182. To the middle part of the cubitus without is fixed a muscle, the tendon of which passes over the convexity of the hand, to proceed to the last phalanx of the index-finger. It extends the index-finger. CUBITO-SUPER-PHALANGETTIAN
OF THE INDEX, *extensor of the index.*

183. A small muscle, fixed to the projecting part of the last bone of the second row of the carpus, proceeds along the cubital edge of the hand, towards the first phalanx of the little finger. This muscle bends the little finger by pulling it a little towards the rest. CARPO-SUPER-PHALANGETTIAN OF THE LITTLE FINGER, *short flexor of the little finger.*

184. A thin muscle, attached to the epicondyle, furnishes a second tendon to the little finger. EPICONDYLO-SUPER-PHALANGETTIAN OF
THE LITTLE FINGER, *extensor of the little finger.*

185. At the lower part of the last bone of the
first

first row of the carpus is fixed a muscle, which proceeds along the cubital edge of the last bone of the metacarpus, and is inserted in the first phalanx of the little finger. This muscle bends the little finger, by pulling it slightly outwards.

CARPO-PHALANGIAN OF THE LITTLE FINGER,
abductor of the little finger.

186. Below the preceding is often found another muscle, which extends from the cubital edge of the fifth bone of the metacarpus, as far as the projection of the last bone of the second row of the carpus, and proceeds along the cubital edge of the hand towards the first phalanx of the little finger. This muscle pulls the little finger before the rest.

CARPO-METACARPIAN OF THE LITTLE FINGER,
opposer of the little finger.

187. As the osseous piece which receives the bone of the thigh is not moveable, like that which receives the bone of the arm, it has no muscles proper for moving it; but it forms a point, to which are attached all those that give motion to the thigh on the pelvis, and a part even of those which move the leg on the thigh.

188. *Muscles which make the thigh move on the pelvis.* The muscles which serve merely for moving the thigh on the pelvis are attached to the

trochanter, the *trochantin*, and the *femoral ridge*. Those attached to the trochanter form the thickness of the hips.

189. The most voluminous, that which covers the rest, is attached above, along the posterior half of the edge of the hip bone; it descends behind along that edge, and along that of the sacrum and coccyx. All the fibres of this muscle approach each other, and terminate inferiorly in a broad tendon which is inserted behind the femur, below the trochanter. This muscle serves to pull the thigh backwards and outwards. SACRO-FEMORIAN, *gluteus maximus*.

This muscle, the size of which is considerable in man, is proportionally smaller in apes and the other mammalia; so that these prominences, called buttocks, are found only in man.

190. Below this muscle, but placed more forwards, is another of less size, the form and direction of which are nearly the same: it is fixed to the exterior face of the hip bone, and along the anterior half of its edge. Its fibres terminate inferiorly in a sort of tendon, which is inserted in the summit of the trochanter. Its action is nearly the same as that of the preceding. GREAT ILIO-TROCHANTERIAN, *gluteus medius*.

191. Below the preceding is also another smaller

finaller muscle, which adheres to the exterior face of the broad portion of the hip bone: its fibres terminate inferiorly in a flat tendon, which is inserted before the summit of the trochanter. Its action is the same as that of the preceding. **SMALL ILIO-TROCHANTERIAN**, *gluteus minimus*.

192. On the sides of the interior face of the os sacrum, between the holes of that bone, is attached, by three or four digitations, a muscle, which being broad in that place passes through the lesser pelvis by the ischiatic notch: it then becomes narrower, and descends obliquely to insert itself by a long tendon in the summit of the cavity of the trochanter. This muscle makes the thigh turn outwards, when extended, and removes it when bent. SACRO-TROCHANTERIAN, *pyriformis*.

193. Two other muscles are fixed along the posterior edge of the ischium, and are inserted together in the summit of the cavity of the trochanter: they have the same action as the preceding. ISCHIO-TROCHANTERIAN, *gemini*.

194. In the inside of the lesser pelvis, along the interior edge of the sub-pubian foramen, is fixed a broad muscle, which changes into a flat tendon. This tendon turns round on the notch which is between the spine and the tuberosity of the ischium; then passes between the two preceding muscles,

muscles, as in a sheath, and is inserted in the summit of the trochanter. This muscle has the same action as the preceding, and exercises it by gliding on the notch of the ischium as on a fulcrum. **INTERIOR SUB-PUBIO-TROCHANTERIAN**, *interior obturator*.

195. A small flat muscle, applied before and around the sub-pubian foramen, proceeds backwards by a tendon, which passes below the cotyloid cavity, and is inserted behind the neck of the femur, in the cavity of the trochanter. This muscle has the same action as the preceding. **EXTERIOR SUB-PUBIO-TROCHANTERIAN**, *exterior obturator*.

196. To the tuberosity of the ischium is fixed a thin flat muscle, which is inserted behind the trochanter: its action is the same as the preceding. It tends to make the thigh turn outwards. **ISCHIO-SUB-TROCHANTERIAN**, *square of the thigh*.

The other muscles proceed from the pelvis to the trochantin, and the femoral ridge; they are placed at the interior and superior part of the thigh.

197. To the sides of the bodies of the lumbar vertebræ and the base of their transverse apophyses is fixed a thick muscle, which descends, growing smaller, and proceeds laterally on the iliac portion of the hip bones: it then advances
towards

towards the pubis, and passes above the arch which that bone forms above the sub-pubian foramen. This muscle then glides on the interior side of the articulation of the femur, which it covers, turns round below the neck of that bone, and terminates before the trochantin. It bends the thigh forwards on the pelvis. **PRÆLUMBO-TROCHANTINIAN**, *psoas*.

198. A broad thick muscle, attached to the circumference of the os ilium, and to a part of its interior face, descends anteriorly towards the pubis, and terminates there in a tendon which is united to that of the preceding muscle, as far as its insertion into the trochantin. It has the same action. **ILIO-TROCHANTINIAN**, *iliac*.

199. Below the symphysis of the pubis is fixed a thin muscle, which descends before that bone, and proceeds backwards in an oblique direction to insert itself, by a flat tendon, behind the trochantin. It has the same action as the two preceding. **SUPER-PUBIO-FEMORIAN**, *pectinalis*.

200. Three muscles are attached before the pelvis: the first towards the symphysis of the pubis; the second below, in the fore-part of that bone close to the sub-pubian foramen; the third still lower, before and above the tuberosity of the ischium. These three muscles proceed behind the thigh, and are inserted along the femoral

ridge, in such a manner that the first passes before the second, and is inserted farther down into the femur. The third descends lower than the other two, and is fixed about the lower third of that bone. These muscles pull the thighs inwards, by bringing them towards each other. PUBIO-, SUB-PUBIO-, and ISCHIO-FEMORIAN, *the three adductors, or femoral triceps.*

201. *Muscles which move the leg on the thigh.* The greater part of the muscles which serve to move the leg on the thigh are attached to the pelvis, and some of them to the femur: those which extend the leg on the thigh are fixed to the rotula; those which bend it are almost all attached to the interior side of the head of the tibia.

202. A muscle situated before the thigh adheres superiorly by two tendons: one, which is short, to the tubercle placed before the edge of the ilium and above the cotyloid cavity; the other to the circumference of that cavity. This muscle becomes thick in the middle, then contracts, and terminates in a flat tendon, which is inserted in the summit of the rotula. It extends the leg. ILIO-ROTULIAN, *straight or slender anterior.*

203. Below this muscle is another very broad and thick one, which envelops the femur before and on the sides. This muscle is separated superiorly

riorly into three portions: the middle portion is fixed before the trochantin; the interior, attached to the same place, descends along the femoral ridge, and along that which proceeds to the interior condyle: the exterior portion is attached before and at the bottom of the trochanter, and continues along the exterior edge of the femoral ridge, and the ridge which descends to the exterior condyle. These three portions unite in the middle of the thigh, and terminate in a large flat tendon, which is inserted in the summit of the rotula. This muscle by its action strongly extends the thigh. TRI-FEMORO-ROTULIAN, *vast interior*, *vast exterior*, and *crural*; or *crural triceps*.

The muscles which bend the leg are more numerous.

204. Before the tuberosity of the ischium is attached a very strong and tendinous muscle, the tendon of which is continued backwards obliquely, as far as the middle of the thigh, where it becomes carneous. This muscle descends before the posterior part of the interior condyle of the femur, where it is changed into a flat divided tendon, which is fixed behind the interior condyle of the head of the tibia. This muscle bends the leg. ISCHIO-SUB-TIBIAN, *semi-membranous*.

205. Behind the tuberosity of the ischium is fixed a muscle, which is carneous as far as the

lower third of the thigh, where it is changed into a slender round tendon, which passes behind the interior condyles of the femur and the tibia, turns itself inwards around the latter, and is inserted in the upper part of the tibia near its anterior edge. It has the same action as the preceding. ISCHIO-PRÆTIBIAN, *semi-nervous*.

In apes the two preceding muscles are fixed to the tibia, much lower down than in man, and keep the leg in a continual state of flexion, which prevents walking erect.

206. On the outside of the thigh behind, is a muscle divided inferiorly into two portions: one longer than the other is fixed to the bottom of the tuberosity of the ischium by a broad tendon, which descends obliquely behind; becomes broader and unites towards the middle of the thigh with the short carneous portion: the latter is inserted in the middle of the femoral ridge; continues along this ridge, and that which proceeds to the exterior condyle. This muscle terminates in a strong tendon, which passes behind the exterior side of the knee, and is inserted in the head of the perone. It bends the leg. ISCHIO-PERONIAN, *femoral biceps*.

207. Behind the articulation of the knee is a short muscle, deeply situated between the bottom of the exterior condyle of the femur, behind the
articular

articular capsule, and the posterior and superior part of the tibia. It tends also to bend the leg.

POPLITO-TIBIAN, *poplitean*.

208. To the anterior angle of the ridge of the ilium is fixed a thin and very long muscle, which descends before the thigh; passes on the interior side of the knee, and is inserted in the upper part of the tibia, on the interior side of its ridge, below the tuberosity of that bone. This muscle bends the leg on the thigh by pulling it inwards, as if to make it cross the other; it makes the thigh and leg also turn outwards when the member is extended. ILIO-PRÆTIBIAN, (*taylor muscle*,) *sartorius*.

209. A thin long muscle attached before the ischium and the pubis, by a broad flat tendon, descends along the interior part of the thigh, and terminates in a round slender tendon, which passes behind the condyles of the femur and the tibia. This muscle then turns round on the interior side of the knee, and is inserted in the top of the ridge of the tibia, near its tuberosity. It bends the leg. PUBIO-PRÆTIBIAN, *slender* or *straight interior*.

210. All the muscles of the thigh are enveloped and maintained in their positions, by a very strong sort of aponeurotic covering, which extends over the pelvis before the pubis, the ischium, the anterior .

terior angle of the ilium, the exterior face of that bone, that of the sacrum and the coccyx, and over the articulation of the head of the femur. This *femoral aponeurosis* is very strong on the exterior side of the thigh; adheres behind along the femoral ridge, and descends on the knee, which it envelops on all sides. It sends out prolongations between the muscles, and separates them without adhering to them. It strongly secures the muscles which it envelops, furnishes them with a firm point of support during their contraction, and in this manner greatly contributes to favour their action.

This aponeurosis exhibits at its upper part two distinct laminæ, between which is lodged a particular muscle. This muscle is fixed towards the top of the anterior angle of the ilium, and descends between the two laminæ of the aponeurosis as far as the middle of the thigh. The principal action of this muscle is to stretch the aponeurosis, and thus to sustain with more force the muscles of the thigh. *APONEUROTIC ILIO-FEMORIAN, muscle of the fascia lata, and aponeurosis of the fascia lata.*

211. *Muscles which move the foot on the leg.* The muscles which make the foot move on the leg extend, and bend it, or pull it to either side.

The feet are extended by the muscles which form the calf of the leg. Two of these muscles

are placed close to each other: the interior, which is thicker and longer, is fixed behind the interior condyle of the femur; and the exterior behind the exterior condyle of that bone; both of them become very thick along the upper half of the leg; they then decrease, are confounded, and terminate in an exceedingly strong and thick flat tendon which is inserted behind the calcaneum. Their action is to extend strongly the foot on the leg. **BI-FEMORO-CALCANIAN**, *gemellus*, *gastrocnemian*.

212. Below these two muscles is another, also very thick, which is fixed at the top, behind the head of the perone, and below that of the tibia. This muscle becomes very broad, and descends behind along the tibia, to which it adheres in a small part of its extent: its inferior tendon is confounded with that of the preceding muscle, and both have the same action. **TIBIO-CALCANIAN**, *soleus*.

These muscles, the gemellus, and the soleus, are those which exercise the most essential action in progression, running and jumping. By extending the foot, these muscles raise the heel and elevate the body, which for a moment rests only on the point of the foot. The carncous swelling of these muscles, which constitutes the calf of the leg, is observed only in man: this structure, by increasing the strength of the leg, adds greatly to the beauty of its form.

213. There

213. There is also another very *slender* muscle which is attached on the side of the exterior condyle of the femur; it is carneous in its upper fourth, then changes into a small tendon which descends between the two preceding muscles, and is confounded with them below on the interior edge of their common tendon. It exercises the same action. FEMORO-CALCANIAN, *tibial* or *slender plantaris*.

In apes, the tendon of this muscle does not adhere to the calcaneum, but passes below, and continues with the aponeurosis plantaris, as the *epitrochlopalmaris* continues with the *aponeurosis palmaris* in man; so that these animals cannot place their heel on the ground without bearing on this tendon, which prevents them from resting the whole sole of their foot on the ground: a condition necessary for walking on two feet.

214. Below and behind the upper articulation of the bones of the leg is attached a muscle which descends along these bones, and adheres to them: it is terminated inferiorly by a tendon which passes on the interior side of the malleolus, and is inserted on the interior side of the os scaphoides and of the first os cuneiforme. This muscle extends the foot, by pulling it inwards. TIBIO-SUB-TARSIAN, *tibialis posticus*.

215. On the side of the tibia, below its exte-

rior condyle, is attached a muscle which proceeds on the exterior side of the perone, and adheres to it for three-fourths of its length at the upper extremity. This muscle is bulky in the middle, and terminates below in a tendon, which passes behind the exterior malleolus, glides on the side of the calcaneum, then proceeds below the os cuboides, and passes obliquely below the foot to insert itself under the tarsian extremity of the first bone of the metatarsus. This muscle extends the foot and pulls it outwards. PERONÆO-SUB-TARSIAN, *long peronæus*.

216. Before the leg, and a little on the outside, is a muscle attached superiorly along two-thirds of the exterior edge of the ridge of the tibia. This muscle terminates inferiorly in a tendon, which proceeding obliquely on the inside, passes before the articulation of the foot, and is inserted on the interior side of the first os cuneiforme. It bends the foot by pulling it gently outwards. TIBIO-SUB-TARSIAN, *anterior tibial*.

217. Before and on the exterior side of the lower two-thirds of the perone is fixed a muscle, the lower tendon of which passes behind the exterior malleolus in a groove, common to it with the preceding muscle. This tendon proceeds on the exterior side of the calcaneum, before and along the exterior edge of the os cuboides, and is
inserted

inserted in the tuberosity which serves as the tarsian extremity of the fifth bone of the metatarsus. This muscle bends the foot by drawing it outwards. GREAT PERONÆO-SUPER-TARSIAN, *middle peronæus*.

218. Before the lower half of the perone is attached a muscle, thin at the top and thicker in the middle: the tendon in which it terminates descends before the convexity of the foot, passes in a groove common to it with another muscle, and proceeds on the outside to insert itself along the exterior edge of the fifth bone of the metatarsus. The action of this muscle is the same as that of the preceding. SMALL PERONÆO-SUPER-TARSIAN; *small peronæus*.

219. The muscles of the leg are enveloped in an aponeurosis, very strong before, but much thinner behind, and particularly below, where it disappears. This *tibial aponeurosis* is attached superiorly around the knee, where it seems to be confounded with that of the thigh: its anterior face throws out membranous prolongations, which are interposed between the muscles of the anterior part of the leg, and adhere to it.

The tendons of all the muscles, which proceed from the leg to the foot, are secured by two *annular ligaments*, similar to that which, as already said, surrounds the wrist in the form of a bracelet. One
of

of these ligaments is at the bottom of the leg, and the other above the foot: they secure the tendons, which they cover and confine in their places.

Below the foot is an aponeurosis, similar to the aponeurosis palmaris. It begins under the calcaneum, where it is very thick, and proceeds expanding itself towards the anterior extremity of the bones of the metatarsus. This aponeurosis plantaris is furnished with several prolongations, which penetrate between the muscles, supply them with numerous points of adhesion, and are fixed on the side of the articulations of the bones of the metatarsus with the first phalanges of the toes.

220. *Muscles which give motion to the toes.* The muscles of the toes, like those of the fingers, are exceedingly numerous: they bend or extend the toes, or make them move towards the sides. They are common to several toes, or are peculiar to some: in a word, they are affixed to the bones of the leg, or to those of the foot.

221. A muscle, attached behind and towards the upper part of the tibia, is changed towards the lower part of that bone into a tendon, which passes in a groove behind the interior malleolus: it descends below the calcaneum, and proceeds outwards beneath the middle of the foot: in that place it receives a fleshy expansion, which arises from the calcaneum (accessory or square portion):

this

this tendon then divides itself into four small flat tendinous bands, which proceed towards the heads of the metatarsus, where they enter a groove common to four other perforated tendons, through which they pass, to proceed to the bottom of the third phalanges of the last four toes. It bends or depresses the toes. COMMON TIBIO-PHALANGETIAN, *common long flexor of the toes.*

222. Below the large tuberosity of the calcaneum is fixed a muscle, which proceeds before and divides itself into four tendons: the extremities of these tendons are cleft to afford a passage to those of the preceding muscle, and they are inserted in the second phalanges of the last four toes. The action of this muscle is the same as that of the preceding. COMMON CALCaneo-SUB-PHALANGETIAN, *common short flexor of the toes.*

223. The interval comprehended between the bones of the metatarsus is occupied inferiorly by three small muscles, analogous to those between the bones of the metacarpus; they contribute to the flexion of the last four toes. INFERIOR METATARSO-INTER-PHALANGIAN, *inferior inter-osseous.*

224. Between the common flexors are four small muscles, as in the hand: they proceed from the tendons of the long flexor, and are inserted below and on the interior side of the first phalanges

langes of the last four toes. They bend these parts, by bringing them near the great toe. **PLANTISUB-PHALANGIAN**, *lumbrical*.

225. Below the exterior condyle of the tibia is attached a muscle which descends and adheres along the interior face of that bone; along the interior edge of the perone, and on the interosseous ligament. On its passage it divides itself into three parts, which terminate in tendons: these tendons descend on the convexity of the foot, and pass in the groove which receives that of the small **PERONEO-SUPER-TARSIAN**. One of these tendons divides itself into two, which are fixed on the phalanges of the two toes, next to the great toe: the other two are inserted in those of the last two toes. This muscle extends or straightens the toes. **COMMON PERONEO-SUPER-PHALANGETTIAN**, *common long extensor of the toes*.

226. On the exterior face of the large tuberosity of the calcaneum is attached a muscle, which proceeds inwards obliquely on the foot: it becomes broader and divides itself into four tendons, which cross and pass under those of the preceding muscle, with which they are fixed on the first phalanges of the last four toes. This muscle extends these toes by pulling them outwards. **COMMON CALCANEO-SUPER-PHALANGETTIAN**, *pedious or short common extensor of the toes*.

227. The intervals between the bones of the

metatarsus are filled superiorly by four small muscles, analogous to those found between the bones of the metacarpus; they contribute to the extension of the last four toes. SUPERIOR METATARSO-INTER-PHALANGIAN, *superior inter-osseous*.

228. A small muscle is attached in a transverse direction below and between the articulation of the bones of the metatarsus with the first phalanges; it brings together the heads of these bones, and causes them to form an arch. TRANSVERSE METATARSO-SUB-PHALANGIAN, *transverse of the toes*.

229. Behind the lower two-thirds of the perone is attached a thin muscle, the tendon of which descends obliquely on the inside, passes behind the lower extremity of the tibia; glides in a groove, which is behind the astragalus, and proceeds to the interior side of the calcaneum of the foot, to fix itself on the interior side of the last phalanx of the great toe. It bends that toe. PERONEO-SUB-PHALANGETIAN OF THE GREAT TOE, *long flexor of the great toe*.

230. Under the interior edge of the tarsus, and principally below the first os cuneiforme, is attached a thick muscle, which advances and divides itself into two parts; these parts diverge from each other, and terminate in two tendinous portions, which are inserted under the first phalanx of the great toe. This muscle bends that
part.

part. TARSO-SUB-PHALANGIAN OF THE GREAT TOE, *short flexor of the great toe.*

231. Before the perone, and along its lower half, is attached a muscle the tendon of which passes over the foot, and is inserted on the two phalanges of the great toe; it extends that part. PERONEO-SUPER-PHALANGETIAN OF THE GREAT TOE, *extensor of the great toe.*

232. On the interior side of the large tuberosity of the calcaneum is attached a muscle, which proceeds before, along the interior and inferior edge of the foot, and is fixed by a tendon below and on the side of the first phalanx of the great toe. It bends that part, by pulling it from the other toes. CALCNEO-SUB-PHALANGIAN OF THE GREAT TOE, *abductor of the great toe.*

233. Below the last two cuneiform bones, and the heads of the bones of the metacarpus corresponding to them, is a muscle which passes before and inwards, and by a tendon proceeds to the exterior side of and below the first phalanx of the great toe. It bends that part by pulling it towards the other toes. METATARSO-SUB-PHALANGIAN OF THE GREAT TOE, *abductor of the great toe.*

234. On the exterior side of and below the last bone of the metacarpus, is a very small muscle, which proceeds under the first phalanx of the

little toe. It bends that part. **TARSO-SUB-PHALANGIAN OF THE LITTLE TOE**, *short flexor of the little toe*.

235. On the exterior side of the calcaneum, before its small tuberosity, is attached a muscle, which proceeds along the exterior and inferior edge of the foot : its tendon furnishes a tendinous portion, which is fixed behind the large head of the last bone of the metacarpus ; then continues along that bone, and is inserted below and on the outside of the first phalanx of the little toe. It bends that part by pulling it from the other toes. **CALCANEO-SUB-PHALANGIAN OF THE LITTLE TOE**, *abductor of the little toe*.

236. The muscles are composed of bundles of fibres ; each muscle, each fibre, and each subdivision, is separated by a cellular covering ; the fibres are divided and subdivided into smaller fibres ; and this indefinite subdivision always escapes the eye, even when assisted by the best microscope ; so that the real intimate structure of the muscular fibre is unknown.

To determine the chemical composition of the muscular flesh, it may be analysed in the following manner : Suffer the flesh to macerate well in cold water, and when it is taken out, heat the water, and there will be coagulated a certain quantity of albumen, which is separated by filtration.

The

The flesh thus deprived of a part of its albumen must then be boiled in a large quantity of water, employing that in which it was first heated. When the ebullition has been maintained for a considerable time, there will be still coagulated a small portion of albumen, which may be separated : a certain quantity of fat also will be disengaged, which must be separated by cooling.

The muscle then exhibits only a coriaceous substance, which is fibrous matter. The water still contains a large quantity of gelatin, which must be precipitated by the tanning principle : several saline substances are also found in this water in small quantity.

The white fibrous parts by very long ebullition are reduced almost entirely to gelatin.

TABLE OF THE MUSCLES

OF THE TRUNK, THE HEAD, AND LIMBS.

MUSCLES WHICH MOVE THE VERTEBRAL COLUMN,

By raising it up and pulling it backwards.

NEW NAMES.

OLD NAMES.

1. Sacro-spiniah.		<div style="display: inline-block; vertical-align: middle; font-size: 3em; line-height: 1;">{</div> <div style="display: inline-block; vertical-align: middle; padding-left: 0.5em;"> <i>Sacro-lumbar.</i> <i>Long dorsal and its accessory, or great transverse of the neck.</i> <i>Transverse spinus.</i> </div>
2. Inter-spiniah.		
		<i>Inter-spinous.</i>

By bending it towards the sides.

3. Inter-transversian.		<i>Inter-transverse.</i>
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By bending the neck forwards.

4. Prædorso-atloidian.		<i>Long of the neck.</i>
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By bending the spine on the pelvis.

5. Pubio-prælumbian.		<i>Small psoas.</i>
6. Ilio-transversian.		<i>Square of the loins.</i>

By pulling the coccyx backwards.

7. Ischio-coccygian.		<i>The same.</i>
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MUSCLES WHICH MOVE THE BREAST,

By raising the ribs.

1. Inter-costian.		<i>Intercostal, interior and exterior.</i>
2. Trachelo-costian.		<i>Scalene.</i>
3. Transverso-costian.		<i>Elevators of the ribs.</i>
4. Dorso-costian.		<i>Small indented posterior, superior.</i>

By depressing the ribs.

5. Lumbo-costian.		<i>Small indented posterior, inferior.</i>
6. Sterno-costian.		<i>Triangular of the sternum.</i>

By dilating and contracting the breast, and separating it from the lower belly.

7. Diaphragm.		<i>The same.</i>
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By bending the breast on the pelvis, and forming the sides of the abdomen.

8. Ilio-pubio-costian.		<i>Exterior oblique, or great oblique.</i>
9. Ilio-costian.		<i>Interior oblique, or small oblique.</i>
10. Pubio-steranian.		<i>Right of the lower belly.</i>
11. Lumbo-abdominal.		<i>Transverse of the lower belly.</i>
12. Pubio-sub-umbilical.		<i>Pyramidal.</i>

MUSCLES

MUSCLES WHICH MAKE THE HEAD MOVE ON THE NECK,

By bending it forwards, and towards the sides.

NEW NAMES.

OLD NAMES.

1. Sterno-mastoidian.	The same.
2. Great-trachelo-sub-occipitian.	Great straight, anterior.
3. Small-trachelo-sub-occipitian.	Small straight, anterior.
4. Atloldo-mastoidian.	Small straight, lateral.

By bending it backwards, and towards the sides.

5. Cervico-mastoidian.	Splenius of the head.
6. Trachelo-occipitian.	Great complexus, and digastric of the neck.
7. Trachelo-mastoidian.	Small complexus, or lateral mastoidian.
8. Atloldo-sub-mastoidian.	Superior oblique, or small oblique.
9. Axoido-occipitian.	Great straight, posterior.
10. Atloldo-occipitian.	Small straight, posterior.

MUSCLES WHICH MOVE THE FACE,

By corrugating the forehead, and raising the eye-brows and eye-lids.

1. Occipito-frontian.	Epicranian and pyramidal of the nose.
2. Fronto-supercilian.	Superciliar.
3. Orbito-palpebralian.	Elevator of the eye-lids.

By shutting the eye-lids.

4. Palpebralian.	Orbicular of the eye-lids.

By dilating and depressing the nostrils.

5. Super-maxillo-nasian.	Transverse of the nose.
6. Alveolo-nasian.	Mystiform.

By distending the cheeks.

7. Bucco-labian.	Buccinator.

By drawing the lips upwards and backwards.

8. Zygomato-labian, great and small.	Great and small zygomatic.
9. Super-maxillo-labian, 1st. great, 2d. middle, 3d. small.	<div style="display: inline-block; vertical-align: middle;"> <div style="font-size: 3em; vertical-align: middle; margin-right: 5px;">{</div> <div style="display: inline-block; vertical-align: middle;"> 1st. Elevator of the ala of the nose, and upper lip.
2d. Incisive, or proper elevator of the upper lip.
3d. Canine, or elevator of the angle of the lips. </div> </div>

By depressing the lower lip.

10. Mento-labian.	Square of the point of the chin.
11. Maxillo-labian.	Triangular, or depressor of the angle of the lips.

By contracting the aperture of the mouth.

12. Labian (single).	{ Orbicular of the lips, or small incisive of the upper and lower lip.

By elevating the lower jaw.

13. Temporo-maxillan.	Ectotaphite, or temporal.
14. Zygomaro-maxillan.	Masseter.
15. Great pterygo-maxillan.	Great pterygoidian, or interior.
16. Small pterygo-maxillan.	Small pterygoidian, or exterior.

NEW NAMES.

OLD NAMES.

By depressing the lower jaw.

17. Mastoido-genian. Digastric*.

A muscle almost without action, situated under the skin of the neck.

18. Thoraco-facian. Cutaneous.

MUSCLES WHICH MOVE THE SHOULDER ON THE BREAST,

By pulling it backwards.

1. Dorso-super-acromian. Trapezium.
 2. Dorso-scapular. Rhomboides.
 3. Trachelo-scapular. Angular.

By pulling it forwards.

4. Costo-coracoidian. Anterior indented, or small pectoral.
 5. Costo-scapular. Great indented.
 6. Costo-clavian. Sub-clavian.

MUSCLES WHICH MOVE THE ARM ON THE SHOULDER,

By pulling forwards.

1. Sterno-humerian. Great pectoral.

By pulling it upwards.

2. Sub-acromio-humerian. Deltoid.
 3. Coraco-humerian. Coraco-brachial.
 4. Super-scapulo-trochiterian, superior. Super-spinous.

By pulling it backwards.

5. Lumbo-humerian. Great dorsal, or very large of the back.
 6. Scapulo-humerian. Great round.

By making it turn outwards.

7. Super-scapulo-trochiterian, inferior. Subspinous and small round.

By making it turn inwards.

2. Sub-scapulo-trochiterian. Sub-scapular.

MUSCLES WHICH MOVE THE FORE-ARM ON THE ARM,

By bending it.

1. Scapulo-radial. Biceps.
 2. Humero-cubital. Brachial, interior.

By extending it.

3. Scapulo-electranian. Brachial triceps.
 4. Epicondilo-cubital. Small anconeus.

* The other muscles which lower the jaw are attached to the os hyoides: a description of them will be found under the head *System of Digestion*.

MUSCLES WHICH MAKE THE OS RADIUS TURN ON THE
OS CUBITUS,

By carrying it forwards for pronation.

NEW NAMES.	OLD NAMES.
1. Epitrochlo-radian.	Round pronator.
2. Cubito-radian.	Square pronator.

By pulling it outwards for supination.

3. Epicondylo-radian.	Short supinator.
4. Humero-super-radian.	Long supinator.

MUSCLES WHICH MOVE THE CARPUS OR WRIST ON THE
FORE-ARM,

By bending it.

1. Epitrochlo-carpian.	Cubital, interior.
2. Epitrochlo-metacarpian.	Radial interior.

By pulling it backwards.

3. Cubito-super-metacarpian.	Cubital, exterior.
4. Epicondylo-super-metacarpian 1st and 2d.	Radial, exterior 1st and 2d.

*Brachial, anti-brachial and palmar aponeurosis; annular ligament;
muscles which seem to act on the palmar aponeurosis.*

5. Epitrochlo-palmar.	Slender cubital, long palmar.
6. Palmo-cutian.	Cutaneous palmar.

MUSCLES WHICH CONTRIBUTE TO THE MOTION OF THE
FINGERS,

By bending the last four fingers.

1. Common epitrochlo-phalangian.	Sublime or perforated flexor.
2. Common cubito-phalangettian.	Profound or perforating flexor.
3. Palmo-phalangian.	Lumbrical.
4. Metacarpo-phalangian, interior.	Interosseous interior or inferior.

By extending the last four fingers.

5. Epicondylo-super-phalangettian, common.	Common extensor of the fingers.
6. Metacarpo-phalangian, exterior.	Interosseous, superior or exterior.

By bending the thumb.

7. Radio-phalangettian of the thumb.	Long flexor of the thumb.
8. Carpo-phalangian of the thumb.	Short flexor of the thumb.

By extending the thumb.

9. Cubito-super-phalangettian of the thumb.	Long extensor of the thumb.
10. Cubito-super-phalangian of the thumb.	Short extensor of the thumb.

By bringing the thumb nearer the other fingers.

11. Metacarpo-phalangian of the thumb.	Adductor of the thumb.
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By

By removing the thumb from the other fingers.

NEW NAMES.

OLD NAMES.

12. Cubito-super-metacarpian of the thumb.	Long abductor of the thumb.
13. Carpo-super-phalangian of the thumb.	Short abductor of the thumb.

By carrying the thumb before the other fingers.

14. Carpo-metacarpian of the thumb.	Metacarpian of the thumb, or opposer.

By extending the index finger.

15. Cubito-super-phalangettian of the index.	Proper extensor of the index.

By bending the little finger.

16. Carpo-super-phalangettian of the little finger.	Short flexor of the little finger.

By extending the little finger.

17. Epicondylo-super-phalangettian of the little finger.	} Proper extensor of the little finger.

By removing the little finger from the rest.

18. Carpo-phalangian of the little finger.	Abductor of the little finger.
19. Carpo-metacarpian of the little finger.	Opposer of the little finger.

MUSCLES WHICH MAKE THE THIGH MOVE ON THE PELVIS,

By pulling it backwards and outwards.

1. Sacro-femorian.	Gluteus maximus.
2. Greater ilio-trochanterian.	Gluteus medius.
3. Lesser ilio-trochanterian.	Gluteus minimus.

By making it turn outwards.

4. Sacro-trochanterian.	Pyramidal.
5. Ischio-trochanterian.	Gemini.
6. Sub-pubio-trochanterian, interior.	Interior obturator.
7. Sub-pubio-trochanterian, exterior.	Exterior obturator.
8. Ischio-sub-trochanterian.	Square of the thighs.

By bending it forwards.

9. Prælumbo-trochantinian.	Psoas.
10. Ilio-trochantinian.	Iliac.
11. Super-pubio-femorian.	Pectinialis.

By pulling it inwards.

12. Pubio-, sub-pubio-, and Ischio-femorian.	Three adductors, or triceps adductor.

MUSCLES WHICH MOVE THE LEG ON THE THIGH,

By extending it.

1. Ilio-rotulian.	Straight or slender anterior.
2. Trifemoro-rotulian.	} Vast interior, vast exterior, and crural or triceps crural.

By

By bending it.

NEW NAMES.	OLD NAMES.
3. Ischio-sub-tibian.	<i>Semi-membraneus.</i>
4. Ischio-prætibian.	<i>Semi-tendinous.</i>
5. Ischio-peronean.	<i>Biceps.</i>
6. Poplito-tibian.	<i>Popliteus.</i>

By bending it and pulling it inwards.

7. Ilio-prætibian.	<i>Sartorius.</i>
8. Pubio-prætibian.	<i>Slender interior.</i>

FEMORAL APONEUROSIS AND MUSCLE WHICH ACTS ON IT,

By contracting it.

1. Aponeurotic-ilio-femorian.	<i>Muscle of the fascia lata.</i>
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MUSCLES WHICH MAKE THE FOOT MOVE ON THE LEG,

By extending it.

1. Bi-femoro-calcanean.	<i>Gemellus, gastrocnemius.</i>
2. Tibio-calcanean.	<i>Soleus.</i>
3. Femoro-calcanean.	<i>Tibialis or slender plantaris.</i>

By extending it and pulling it inwards.

4. Tibio-sub-tarsian.	<i>Tibialis posticus.</i>
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By extending it and pulling it outwards.

5. Peroneo-sub-tarsian.	<i>Long peroneus.</i>
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By bending it.

6. Tibio-sub-tarsian.	<i>Tibialis anticus.</i>
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By bending it and pulling it outwards.

7. Greater peroneo-super-tarsian.	<i>Middle peroneus.</i>
8. Less peroneo-super-tarsian.	<i>Less peroneus.</i>

Tibial and plantar aponeurosis and annular ligaments.

MUSCLES WHICH SERVE TO MOVE THE TOES,

By bending the last four toes.

1. Tibio-phalangettian, common.	<i>Long common flexor.</i>
2. Calcaneo-sub-phalangettian, common.	<i>Short common flexor.</i>
3. Metatarso-inter-phalangian, inferior.	<i>Inferior interosseous.</i>
4. Planti-sub-phalangian.	<i>Lumbrical.</i>

By straightening the last four toes.

5. Peroneo-super-phalangettian, common.	<i>Long common extensor of the toes.</i>
6. Calcaneo-super-phalangettian, common.	<i>Pedious, or short common extensor of the toes.</i>
7. Metatarso-inter-phalangian, superior.	<i>Superior interosseous.</i>

By

By bringing the articulations of the bones of the metatarsus closer to the first phalanges, in the form of an arch.

NEW NAMES.

OLD NAMES.

8. Transverse-metatarso-phalagian. *Transverse of the toes.*

By bending the great toe.

9. Peroneo-sub-phalagettian of the great toe. *Long flexor of the great toe.*
10. Tarso-sub-phalagian of the great toe. *Short flexor of the great toe.*

By straightening the great toe.

11. Peroneo-super-phalagettian of the great toe. *Extensor of the great toe.*

By bringing the great toe nearer to the rest.

12. Metatarso-sub-phalagian of the great toe. *Adductor of the great toe.*

By removing the great toe from the rest.

13. Calcaneo-sub-phalagian of the great toe. *Abductor of the great toe.*

By bending the little toe.

14. Tarso-sub-phalagian of the little toe. *Short flexor of the little toe.*

By removing the little toe from the rest.

15. Calcaneo-sub-phalagian of the little toe. *Abductor of the little toe.*

CEREBRAL AND NERVOUS SYSTEM.

237. *THE cerebral and nervous system in animals.*

The cerebral and nervous system in zoophytes, has the same appearance as the other parts ; for the gelatinous and homogeneous consistence of the substance of these animals prevents their different organs from being distinguished. It cannot, however, be supposed that this system is wanting in animals, which have the senses of touching and smell exceedingly delicate, and which are sensible to the impressions of the light, heat, and moisture : it is probable that it is equally diffused throughout their whole substance ; and as these animals can be divided into several parts, susceptible of increase and life, this opinion seems thence to acquire a further degree of strength.

The cerebral system begins to be observed in worms, the nereids and amphinoma ; it consists of a long cord divided by knots ; in the leech the knots are more perceptible, and appear to be ganglions. These ganglions are very distinct in the aculeated aphrodite (*aphrodita aculeata*), where they assume an arrangement which is found among insects.

In the *mollusca acephala*, such as the oyster, the cerebral system consists of two ganglions united by two nervous cords.

In

In the gasteropoda, such as the snail and the slug, this system consists of a cerebral ring around the œsophagus, and a greater or less number of ganglions, scattered throughout the different organs. These parts have a communication with each other by means of a cord, and give birth to the nerves.

In the *mollusca cephalopoda*, such as the cuttle-fish (*sepia officinalis* and *sepia octopus*), the cartilage of the head contains a peculiar cavity, in which is lodged the cerebral collar, and this cartilage is pierced with holes to afford a passage to the nerves.

Insects and the *crustacea* have a brain, consisting of two lobes, from which proceed nerves for the eyes, the antennæ and the mandibles: this brain then furnishes two nervous cords, which surround the œsophagus, and proceed to a series of ganglions, more or less numerous, united by a cord, and giving birth to the nerves which are distributed to the other parts.

238. In vertebral animals, the cerebral and nervous system is more complex; and notwithstanding the great variety of configuration which must occur among animals so different as fishes, reptiles, birds, and the mammalia, this system seems to be established in them all, according to a uniform plan. It always consists, 1st, of an organ contained in the cavity of the cranium

encephalon; 2d, of a *prolongation* lodged in the hole or cavity of the vertebral column: the *cerebral* or *rachidian prolongation*; 3d, of a nervous cord, or a series of ganglions, united by a nervous cord, situated interiorly on the sides of the vertebral column: *trispianchnic*. Ganglions also are found in various parts. Nerves distributed to all the organs proceed from these different sources.

239. *Encephalon*. The encephalic system, and its prolongation, are inclosed in a double membrane; the exterior, which is thicker, is called the *meninx* or *dura mater*: the interior (*meningine*) consists of two membranes, the exterior one of which is called the *arachnoid*, and the interior the *pia-mater*.

The *encephalon* always exhibits the two lobes of the brain, the layers of the ocular nerves, the cerebellum, and the commencement of the cerebral prolongation. These parts are very different in the various classes; but they almost always give birth to twelve pairs of nerves which proceed from the cranium, to distribute themselves to the same number of organs.

The first pair proceed to the nostrils, by traversing the os ethmoides. The *ethmoidal*.

The second pair to the eye, where they form the retina. The *ocular*.

The third pair to the muscles of the eye. The *common oculo-muscular*.

The

The fourth pair to the large oblique muscle of the eye. The *interior oculo-muscular*.

The fifth pair divide themselves into three branches, which are distributed to different parts of the face. The *trifacial*.

The sixth pair proceed to the right exterior muscle of the eye. The *exterior oculo-muscular*.

The seventh pair proceed to the face. The *facial*.

The eighth pair, to the labyrinth of the ear. The *labyrinthic*.

The ninth pair, to the pharynx and muscles of the tongue. The *pharyngo-glossian*.

The tenth pair, to the organs of respiration and digestion. The *pneumo-gastric*.

The eleventh pair, to the tongue and its muscles. The *hyo-glossian*.

The twelfth pair arise from the *rachidian* prolongation, and ascend into the cavity of the cranium, from which they are distributed to the cervical and dorsal regions. The *trachelo-dorsal*.

In fishes, birds, and reptiles, the different parts of the encephalon are more or less distinct and separated; so that these parts often touch each other only in one point: in the mammalia they approach each other, and are in some measure confounded.

In quadrupeds, the brain, which is flat and short, leaves the cerebellum uncovered behind.

In

In apes it assumes more thickness, and is continued backwards on the cerebellum. This arrangement is more apparent in man.

In fishes, reptiles, and birds, the surface of the brain is smooth; in the *mammalia* it exhibits *circumvolutions*. In man and the dolphin these circumvolutions are numerous and deep: in apes, and carnivorous animals they are less visible, and in the *rodentia* scarcely appear.

In fishes, the encephalon is very small; it occupies only a part of the cavity of the cranium, and is composed of a double series of *tubercles*, united in a point. Two of these tubercles represent the *lobes* of the brain; two others form the ocular layers; that which constitutes the cerebellum is comparatively very large; in the last place, there is one which produces the commencement of the cerebral prolongation.

The encephalon of fishes has behind the cerebellum various other small lobes, which give birth to some pairs of nerves, not found in the other classes.

The encephalon of reptiles varies greatly in the different genera of this class; but it is always formed of distinct tubercles for the lobes of the brain, the ocular layers, the cerebellum, and the cerebral prolongation.

In birds the encephalon consists of six tubercles: two of these form the lobes of the brain;

two others the ocular layers: one constitutes the cerebellum, and the last the cerebral prolongation.

In the mammalia these parts approach each other, so that the lobes of the brain are almost united; the ocular layers are confounded with the brain; but the cerebellum remains distinct.

Each lobe of the brain has in the middle a cavity: *ventricle*. The ventricles of the brain assume various configurations, and the sides of them have several prominences: that found in all vertebral animals is a protuberance marked with *friæ* alternately gray and white in the inside, among the mammalia; and with some whiter lines, in the other classes: *corpora striata, striated bodies*. These bodies are very large in birds, and constitute almost alone the whole lobe of the brain.

The upper part of the lobes of the brain, which is continued with the striated bodies, and forms the hemispheres, is thin in fishes, reptiles, and birds: in the mammalia it assumes more thickness, and in man its thickness is considerable.

These ventricles have in the inside also several prominences, which in different classes of animals are wanting, either in whole or in part; and which we shall examine minutely in man.

In fishes, reptiles, and birds, the layers of the ocular nerves are distinct, separated, and exhibit
ventricles

ventricles in the inside : in the mammalia they are found in the substance of the lobes of the brain, and have no ventricles. Below and between the ocular layers is a *third ventricle*.

The cerebellum in all animals is a distinct part : in fishes it is round and very large ; in birds it is flattened in a transverse direction. In the mammalia there are two lateral lobes and a middle lobe. In man, the middle lobe, which is very small, is concealed by the other two.

In fishes, reptiles, and birds, the surface of the cerebellum is smooth ; in all the mammalia it is marked with transverse and parallel furrows. The cerebellum is united to the brain by two *transverse peduncles* ; and the latter proceed to two *longitudinal peduncles*, by means of which the brain is continued with its cerebral prolongation.

The commencement of the cerebral prolongation is generally marked by a distinct tubercle, of a different form.

Between the cerebellum and the rachidian prolongation is a *fourth ventricle*, in which is always observed a thin medullary lamina, called improperly a *valvula*.

All the ventricles have a communication with each other by foramina, the sides of which are contiguous.

In birds, the anterior ventricles are shut on the interior side by a thin and radiated partition.

The conduit which forms a communication be-

tween the third and fourth ventricle is called the *aqueduct of Silvius*. The ventricles of the ocular layers have a communication, by this aqueduct, with the other ventricles.

Before and behind the third ventricle is always found a transverse cord: the two *commissuræ*, the *anterior* of which is generally longer and thinner, the *posterior* larger and shorter.

Before the third ventricle is a funnel-like excavation, which is directed downwards, and continues with a tube that adheres to a tubercle. This tube and tubercle are distinguished by the name of the *pituitary gland*.

In all vertebral animals is found a tubercle, called the *pineal gland*.

In the mammalia are observed some parts which are not found in the other classes.

In the bottom of the interval, which separates the two lobes of the brain, is a large band, the extremities of which are folded downwards: *mesolobe*.

Below, is found a triangular protuberance, *arch with three pillars*: two of its angles are prolonged backwards and downwards; the third is formed of two cords, united, which proceed forwards and downwards. This trigone is continued inferiorly and anteriorly with a thin partition, called the *septum lucidum*. This partition, which separates the two ventricles of the brain, is formed of two

contiguous laminæ; the triangular space left between them is known by the name of the *fifth ventricle*.

In a part of the ventricles of the brain is found an elongated *protuberance*, which in quadrupeds is larger than in man, *cornua ammonis* (ram's horns).

Above the aqueduct of Silvius there are four tubercles (*tubercula quadrigemina*), which are also larger in quadrupeds than in man. The two anterior (*nates*), which are higher, are much larger in graminivorous than in carnivorous animals: on the other hand, the two posterior (*testes*) are much more voluminous in the carnivorous than in the graminivorous.

Fishes and birds have also four tubercles; but they are placed before and above the ocular layers.

In apes and in man, the ventricles of the brain are continued backwards, with a cavity (*digitalis*) which lodges a protuberance (*the spur*).

240. *Cerebral or rachidian prolongation.* The cerebral prolongation gives birth to as many pairs of nerves as there are inter-vertebral spaces. Each rachidian nerve arises from two roots, separated by a thin membrane; these two roots pass through the meninx, and proceed to a ganglion which gives birth to two nervous branches.

The rachidian or vertebral pairs are distinguished into *cervical*, *dorsal*, *lumbar*, *pelvian*, and *caudal*; and are distributed to different parts of the trunk.

The last cervical and the first dorsal pairs unite to form a plexus, which furnishes the nerves of the thoracic member. The last lumbar and the first pelvian form the plexus, which furnishes the nerves of the pelvian member.

241. *Trisplanchnic*. All vertebral animals, on the sides of the præspinal face of their vertebral column, have a nervous cord in the same manner as fishes; or a series of ganglions united by a nervous cord, in the same manner as the mammalia and birds. This system has a communication, by filaments, with all the vertebral and with some of the encephalic pairs: it furnishes branches which are distributed to the vessels of the three large cavities.

242. *Cerebral and nervous system of man*. In man, the cerebral and nervous system is composed of the encephalic organ, the cerebral prolongation, the trisplanchnic, and various ganglions and nerves which proceed from these different parts.

Encephalon. The encephalic organ comprehends the brain, the cerebellum, the mesencephalon, and the commencement of the cerebral prolongation. It has the form of the cavity of the
cranium

cranium in which it is contained ; it is soft, and its gravity is to that of water as 1310 is to 1000. It forms the thirtieth part of the weight of the body in adults, the seventh or eighth part at the period of birth, and nearly one half of its total weight during the first months of conception. Its surface exhibits a number of deep sinuous anfractuositities over which the sanguine vessels are spread. The blood which arrives at this organ has been estimated at nearly the seventh or eighth part of that which issues from the aorta. The cerebral arteries are exceedingly flexuous, and their sides are very thin : at the base of the cranium they form an anastomotic circle ; they then expand over the whole surface of the brain, divide and subdivide themselves into communicating branches, and terminate in very delicate ramifications, which penetrate into the substance of the brain, and in a great measure disappear from the sight.

The blood returns by veins without valves exceedingly flexuous, which present frequent anastomoses, and do not follow the direction of the arteries ; they form distinct branches, which, instead of uniting to constitute trunks, pour the blood obliquely, in the inverse direction of its course, into sinuses or membranous ducts.

Though we do not know what takes place between these two orders of circulation ; though the encephalic organ presents itself under a pulpy and

homogeneous appearance, and though microscopic observation shows nothing in it but a collection of very fine globules, every thing announces the most perfect organization, and the most important secretion.

In the interior, the encephalic organ exhibits a structure altogether peculiar; the sides of the cavities are lined with a thin membrane; there are found also protuberances, small bands, cords, striæ of different forms, colours and densities; holes, fissures and conduits, which have a communication with each other; and the whole of these forms, exceedingly numerous, exhibits a constant regularity.

In the last place, this encephalic organ and its rachidian prolongation are covered by a double membranous tunic, and enclosed in strong osseous cavities; they give birth to numerous pairs of nerves, which proceed to every part of the body; these nerves divide themselves into branches, which are subdivided into very delicate ramifications, that spread in all the organs, penetrate into every part of them, where they terminate in different ways, and carry thither the principle of action and of life.

As we are unacquainted with the particular use of the different parts which enter into the composition of the encephalic organ, the description of them is merely graphic.

243. The double membrane which envelops this organ (*meninx* and *meningine*) form folds which are interposed between its lobes.

The *meninx* (*dura mater*) is a thick, semi-transparent membrane, over which the meningian arteries are spread: it lines the interior face of the cranium, to which it serves as periosteum and strongly adheres to it, especially along its sutures and at its base. Its interior face covers the meningine, without adhering to it.

The *meningine* (*pia mater*) consists of two laminæ, closely united; the interior of these laminæ furnishes different folds, of which there are three principal ones. One of them extends from the ethmoidal ridge to the occipital protuberance, and forms a partition between the two lobes of the brain: *median septum*; *falx of the brain*.

Another is placed below the posterior part of the brain, which it separates from the cerebellum; it extends from the occipital protuberance to the superior edge of the apophysis petrosa; it is pierced before with a hole for the mesencephalon: *transverse septum of the cerebellum*; *tentorium of the cerebellum*.

A third extends from the occipital protuberance to the occipital hole, and separates the two lobes of the cerebellum*: *median septum of the cerebellum* (*falx of the cerebellum*).

The

* The meninx furnishes also two folds, which extend from the

The meninx is prolonged through all the holes of the base of the cranium, and accompanies the parts which issue from them. It furnishes chiefly a *meningian sheath* to the *rachis*: this sheath adheres along the vertebral canal, envelops the rachidian prolongation, and furrounds the origin of the nerves which proceed from it.

The meninx in different parts of its thickness has different conduits, often of a triangular form (*sinus*), which receive the blood of the veins, and pour it into the gulf of the jugular. These sinuses are very numerous: but there are reckoned to be four principal ones: one of them extends from the ethmoidal ridge to the occipital protuberance, along the upper edge of the median septum of the brain: *median sinus* (*superior longitudinal sinus*). It there divides itself into two *lateral sinuses* hollowed out in the thickness of the adhering edge of the transverse septum of the cerebellum, which extend as far as the occipito-petrea hiatus, and proceed to the jugular fossæ. These sinuses exhibit in the interior some transverse fræna, and a few small granulous bodies.

At the base of the median septum of the brain, and near the transverse septum of the cerebellum, is a *choiridian sinus* (*straight sinus*), which transmits into the lateral sinuses, the blood it receives from the choroidian veins, and from the *inferior* the anterior clinoid apophyses, to the posterior, and two others which run along the small alæ of the sphenoid.

longitudinal

longitudinal sinus. The latter proceeds along the median septum of the cerebellum*.

The *meningine* is a thin transparent membrane, situated beneath the meninx, and which envelops the encephalic organ and its prolongation; it is formed of two laminae, between which are dispersed a great number of vessels.

The exterior lamina (*arachnoid*) covers the exterior face of that organ; it accompanies, to the place where they issue, the nerves which proceed from it; and then bends back on the interior face of the meninx, in the same manner as the serous membranes†. This lamina has several prolongations: one of them penetrates into the lateral ventricles, and covers the different prominences,

* The meninx forms also several small sinuses, some of which run along the posterior edge of the median septum of the cerebellum. *Occipital sinuses*; others are placed along the upper edge of the petrous apophysis: *superior petrous sinuses*. Below the preceding, there are two others which extend along the articulation of the petrous apophysis with the occipital: *Inferior petrous sinuses*: they empty themselves directly into the gulf of the jugular.

A *sinus* is situated transversely on the basilar apophysis, and communicates with the two preceding ones.

Two *cavernous sinuses* are lodged in the carotid canals, and open into the *petrous sinuses*. In the last place two *sinuses*, one before and the other behind the sella turcica, communicate with the cavernous, and form a circle (coronary) around that part.

† See *Traité des Membranes*, du C. Pichat.

observed

observed in them. Another covers, with the meninx, the rachidian prolongation; accompanies to the place where they issue the nerves which proceed from it, and bends back on the interior face of the meninx. The interior lamina of the *meningine* (*pia mater*) produces prolongations which penetrate into all the anfractuosities of the brain. It accompanies the meninx in its different passages, and produces along the vertebral canal indented expansions, which are interposed between the anterior and posterior bundles of the nerves of the rachis.

The surface of the brain exhibits numerous flexuous and deep anfractuosities, and is divided longitudinally, at the summit, into two lobes, separated by the median septum. Each of these lobes may be divided inferiorly into three lobules. The first rests on the orbital arches; the second is lodged in the temporal fossæ; it is separated from the first by a deep scissure: the third rests on the cerebellum, from which it is separated by the transverse partition of the meninx.

When the two lobes of the brain are separated, there is seen a large white band, which unites these two bodies near their base. C. Chauffier has given it the name of *mesolobe**: (*corpus callosum*).

The

* We shall provisionally adopt the more rational language which C. Chauffier has substituted for the whimsical and ridiculous

The superior face of the mesolobe is covered by the sharp edge of the longitudinal septum, and by sanguine vessels; it exhibits in the middle a sort of furrow, and on the sides transverse striæ.

The posterior extremity of the mesolobe, which is broader than the anterior, forms a thick round roll. The mesolobe occupies nearly the middle half of the space comprehended between the forehead and the occiput; it is, however, nearer to the former. It continues on the sides with the *white substance* (medullary) of the lobes of the brain. This part forms in the middle of the lobes an oval centre, surrounded by the gray substance (cortical).

Below the mesolobe are the two ventricles of the brain (lateral ventricles). These cavities, the sides of which are contiguous, describe in their passage two oval furrows, interrupted before, placed back to back internally, and separated from each other by a thin lamina: *median septum of the ventricles*, (*septum lucidum*).

These furrows, taken towards their anterior and posterior ends, have received different names employed by the ancients to denote the different parts of the encephalic organ. But, it must be confessed, that zootomy will never be in possession of a nomenclature completely satisfactory, and susceptible of being generally adopted, until intelligent anatomists employ themselves, as the modern chemists have done, to reform the language of their science; and until, after adopting *a method of nomenclature*, they shall have given to the different parts names suited not only to the organs of man, but also to the similar or analogous parts in animals, so as to connect by language two branches of natural history, which ought never to be separated.

interior

interior extremity, proceed backwards till they approach near to the posterior lobes, where they are reflected outwards, and return in the thickness of the middle lobes, directing themselves forwards and downwards.

The ventricles of the brain are broad at their entrance, and terminate in a point behind; in their passage they describe the portion of a curve, the convexity of which is turned outwards.

The median septum is formed of two very thin laminae: these laminae, which are not contiguous, leave between them a vacuity, in which a serous matter is sometimes collected. *Ventricle of the septum, (5th ventricle).*

The sides of the ventricles of the brain have protuberances and cavities, which are fitted to each other, so as to leave no vacuity between them; they are lined with a very fine serous membrane, which is a continuation of the meningine, and which secretes a lymphatic dew; when this lymph is collected, it distends the sides of the ventricles, and forms of them real cavities.

Along the base of the ventricles proceeds a membrano-vascular *plexus*, of a reddish colour, free and floating at the top, which adheres by its inferior face to the serous membrane that covers the ventricles. This body seems to be formed by the union of the arteries which proceed from the middle lobar, and the veins which convey the blood into the choroidian sinus: *choroid plexus*.

Below the median septum and the choroid plexus, and at the inferior side of the ventricles, is a body of a white substance, which has the form of a right-angled triangle, *cerebral trigone*, (arch with three pillars). The anterior angle terminates in two cords, which descend between the layers of the ocular nerves. The two posterior angles turn backwards and outwards, and terminate in a point in the exterior and inferior part of the ventricles. The inferior face, which is slightly excavated, exhibits a triangular space, on which are observed longitudinal striæ in the form of a *lyre*.

On the sides of the ventricles there are two broad, round eminences, which approach each other before, and terminate gradually in a point behind. The outside of them is formed of a grayish substance, interspersed in the interior with white striæ, which proceed from a centre of the same colour, *pyriform eminences*, (striated bodies).

Towards the middle of the ventricles of the brain, below and behind the pyriform eminences, are two whitish ovoid protuberances, covered by the choroid plexus, and the cerebral trigone, *layers of the ocular nerves*, (layers of the optic nerves). They are confounded on the outside with the lobes of the brain; and the exterior part of them consists of a white stratum, which mixes itself with the gray substance in the centre.

The pyriform eminences, and the layers of the
ocular

ocular nerves, are separated, on each side, by a furrow, which lodges a small grayish semi-circular band. These small bands are thicker and nearer each other before than behind. *Small bands of the pyriform eminences*, (small semicircular bands).

In that part of the ventricles, which is turned posteriorly outwards and downwards, are two whitish, oblong, cylindric protuberances, thin and narrow behind: their anterior extremity, which corresponds to the termination of the ventricles, is broader and thicker, and exhibits three or four light tubercles, separated by furrows: *cylindroid protuberances*, *cornua Ammonis*, *ram's horns*.

On the interior side of the cylindroid protuberances, at the termination of the posterior pillars of the trigone, is observed a grayish lamina, indented and free towards its exterior edge. The *bordered or fringed bodies*, (*corpora fimbriata*). The exterior side of these protuberances exhibits an eminence, broader behind than before, which corresponds to an anfractuosity of the inferior part of the brain. The *accessories of the cylindroid protuberances*, (*accessories of the cornua Ammonis*).

Above and behind the cylindroid protuberances are two cavities, in the form of a bag, hollowed out in the substance of the posterior lobes of the brain, *appendices of the ventricles*, (*digital cavities*). In these cavities is observed an *unciform eminence*, broad before, terminating in a point behind, and
bent

bent inwards; (*the spur*) which is formed by a prominence of a gray substance, covered by a white stratum.

The sides of the ventricles are lined with a very fine serous membrane, overspread with arteries and veins. The veins unite to those which proceed from the choroid plexus, and form in each ventricle a *choroidian vein* (vein of Galen), which approaches that on the opposite side, between the layers of the ocular nerves. These veins proceed backwards, and anastomose in a common short trunk, which enters the anterior extremity of the right sinus.

The layers of the ocular nerves leave between them an interval in the form of a fissure, *the third ventricle*. This interval is bounded at the top by the cerebral trigone, and at the bottom by the mesencephalon. The ocular layers are united at the bottom by a soft grayish tubercle; before this tubercle is observed an elongated aperture: *anterior aperture* (vulva); and behind a round aperture, *posterior aperture* (anus): these apertures communicate with the lateral sinuses, and are covered superiorly by the cerebral trigone. The lateral sinuses are bounded at the bottom by the mesencephalon.

Before the anterior aperture is a whitish cord, which extends profoundly, in a transverse direction, into the substance of the middle ventricles

of the brain, and turns in the form of a bow :
anterior commissura.

Below the anterior commissura is a funnel-shaped excavation ; the bottom of this excavation is continued with a solid grayish peduncle, which terminates at a round tubercle, resting on the body of the os sphenoides : *supersphenoidal peduncle and appendix* (pituitary peduncle and gland).

Below and behind the posterior aperture of the third ventricle is a second whitish cord, larger and shorter than the anterior, which extends transversely in the strata of the ocular nerves :
posterior commissura.

Behind the posterior commissura is a small grayish conical body, of the size of a pea, softish, and often containing gravel in the inside : *the conarium* (pineal gland). The base of the conarium, which is turned forwards, seems to adhere to two very fine white cords, which pass over the posterior commissura, and are continued on the interior sides of the strata of the ocular nerves :
peduncles of the conarium (the kidneys).

The conarium rests above the four white tubercles : *tubercles of the mesencephalon* (tubercula quadrigemina). The two superior and anterior of these tubercles, which are oval and larger (nates), are continued before with the posterior commissura. The two inferior ones, which are round and smaller (testes), are continued with the
superior

superior *prolongations* of the peduncles of the cerebellum, and with a whitish lamina, rounded at the top and covered with horizontal *striæ*: *medullary lamina of the cerebellum* (valvula of Vieussens).

Below the posterior commissura and the tubercles of the mesencephalon is a canal, which proceeds downwards: *intermediate canal of the ventricles* (aqueduct of Sylvius). It proceeds between the sides of a fourth cavity: *fourth ventricle*.

This ventricle is situated below and between the peduncles of the cerebellum. It exhibits before, a longitudinal groove and two lateral ones, which terminate obliquely in a point on the first, and resemble the cut part of a pen (*calamus scriptorius*). Behind, this ventricle is closed by the medullary lamina of the cerebellum; the base of it corresponds to the cerebral prolongation, and at its summit is found the aperture which conducts to the third ventricle.

The third and fourth ventricles contain a small choroid plexus; their sides are contiguous, and lined with a *serous membrane*, overspread with sanguine vessels. This membrane continually pours forth a lymphatic dew, which is sometimes found in a pretty large quantity, and which, in this case, distends the sides of these cavities.

In the last place, the brain exhibits below and in the middle two large *peduncles* (prolongations

of the brain, crura of the brain, crura of the medulla oblongata); these peduncles arise from the inferior part of the pyriform eminences. They separate at their origin, and are placed behind the sphenoidal flank; they unite with those of the cerebellum, and concur together to the formation of the mesencephalon. Before these peduncles, there are two round tubercles situated close to each other, which result from the bifid termination of the anterior pillar of the trigone: *pyriform tubercles* (mammillary eminences).

244. The cerebellum is lodged in the occipital fossæ, which determine its form: it is situated under the posterior lobes of the brain, from which it is separated by the *transverse septum*; its volume is nearly the eighth or ninth part of that of the cerebrum. It is divided posteriorly, into two lobes, by a scissure, which lodges the *median septum*, and on its surface has deep transverse furrows, which intersect each other at an acute angle.

The surface of the cerebellum exhibits also a pretty large number of mammillary protuberances; in general, there are five on the upper face, ten on the inferior, and two or three behind.

Between the lobes of the brain before is a protuberance, placed behind the quadrijumelli tubercles: *median protuberance of the cerebellum* (superior vermicular eminence); at the bottom and in the
middle

middle is found the *median lobule* (inferior vermicular eminence).

The number of laminæ produced by these anfractuosities, is from 25 to 30 on each face. Between these laminæ are found others smaller and thinner.

The laminæ of the cerebellum are formed of a gray substance, and ramifications of a white substance; the white ramifications of several laminæ unite and form branches. These branches proceed to a white nucleus, placed in the middle of each lobe of the cerebellum (*arbor vitæ*).

The middle and anterior part of the cerebellum furnishes two large cords or *peduncles*, which arise in the white centre of its two lobes. These peduncles become larger, and each divides itself into three bundles: one ascends before, and unites with the inferior tubercles of the mesencephalon; the other proceeds to the lateral parts of the bulb of the cerebral prolongation; the third, which is much larger, concurs towards the formation of the mesencephalon: *superior, middle, and inferior prolongations of the cerebellum*.

The peduncles of the cerebellum are formed of a very white substance, which towards the centre contains a yellowish gray substance. They unite with the peduncles of the brain to form the *mesencephalon* (*annular protuberance—pons Varolii*).

245. The mesencephalon is found below the

brain and before the cerebellum; its superior face, inclined backwards, corresponds to the third ventricle, and the intermediate canal of the ventricles; its inferior face, which is rounded, rests on the basillary eminence of the occipital bone. On its middle part is observed a longitudinal furrow or raphe, which lodges the trunk of the mesencephalic artery. Its anterior convex part is continued with the peduncles of the brain; its posterior concave part corresponds on the sides to the peduncles of the cerebellum; and in the middle gives birth to the cerebral prolongation. The exterior part of its substance consists of white fibres, which lose themselves in the gray substance of the interior part. It exhibits transverse or horizontal fibres, intersected at right angles by two bundles of a whitish substance; one on the right, the other on the left. These bundles traverse the mesencephalon, expand and proceed before to the pyriform bodies, and behind to the cerebral prolongation.

246. The commencement of the cerebral or rachidian prolongation is separated from the mesencephalon by a transverse furrow; its form is pyramidal and quadrilateral; its anterior face, inclined downwards, has in the middle a longitudinal furrow, on the sides of which are observed the *pyramidal eminences*. These eminences are separated by a longitudinal furrow from two other *eminences* called the *Olivarian*.

The

The diameter of the *rachidian prolongation* (*medulla elongata*) is to that of the brain as 1 to 7; it has the form of the cavity which contains it. At its entrance into that cavity it is large, and decreases towards the fourth cervical vertebra, but increases towards the following ones. It then decreases along the dorsal vertebræ, and again becomes larger towards the last of that region. This prolongation terminates, towards the first lumbar vertebra, in two tubercles, situated before the other, and separated by a groove: they give birth to a bundle of nerves which occupies the rest of the vertebral canal.

The cerebral prolongation is of a softer consistence than the brain; its substance is white, and in the inside has a grayish furrow. It gives birth to thirty pair of nerves, which issue through the vertebral holes.

247. ENCEPHALIC NERVES. The brain, at its base, gives birth to twelve pair of nerves, which issue through different holes of the base of the cranium.

248. The *first pair* arise from the inferior and anterior part of the brain, by three filaments; two of which come from the interlobar scissure; the third, inferior, issues before and below the pyriform eminences. These filaments unite into a thick triangular cord, which soon becomes smaller: this nerve advances under a furrow of

the anterior lobe of the brain, and approaches that of the opposite side; it becomes larger and terminates on the sides of the ethmoidal ridge, in a round tubercle, exceedingly soft, semi-transparent and grayish.

This tubercle gives birth to from 20 to 24 very delicate filaments, which traverse the holes of the cribriform plate of the os ethmoides, descend along very small canals, and proceed to the nasal fossæ. A part of these nervous filaments are distributed within, on the septum, and without, on the superior and middle cornets: they then become so slender and pulpy, that they escape the sight. ETHMOIDAL NERVE, *olfactory*. This nerve, in most quadrupeds, is hollow.

249. *The second pair* arise from the posterior and inferior of the ocular strata.

The cords of which they are composed separate by bending around the peduncles of the brain, and approach each other before the anterior commissura; they then again separate; proceed obliquely towards the ocular holes, and penetrate into the orbit enveloped in a sheath, furnished by the meninx.

The ocular nerve passes between the tendons of the four straight muscles; when it arrives behind the lobe of the eye, it pierces the sclerotica and the choroid, becoming smaller, and then expands to form the retina: OCULAR NERVE, *optic*.

250. *The*

250. *The third pair* arise from an excavation found between the peduncles of the brain, near the mesencephalon, and issue in several filaments, which unite into a cord. This nervous cord diverges from that on the opposite side, advances behind the posterior clinoid apophyses, passes through the sphenoidal fissure, and penetrates into the orbital cavity, where it separates into two branches: one of these, called the superior, distributes itself by several filaments to the superior straight muscle, and proceeds to the orbito-palpebralian; the other branch, which is larger, divides itself into three smaller branches: the first, or inferior, which is the largest, distributes itself to the interior straight muscle, passing under the ocular nerve; the second, or exterior, which is longer, first furnishes a ramus to the orbital ganglion, and then distributes itself to the small oblique muscle; the third proceeds to the inferior right muscle: COMMON OCULO-MUSCULAR, *common mover*.

251. *The fourth pair* arise by two or three small filaments, close to each other, between the peduncle of the cerebellum, and the inferior tubercles of the mesencephalon; turn round on the sides of the mesencephalon; advance along the cavernous sinus, in a canal formed by the meninx, and penetrate into the orbit by the sphenoidal fissure. This nerve passes under the common
oculo-

oculo-muscular, proceeds towards the upper and interior side of the orbit, and distributes itself to the large oblique muscle: INTERIOR OCULO-MUSCULAR, *pathetic*.

252. *The fifth pair* arise from the inferior and anterior part of the peduncles of the cerebellum, near the mesencephalon, in two portions: one, behind, consists of about thirty filaments united; the other, before, which is smaller, consists of several lax filaments. This nerve pierces the meninx towards the petrous apophysis, and forms there a plexus, which gives three branches. THE TRIFACIAL, *the trigemini*.

Of these three branches one penetrates into the orbit by the sphenoidal fissure: the *orbito-frontal*; the other proceeds to the face by the large round foramen; *the sub-maxillary*: the third distributes itself to the lower jaw: *the maxillary*.

A. THE ORBITO-FRONTAL, *ophthalmic of Willis*, on entering the orbit divides itself into three rami.

a. One proceeds over the periosteum of the arch of the orbit; issues through the super-orbital foramen, and distributes itself to the eye-lid and the fore-head: *the palpebro-frontal* (frontal or supercilian). In its passage, it divides itself into two rami: the *interior ramus* sends out a filament which unites to another of the nasal; it issues from the orbit above the cartilaginous pulley (*trochlea*), and separates into a great number of small

small branches, which are distributed to the fronto-supercilian muscle, the occipito-frontian, the integuments, and the bulbs of the cilia.

The *exterior ramus*, which is larger, follows the direction of the muscle that raises the eye-lid; issues through the super-orbital foramen, and divides itself into a great number of filaments, distributed to the eye-brows, the fore-head, and even to the summit of the head: a filament unites to a branch of the facial in the substance of the eye-lid.

b. The other ramus proceeds along the exterior side of the orbit, distributes itself to the lachrymal gland and the upper eye-lid: *lachrymal*. In its passage it throws out a filament which issues again through the spheno-maxillary fissure, and communicates with another of the superior maxillary; a second filament passes through a hole of the os jugale, and anastomoses with another of the facial; the trunk then traverses the gland, and loses itself on the conjunctive membrane.

c. The last, the *nafo-palpebral* (nasal), throws out a filament on its entrance into the orbit: this filament unites to another which comes from the superior cervical ganglion of the trisplanchnic, and both proceed to the *orbital ganglion*. The nafo-palpebral nerve then proceeds towards the interior side of the orbit, and divides itself into two rami.

The first passes through the anterior orbital
hole,

hole, and penetrates into the cranium, traversing the cribriform plate of the os ethmoides; it then re-enters the nasal fossæ, by another hole of that bone; gives some filaments to the anterior ethmoidal and frontal cells; descends behind the bones of the nose along their cartilages, and expands on the lobe of the nose.

The second proceeds towards the interior angle of the orbit, where it unites to a filament of the frontal; it then passes under the cartilaginous pulley of the great oblique muscle, distributes itself to the neighbouring parts, and terminates at the eye-lids: *palpebral*.

The ORBITAR GANGLION, *ophthalmic* or *lenticular*, is very small; it is found on the exterior side of the ocular nerve, near its entrance into the orbit. It receives the two filaments already mentioned and another very short one transmitted to it by the common oculo-muscular: there proceed from it ten or twelve filaments, which surround the optic nerve; traverse the sclerotica in different parts, creep over the choroid, and expand on the iris: *irian*.

B. THE SUPER-MAXILLARY, *superior maxillary*, issues from the cranium, through the superior maxillary foramen. On issuing from that hole, it throws out a ramus which penetrates into the orbit, by the spheno-maxillary fissure; *the orbital*: it then proceeds towards the exterior side of that cavity, and divides itself into two filaments: one
of

of these unites to the filament of the lachrymal, which traverses the os jugalis; the other pierces the orbital portion of that bone, and penetrates into the temporal fossa, where it unites with a filament of the inferior maxillary.

The super-maxillary nerve penetrates into the summit of the zygomatic fossa; and furnishes two filaments, which proceed to the *sphenoidal ganglion*. It throws out also several others which proceed behind the maxillary sinus: some penetrate into the tuberosity of that bone, and terminate in the dentar cavities of the last molar teeth (*posterior dentary*), the rest are distributed to the gums and the buccinator muscle.

The super-maxillary then enters the *super-orbital* canal, along which it gives out a ramus (*interior dentary*) that divides itself into several filaments. These filaments pierce the alveolar edge, and distribute themselves to the roots of the other teeth: one of these filaments communicates with another of the posterior dentary.

The super-maxillary nerve then issues through the sub-orbital foramen, and divides itself into a great number of rami, which have a communication with each other and with filaments of the facial; their aggregate forms a sort of plexus, the ramifications of which are distributed to the muscles of the nose, the lips and the cheek.

The SPHENOIDAL GANGLION, *spheno-palatine*, is situated at the summit of the zygomatic fossa;

it receives, independently of the two filaments furnished to it by the super-maxillary, a ramus formed by the union of a filament of the facial and another of the upper cervical ganglion.

The first filament (the superior ramus of the *vidian*) issues from the *inflex* canal of the os temporis, through the *hiatus* of that bone, escapes from the cranium through the anterior foramen lacerum, and unites itself to the second filament; the latter (the inferior branch of the vidian) arises from the superior cervical ganglion of the great sympathetic, ascends along the carotid canal, and its union with the first produces the pterygoidian (*vidian*) nerve; this nerve traverses the canal of the same name, and proceeds behind the *sphenoidal ganglion*.

The sphenoidal ganglion furnishes several rami or filaments.

a. The largest of these proceeds towards the posterior palatine canal, which it penetrates, after throwing out one or two filaments that pass through the holes in the tuberosity of the palatine bone; these filaments distribute themselves to the guttural conduit of the ear, to the velum palati, and to the uvula. The *gutturo-palatine* (palatine). This large ramus then traverses the posterior palatine canal, and on issuing from it divides itself into several filaments, which are distributed on the palatine arch: *the superior palatine*.

b. The other filaments, furnished by the sphenoidal

noidal ganglion, arise from the interior part of it; penetrate into the nasal fossæ, through the sphenopalatine foramen, and distribute themselves on the exterior side of that cavity: The *ethmoidal* (sphenopalatine). One of these filaments descends in the inside on the partition of the nose, to the bottom of the entrance of the nostrils, where it passes into the anterior palatine foramen, unites to that on the opposite side, and forms a bulb or ganglion, which corresponds to the palatine arch behind the dentes incisores: *the naso-palatine*.

c. The MAXILLARY; *inferior maxillary*, is the largest branch of the trifacial: it issues from the cranium by the inferior maxillary foramen, penetrates into the zygomatic fossa, and sends out a great number of rami, which form two bundles. The first or superior one furnishes:

a. A ramus which descends below the exterior pterygoidian, passes before the condyle of the jaw, and expands in the zygomato-maxillian muscle: *the sub-zygomatic*.

b. Two filaments, which ascend in the temporal fossa, distribute themselves to the muscle which covers it, and unite with a filament of the orbicular: *the temporo-muscular*.

c. A ramus which descends between the pterygo-maxillian muscles, gives some filaments to the small pterygo-maxillian, as well as to the temporo-maxillian; passes behind the coronoid apophysis of the

the jaw, expands into several filaments, in the bucco-labian muscle, communicating with the facial and the sub-orbital : *the bucco-labian*.

d. In the last place a delicate and profound ramus which descends before, and distributes itself to the grand pterygo-maxillan muscle : *the pterygo-muscular*.

The second or lower bundle furnishes :

a. A ramus which descends behind the condyle of the jaw, sends out a filament to the auditory conduit, and another which communicates with the facial at the place where it issues from the stylo-mastoidian foramen. This ramus is then reflected before the ear, and divides itself into two filaments, which are distributed to the temporo-maxillan muscle, accompanying the super-facial temporal artery, and communicating with filaments of the facial : *the cutaneous temporal*.

b. A ramus which descends obliquely behind the ramus of the lower jaw, passes under the sub-maxillary gland on the mylo-hyoidian muscle, proceeds to the sides of the tongue, and loses itself at the point of it : *the lingual*.

In its passage, this ramus receives the tympanic ramus arising from the facial : it then throws out two or three filaments which form a plexus or ganglion, whence proceed other filaments which are distributed to the sub-maxillary gland and surround the sub-lingual artery : *the sub-maxillary*.

In

In the last place, it furnishes some filaments which are distributed to the sub-lingual gland, and others which proceed to the membrane of the mouth, and communicate with filaments of the hyo-glossian muscle.

The lingual then separates into two rami; one of which sends out filaments that proceed to the muscles of the tongue; the other furnishes some which are ramified on the sides and at the tip of it, and which, by their termination, form the papillæ of that organ.

c. A third ramus, which arises from a trunk common to the preceding, *the maxillo-dentary*, descends behind the condyle of the jaw, and proceeds towards the maxillary canal. Before it enters this canal it gives out a filament which is distributed to the maxillary gland, the mylo- and genio-hyoidian muscles (*the mylo-hyoidian*): this ramus then runs through the dentary canal, and in its passage sends out filaments, which proceed to the dentary cavities of the large and of the first of the small dentes molares (*dentary*). When it comes opposite to the hole of the chin it furnishes a filament which follows the direction of the dentary canal, and is distributed to other teeth: it then issues through that hole, is reflected upwards, and divides into several filaments, which expand to the muscles of the lower lip and the cheek.

253. The *sixth pair* arise in several united fila-

ments from the furrow which separates the mesencephalon from the cerebral prolongation. This nerve is flat, advances towards the point of the petrous apophysis, and pierces the meninx to proceed into the cavernous sinuses, where it receives two filaments, which embrace the anterior cerebral artery: these filaments, which arise from the superior cervical ganglion of the tri-splanchnic, form a plexus around that artery; it then penetrates into the orbit by the sphenoidal fissure, and distributes itself to the exterior right muscle of the eye. EXTERIOR OCULO-MUSCULAR, *exterior motor*.

254. The *seventh pair* arise from the triangular fossa which is found between the mesencephalon and the exterior side of the base of the rachidian prolongation, near the olivarian eminence: it proceeds outwards with the labyrinthic nerve, then bends forwards and proceeds to the auditory foramen. This nerve soon separates from the labyrinthic to penetrate into the spiroid canal of the temporal: it passes through its different windings and gives several rami, which are distributed to the face. THE FACIAL, *the hard portion of the seventh pair*.

a. One enters the cranium by the *hiatus* of the temporal bone, issues through the anterior foramen lacerum, and unites to a ramus which ascends from the superior cervical ganglion of the tri-splanchnic

planchnic by the carotidian canal: it then proceeds to the sphenoidal ganglion: *the pterygoidian*.

b. Others very small proceed to the muscles of the small bones of the tympanum.

c. A third, which is very delicate, penetrates into the tympanic cavity, passes between the incus and the malleus, applies itself to the membrane of the tympanum, issues from that cavity by the glenoidal scissure, and forms a communication with the lingual nerve of the maxillary: *the tympanic*: (cord of the tympanum.)

d. The facial nerve issues from the spiroid canal by the stylo-mastoidian foramen, and immediately produces several rami: one ascends before the mastoid apophysis, and distributes itself behind the ear, *the posterior auricular*; others descend below the sterno-mastoidian muscle, and proceed to the trachelo-occipitian and the stylo-hyoidian muscles: *the sub-mastoidian*, and *stylo-hyoidian*: the former communicates with the pharyngo-glossian muscle.

The facial nerve then descends in the substance of the parotid gland, where it divides itself into two branches.

e. The first proceeds upwards, passes before the articulation of the jaw, and divides itself into several rami, some of which are distributed on the temples: *the super-orbital*. Others are distributed below the eye and lose themselves in the orbicular

and zygomato-labian muscles: *the sub-orbital*: the third proceed across on the cheek, and expand into a great number of filaments on the muscles of that part and on those of the lips, *the labial*: these rami are anastomosed with the preceding and with an orbital ramus of the maxillary.

f. The second branch descends behind the angle of the jaw, and divides itself into several rami: some proceed before the zygomato-maxillary muscle, *the mentoniar*, and divide into a great number of filaments which are distributed to the muscles of the chin: they communicate with the filaments of the superior branch and rami of the buccal. Others descend under the chin: *the sub-mentoniar*, and expand on the cutaneous muscle into a great number of filaments, which communicate with some arising from the first cervical pairs.

255. The *eighth pair* are placed behind the preceding, to which they are connected by some filaments: the root of them is turned back on the posterior edge of the median protuberance of the cerebellum: it is confounded behind with that of the opposite side.

This nerve accompanies the facial to the interior auditory foramen, which it abandons towards the orifice of the spiroid canal, and penetrates into the vestibulum, where it divides itself into two branches: one proceeds forwards and expands in the form of a brush in the ramps of the cochlea; the other proceeds

proceeds backwards and divides itself into three rami, which are distributed in the vestibulum and in the interior of the semi-circular canals. THE LABYRINTHIC NERVE, *soft portion of the seventh pair.*

256. The *ninth pair* of nerves arise in three or four filaments, from the peduncle of the cerebral prolongation, near the olivarian eminence. This nerve issues from the cranium by the posterior foramen lacerum, and immediately receives a filament from the facial, and another larger from the pneumo-gastric. It descends along the stylo-glossian muscle, throws out filaments which follow the divisions of the maxillo-facial artery, and which concur to the formation of the plexus surrounding the divisions of that artery. This nerve gives out a great number of filaments, which distribute themselves to the muscles of the pharynx, and its interior membrane, *the pharyngian*. Some unite to others arising from the pneumo-gastric, the handle of the hyoidian and the tri-splanchnic, and form a plexus on the sides of the pharynx.

The nerve of the *ninth pair* then descends between the stylo-pharyngian and stylo-glossian muscles, gives filaments to them as well as to the tonsillæ, and is lost by distributing itself to the muscles which are at the root of the tongue. THE PHARYNGO-GLOSSIAN, GLOSSO-PHARYNGIAN, *branch of the eighth pair.*

257. The *tenth pair* arise from the cerebral prolongation by ten or twelve filaments, which issue immediately behind those of the preceding nerve. These two nerves pass together through the posterior foramen lacerum, where they are separated by a membranous production.

This nerve descends before the neck, and penetrates into the thorax, where it gives out rami to the lungs. It then issues from that cavity with the œsophagus, enters the abdomen, and distributes itself to the stomach and liver. THE PNEUMO-GASTRIC, *eighth pair, wandering pair*.

On its issuing from the cranium, this nerve furnishes filaments which communicate with the pharyngo-glossian, the hyo-glossian, and the triplanchnic; it then descends before the neck, and gives out a large ramus, which passes behind the anterior cerebral artery, and which proceeds to the larynx, where it divides itself into two rami: one of these is distributed to the muscles of the pharynx and to the œsophagus; *the pharyngian*: the other, which is larger, penetrates into the larynx, enters the os hyoides and the thyroid cartilage, and divides itself into several filaments, which are distributed to the muscles and the interior membrane of that organ: *the laryngian*.

The pneumo-gastric nerve then descends on the exterior side of the anterior cerebral artery; furnishes one or two filaments to the cardiac plexus,

plexus, and penetrates into the breast. It passes before the sub-claviar artery, and on the left before the aorta, where it gives a large recurrent ramus; *the tracheal*. This tracheal ramus proceeds inwards, is reflected on the sub-claviar artery or aorta, and furnishes several filaments to the cardiac plexus: it then ascends again on the sides of the tracheal artery, gives numerous filaments to it as well as to the œsophagus, *the œsophagian*; and at length reaches the larynx, into which it penetrates between the cricoid and the thyroid cartilages, where it terminates in several filaments, which are distributed to the muscles of that organ, forming a communication with those of the laryngian nerve.

This nerve furnishes also a very great number of filaments, which concur to the formation of the pulmonary plexus.

The two pneumo-gastric nerves descend along the œsophagus, one before (that on the left) and the other behind (that on the right). They reciprocally throw out a great number of filaments, which form a plexus around that canal. When they reach the abdomen, the *one before* divides itself into several filaments, which follow the small curvature of the stomach, and expand on its diaphragmatic face. Some of these filaments proceed to the liver, and concur towards the formation of the hepatic plexus. The *one behind* divides itself also into numerous filaments, some of which are distributed

distributed to the orifice of the œsophagus and the inferior face of the stomach: the rest concur to the formation of the cœliac plexus.

258. The *eleventh pair* arise towards the middle of the furrow placed between the pyramidal and the olivarian eminences, and lower than the latter, in separate filaments, which soon are collected into two or three bundles of a pyramidal form. These bundles unite, and, issuing from the cranium through the anterior condyloid foramen, are distributed to the neck and the tongue. **HYOGLOSSIAN**, *ninth pair, great hypoglossa, lingual*.

On issuing from the cranium, the hyoglossian nerve accompanies the pneumo-gastric, the direction of which it soon crosses. It receives a ramus of the sub-occipital, at the height of the transverse apophysis of the atlas, and descends obliquely before the anterior cerebral artery.

Towards the middle of the neck this nerve gives out a branch which unites to one or two filaments of the sub-occipital, and to filaments furnished by the second, third, and sometimes the fourth cervical pair. These parts form together a reticulated arch of the *hyoidian* nerves, the convexity of which turned downwards, gives birth to four or five twigs for the depressing muscles of the os hyoides.

The trunk then throws out a branch to the hyo-thyroidian muscle, *the hyo-thyroidian*; then passes between the mylo-hyoidian and hyo-glossian muscles,

muscles, and penetrates under the tongue, where it divides itself into several filaments: some of these communicate with the lingual nerve, and others are distributed to the muscles of the tongue.

259. The *twelfth pair* arise, in several separate filaments, from the sides of the cerebral prolongation, towards the middle of the trachelian region. These filaments ascend along the rachidian canal, unite at a very acute angle, and form a common trunk, which issues through the posterior foramen lacerum, on the exterior side of the pneumo-gastric nerve.

In its passage, or on its issuing from that hole, this nerve gives out or receives a ramus, which, united to several others of the pneumo-gastric, directs itself inwards on the anterior cerebral artery, furnishes some filaments to the plexus which surrounds the divisions of that artery, and expands on the sides and in the top of the pharynx. This nerve descends before the transverse apophysis of the atloid; traverses the sterno-mastoidian, after having furnished some filaments of communication to the first cervical pairs, and distributes itself to the dorso-super-acromian muscle. THE TRACHELO-DORSAL, *the spinal or accessory of Willis.*

260. VERTEBRAL NERVES. These nerves are in number thirty on each side, viz. eight in the cervical

cervical region, twelve in the dorsal, five in the lumbar, and five in the sacral.

These nerves arise from the cerebral prolongation in a great number of filaments united into two bundles, the posterior of which is larger than the anterior: both these proceed to a ganglion which gives out only one nervous trunk. This nerve soon divides itself into two branches, which issue through the vertebral holes, and proceed, the one behind and the other before.

261. *The cervical pairs.* The posterior branches of all the cervical pairs, the first excepted, have a communication with each other, and pass between the trachelo-occipitian muscles and the transverse of the neck. The two first are then reflected, and lose themselves in the teguments of the occiput, while the rest are distributed to those of the neck.

The anterior branches have also a communication with each other, and all present one or more filaments of communication with the trisplanchnic.

The first cervical pair arises between the occipital and the atloid; its anterior branch proceeds above the transverse apophysis of the atloid; surrounds it in part, and anastomoses before it with a ramus arising from the anterior branch of the second pair.

The posterior branch, which is larger, directs
itself

itself towards the triangular interval left between the atloido-occipitian, the atloido-sub-mastoidian, and the axoido-atloidian muscles, where it distributes itself, and becomes lost in the muscles which cover the former.

The anterior branch of the second pair subdivides itself into three rami, one of which unites with the anterior branch of the first pair, and concurs to form the nervous arch which is observed before the transverse apophysis of the atloid. From this arch arise filaments, which proceed to the trisplanchnic, the hyo-glossian and the pneumogastric. The second ramus unites to a filament of the third pair, to form the nervous arch of the hyoidian nerves; the third, after giving out some filaments to the prædorso-atloidian muscles and the great-trachelo-occipitian, concurs to the formation of the *trachelo-cutaneous plexus*.

The anterior branch of the third pair sends out a filament to the nervous arch of the hyoidian nerves; it then unites to the fourth, and concurs towards the formation of the same *plexus*.

The anterior branch of the fourth pair furnishes, in general, a filament to the diaphragmatic nerve, and concurs also to the formation of that plexus.

The TRACHELO-CUTANEAN PLEXUS is situated on the sides of the neck, at the height of the fourth cervical vertebra, and expands under the thoraco-facian. It is composed of two bundles of nerves,

nerves, one of which proceeds towards the head, and the other descends on the thorax.

The *first* divides itself into three branches, which ascend, turning back on the posterior edge of the sterno-mastoidian : *the cephalic*.

One of them gives out filaments to the thoraco-facial and the teguments of the anterior and superior part of the neck : *the sub-mentonniar*.

The other proceeds before the ear, and divides itself into several filaments, which are distributed to the parotid gland, the auditory conduit, and the neighbouring integuments. These filaments communicate with the facial : *the zygomato-auricular*.

The third proceeds towards the mastoid apophysis, and divides itself into several filaments, which are distributed behind the ear and to the neighbouring integuments : *the occipito-auricular*.

The *second* bundle of the trachelo-cutaneàn plexus, the *thoracic*, divides itself, like the first, into three branches.

One of these branches, which is often double, descends before the sterno-mastoidian, passes on the clavicle, and expands in the neighbouring integuments : *the sternal*.

The other, which is larger, descends directly, and expands in the substance of the skin which surrounds the shoulder : *the acromian*.

The third is formed of several filaments, which descend deeply behind, and distribute themselves
to

to the muscles of the shoulder: these filaments communicate with the trachelo-dorsal: *the scapulary.*

The anterior branch of the fifth pair gives out a filament to the *diaphragmatic* nerve; it then furnishes several rami, which proceed backwards, send out some to the trachelo-scapulian, dorso-scapulian, and dorso-super-acromian muscles, and contribute to the formation of the *brachial plexus.*

The DIAPHRAGMATIC nerve is formed by filaments transmitted to it by the anterior branches of the fourth, fifth, and sometimes the sixth cervical pairs; it descends along the neck, gives out a filament to the trisplanchnic, and penetrates into the breast between the artery and the sub-clavian vein. It runs over the sides of the mediastinum, and reaches the diaphragm, on which it expands into several filaments.

The anterior branch of the sixth cervical pair unites to that of the fifth, seventh, and eighth, and to the anterior branch of the first dorsal, and concurs towards the formation of the *brachial plexus.*

The BRACHIAL PLEXUS, situated on the inferior and lateral part of the neck, is formed of two bundles, a superior and an inferior.

The superior bundle results from the union of the three first pairs: the last two compose the first. These two bundles approach and cross each other,

other, and pass under the clavicle, embracing the sub-claviar portion of the brachial artery. From this plexus then proceed nine distinct nerves or nervous bundles, which are distributed to the thoracic member.

262. NERVES OF THE THORACIC MEMBER.

The first arises from the fifth trachelian pair, proceeds backwards, towards the superior edge of the scapula, passes through the notch or hole observed in it, and sends filaments to the superior super-scapulo-trochiterian muscle; it then descends under the acromion, enters the sub-spinal fossa, and divides itself into several filaments, which proceed to the inferior super-scapulo-trochiterian and the dorso-super-acromian muscles: *the super-scapulary*.

The second, which are three in number, and sometimes four, arise from the seventh and eighth pair.

One of them descends obliquely before, and distributes itself to the sterno-humerian and costo-coracoidian muscles.

The other passes behind the axillary vessels, and divides itself into several filaments, which proceed to the costo-coracoidian muscle, and the neighbouring integuments.

The third, which is longer, passes under the plexus, and, proceeding to the sides of the thorax, divides itself into several filaments, which expand

on

on the costo-scapular muscle: *the sterno-thoracic (thoracic)*.

The third, the principal ones of which are three in number, distribute themselves in the following manner: one proceeds to the costo-scapular muscle, another to the lumbo-humerian, and the sub-scapulo-trochian, and the last to the super-scapulo-humerian and the inferior super-scapulo-trochiterian: *the sub-scapulary*.

The fourth issues from the posterior part of the brachial plexus, and arises from the two last tracheal pairs and the first dorsal; it passes before the sub-scapulo-trochian, and gives some rami to it as well as to the scapulo-humerian: this nerve then turns round under the head of the humerus, and proceeds to the sub-acromio-humerian: *the scapulo-humeral (axillary, circumflex)*.

The fifth arises from the fifth and sixth tracheal pairs, descends to the interior side of the arm, sends out a filament to the coraco-humerian-muscle, which it traverses, and glides under the scapulo-radian, to which it furnishes filaments as well as to the humero-cubitian. When it approaches the articulation it issues under the tendon of the scapulo-radian muscle, descends along the radial edge of the fore-arm, sending filaments to the teguments of that part, and terminates towards the thumb: *the radio-cutaneous (musculo-cutaneous)*.

The sixth is the smallest of those furnished by

the plexus; it arises from the last trachelian pair and the first dorsal. This nerve descends along the interior part of the arm, and the fore-arm, to the little finger. In its passage it first sends out a ramus, which follows the direction of the scapulo-radial muscle, and distributes itself to the palmar face of the fore-arm: when it approaches the articulation of the elbow, it sends out one or two rami, which pass before the epitrochlea, are reflected, and distribute themselves on the superpalmar face of the fore-arm. This nerve then distributes itself along the cubital edge of that part, as far as the little finger: *the cubito-cutaneous (interior cutaneous)*.

The seventh is the largest of the brachial plexus: it arises from the last three trachelian pairs. This nerve descends obliquely behind, turning round the humerus; it then advances along the radial edge of the fore-arm, and terminates on the convexity of the hand: *the radio-digital (radial)*.

This nerve descends in the substance of the scapulo-olecranian muscle, and furnishes three rami, which divide themselves into filaments, and are distributed to three portions of that muscle.

Towards the middle of the humerus this nerve turns round; passes between the humero-superradial and the epitrochlo-metacarpian muscles, and furnishes a long cutaneous ramus, which proceeds

ceeds to the wrist, and along the super-palmar face of the fore-arm: it gives some branches also to the epicondylo-radian and super-metacarpian.

Near the articulation of the elbow the radio-digital nerve gives out a large branch, which penetrates deeply; furnishes filaments to the epicondylo-metacarpian and the epicondylo-radian muscles, traverses the latter, and is distributed in several filaments to the muscles of the super-palmar face of the fore-arm: one of these filaments passes under the annular ligament, and expands on the carpus and the metacarpus. Having furnished this branch, the radio-digital nerve continues under the humero-super-radian muscle along the radial edge of the fore-arm as far as its middle part, where it proceeds beneath the skin, and divides itself into two rami: one of these descends along the first bone of the metacarpus, and separates into two filaments, which are distributed on the sides of the thumb and the radial face of the index finger. The other proceeds on the convexity of the hand, and divides itself into several filaments, which proceed to the cubital face of the index finger, the two sides of the middle finger, and the radial face of the ring finger.

The eighth arises from the last trachelian pair and the first dorsal. It descends on the interior side of the arm, passes behind the articulation of the elbow, continues along the cubital edge of

the fore-arm, and terminates at the last fingers: *the cubito-digital (cubital)*.

This nerve follows the interior edge of the scapulo-olecranian muscle, gives some filaments to it near the articulation of the elbow, as well as to the neighbouring integuments; then passes between the olecranon and the epitrochlea, where it runs beneath the skin, and is reflected between the muscles on the palmar face of the fore-arm. When it reaches the lower third of that part it sends out a ramus, turns round on the back of the hand, and divides into two filaments, one for the little finger, the other for the ring finger and the middle finger.

The cubito-digital nerve issues from below the epitrochlo-carpian muscle, passes before the annular ligament, advances towards the palm of the hand, and divides into two branches.

The first is superficial, and divides itself into two rami, one of which proceeds to the cubital side of the little finger and to its muscles; the other separates into two filaments, which proceed on the corresponding sides of the last two fingers.

The second proceeds profoundly below the tendons of the common epitrochlo-phalangean muscle, and of the common cubito-phalangean, and distributes itself, by a great number of filaments, to the metacarpo-super-phalangean muscle and to the cubito-super-metacarpian of the thumb.

The

The ninth arises from the last two trachelian pairs and the first dorsal pair: it receives a ramus from the musculo-cutaneous. This nerve descends along the interior part of the arm, passes before the articulation on the middle of the palmar face of the fore-arm, and is distributed to the fingers: *the digital median (median)*.

In its passage along the arm, this nerve accompanies the humeral artery; passes with it on the aponeurosis of the scapulo-radial muscle, near the articulation, and sends numerous rami to the muscles of the fore-arm. One of these rami descends before the inter-osseous ligament with the artery of the same name; and, when it reaches the wrist, traverses with it that ligament, and is reflected on the convexity of the hand.

After having furnished these rami, the digital median nerve traverses the epitrochleo-radial muscle, descends profoundly along the fore-arm till towards the wrist, where it becomes superficial, and gives a ramus to the integuments of the palm of the hand. It then passes under the annular ligament; becomes broader and divides itself into five rami, the first of which is distributed to the muscles of the thumb, and the second to the radial side of that finger. The third passes between the first and second bone of the metacarpus, gives a filament to the first palmo-phalangeal muscle, proceeds to the radial side of the index finger and

the cubital side of the thumb. The fourth passes between the second and third bone of the metacarpus, gives a filament to the second palmo-phalangan muscle, and terminates on the corresponding faces of the index finger and middle finger. The fifth passes between the fourth and the fifth bone of the metacarpus, gives a filament to the third palmo-phalangan muscle, and another of communication with the cubito-digital, and terminates by two filaments on the opposite faces of the ring and middle fingers.

263. *Dorsal pairs.* The twelve dorsal pairs arise, like the cervical, by two bundles, which unite to form a ganglion, whence two branches proceed.

The posterior branches proceed between the transverse apophyses of the dorsal vertebræ, and give out rami to the muscles of the back, which they traverse to distribute themselves to the integuments that cover them. The same disposition prevails in regard to all the dorsal pairs.

The anterior branches, which are larger, pass between the heads of the ribs, and communicate by two filaments with the thoracic ganglions of the large sympathetic nerve.

Those of the first ribs send filaments to the inter-costal muscles, which they traverse near the sternum, and expand before the upper part of the thorax. Those of the last, which are larger and more

more oblique, are distributed in the same manner to the inter-costal muscles, which they traverse to proceed to the integuments of the abdomen.

We shall here give a view of the peculiarities which the anterior or sub-costal branch of each pair exhibits.

The first pair gives a large cord to the brachial plexus.

The second passes under the second rib; about its middle sends out a ramus which issues from the thorax, and communicates with a filament of the brachial plexus, from which results a long, slender nerve, distributed along the cubital edge of the arm.

The third, in like manner as the preceding, furnishes a ramus which is distributed to the integuments of the axilla: *cutaneous of the axilla*.

The fourth gives a ramus which divides itself into two filaments: one proceeds to the integuments of the anterior part of the thorax, and to the mammilla; the other proceeds towards the spinal part of the back.

The fifth and sixth divide themselves also in their middle into two rami, one of which is distributed to the lateral parts of the thorax, and the other proceeds towards the sternum.

The seventh gives also two rami, one of which distributes itself to the integuments of the inferior part of the thorax; and the other expands in several

ral filaments to the inter-costian and sterno-costian muscles.

The sub-costal branches of the eighth, ninth, tenth, and eleventh dorsal pairs divide themselves also into two rami, the first of which is subdivided into two filaments. One of these is reflected on the sides of the thorax; the other proceeds on the muscles of the abdomen. The second ramus is distributed also among the muscles which form the sides of the abdomen.

The twelfth communicates with the first lumbar pair; then sends out some rami, which supply the diaphragm and the ilio-transversian muscle, and distribute themselves, in several filaments, to the muscles of the abdomen.

264. *Lumbar pairs.* The five pairs of lumbar nerves are furnished by the rachidian prolongation, in the same manner as the cervical and dorsal; their two bundles produce a ganglion, from which arises a trunk that divides itself into two branches.

The posterior branches pass between the transverse apophyses of the lumbar vertebræ, descend obliquely behind in the substance of the muscles of that region, and proceed to the integuments of the nates and thighs.

The anterior branch of the first lumbar pair divides itself into three rami; one traverses the præ-lumbo-trochantinian muscle, proceeds towards the anterior angle of the hip-bone, and separates into
several

several filaments, which are distributed to the muscles of the abdomen, to the superior and exterior part of the thigh, and towards the pubis (*super-pubian*). The second traverses, in an oblique direction, the prælumbo-trochantinian muscle and the iliac fossa, below the peritoneum; proceeds towards the anterior angle of the hip-bone, glides between the muscles of the abdomen, and loses itself in the integuments of the groin (*inguino-cutaneous*). The third descends on the interior side of the other two; proceeds towards the crural arch, and divides itself into several filaments, some of which accompany the testicular cord and proceed to the scrotum: the rest pass under the crural arch, are distributed to the integuments of the interior and superior part of the thigh, and communicate with the *crural plexus*.

The anterior branch of the second lumbar pair divides itself into two rami: one proceeds towards the crural arch, and terminates in several filaments, which distribute themselves to the fascia lata, and the integuments of the anterior part of the thigh; the other, which is larger, descends on the body of the second lumbar vertebra, and unites to the third pair, to concur towards the formation of the *crural plexus*.

The anterior branches of the third, fourth, and

fifth lumbar pairs unite also for the formation of the same *plexus*.

265. *Sacral pairs*. The five sacral pairs arise from the end of the cerebral prolongation. They are formed, like the other pairs, by two bundles, which unite to produce a ganglion, whence proceeds a trunk which divides itself into two branches.

The posterior branches issue through the holes of the spinal face of the sacrum, traverse the sacro-femorian muscle, and terminate at the margin of the anus and a part of the nates.

The anterior branches, which are larger, issue through the holes of the pelvian face of the sacrum, and by their union concur to the formation of the *hypogastric plexus* and the *crural plexus*.

The anterior branch of the fourth pair sends also some rami to the ischio-coccygian muscle and to those of the anus. That of the fifth, which is very small, issues between the sacrum and the coccyx, and distributes itself to the muscles of the anus.

The HYPGASTRIC PLEXUS is formed by several rami of the third sacral pair, and a great part of the fourth, and communicates with filaments of the tri-splanchnic; it is situated on the sides of the bladder, and furnishes a great number of filaments, which are distributed to that organ, to the prostate

prostate gland, to the rectum, and to the genital parts contained in the pelvis : *the pelvian.*

The CRURAL PLEXUS is formed by the last four lumbar pairs and the first four of the sacral : it soon divides itself into two others, viz. the *lumbar* plexus and the *sacral*. These two plexus, each furnish four distinct nerves, which are distributed to the pelvian limb.

266. NERVES OF THE PELVIAN LIMB. Of the four nerves furnished by the *lumbar* plexus to the pelvian limb :

The first traverses the prælumbo-trochantinian muscle, and the iliac fossa, proceeds towards the anterior tubercle of the ilium, and distributes itself to the integuments of the superior and exterior part of the thigh and haunch : *the exterior cutaneous.*

The second is formed of from three to five filaments, which issue through the crural arch, and distribute themselves to the integuments of the groin and the organs of generation, as well as to the interior and superior part of the thigh : *the inguinal.*

The third, the largest of the nerves furnished by the crural plexus, is formed by the first four lumbar pairs : it is placed behind the prælumbo-trochantinian muscle, which it traverses obliquely, and issues from the abdomen by the crural arch, on the exterior side of the femoral artery.

This

This nerve divides itself in that place into a very great number of rami: the *superficial* ones are distributed to the integuments of the anterior and interior part of the thigh, accompanying the saphene vein. Of the *profound* ones, some descend between the ilio-prætibian, the ilio-rotulian and the trifemoro-rotulian muscles, and are subdivided into a great number of filaments, which distribute themselves to these muscles. The rest accompany the crural artery, and proceed to the super-pubio-femorian and the pubio-prætibian muscles. One of these rami proceeds along the ilio-prætibian, and passes on the interior side of the knee: it then descends along the leg, *the tibio-cutaneous (saphene)*; sends out filaments to the anterior face of that part; accompanies the saphene vein, and terminates on the convexity of the foot: *femoro-prætibial (crural)*.

The fourth arises, for the most part, from the second, third, and fourth lumbar pairs; it descends along the interior edge of the prælumbo-trochantian muscle, penetrates into the lesser pelvis, and issues from it by the sub-pubian-hole; giving out a ramus to the sub-pubio-trochanterian muscles.

On issuing from the sub-pubian hole, this nerve divides itself into two rami; the anterior one passes between the pubio- and sub-pubio-femorian muscles, and proceeds to the integuments of the anterior part of the thigh: the posterior branch descends

descends between the sub-pubio- and the ischio-femorian muscles, and divides itself into a great number of filaments, which are lost in these muscles: *the sub-pubio-femoral.*

The *sacral plexus* furnishes the other four nerves of the pelvian limb.

The first arises from the third and fourth sacral pairs. It issues through the ischiatic notch, and distributes itself to the perinæum and the penis: *the ischio-penian.*

This nerve descends obliquely between the sacro-sciatic ligaments, and divides into two branches. The inferior one separates into a great number of filaments, which proceed to the muscles and integuments of the anus; to those of the perinæum, to the urethra, the scrotum and the dartos. The upper one proceeds towards the sciatic tuberosity, passes between the roots of the cavernous bodies, runs along the ascending branch of the ischium and the pubis; and, on its passage, throws out rami which are distributed to the interior sub-pubio-trochanterian muscle, the bulbo- and the ischio-cavernous, the ischio-perinæan, and the urethra. This branch then continues on the penis, where it is ramified, and furnishes filaments to the glans and præputium. In the female, this nerve, the *ischio-clitorian*, exhibits the same distribution: its inferior branch proceeds to the large labia, and the superior to the clitoris.

The

The second is composed of two rami which issue from the pelvis through the ischiatic notch, and distribute themselves to the sacro-femorian and ilio-trochanterian muscles : *the fessiers*.

The third arises from the second and third sacral pairs, and issues from the pelvis by the ischiatic notch : *the small femoro-poplitean*. It first furnishes two or three rami which proceed to the muscles surrounding the ischium and the trochanter : *the ischio-trochanterian* ; it then descends between the large trochanter and the tuberosity of the ischium, and divides into two rami : the interior is reflected below the ischium, and distributes itself inwards, about the upper part of the thigh, to the perinæum and the penis : *the cutaneous sub-pelvic*. The exterior expands beneath the skin of the posterior part of the thigh, and extends to the ham.

The fourth, which is the largest, distributes itself to the muscles of the posterior part of the thigh, the leg, and the foot : **THE GREAT FEMORO-POP-LITEAN**. It arises from the last two lumbar pairs and the first three sacral, and issues through the ischiatic notch.

It first furnishes rami to the muscles which make the thigh turn outwards ; it then passes between the great trochanter and the ischium, and descends profoundly along the posterior part of the femur, as far as the ham, where it becomes superficial. In its passage it furnishes several rami to the muscles

cles of the posterior and interior part of the thigh. This nerve, when it reaches the ham, divides itself into two branches, which are distributed to the leg and the foot.

A. One of these branches, the *PERONIAL*, sends out a ramus around the articulation of the knee: it furnishes one or two also beneath the aponeurosis which covers the calf of the leg, the *peroneo-cutaneous*, and separates into two other rami, below the superior extremity of the perone.

a. One, the *prætibio-digital*, descends between the peroneo-sub-tarsian and the common peroneo-super-phalangeal muscles, and gives rami to all the muscles which are before the leg: when it reaches the middle of that part it becomes superficial, and divides itself into two branches. The *interior* proceeds obliquely towards the tibial edge of the foot; sends some filaments to the integuments of that part, communicates with the tibio-cutaneous ramus of the femoro-prætibial, and separates into two rami, one of which proceeds on the tibial side of the great toe; the other passes over the convexity of the foot, and distributes itself to the opposite faces of the first two toes. The *exterior* proceeds on the convexity of the foot, where it divides itself into three rami, one of which passes between the second and third bone of the metatarsus, and divides into two filaments,
which

which proceed to the opposite faces of the two corresponding toes. The second descends, in like manner, between the third and fourth bones of the metatarsus; and distributes itself to the corresponding toes; the last follows the same direction between the last two toes.

b. The second branch of the peroniar, the *præ-tibio-super-plantaris*, passes between the tibio-super-tarsian and the common peroneo-super-phalangeal muscles, and descends before the interosseous ligament, on the interior side of the tibial artery. In this passage it sends filaments to several muscles of the anterior part of the leg, and to the periosteum. This branch then passes under the annular ligament, and divides itself into two rami, the exterior of which glides under the common calcaneo-super-phalangeal muscle and the last superior metatarso-inter-phalangeal. The interior passes between the first and the second bone of the metatarsus; sends filaments to the first superior metatarso-inter-phalangeal muscle, and divides itself into two rami, which proceed to the opposite faces of the first two toes.

B. The second branch of the great femoropoplitean, the *TIBIAL*, which is larger, descends in the hollow part of the ham, on the popliteal vessels, where it sends out a very strong ramus: *the peroneo-digital*.

This ramus descends behind the bifemoro-cal-
canean

canean muscle, and proceeds along the tibial edge of the calcanean tendon, accompanying the exterior saphene vein. It then passes behind the exterior malleolus, sends filaments to the integuments of the heel; is reflected on the convexity of the foot, and proceeds between the fourth and fifth bones of the metatarsus to distribute itself between the corresponding toes.

After sending out this ramus, the tibial nerve descends between the bifemoro-calcanean muscles, and furnishes a great number of rami, which are distributed to the articulation of the knee and the superior part of the muscles that form the calf of the leg.

This nerve then passes behind the malleolus of the tibia; gives some filaments to the integuments of the heel; proceeds under the arch of the calcaneum, and divides itself into two rami.

The *interior* advances on the metatarso-phalangean muscle of the great toe; gives some filaments to it, as well as to the common calcaneo-phalangean, and divides itself into four filaments, the first of which proceeds to the tibial edge of the large toe: the three others, each divide into two, and proceed on the faces comprehended between the first four toes.

The *exterior* proceeds obliquely between the muscles, towards the fifth bone of the metatarsus, and divides itself into two rami; one which is

superficial subdivides, and a filament proceeds on the exterior edge of the little toe: the other proceeds between the two last toes. The *profund* ramus throws out several filaments, which are distributed to a part of the profound muscles of the sole of the foot.

267. TRI-SPLANCHNIC. Along the lateral and anterior parts of the bodies of the vertebræ, from the base of the cranium to the sacrum, is a series of ganglions united by a nerve which retains nearly the same size throughout.

These ganglions, and the nerve which unites them, *receive* several filaments of the rachidian pairs, and communicate with some encephalic pairs: they *furnish* numerous filaments which form plexus, and distribute themselves to the vessels and organs of the three large cavities: THE TRI-SPLANCHNIC, *great sympathetic, inter-costal nerve*.

The first ganglion, the *superior cervical*, is at the superior part of the neck; it is situated before the transverse apophysis of the atlas, and behind the anterior cerebral artery: it is very large and elongated.

It *receives* several filaments of the pneumo-gastric, the hyo-glossian and the nervous arch, formed by the second and sometimes the third cervical pair.

It *furnishes*, superiorly, four filaments, which penetrate

netrate through the inflex canal of the temporal, and which form a plexus around the anterior cerebral artery : one of these filaments proceeds to the *orbital ganglion*, uniting itself to the naso-palpebral of the orbito-frontal ; the second unites itself to the pterygoidian filament of the facial, and both concur to the formation of the *sphenoidal ganglion* : the two other filaments unite with the exterior oculo-muscular in its passage through the sinus cavernosus.

The superior cervical ganglion gives out, before, some filaments which unite with those forming the plexus that surrounds the divisions of the maxillo-facial artery. From its inferior part arises a filament, which concurs to the formation of the cardiac plexus. This ganglion continues with the portion of the tri-splanchnic which descends behind the anterior cerebral artery : it communicates, on the outside, with filaments of the fourth and fifth cervical pairs, and within sends out some filaments to the œsophagus, and one or more filaments to the cardiac plexus.

At the height of the fifth or sixth vertebra of the neck, the tri-splanchnic generally presents a small *ganglion* or *plexus*, the *middle cervical*. This ganglion or plexus communicates with a filament of the sixth cervical pair, and sends out a great number of filaments : some of these form a plexus around the thyroidian artery ; others unite to

those which the superior cervical ganglion furnishes for the cardiac plexus : the last descend behind and before the sub-claviar artery, which they embrace, and proceed to the *inferior cervical ganglion*.

The portion of the tri-splanchnic which unites the middle cervical ganglion to the inferior is very short. The *inferior ganglion* is situated before the neck of the first rib; it is round, smaller than the superior ganglion, and more voluminous than the middle one. It communicates with filaments of the last three cervical pairs, and of the first dorsal : it sends out filaments which concur to the formation of the pulmonary plexus, and others which concur to that of the cardiac plexus.

The filament of the superior cervical ganglion which unites itself to those arising from the plexus of the cephalic artery, descends along that artery, and unites itself to some filaments of the tracheal and tri-splanchnic. This union produces a nerve which joins those filaments arising from the middle cervical ganglion and the pneumo-gastric.

This nerve gives some filaments to the pericardium, and descends on the origin of the aorta, where it divides itself into a very great number of filaments : these filaments form a *plexus*, the last distributions of which lose themselves on the pulmonary ventricle, and the aortic auricle of the heart : *the anterior cardiac plexus*.

From

From the middle cervical ganglion, and particularly the inferior, as well as from the pneumogastric, proceed numerous filaments which descend before the tracheal artery, unite to some filaments of the left tracheal, surround the pulmonary artery, before which they form a *plexus (the pulmonary)*, and terminate on the right auricle and the aortic ventricle: *the posterior cardiac plexus*.

From the inferior cervical ganglion, the tri-splanchnic penetrates into the thorax, and descends on the side of the bodies of the vertebræ, in the posterior space of the mediastinum.

In this passage, it exhibits small ganglions, which correspond between the heads of the ribs, and which *receive* two filaments from the dorsal pairs. It *gives* within, towards its superior part, some filaments to the aorta; and from the fifth to the eleventh intercostal space it sends out five or six filaments. These filaments unite to form the *great splanchnic*, which penetrates into the abdomen, between the pillars of the diaphragm, and proceeds to an assemblage of ganglions situated on the aorta, and the pillars of that muscle: **THE CÆLIAC GANGLION**, *semi-lunar*.

The tri-splanchnic sends out also, towards the eleventh and twelfth dorsal vertebræ, one or two filaments, which constitute the *small splanchnic*. This nerve penetrates into the abdomen, and unites itself to others more numerous, arising

from the ganglion and cœliac plexus. These nerves form a plexus on the artery of the kidneys, which they accompany in all their divisions: they give also some filaments to the capsular arteries, and others to the spermatic artery.

From the cœliac ganglion arise numerous rami of nerves, which proceed on the aorta, where they form a considerable plexus: THE CŒLIAC PLEXUS, *soleus*; at the top it furnishes filaments which accompany the inferior diaphragmatic artery: it sends out filaments which unite with those of the opposite side, and some of the pneumo-gastric, to form plexus, which surround on all sides the divisions of the opisto-gastric artery and the superior mesenteric: *the gastric plexus, hepatic, splenic, and superior mesenteric.*

These numerous filaments spread over the divisions of these arteries, embrace them, and accompany them in all their distributions.

The cœliac plexus furnishes a great number of filaments, which descend before the aorta, as far as the inferior mesenteric artery, where they unite to filaments of the lumbar portion of the tri-splanchnic, and form around that artery a plexus, the numerous filaments of which accompany it in all its distributions: *the inferior mesenteric plexus.*

This cœliac plexus furnishes also filaments which unite with some arising from the fourth and fifth

fifth sacral pairs, to concur towards the formation of the *hypogastric plexus*.

The tri-splanchnic, after sending out filaments which form the great and small splanchnic, penetrates into the abdomen, on the exterior side of the pillar of the diaphragm, descends on the side of the lumbar vertebræ, as far as the sacrum, and exhibits ganglions, which correspond to the intervals between the vertebræ.

In its passage it *receives* one or two filaments from the anterior branch of each lumbar pair, which proceed to its ganglions.

It *sends out* filaments, before, to the inferior mesenteric plexus, and some to the other plexus furnished by the cœliac ganglion.

The tri-splanchnic then penetrates into the lesser pelvis, and descends before the sacrum, where it presents ganglions as in its other parts: it *receives* two or three filaments from the anterior branches of the sacral pairs.

It *furnishes* very delicate filaments, which proceed to the hypogastric plexus, and others which are distributed to the rectum and to the neighbouring cellular tissue. It terminates either by being confounded with some sacral pairs, or by uniting with that of the opposite side on the coccyx.

268. The cerebral organ, whether encephalic

or rachidian, has the appearance of a pulpy and homogeneous substance. The great tenuity of its organic texture prevents its interior structure from being known. This organ is inclosed in a double membranous covering (the meninx and meningine).

The nerves have the appearance of whitish cords, composed of fibres in *bundles*; these fibres are surrounded by a stratum of cellular tissue, which dividing them from each other, serves to unite them. This cellular tissue forms also a common covering around the nervous cords. Notwithstanding this fibrous appearance, their composition seems to be analogous to that of the brain. Each fibre indeed of a nerve seems to be formed of a pulpy substance, contained in a membranous vagina or sheath: the pulpy substance of the nerves continues with that of the cerebral organ, and their membranous sheath (neurolemma) with the meningine.

Reil has proved this mode of structure, by plunging the nerves either into dilute nitric acid, or into an alkaline ley (of potash or soda). In the first case, the nervous covering becomes dissolved, and the pulpy substance remains concrete. In the second case, the pulpy matter is dissolved, and the membranous tube remains empty.

The nerves are distributed to the different parts
by

by the mere separation of their numerous small fibres; it does not appear that these small fibres ever divide themselves into ramusculi.

At their termination, the nerves seem to abandon their membranous covering, and to lose themselves in the substance of the different organs, by an expansion of their pulpy substance.

Towards the cerebral organ, the nerves also leave their covering, which is continued with the meninge, and their pulpy substance is confounded with that of the brain, the mesencephalon, or rachidian prolongation.

Soemering says, he traced the encephalic nerves, and particularly those of the organs of the senses, as far as the sides of the ventricles of the brain; from which he concludes that the fluid contained in the interior of the ventricles must be considered as the centre of sensation.

From various chemical experiments made on the pulpy substance of the cerebral organ, it results, that this substance is almost entirely a sort of albumen in a state of semi-concretion.

TABLE OF THE CEREBRAL SYSTEM.

The cerebral system consists of the encephalic organ, the cerebral prolongation, the tri-splanchnic and some ganglions.

The encephalic organ comprehends the cerebrum, the cerebellum, the mesencephalon, and the commencement of the cerebral prolongation. It has the form of the cavity of the cranium in which it is contained; its surface exhibits numerous winding and deep anfractuosities, over which the sanguine vessels are spread; it is inclosed in a double covering; the exterior, which is very strong, is called

	NEW NAMES.	OLD NAMES.
The meninx.		<i>Dura mater,</i>
		and the interior, much thinner,
Meningine.		{ <i>Arachnoid.</i> <i>Pia mater.</i>

The meninx is formed of two laminæ closely united; the exterior adheres to the cranium, and serves it as a periosteum; the interior is prolonged between the divisions of the cerebrum, and forms different folds, of which there are three principal ones:

One of them is between the two lobes of the cerebrum:

Median septum of the cerebrum.		<i>Falx of the cerebrum.</i>
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The other is placed between the cerebrum and the cerebellum:

Transverse septum of the cerebellum.		<i>Tentorium of the cerebellum.</i>
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The third is interposed between the two lobes of the cerebellum:

Median septum of the cerebellum.		<i>Falx of the cerebellum.</i>
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The meninx is prolonged in the cerebral canal; adheres to its sides; serves them as a periosteum, and surrounds the vertebral nerves at their origin: it is reflected also into the different holes of the cranium, and confounded with the neighbouring periosteum.

The meninx exhibits, in different parts of its substance, *sinuses*, which receive the blood of the veins, and pour it into the jugular; of these sinuses, which are very numerous, there are four principal ones:

One

TABLE OF THE CEREBRAL SYSTEM. 217

One of them runs along the superior edge of the median septum of the brain :

NEW NAMES.	OLD NAMES.
The median sinus.	<i>Superior longitudinal sinus.</i>

It is continued with

The lateral sinuses.	<i>The same.</i>
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The third is at the base of the median septum of the brain :

Choiridian sinus.	<i>Straight sinus.</i>
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And the fourth runs along the longitudinal septum of the cerebellum:

Inferior longitudinal sinus *.	<i>The same.</i>
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The meningine is formed of two very thin laminæ, one of which envelops only the exterior surface of the encephalon :

The arachnoid.

The other is prolonged throughout all its anfractuosities :

Pia mater.

The encephalon is composed, in the interior part, of a *white substance*, covered by a thick stratum of a *gray substance* :

White substance.	<i>Medullary substance.</i>
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Gray substance.	<i>Cortical substance.</i>
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The brain is divided longitudinally, on the summit, into two lobes ; and each of these is divided into three lobules : the *anterior*, *middle*, and *posterior*. The first two are divided inferiorly by a transverse scissure :

Inter-lobar scissure.	<i>Scissure of Sylvius.</i>
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Between the lobes of the brain is found a broad white band :

Mesolobe.	<i>Corpus callosum.</i>
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Below these are two ventricles, the sides of which are contiguous :

Ventricles of the brain,	<i>Lateral ventricles.</i>
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They form two ovoid furrows, incomplete before, placed back to back within, and separated by a thin lamina :

Median septum of the ventricles.	<i>Septum lucidum.</i>
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* The others are the occipital sinuses; the superior petrous sinuses; the inferior petrous sinuses; the transverse sinus; the cavernous sinus; the coronary sinuses.

This lamina is formed of two contiguous thin leaves, the separation of which can produce a triangular cavity :

NEW NAMES.	OLD NAMES.
Ventricle of the septum.	<i>Fifth ventricle.</i>

The ventricles of the brain communicate, behind, with another cavity, the sides of which are contiguous :

Appendix of the ventricles.	<i>Digital cavities.</i>
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Along the base of the ventricles of the brain runs a membranous, vascular, and reddish plexus.

Plexus choroides.	<i>The same.</i>
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Below the septum, at the base of the ventricles, is a part of a triangular form :

Cerebral trigone.	<i>Fornix with three pillars.</i>
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On the sides of the ventricles are two oblong grayish bodies, placed back to back :

Pyriform eminences.	<i>Striated bodies.</i>
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Towards the middle of the ventricles of the brain, below and behind the pyriform eminences, are two whitish ovoid *protuberances*, united by a small, soft, and grayish cord :

Strata of the ocular nerves.	<i>Strata of the optic nerves.</i>
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The pyriform eminences, and the strata of the ocular nerves, are separated by a furrow, which lodges a small grayish band :

Small band of the pyriform eminences.	<i>Small semi-circular band.</i>
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In the exterior part of the ventricles of the brain there are two *protuberances*, of the form of these cavities :

Cylindroid protuberances.	<i>Cornua Ammonis.</i>
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On the interior side of these eminences is a grayish serrated lamina :

Fringed body.

On the exterior side are two other *protuberances* :

Accessories of the cylindroid protuberances.	<i>Accessories of the cornua Ammonis.</i>
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In the appendix of the lateral ventricles is observed

The unciform eminence.	<i>The spur.</i>
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Between the strata of the optic nerves is found the trunk of

The choiridian vein.	<i>Vein of Galen.</i>
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The strata of the ocular nerves leave between them an interval in the form of a fissure :

Third ventricle.	<i>The same.</i>
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This ventricle contains a small choroid plexus; it presents before

NEW-NAMES.	OLD NAMES.
Its anterior aperture.	<i>Vulva,</i>

It exhibits at the top and behind

Its posterior aperture.	<i>Anas.</i>
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Before the anterior aperture is a long, whitish cord, which extends across it, in the form of an arc :

Anterior commissura.	<i>The same.</i>
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Below this commissura is a funnel-formed excavation :

Infundibulum.

The bottom of this excavation is continued with a grayish cord, adhering to a round tubercle, which rests on the body of the sphenoid :

Super-sphenoidal peduncle and appendix.	<i>Pituitary peduncle and gland.</i>
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Below and behind the posterior aperture of the third ventricle is another thick and short transverse cord:

Posterior commissura.	<i>The same.</i>
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Behind the posterior commissura is a small conical and grayish body :

Conarium.	<i>Pineal gland.</i>
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It seems to adhere to two very fine cords, which pass over the posterior commissura, and proceed on the ocular strata :

Pedunculi of the conarium.	<i>Pedunculi of the pineal gland.</i>
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The conarium rests on the mesencephalon, below four white tubercles :

Tubercles of the mesencephalon.	$\left. \begin{array}{l} \textit{Tubercula quadrigemina.} \\ \textit{Testes et nates.} \end{array} \right\}$
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The two inferior are continued with a whitish lamina, round at the top and striated:

Medullary lamina of the cerebellum.	<i>Valvula of Vieussens.</i>
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Below the posterior commissura is

The intermediate canal of the ventricles.	<i>Aqueduct of Sylvius.</i>
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This canal proceeds to

The fourth ventricle,	<i>The same,</i>
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which is situated between the pedunculi of the cerebellum and the cerebral prolongation.

This ventricle contains a small choroid plexus; it exhibits behind
a lon-

a longitudinal and two lateral grooves, which terminate in a point on the former :

NEW NAMES.

OLD NAMES.

Calamus scriptorius.

The contiguous sides of the ventricles of the brain are lined with a serous membrane, which is a continuation of the meninge; this membrane continually secretes a lymphatic moisture, which lubricates its surface. In the last place, the brain presents below, and in its middle,

Its two pedunculi

} *Prolongation of the brain, crura of the brain, arms of the medulla oblongata.*

Before the junction of the pedunculi are found

The pisiform tubercles.

Mammillary eminences.

The cerebellum presents on its surface mammillary eminences, and transverse and lamellar anfractuositities, which intersect each other at an acute angle. The centre of this organ is formed of a white substance, which is prolonged and ramified between the gray substance and its laminæ :

Arbor vitæ.

Between the lobes of the cerebellum appears before,

The median protuberance.

Superior vermicular eminence.

Below and in the middle of it,

The median lobule.

Inferior vermicular eminence.

From the white centre of each lobe arise before,

The pedunculi of the cerebellum,

Prolongation of the cerebellum,

which are divided into three bundles :

Superior, middle, and inferior prolongations.

The pedunculi of the cerebellum unite to those of the brain to form

The mesencephalon.

} *The annular protuberance.
Pons Varolii.*

The mesencephalon is continued with the commencement of

The cerebral prolongation,

Medulla oblongata,

from which it is separated by a transverse furrow.

The commencement of the cerebral prolongation is of a pyramidal form; it exhibits before and in its middle a longitudinal furrow, on the sides of which are observed

The

TABLE OF THE CEREBRAL SYSTEM. 221

NEW NAMES.

OLD NAMES.

The olivarian eminences. *The same.*

Close to these eminences is another furrow, which separates them from

The pyramidal eminences. *The same.*

The cerebral or rachidian prolongation has the form of the vertebral canal in which it is contained ; it terminates towards the first lumbar vertebra in two tubercles, and a loose tufted nervous bundle :

Bundle of the lumbar and sacral nerves. *Cauda equina.*

It exhibits before and behind a longitudinal groove ; it is white, of a soft consistence, and in the middle has a grayish furrow.

The encephalon gives birth to twelve pairs of nerves, and the cerebral prolongation to thirty.

TABLE OF THE NERVES.

All the nerves originate from the encephalic organ, the rachidian prolongation, the tri-splanchnic, and some ganglions.

The encephalic organ gives birth, at its base, to twelve distinct pairs of nerves; the rachidian prolongation to thirty, and the tri-splanchnic to an indeterminate number.

ENCEPHALIC NERVES.

NERVE WHICH PROCEEDS ON THE SIDES OF THE NASAL CAVITIES.

I PAIR: arise by three filaments, two of which come from the interlobular scissure, and the third from the striated bodies:

NEW NAMES.	OLD NAMES.
Ethmoidal.	Olfactory.

NERVE WHICH PROCEEDS TO THE EYE, AND FORMS THE RETINA.

II PAIR: derive their origin from the posterior tubercles of the ocular strata:

Ocular.	Optic.
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NERVES WHICH PROCEED INTO THE ORBIT,

Distributing themselves to almost all the muscles of the eye.

III PAIR: arise by several filaments from the excavation between the pedunculi of the brain, near the mesencephalon.

Common oculo-muscular.	Common motor.
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Distributing themselves to the great oblique muscle of the eye.

IV PAIR: arise by two or three small filaments close to each other, between the pedunculi of the cerebellum, and the inferior tubercles of the mesencephalon.

Interior oculo-muscular.	Pathetic.
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NERVE WHICH PROCEEDS TO THREE PARTS OF THE FACE.

V PAIR: it issues from before the pedunculi of the cerebellum, near the mesencephalon:

Trifacial.	Trigemin.
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This

This nerve divides itself into three branches :

The first distributes itself to the eyes and the forehead,

NEW NAMES.

A. Orbito-frontal.

OLD NAMES.

. Ophthalmic of Willis.

It divides itself into three rami :

1. The palpebro-frontal, Frontal or superciliar,

which gives a *palpebralian* ramus, that expands in ciliar ramusculi :

2. The lachrymal. The same.

3. The naso-palpebral. Nasal.

The latter gives a filament to the orbital ganglion—a ramus to the *nasal*—*ethmoidal* filaments—*naso-lobar* filaments—a *palpebral* ramus.

GANGLION SITUATED NEAR THE INSERTION OF THE OCULAR
NERVE INTO THE EYE.

Orbital ganglion. Ophthalmic or lenticular ganglion.

It receives

A filament from the naso-palpebral—a filament from the superior cervical ganglion—a filament from the common oculo-muscular.

It furnishes

Ten or twelve filaments which proceed to the eye, and distribute themselves behind the iris :

The irian. The Irian.

The second ramus of the trifacial distributes itself to the middle part of the face :

B. The super-maxillary. Superior maxillary.

It gives,

First, An orbital ramus, from which proceeds a jugal and a temporal filament; second, one or two filaments to the sphenoidal ganglion; third, anterior and posterior dental filaments; fourth, the sub-orbital nerve.

GANGLION SITUATED AT THE SUMMIT OF THE ZYGOMATIC
FOSSA :

Sphenoidal ganglion. Spheno-palatine ganglion.

It receives

It gives

Two filaments from the super-maxillary, a ramus formed by a pterygoidian filament of the tri-
splanchic, and a pterygoidian ramus of the facial.

Two filaments of the superior maxillary, the
pterygoidian or vidian branch.

It

It gives

Nerves which proceed to the guttural region of the pharynx and to the palate:

NEW NAMES.	OLD NAMES.
The gutturo-palatine.	} <i>Palatine.</i>
The superior palatine.	

To the nasal fossæ :

The ethmoidal.	<i>Spheno-palatine.</i>
Naso-palatine.	<i>The same.</i>

The third branch of the trifacial distributes itself to the inferior jaw :

C. The maxillary.	<i>Inferior maxillary.</i>
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It gives two bundles:

The superior one furnishes

1st, The sub-zygomatic; 2d, the temporo mus- lar; 3d, the bucco-labial; 4th, the pterygo-mus- cular.	1st, <i>The masseterin</i> ; 2d, <i>the temporo-profound</i> ; 3d, <i>the buccal</i> ; 4th, <i>the pterygoidean.</i>
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The inferior gives

1st, The cutaneous temporal; 2d, the lingual, from which proceed the sub-maxillary; 3d, the maxil- lo-dentary, from which proceed the mylo-hyoi- dian and the dentary.	1st, <i>The superficial temporal</i> ; 2d, <i>the lingual</i> ; 3d, <i>the inferior dentary.</i>
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NERVE WHICH PROCEEDS INTO THE ORBIT;

And distributes itself to the interior right muscle.

VI PAIR: it arises between the mesencephalon and the cerebral prolongation, in several filaments united:

Exterior oculo-muscular.	<i>Exterior motor.</i>
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It receives

Two filaments, which united to two others of the superior cervical ganglion, form a plexus around the divisions of the anterior cerebral artery.

NERVE WHICH DISTRIBUTES ITSELF TO THE FACE,

Passing through the spiroid canal of the temporal bone.

VII PAIR: it issues from the triangular facet which is found between the mesencephalon and the exterior side of the base of the rachidian prolongation:

The facial.	<i>Hard portion of the seventh pair.</i>
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It gives

NEW NAMES.

1st, A pterygoidian filament; 2d, filaments to the small bones of the tympanum; 3d, a tympanic ramus, posterior auricular filaments, a sub-mastoidian ramus, a stylo-hyoidian ramus, super-orbital, labial, mentonniar and sub-mentonniar rami.

OLD NAMES.

1st, *Superior ramus of the vidian*;
2d, *The same*;
3d, *Cord of the tympanum; temporal, molar and buccal rami.*

NERVE WHICH PROCEEDS INTO THE EAR,

Distributing itself in the labyrinth:

VIII PAIR: it arises from the sides of the fourth ventricle, behind the seventh pair, with which it is connected by some filaments:

The labyrinthic. *Soft part of the seventh pair.*

NERVE WHICH PROCEEDS TO THE TONGUE,

Distributing itself to the pharynx, and to the muscles at the root of the tongue:

IX PAIR: it originates in three or four filaments from the pedunculus of the rachidian prolongation, near the olivarian eminence:

The pharyngo-glossian. *The glosso-pharyngian or branch of the eighth pair.*

It gives

The pharyngians.

NERVE WHICH PROCEEDS TO THE LUNGS AND THE STOMACH,

Distributing itself along the neck, in the thorax and abdomen:

X PAIR: it comes from the base of the rachidian prolongation, in ten or twelve filaments:

The pneumo-gastric. *Eighth pair or par vagum.*

It furnishes

On the neck, pharyngian rami, a laryngian ramus,

filaments to the cardiac plexus, a tracheal ramus. *The recurrent.*

To the thorax, filaments for the pulmonary plexus;

In the abdomen, rami to the stomach. *The stomachic anterior and posterior.*

NERVE WHICH PROCEEDS TO THE NECK AND THE TONGUE,

Distributing itself to the muscles of the tongue, and to the greater part of those attached to the os hyoides:

XI PAIR: it arises towards the middle of the furrow placed between the pyramidal and olivarian eminences:

Hyo-glossian. *Ninth pair, great hypoglossus, lingual.*

It furnishes

A branch for the plexuous arch of the hyoidians—a hyo-thyroidian ramus—filaments to the muscles of the tongue.

NERVE WHICH DISTRIBUTES ITSELF TO THE STERNO-MASTOIDEAN AND THE DORSO-SUPER-ACROMIAN:

XII PAIR: it arises towards the middle of the trachelian region, and the sides of the rachidian prolongation, by several distinct filaments, which unite into one trunk: this trunk enters into the cranium through the occipital hole, and issues through the posterior foramen lacerum:

NEW NAMES.	OLD NAMES.
Trachelo-dorsal.	Spinal, accessory of Willis.

VERTEBRAL NERVES.

These arise from the cerebral prolongation, by a great number of filaments, united into two bundles, the posterior of which is larger than the anterior; both proceed to a ganglion, from which one trunk of nerves then issues; this nerve soon divides itself into two branches, which issue through the foramina of the rachis. The posterior branches proceed to the spinal face of the rachis, and distribute themselves to the muscles and the neighbouring integuments. The anterior branches, soon after they issue from the vertebral foramina, unite with each other by filaments of communication, and all of them send one or more filaments to the trisplanchnic.

NERVES WHICH PROCEED TO THE NECK.

The eight cervical pairs,

Distributing themselves to the muscles and the integuments of the spinal face of the neck:

The posterior branches.

Which distribute themselves behind the head and the neck:

The anterior branches.

These furnish

1st, The nerves which form the trachelo-cutaneous plexus, and which are: the branches of the second, third, and fourth cervical pairs.

This

This plexus furnishes, 1st, mentonniar, zygomato-auricular, and occipito-auricular branches; 2d, sternal, acromian and scapular branches.

2d, The rami which form the diaphragmatic nerve, and which are: the anterior branches of the fourth, fifth, and sometimes the sixth cervical pairs.

3d, The nerves which form the *brachial plexus*, and which are: the anterior branches of the last four cervical pairs, and of the first lumbar.

The nerves which proceed to the thoracic member arise from

NEW NAMES.	OLD NAMES.
The brachial plexus.	<i>The same.</i>

This plexus divides itself into nine branches or bundles.

1ST. NERVE WHICH PROCEEDS TO THE SHOULDER,

Distributing itself to the super-scapulo-trochiterian, and dorso-super-acromian muscles:

The super-scapular.	<i>The same.</i>
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2D. NERVES WHICH PROCEED TO THE STERNAL FACE OF THE THORAX,

Distributing themselves in three filaments: 1st, to the sterno-humerian; 2d, to the costo-coracoidian; 3d, on the side of the thorax:

The sterno-thoracic.	<i>Thoracic.</i>
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3D. NERVES WHICH PROCEED TO THE SHOULDER AND THE ARM,

Distributing themselves by three filaments: 1st, to the costo-scapular; 2d, to the lumbo-humerian and the sub-scapulo-trochinian; 3d, to the scapulo-humerian, and the inferior super-scapulo-trochiterian muscles:

The sub-scapular.	<i>The same.</i>
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4TH. NERVE WHICH PROCEEDS AROUND THE SCAPULAR ARTICULATION OF THE HUMERUS,

Distributing itself: 1st, to the sub-scapulo-trochinian muscle; 2d, to the sub-acromio-humerian; 3d, to the radial edge of the arm:

The scapulo-humerian.	<i>Axillary or circumflex.</i>
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5TH. NERVE WHICH PROCEEDS TO THE ARM AND FORE-ARM, *Distributing itself superficially to the interior side of the arm, along the radial edge of the fore-arm as far as the thumb:*

The radio-cutaneous.	<i>Musculo-cutaneous.</i>
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6TH. NERVE WHICH PROCEEDS TO THE ARM AND FORE-ARM,
*Distributing itself superficially along the cubital edge of the arm
 and fore-arm, as far as the little finger :*

NEW NAMES.	OLD NAMES.
The cubito-cutaneous.	Interior cutaneous.

7TH. NERVE WHICH PROCEEDS TO THE ARM, THE FORE-ARM,
 AND HAND,
*Distributing itself around the humerus, behind, along the radial edge
 of the fore-arm, on the convexity of the hand, and to the first three
 fingers :*

The radio-digital.	Radial.
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8TH. NERVE WHICH PROCEEDS TO THE ARM, THE FORE-ARM,
 AND THE HAND,
*Distributing itself to the interior side of the arm, behind the articu-
 lation of the elbow ; along the cubital edge of the fore-arm, and to
 the two last fingers :*

The cubito-digital.	Cubital.
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9TH. NERVE WHICH PROCEEDS TO THE ARM, THE FORE-ARM,
 AND THE HAND,
*Distributing itself to the interior of the arm, before the articulation
 of the elbow ; on the middle of the palmar face of the fore-arm,
 and to the fingers :*

Digital median.	Median.
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NERVES WHICH PROCEED TO THE DORSAL REGION, AND TO
 THE SIDES OF THE THORAX AND ABDOMEN :

The twelve dorsal pairs.

Which distribute themselves to the integuments of the back :

The posterior branches.

*Which pass between the ribs, and distribute themselves before the
 thorax, to the muscles and integuments of the abdomen :*

The anterior branches.

NERVES WHICH PROCEED TO THE LUMBAR REGION, TO THE
 SIDES OF THE ABDOMEN, AND INTO THE PELVIS :

The five lumbar pairs.

*Which distribute themselves to the muscles of the lumbar region and
 to the integuments of the nates :*

The posterior branches.

Which

Which distribute themselves to the sides of the abdomen and the pelvis, and furnish some to the crural plexus :

The anterior branches.

NERVE WHICH TRAVERSES THE PELVIS, AND PROCEEDS TO THE
REGION OF THE GROIN :

The anterior branch of the first lumbar pair.

It gives,

1st, A ramus which proceeds to the muscles of the abdomen and to the pubis, *sub-pubian*; 2d, a ramus to the integuments of the groin; 3d, a ramus which follows the contour of the ridge of the ilium, and proceeds to the scrotum, along the testicular cord.

NERVES WHICH ISSUE FROM THE OS SACRUM:

The five sacral pairs.

Which distribute themselves to the nates and to the anus :

The posterior branches.

Which supply the hypogastric and crural plexus, and distribute themselves to the coccyx and anus :

The anterior branches.

NERVES WHICH FORM THE HYPOGASTRIC PLEXUS:

The anterior branches of the fourth and fifth sacral pairs, and filaments of the tri-splanchnic.

They furnish

The pelvian, which are distributed to the bladder, the rectum, and the genital parts contained in the pelvis.

NERVES WHICH FORM THE CRURAL PLEXUS:

The anterior branches of the last four lumbar pairs, and of the first four sacral.

The nerves distributed to the pelvian members arise from the crural plexus, which divides itself into two other plexus: 1st, the lumbar plexus; 2d, the sacral plexus: they each furnish four principal branches to the pelvian member.

 NERVES ARISING FROM THE LUMBAR PLEXUS:

1st, Nerve which proceeds to the thigh,

Passing near the anterior tubercle of the ilium, and sending out ramifications to the exterior part of the thigh and the leg :

NEW NAMES.

OLD NAMES.

The interior cutaneous. Crural.

2d. Nerves which distribute themselves in three, four, or five filaments to the glands, the integuments of the groin, and to the genital parts :

The inguinal. Crural.

3d. Nerve which proceeds to the thigh, the leg, and the foot,
Descending behind the prælumbo-trochantinian muscle, passing through the crural arch, and distributing itself to the integuments of the anterior part of the thigh, and by a long ramus (tibio-cutaneous) to the muscles and integuments of the leg and the foot :

The femoro-prætibial. Crural.

4th. Nerve which proceeds to the interior part of the thigh,
Passing through the sub-pubian hole, and distributing itself to the muscles and integuments of the anterior and interior part of the thigh :

The sub-pubio-femoral. Obturator.

 NERVES ARISING FROM THE SACRAL PLEXUS :

1st. Nerve which proceeds to the penis and the clitoris,
Passing through the ischiatic notch, and distributing itself to the perinæum, to the penis, and the clitoris :

Ischio-penian, ischio-clitorian. Pudicæ.

2d. Nerve which proceeds to the nates,
Distributing itself to the sacro-femoral muscle, the ilio-trochanterian muscles, and to the integuments of the thigh :

The fessiers.

3d. Nerve which proceeds to the posterior part of the thigh,
Giving, 1st, two or three ischio-trochanterian rami to the muscles situated in the neighbourhood of the ischium and the trochanter ; 2d, the cutaneous sub-pelvician, which proceeds to the integuments of the sub-pelvician region and the interior part of the thigh ; 3d, the posterior cutaneous of the thigh, a long ramus which is distributed

buted to the integuments of the poplitean face of the thigh, and extends as far as the ham :

NEW NAMES.

OLD NAMES.

The small femoro-poplitean.

4th. Nerve which proceeds to the posterior face of the thigh, to the leg and to the foot,

Giving two branches : one (the peroniar) furnishes ; 1st, the peroneo-cutaneous ; 2d, the prætibio-digital and the prætibio-sub-plantar. The other (the tibial) gives ; 1st, the digital peroniar ; 2d, the tibio-plantar.

On the anterior and lateral parts of the bodies of the vertebræ, from the base of the cranium to the sacrum, is a series of ganglions united by a nervous cord :

The tri-splanchnic. The great sympathetic or intercostal nerve.

The ganglions of the cervical region are :

1st. A *superior*, very large and fusiform.

2d. A *middle one*, very small, and often even a simple plexus.

3d. An *inferior*, round, and situated before the neck of the first rib.

The ganglions of the other regions are disposed in such a manner, that they correspond nearly to the sides of each inter-vertebral space.

The nerves which communicate with the tri-splanchnic are :

Some encephalic pairs, and the thirty rachidian : they each send to it, one, two, three, four, and even five filaments.

The nerves furnished by the tri-splanchnic, either from its ganglions or the cord which unites them, are distributed chiefly to the arteries of the organs contained in the three large cavities.

In their distribution these nerves form, or contribute to form, a great number of plexus ; such as,

1st. The plexus, which surrounds the trunk of the anterior cerebral artery, in its passage along the inflex canal of the temporal.

2d. The plexus cardiaci.

From the fifth to the eleventh intercostal space the tri-splanchnic gives five or six filaments, which unite and form the *great splanchnic* : this nerve penetrates into the abdomen, and proceeds to an assemblage of ganglions, situated on the aorta and the pillars of the diaphragm :

Celiac ganglion. Semi-lunar.

The numerous filaments which proceed from the cœliac ganglion form, on the aorta, the divisions of the opisto-gastric artery, and on the superior mesenteric artery, a considerable plexus.

NEW NAMES.

OLD NAMES.

Cœliac plexus. Solar.

The filaments which proceed from this plexus are distributed on the trunks of the principal arteries, surround them, and form on them the *gastric, hepatic, splenic, mesenteric, &c.* plexus, and accompany them in all their distributions.

Towards the eleventh and twelfth dorsal vertebræ, the tri-splanchnic gives also one or two filaments, which constitute the *small splanchnic*: this nerve penetrates into the abdomen, unites to others of the cœliac plexus, and forms a plexus around the renal and spermatic artery.

The tri-splanchnic penetrates into the pelvis, and unites on the sacrum with that on the opposite side.

SYSTEM OF THE SENSES.

OF VISION.

271. THE organ of sight consists essentially of a very thin membrane, placed at the bottom of the eye. This membrane has the property of perceiving the action of the light reflected from external bodies, and refracted on it by the transparent liquids of the eye.

The eyes seem to be wanting in zoophites, several of the articulated worms, in some of the larvæ of insects, and in the acephala mollusca.

All vertebral animals have two eyes, situated in the cavities of the bones of the face*. They are composed of two or three transparent fluids of different densities, placed the one before the other, each of which is contained by a thin pellicle; and they are covered at the back by the fine membrane which perceives the contact of the light.

This apparatus is contained in a common, thick, double covering, for the most part blackish in the inside, having in it an aperture susceptible of contraction, before which is placed a membranous and transparent segment of a sphere.

* The eyes of insects are very numerous, and have a peculiar structure, which cannot be known on account of their smallness.

This

This organized dioptrical apparatus is nearly round in all animals; but its anterior part, more or less truncated, is covered by a transparent spherical segment called the *cornea*.

272. The *cornea* is nearly round; but its transverse diameter is often somewhat longer: it is composed of laminae cemented together, and is thicker in the middle than at the edges. In fishes, the cetacea, and the greater part of reptiles, it is very much flattened; so that the eye of these animals is often a hemisphere. In the terrestrial mammalia the cornea is a short segment of a sphere, smaller than that of the eye; and this organ is nearly round. The cornea of birds is a narrow hemisphere, and the eye has a greater degree of projection.

Behind the cornea, and before the eye, the mammalia and birds have an *aqueous humour*, somewhat saline, the density of which is nearly equal to that of water: it seems to be contained in a very thin pellicle.

This aqueous humour is often wanting in fishes; the small quantity of it found sometimes in the eye of these animals is always viscous: it does not exist in the sepia.

273. *Crystalline humour*. Behind the aqueous humour, in the mammalia and birds, and behind the cornea of aquatic animals, is a thick, diaphanous substance, heavier than water, and enveloped,

without adhesion, in a very fine membranous capsule: the *crystalline humour*.

In fishes, the crystalline humour is nearly round; in the mammalia it has a lenticular form; it is more flattened in birds, and still more so in man. In all these animals this body is formed of two spherical segments, the posterior of which is smaller. Its convexity is in the inverse ratio of that of the cornea. The crystalline is harder, the greater its convexity; and its consistence decreases from the centre to the circumference.

274. *Vitreous humour*. The crystalline is lodged in a depression presented to it by another body of less density, having the consistence of the white of an egg, which occupies the greater part of the bottom of the eye, and is enveloped by a thin diaphanous membrane. This fluid is called the *vitreous humour*.

From the transparent membrane (*membrana hyaloidea*), which envelops the vitreous humour, proceed internally a great number of thin laminae, which cross each other in different directions, and form lenticular cells containing the viscous fluid.

The density of this fluid, which constitutes the vitreous humour, is greater than that of the aqueous humour, and less than that of the crystalline. This substance hardens and becomes opaque by heat and by alcohol.

The anterior surface of the vitreous humour is separated into two laminae, one of which passes behind

behind the crystalline, and the other is reflected on its sides.

275. *The retina.* The vitreous humour is enveloped, behind and on the sides, by an exceedingly fine membrane, of little consistency, which receives the impression of the rays of light. It is only an expansion of the optic nerve; and is distinguished by the name of the *retina*.

The retina expands different ways on the vitreous humour; but in all animals it terminates around the aperture of the cornea, and does not pass before the crystalline.

The aqueous humour, the substance of the crystalline, and the viscous fluid contained in the cells of the vitreous body, are secreted by the surfaces of the membranous capsules which contain them.

These three transparent bodies are contained in a common double covering.

276. *Sclerotica.* The exterior tunic, called the sclerotica, is soft, thin, and of a close texture in the greater part of the mammalia; and the eye has that round form which all fluids contained in a flexible membrane naturally tend to assume; but among animals, in which the configuration of the eye is different, the peculiar form of that organ depends on the greater thickness or strength of this tunic, or on its being supported by small bones.

This external tunic of the eye is hard and very

thick in some aquatic animals, such as the whale, and particularly the sturgeon, where it is thicker than the rest of the eye: in other fishes it is thin, but has the consistence of a cartilage.

In birds this tunic is thin, and is divided before, into two small leaves; between these leaves are received small osseous laminæ which lap over each other, and form a circle or oval, proper for sustaining it.

The sclerotica has always in the fore-part a large aperture, shut by the cornea, with which it is united: behind, it affords a passage to the optic nerve by a hole or canal.

277. The *choroid membrane*. The interior face of the sclerotica is lined by another thin tunic, called the *choroid*, united to it by a lax cellular tissue: before, it adheres with greater force around the aperture which covers the cornea, where there is a whitish viscous and soft ring, called the *ciliary ligament*.

The choroid membrane is then turned forwards, and seems to constitute two folds: one of them, exceedingly thin, is folded back and disposed in the form of radii (*the ciliary process*); it passes before the vitreous humour, in which it is depressed into a hollow, and terminates on the edges of the crystalline humour. This arrangement does not take place in fishes: the other fold, called the
uvea,

uvea, proceeds more forward, and forms an expansion pierced with a hole, known by the name of the *pupil*: it is covered before with a fibrous membrane which adheres to it closely, and which presents striæ of different colours: *the iris* *.

The iris has the property of dilating and contracting, for the purpose of diminishing or enlarging the pupil.

In the state of dilatation, the pupil is generally round; but when the iris dilates, this aperture, in contracting, often changes its form. In man, apes, many carnivorous animals, and birds, it retains its round form; in cats it assumes that of a lozenge, which goes on always contracting, and at length becomes a vertical line. In the horse, the ox, and the whale, it affects the same form, but in a transverse direction.

The pupil of some animals is susceptible also of assuming various peculiar configurations, by the expansion of the iris.

The ray and the torpedo have at the top of the iris a membrane, folded back, which is susceptible of falling down, so as to shut the pupil by expanding itself like a curtain or blind. This peculiarity has been remarked in these animals only.

* In most of the mammalia the iris has a brown colour; and in birds it is ornamented with the most beautiful tints.

It has been observed, that the pupil in the foetus of several animals is shut by a thin membrane (*the pupillary*), which is destroyed and disappears some time before birth.

All this part of the choroid, which forms the uvea and the iris, is generally plane, and sometimes a little convex ; between it and the cornea the aqueous humour is lodged.

The choroid, which is much thinner than the sclerotica, is formed of a beautiful vascular tissue : in the mammalia a part of it is often coloured.

In fishes with fixed branchiæ it is composed of two distinct laminæ, between which is a soft glandulous cylindric body, very often of a beautiful red colour.

The choroid is generally covered with a blackish, mucous substance, often very thin, which does not prevent from being seen through it the beautiful colours with which in some animals * it is ornamented : it covers also the interior face of the ciliary process of the uvea. This blackish, mucous substance, which is found in almost all animals, is wanting in the *Albinos*, among whom a state of whiteness is always a disease.

* In the ox this part is of a beautiful golden green changing to sky-blue ; in the horse, the goat, the cervine antelope, and the stag, it is a silvery blue changing to violet ; in the sheep, of a pale golden green, and sometimes blueish ; in the lion, the cat, and the dolphin, it is of a pale golden yellow ; in the dog, the wolf, and the badger, it is pure white, bordered with blue.

278. *The*

278. *The orbits.* In all animals the eyes are placed in cavities of greater or less depth, called the orbital fossæ, or orbits.

The orbits of fishes are not very distinct, being confounded externally with the temporal fossæ; the inferior edge of them is formed of one osseous piece, or a series of small bones, which, for the most part, are five in number. In birds they consist in a depression interrupted at the bottom. In reptiles the exterior edge of the orbits is formed, in whole or in part, by an osseous branch, behind which the temporal fossæ are confounded with the orbital.

In quadrupeds is observed also an ascending branch, which forms, on the outside, a complete border to the orbits; but behind this border the exterior side is wanting, and the orbital and the temporal fossæ are united. In man and apes these orbits are complete.

In apes, and in man, the edges of the orbits are formed by the frontal, the super-maxillary, and the jugal bones. The sides are formed by the frontal, the ethmoid, the lacrymal, the palatine, the super-maxillary, the jugal, and the sphenoid: the cavity which they compose is a cone, the apex or point of which is turned backwards.

The orbital fossæ sometimes are separated from each other only by a thin lamina, which is often in part wanting, as is the case in fishes; but, in general, they are separated by the nostrils.

These

These fossæ, in most animals, are turned more or less towards the sides; in some reptiles and several fishes* they are turned upwards, and in the quadrumana and man they look almost directly forwards.

The eyes rest in the orbits on a small cushion of very fine fat, which permits them to glide with great facility; this cushion is thicker in the mammalia, the orbits of which are deeper. In fishes it is formed of a gelatinous substance, enveloped by a lax cellular tissue; but in the ray and shark the eyes are articulated on a cartilaginous peduncle, which is itself articulated in the bottom of the orbit.

279. *Muscles of the eye.* The eye, in man, apes, birds, and fishes, is moved by six muscles; in most of the mammalia by seven. These muscles are fixed to the bottom of the orbit, and are attached before on the contour of the sclerotica. Of these muscles, four are *straight*, and placed on the four sides of the orbit; the two others have an *oblique* direction.

280. *Eye-lids.* In fishes, serpents, and some other reptiles, the eye-lids are wanting; lizards and the moon-fish have one of a circular form; in the mammalia there are two. Birds and several reptiles have three; in these animals the third eye-

* The pleuronectes have the two orbits on the same side of the head; but only one of them is perfect.

lid, *membrana nictitans*, is found towards the interior angle; it is thin, and extends over the eye like a curtain, by a muscular arrangement altogether peculiar: this fine eye-lid permits birds to see through it, and to look at the sun.

The mammalia, towards the interior angle of the eye, instead of the third eye-lid of birds, are furnished with a membranous fold, which in man and apes is very small, and has the form of a crescent. In the other mammalia it is larger, semilunar, and porous; and in part of its extent has the appearance of a cartilaginous lamina.

The eye-lids seem to be merely a prolongation of the skin: the interior face of them is reflected on the eye, and forms the white of it, called the *membrana conjunctiva*.

The eye-lids are closed by the action of a muscle, called *the palpebralian*, the fibres of which are disposed in the form of radii: in birds they have also in their thickness a membrane which lines the inside of the orbit.

In most of the mammalia, the edge of the eye-lids is terminated by a cartilaginous circle, *the tarsus*, furnished with hair, *eye-lashes*. In these animals the upper eye-lid is the largest, and, by falling down, covers the greater part of the eye: it is raised by a particular muscle called the *superior orbito-palpebralian*, which is attached in the bottom of the arch of the orbit.

The

The eye lids of birds have, in general, a contrary disposition: the lower, which is the largest, is lined by an ovoid, cartilaginous membrane, and by rising up covers a great part of the eye: it is pulled down by a particular muscle, which is attached to the bottom of the orbit.

The eyes of animals which live in the air are continually moistened by a fluid (tears) secreted from a particular gland, called the *lacrymal*. This gland is situated at the top, and often around the orbit; it is of a white or grayish colour, granulated, and often divided into several follicles, from which proceed very fine small ducts, having their apertures near the interior edge of the eye-lids.

The liquid which distills from them, being diffused over the eye, serves to moisten it; and the superfluous part, proceeding towards the interior angle of the orbit, is in general absorbed by two small tubercles, having each at the summit a fistulous hole, *puncta lacrymalia*: these holes are continued in two small ducts, which proceed to a common excavation, *saccus lacrymalis*, and terminate at the nose in a particular duct called the *nasal*.

In some species, such as hares and rabbits, the tears trickle down by a sinuous and cartilaginous furrow, which ends in a common bag furnished with a valvula.

In the mammalia the edge of the eye-lids is furnished also with a great number of glandulous

follicles, which secrete an unctuous humour called the gum of the eyes. Birds, and some of the mammalia, towards the interior angle of the orbit, have a small gland of a different form, which secretes a thick humour, yellowish in birds, and whitish in the mammalia. This gland, called that of *Harderus*, pours the product of its secretion through an aperture situated behind the third eye-lid, or its representative : it is the largest of those of birds.

The mammalia have also, towards the nasal angle, a small reddish body consisting of several glandulous follicles, *caruncula lacrymalis*, which secretes a thick and whitish humour.

281. *In man*, the eyes are placed in complete orbits, which have the form of a cone irregularly flattened ; the base forms the entrance, and the apex is turned inwards and backwards.

At the bottom of the upper side is the *ocular foramen*, and below and within this hole is the *sphenoidal fissure*. Along the exterior and inferior angle is the *spheno-maxillary fissure*, before which is the sub-orbital canal : towards the interior angle is observed also the *fossa lacrymalis*.

The orbital fossa presents also small holes, which afford a passage to vessels and nerves, and an excavation which lodges a gland.

The eye has a round form, somewhat depressed at the top, at the bottom, and on the sides.

The

The cornea is the segment of a smaller sphere than that of the eye; it is transparent, cartilaginous, and unites with the sclerotica by an edge cut externally into a bevel.

The aqueous humour, which is diaphanous, and nearly of the same density as water, is lodged between the cornea and the iris; and a small quantity of it is contained even between the iris and the crystalline. It appears to be secreted and contained by an exceedingly fine membrane.

The crystalline is lodged behind the aqueous humour, in a depression of the vitreous body.

It is lenticular, and more convex behind; it is from four to five lines in diameter, and somewhat more than two lines in thickness; it is rounder in the foetus, and with age becomes flattened, yellow, and muddy. Its density increases from the centre to the circumference; it appears to be formed of fibrous strata, placed one above the other: the capsule, by which it is enveloped without adhering to it, is moistened by a humour called that of *Morgagni*, which is rarer before.

The vitreous humour fills up behind, the greater part of the eye; it occupies $\frac{1}{2}\frac{5}{2}$ of its whole axis; while the crystalline occupies only $\frac{1}{2}\frac{1}{2}$, and the aqueous humour $\frac{3}{2}\frac{1}{2}$: its density is greater than that of water.

The *hyaloid* membrane which retains it, gives birth to a great many expansions; and these by

crossing form regular cells which communicate with each other.

The hyaloid membrane is divided before into two laminæ, one of which passes behind the crystalline humour; the other proceeds before, under the ciliary processes, which imprint on it blackish striæ, and is confounded with the anterior part of the capsule of the crystalline. The circular space comprehended between these two laminæ forms, on the edge of the crystalline humour, a triangular plaited canal, which is rendered apparent by forcing into it some bubbles of air.

The retina, which is an expansion of the optic nerve, is a membrane of a white ash colour, and of a softish consistence: it seems to be fibrous and vascular without, and villous within.

Soëmering discovered in the posterior part of the retina a very small hole, the edges of which are plaited, and of a *yellow colour*: this hole, which has been found in the ape, has not been observed in other animals.

The retina, after enveloping the whole vitreous humour, continues before, and terminates behind the ciliary processes.

The humours of the eye are contained in two membranes.

1st, The sclerotica, which is thick, white, and of a close texture; it has before a large aperture, closed by the cornea with which it is united.

Behind,

Behind, it affords a passage to the ocular nerve, and is traversed in an oblique direction, throughout the rest of its extent, by vessels and nerves.

2d, The choroid, which covers the sclerotica internally : it appears under the form of a delicate membrane of little consistence, composed of an exceedingly fine and beautiful vascular reticulation. Its exterior face, which is reddish, adheres to the sclerotica by a loose cellular tissue, and by vessels and nerves : the interior face, which is villous, is covered with a blackish coating ; it is applied to the retina, and affords a passage to the ocular nerve.

Before, the choroid is confounded with the sclerotica around the cornea, where the ciliary ligament is found, under the form of a thick spongy and whitish ring.

Below this ring arise the ciliary processes, which appear to be a continuation of the choroid. They expand before the vitreous humour, and terminate in a serrated border around the crystalline.

The ciliary processes are composed of a radiated membrane, smooth before, and plaited behind ; the projections of the folds are covered with a blackish substance, like the choroid, and are depressed into a hollow before the vitreous humour. This blackish substance, or varnish, remains on the vitreous humour when the ciliary processes are removed,

and produces a radiated ring formed of black *friae*.

Before the ciliary ligament is the commencement of the uveous membrane, which seems to be a continuation of the choroid; it proceeds directly towards the axis of the eye, before the ciliary processes, and produces the aperture of the pupil.

Behind, this membrane is composed of fibres, which converge from the ciliary ring towards the pupil; it is covered by a blackish varnish, in the same manner as the choroid.

Before, it is covered by numerous small fibres, disposed in the manner of rays, and which form the iris. These small fibres are susceptible of elongation and contraction, for the purpose of contracting or enlarging the aperture of the pupil: this contraction, in all probability, is produced by a spontaneous afflux of blood towards that part.

In man, the colour of the iris varies.

The eyes may be covered by both the eye-lids: the upper, which is larger, is a continuation of the eye-brows.

The eye-brows rest on the superciliary arch; they are formed by the superciliary muscles, and by the skin, which in that part is covered with hair: these muscles depress the eye-brows by bringing them nearer to each other.

The eye-lids are formed by the skin and the palpebralian

pebralian muscle; the upper one has also a proper elevating muscle. When the eye-lids are brought together, the upper one falls down as four, and the lower one rises as one.

The free edges of the eye-lids are furnished with a cartilage (*tarsus*), retained by a thin ligament, the *palpebral*. The tarsian cartilage has a great many furrows, which serve to lodge glandulous follicles, called the *glands of Meibomius*: they are of a yellowish white colour, and secrete the gummy matter. This thick, unctuous humour issues through a great number of pores called the *ciliary pores*. Towards the interior commissura, behind the *membrana nictitans*, is a small, reddish, conical, villous tubercle, composed for the most part of seven small follicles, cemented two and two, with an odd one called the *caruncula lacrymalis*.

The edges of the eye-lids are furnished with one or two rows of eye-lashes.

The skin, which forms the eye-lids, seems to be reflected interiorly, and then to be continued before on the lobe of the eye, to form the conjunctive membrane, which appears to be continued as far as the cornea.

The conjunctive membrane is formed of a close, smooth tissue, transparent on the cornea: it continually secretes a serous matter, which moistens the eye. Towards the interior commissura of the eye-lids

lids is a fold in the form of a crescent, which constitutes a sort of membrana nictitans.

The lacrymal gland, which is oblong and of a whitish gray colour, is situated in the upper part of the orbit, towards its exterior angle, and is applied on the lobe of the eye. The excretory ducts of this gland open on the interior face of the upper eye-lid near its edge, where there are six or seven small apertures, which pour the tears upon the eye. These tears are diffused over the whole surface of the eye by the action of the orbital palpebralian muscle, which always brings them back towards the interior commissura.

The free edge of each of the eye-lids has, towards its interior angle, a small hole, the projecting mouth of which is cartilaginous. When the eye-lids are shut these two holes correspond; they are continued by two ducts, which proceed to the sacculus lacrymalis.

This membranous bag is lodged in the lacrymal fossa, and is continued inferiorly with the nasal canal.

The eye is moved by six muscles, four of which are *straight* and two *oblique*. The four straight muscles are attached to the bottom of the orbit, at the circumference of the ocular hole; they then proceed forwards, and each terminates in a broad tendinous expansion on the sclerotica, embracing the contour of the globe of the eye before.

Of

Of these four muscles the superior elevates the eye; the inferior depresses it; the interior pulls it inwards, and the exterior outwards. Of the two oblique ones, the superior, which is larger, is attached to the bottom of the eye, on the interior edge of the ocular hole, and changes to a tendon, which is reflected on a cartilaginous lamina fixed at the interior angle of the os frontalis. This tendon receives in that part a sheath, and then proceeds outwards, passing over the superior right muscle, and is fixed at the top and behind to the exterior side of the eye, which it causes to turn inwards and downwards.

The inferior oblique muscle, which is smaller, is attached to the base of the orbit, and to the bottom of the lacrymal canal; it proceeds backwards in an oblique direction, passing under the depressor, and fixes itself to the posterior and exterior part of the eye, which it pulls upwards and outwards.

OF HEARING.

282. **THE** organ of hearing is observed in some of the mollusca, some insects, and in all vertebral animals. It consists chiefly of a membranous capsule, containing a viscous fluid, in the middle of which the auditory nerve is expanded.

This capsular apparatus is found in the ear of all animals: in crabs, and the sepia, it exists alone.

In fishes, the capsule, for the most part, is divided by several contractions; and contains one, two, or three small bones of different densities, suspended in the middle of the viscous substance. In these animals are observed three bent or semi-circular vessels, the extremities of which proceed into the interior of the capsule.

In the greater part of fishes the whole of this apparatus is contained in the common cavity of the cranium, which has depressions fitted for receiving it, and some furrows which serve to lodge a part of the semi-circular vessels.

In fishes with fixed branchia, this apparatus is contained in the thickness of the bones of the cranium, and the capsule communicates with a *conduit*, which traverses the cranium behind. The aperture of this conduit is covered, on the outside,

side, by a thin membrane called the *membrana tympani*, and by the skin.

The space comprehended between this membrane and the capsule is called the *barrel* or *tympanum*.

In some reptiles the barrel is covered only by the skin: in the greater part of them it is furnished with a *membrana tympani*; and in all, the salamanders excepted, this cavity communicates with the capsule by an aperture covered with an osseous plate, and with the mouth by a particular conduit called the *guttural conduit*, *Eustachian tube*.

In birds, the semi-circular vessels have not a direct communication with the membranous capsule, but with an intermediate cavity, known by the name of the *vestibulum*. In these animals, the capsule exhibits also a conical prolongation, bent and divided by a membranous partition into *two cells*, which communicate with each other: one of these proceeds into the *vestibulum*, and the other into the *barrel* or *tympanum*, by an aperture covered with a very fine membrane.

In the mammalia, the organ with two cells is formed of two *scalæ*, divided by a membranous or osseous partition: these *scalæ* make several turns in a spiral form, so as to represent the shell of a snail, and on this account are called the *coclea*.

The membranous apparatus of the *coclea*, the *semi-circular canals*, and the *vestibulum*, constitute the MEMBRANOUS LABYRINTH.

In

In fishes with fixed branchiæ, this *labyrinth* is enveloped by an osseous stratum of the same form, very wide, and in the middle of which these parts are free, and as it were suspended. In most reptiles, in birds, and in the mammalia, it is enveloped by a thin osseous stratum, which embraces it closely, and seems to have been moulded on the form of its parts: this solid covering constitutes the *osseous labyrinth*.

In young mammalia, the osseous labyrinth may be disengaged from the body of the bone, which only surrounds it; but in adults it is confounded with it, and seems hollowed out in its substance.

The vestibulum is pierced with seven apertures, viz. five for the three semi-circular canals, because the two extremities of one of these canals unite before they reach the vestibulum; the sixth communicates with one of the scalæ of the organ *with two cells*, or of the *cochlea*; the seventh opens into the barrel or tympanum, and is covered by a small bone.

In most of the mammalia, the cochlea makes two turns and a half in a spiral form; in cetaceous animals it is short and plane, and makes only one turn and a half; in the Guinea pig, the *cabiai*, and porcupine, it is of a turreted form, and makes three turns and a half.

The barrel or tympanum, which is very large in birds, is extended in the thickness of the bones of the cranium. In the mammalia, it is for
the

the most part single, but sometimes divided, as in the genus of the cat, and of the civet-cat.

In most reptiles, in birds, and in the mammalia, the barrel has four apertures: one is that of the vestibulum, which is covered by an osseous plate; the second is that of the cochlea, which is closed by a membrane; the third is the hole or canal that communicates with the mouth; and the fourth, which is larger, conducts to the outside, and is shut by the membrana tympani. All these apertures are of different sizes, and assume different forms and directions, in the different kinds of animals.

In fishes with free branchiæ, and in salamanders, the membrana tympani, and also the barrel, are wanting. This membrane, which in fishes with fixed branchiæ, and in some reptiles, is on a level with the head, is covered only by the skin, which in that part is often thinner.

Birds, and particularly the mammalia, have the membrana tympani placed at a greater depth in the thickness of the bones: in these animals it is fixed on an osseous frame, susceptible at a young age of being separated from the body of the bone: this frame, for the most part, is incomplete. The membrana tympani affects also different forms: in some reptiles it is plane; in birds it is convex on the outside, and in the mammalia it projects inwards.

The

The osseous plate which covers the aperture of the vestibulum is for the most part continued in a handle, or series of small bones, one of which is applied to the membrana tympani, to which it adheres.

Salamanders, on the aperture of the vestibulum, have only a small cartilaginous piece covered by the flesh.

In serpents and the camelion the handle of small bones traverses the flesh, and rests against the bone which supports the lower jaw. In all these animals the membrana tympani is wanting.

Birds and some reptiles have only one small bone; in the frog and the toad there are two, and in all the mammalia there are four.

These four small bones are: the *malleus*, *incus*, *stapes*, and *os orbiculare*.

The plate of the *stapes* covers the aperture of the vestibulum; and the handle of the *malleus* adheres to the membrana tympani.

These small bones are moved by one or more small muscles, which are often scarcely perceptible. Birds have one, and the mammalia three: in the latter, two are attached to the malleus, and one to the stapes.

Fishes and reptiles have no exterior auditory conduit.

Birds have one, which is very short: the exterior orifice is surrounded and covered by a few very

fine feathers, disposed in a manner altogether peculiar.

In the mammalia; the auditory conduit is of greater extent, and affects various directions : it is in part osseous, and is generally terminated on the outside by a cartilaginous expansion, *concha*, of different forms and sizes, and more or less moveable by means of particular muscles.

Cetaceous animals have for auditory conduit a very small, twisted, cartilaginous canal, which is lodged in the thickness of the fat.

In several of the mammalia the *concha* is wanting.

283. *In man*, the organ of hearing consists also of a membranous labyrinth contained in an osseous one, a barrel or tympanum, an auditory conduit, and a *concha*.

The membranous labyrinth is composed of a capsule containing a viscous fluid, in which is found the labyrinthic nerve: this soft and pulpy nerve expands into a reticulation in the different excavations of that part.

The membranous labyrinth has the same form as the osseous one in which it is contained. It consists of a cochlea, a vestibulum, and three semicircular canals. All this apparatus, contained in the petrous portion of the temporal bone, seems, in the foetus, to be separated from the rest of the bone; but in the course of time it becomes con-

founded with it, and appears to be hollowed out in the substance of it.

The cochlea is placed over and corresponds with the carotid canal; its cavity presents a double spiral, which makes two turns and a half. The base of the centre of the spiral corresponds nearly with the acoustic foramen; it is pierced with several holes to afford a passage to the filaments of the labyrinthine nerve, and its summit directed outwards, and upwards terminates in a sort of funnel.

The partition which separates the two scalæ of the cochlea is half osseous and half membranous: the osseous part is towards the axis.

Of the two scalæ of the cochlea, the interior, which is larger and shorter, is terminated at the base by a round aperture that proceeds to the barrel or tympanum: *foramen of the cochlea*.

The exterior one, which is narrower and longer, ends at the vestibulum: these two scalæ communicate with each other at the summit of the cochlea.

The three semi-circular canals, situated behind the cochlea, are separated from that part by the cavity of the vestibulum. They form three arcs, the two extremities of which are widened and proceed into the vestibulum. The three semi-circular canals give only five apertures in the vestibular cavity, because two of them are confounded together on entering it.

The vestibulum forms an intermediate cavity between the cochlea and the three semi-circular canals. It is of a round form, and presents in the inside: the five apertures of the semi-circular canals; the orifice of the exterior scala of the cochlea; an oval hole which enters the tympanum; and a small triangular aperture which penetrates into the cranium. This aperture is terminated by a slit towards the middle of the superior edge of the apophysis petrosa, where it conducts to a *receptacle* formed by the two laminæ of the meninx, and which contains a serous matter: *aqueduct of the vestibulum or of cotunni*.

Near the aperture of the interior scala of the cochlea is another very small one, which proceeds to the interior of the cranium, opening in the middle of the posterior edge of the apophysis petrosa: *aqueduct of the cochlea*.

The osseous labyrinth communicates with the tympanic cavity by the aperture of the cochlea and that of the vestibulum.

The tympanic cavity corresponds with the exterior side of the labyrinth; it is round, contains a series of four small bones, and exhibits several apertures.

Of the apertures which enter the tympanic cavity, one of them, of a round form, communicates with it at the bottom of the interior scala of the cochlea; the other, which is oval, opens into the vestibulum;

vestibulum ; it is covered by the base of the stapes. These two apertures are separated by a round eminence called the *promontory*.

The tympanic cavity exhibits also before, an aperture divided at its entrance by an osseous plate shaped like the mouth of a spoon : this aperture affords a passage, above the plate, to the interior muscle of the malleus, and below to the *guttural conduit of the ear*.

This conduit, which is very narrow, issues from the temporal above the inflex canal of that bone ; it becomes cartilaginous, and forms a sort of *Eustachian tube*, which proceeds to the bottom of the mouth behind the nasal fossæ. This conduit, which establishes a communication between the back part of the mouth and the tympanic cavity, is lined with a mucous membrane.

Behind, the tympanic cavity presents a triangular aperture, which proceeds into the mastoidian cells ; these cells are not very apparent in infancy, but expand with age. At the top and behind, it exhibits a sort of pyramid, having at its base an aperture which communicates with the spiroid canal of the temporal bone, and affords a passage to the tympanic nerve. At the bottom it has a small slit through which pass one of the muscles of the malleus and the tympanic nerve, *glenoidal fissure*. At the lower part it has several small holes for the passage of the sanguine vessels.

The

The four small bones, contained in the cavity of the tympanum, are the stapes, the os orbiculare, the incus and the malleus.

The *stapes* has exactly the form indicated by its name; the base of it is applied to the oval aperture of the vestibulum, where it is retained by an expansion of the periossteum. On the summit it has a small cavity which receives the *os orbiculare*.

This bone, which is exceedingly small, is found between the stapes and the long branch of the incus.

The *incus* consists of a body and two branches; the body has an elliptic cavity, which receives the head of the malleus.

The *malleus* has the form of a club; its head, turned upwards and backwards, is articulated with the body of the incus; its neck has a long slender apophysis, and its handle another shorter one, which is turned outwards and upwards. The extremity of the handle of the malleus is fixed towards the middle part of the membrane of the tympanum.

These bones are moved by three muscles, two of which belong to the malleus, and the third to the stapes.

Of the two *muscles of the malleus*, the *interior* one is attached to the apophysis placed below the neck of that bone, and proceeds in the canal of the guttural conduit of the ear: it seems as if intend-

ed to pull the malleus inwards and forwards, and to stretch the tympanic membrane. The anterior, which is less apparent, is attached to the long apophysis of the neck of the malleus; issues through the glenoidal fissure, and is attached to the exterior side of the guttural conduit: it seems intended to pull the malleus outwards and forwards, and to relax the tympanic membrane.

The *muscle* of the *stapes* is the smallest; it is attached, on one side, to the summit of the pyramid, and on the other to the neck of the stapes. Its action seems to be to pull the stapes outwards, and to stretch the membrane which retains the base of that bone around the aperture of the vestibulum.

The four small bones, by their union, form a chain between the aperture of the vestibulum and the tympanic membrane.

This membrane forms the exterior side of the tympanic cavity. It corresponds, without, to the bottom of the auditory conduit, and separates the interior from the exterior part of the ear. In the foetus, it adheres around an osseous ring incomplete at the top. This ring, in adults, is confounded with the body of the bone, and is converted into an osseous conduit.

The *membrana tympani* has an oblique direction; it projects outwards, and in the middle adheres to the extremity of the malleus; it is thin
and

and transparent, and seems susceptible of being separated into four thin leaves.

On the exterior side of the *membrana tympani* there is found, in adults, an osseous conduit of eight or ten lines, slightly bent downwards. This conduit, which is broad at the bottom, has afterwards a sort of contraction, and becomes wider on the outside.

The edges of the exterior orifice of this osseous conduit are unequal, and have attached to them a cartilaginous cornet, which becomes wider, and forms a cavity : *concha*.

The exterior edges of the *concha* are produced by a cartilaginous thick roll, called the *anthelix*. This roll is single towards the lower part of the ear, and at the upper is divided into two grooves, which leave between them a small fossa, called the *navicular*.

From the upper part of the *concha* arises another cartilaginous roll, which proceeding upwards, and then backwards, marks out the contour of the ear : *helix*. It is terminated, at the bottom, by a soft flexible appendix. The interval between the two rolls is marked by a *groove*.

Before the *concha* is a triangular eminence, which rises above the middle of its cavity, *tragus* ; opposite to this eminence is another, towards the lower part of the *anthelix* : it is separated from the former by a deep groove, *antitragus*. The whole dis-

position of the exterior ear is such, that the sonorous radii, which fall on these different parts, are reflected towards the auditory conduit.

The exterior ear, which is formed of a cartilaginous substance covered by the skin, is retained by three ligamentous expansions, and exhibits the elements of several muscles.

Of three ligaments which proceed towards the cartilage of the ear, the *upper* one arises from the exterior aponeurosis of the temporo-maxillian muscle; the *anterior*, from the base of the zygomatic apophysis; and the *posterior*, from the base of the mastoidian apophysis.

Of the muscles of the ear, three are situated around the exterior part of it, and could move it if they were more prominent: one of them is at the top, the other below, and the third behind. *Exterior muscles.*

The rest, still less apparent, are situated on the interior part, and do not extend beyond it. *Interior muscles.*

284. *The exterior muscles.* The *superior* extends from the aponeurosis of the occipito-frontian, to the navicular fossa, *temporo-auriculian*: it would tend to raise the cartilage of the ear.

The *anterior* extends from the aponeurosis of the occipito-frontian, above the zygomatic apophysis, as far as the anterior part of the helix: the *zygomato-auriculian*: it would draw the ear forwards.

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The *posterior*, which is the most apparent, varies both in its form and position, and is often divided: it extends, in general, from the mastoid apophysis to the posterior part of the concha, the *mastoido-auricularian*; it would tend to pull the ear backwards. In some persons this muscle has been seen to perform very striking movements.

The muscles called *interior* consist of some pale fleshy fibres, scarcely sensible, diffused over the helix, the tragus, the anti-tragus, and the concha; the *great* and the *small helixian*, the *tragian*, the *anti-tragian*, and the *transversian*.

The skin of the interior part of the concha, and that of the exterior auditory conduit, contain a great number of glandulous follicles, which secrete a thick humour of a yellowish colour, and similar to wax, called the *cerumen*.

The entrance of the auditory conduit is covered also with very fine hairs, proper for intercepting small bodies which might be introduced into that cavity.

OF SMELLING.

285. THE organ of smelling consists chiefly of a membrane called the *olfactory*, which lines the folds of the nasal fossæ, and which has the property of perceiving the contact of certain molecularæ of matter.

The nasal fossæ serve always for affording a passage to the air, in the respiration of animals with lungs; in fishes these fossæ are hollowed out only in the thickness of the snout.

The organ of smell seems to be stronger, according as the olfactory membrane is of greater extent.

The nasal fossæ of the mammalia are formed by the os ethmoides, its anfractuosities and its turbinated portions, the vomer, the bones of the nose, the super-maxillary bone, the inter-maxillary, the sphenoid, and the palatine.

The nasal fossæ are of greater or less extent, being sometimes broad and sometimes narrow: the entrance of them is generally turned forwards; in cetaceous animals, and birds, they are turned upwards.

Some fishes, such as the toad-fish, have their nostrils supported by pedunculi,

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The size of the nostrils is much increased by the numerous twisted folds, communicating with each other, of the ethmoid ; and of its turbinated portions, which have a spiral form. These turbinated bones, in most of the mammalia, are very large, and turned round in a very singular manner : in birds they are, for the most part, cartilaginous, and large, especially in birds of prey.

Reptiles have some membranous laminæ, which enlarge the surfaces of their nasal fossæ.

In fishes, these surfaces are enlarged by membranous prolongations, which are indefinitely subdivided in wonderful order.

In the mammalia, the nasal fossæ have a communication with cavities formed in the thickness of the frontal bone, the maxillary and the sphenoid ; these cavities, which communicate with the nasal fossæ by narrow apertures, are distinguished by the names of : *the frontal, maxillary, and sphenoidal sinuses*, according to the bones in which they are formed.

The *frontal sinuses* are wanting in some of the rodentia, some edentia, and several other animals ; they are very small or are wanting in apes ; in man, and in many of the mammalia, they are very striking ; and in some carnivorous animals, such as the dog, wolf, and fox, and particularly in some ruminating animals, as the ox, the goat and the sheep, they are of great extent : they are very
large

large also in the swine, and exceedingly large in the elephant.

The *maxillary sinuses* are generally very small in carnivorous animals, in most of the rodentia and edentia. In ruminating animals, and in several more of the mammalia, they are very large.

The *sphenoidal sinuses* are wanting in most animals, and particularly in those which have the body of the sphenoid very much flattened. They are small in the swine and the hippopotamus, and very large in the elephant.

Cetaceous animals have no sinuses. In birds the cavities of the bones of the cranium have a communication with the ears, and not with the nostrils.

The nasal cavities and their numerous folds are covered by a periosteum, like all the other bones. But this periosteum is lined with a fungous, thick and very red membrane, on which is expanded a beautiful vascular reticulation; it is furnished with glandulous follicles, which secrete a peculiar kind of mucous matter, and adheres very strongly to the periosteum.

The membrane which covers the inside of the sinuses, and serves them as a periosteum, is very thin: it is smooth, and seems to be of a texture different from that which lines the nostrils.

The summit of the ethmoid bone, which corresponds to the base of the cranium, in all the mammalia,

mammalia, cetaceous animals excepted, is pierced with a great number of small holes : in other animals it has only one hole or canal. These holes afford a passage to branches of the ethmoidal nerve, which expand over the whole surface of the nasal membrane.

The number and size of these holes seem to be proportioned to the power of smelling : in carnivorous animals they are very numerous.

To the fore-part of the bones, which form the anterior edges of the nasal cavities, and the osseous plate which separates these cavities, are attached cartilages, which are prolonged in order to form the edges of the nostrils. These cartilaginous edges are of different sizes, and assume various configurations in different animals ; in the greater part of the mammalia they are moved by some particular muscles, fixed on the cheeks, and which tend to dilate or to contract the entrance of the nasal cavities, and to move, in different directions, the projecting muzzle of some species, such as the swine's snout. -

In the elephant, the nostrils affect a configuration altogether peculiar ; they are continued in the form of a very elongated cone, which constitutes the trunk. This canal, which is broader at the root, and divided by a partition, has two spiral turns towards its base, and communicates with the osseous nostrils by means of a valve, which can be raised.

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The trunk of the elephant is lined with an aponeurotic membrane, pierced with holes through which oozes a viscous liquid. The sides are formed of two layers of fibres, one of which proceeds, in a radiated form, from the interior aponeurosis towards another aponeurosis beneath the skin: these fibres, by contracting, render thinner and extend the sides of the trunk, without diminishing its cavity; the other layer consists of short longitudinal fibres, placed quite around it, and proper for shortening the trunk partially.

Most reptiles have some small muscles for dilating or contracting the entrance of the nostrils. In birds, the aperture of the nostrils is surrounded only by a roll of the skin. In fishes, they are narrower at the bottom, and susceptible of some movement.

In cetaceous animals, the nostrils exhibit no projecting folds in the inside, and have no communication with the sinuses; they are lined with a thin membrane of a close and smooth texture, the structure of which has no resemblance to that with which these cavities are covered in other animals: the ethmoid has no aperture, and there is no olfactory nerve; so that it is highly probable that the nostrils in these animals cannot serve as the organ of smelling. Their peculiar structure renders them proper for another purpose; they are divided, at their osseous entrance, by a valve which can
be

be raised; the inferior part, or that which corresponds to the pharynx, is provided with a very strong muscular apparatus, and in the superior or external part is a cavity, the contractible sides of which terminate outwardly in the narrow aperture of the nostrils. These animals, by means of this arrangement, can throw up the water, which they have in their mouth, to a very great height, through the nostrils.

In the guttural conduit of the ear of cetaceous animals is observed a pretty wide hole, terminating in a large cavity, lined with a soft, mucous, and blackish membrane, which has a communication with the frontal sinus. The nerves of this cavity, as well as those of the nostrils, proceed from a pair, (the fifth) which, in all the mammalia, send out others to the nostrils; so that it is very probable that this peculiar apparatus serves as the organ of smelling to these animals.

286. *In man*, the olfactory membrane is of a moderate size, and of a rose colour; is thick, of a villous texture, and contains a great number of mucous follicles, which secrete the mucus of the nostrils. This membrane receives a great number of sanguine vessels, which arise chiefly from the sphenopalatine and ethmoidal arteries.

The ethmoidal nerve, when it arrives near the ethmoid bone, becomes thicker; assumes a pulpy consistence,

consistence, and penetrates to the nostrils by a great number of small holes or osseous tubes, exhibited by that bone. This nerve seems to be exclusively appropriated to the sense of smelling. The fifth pair furnish, in the nose, several nerves which seem to be destined only for the life of that organ.

The nasal fossæ have a communication with the frontal, maxillary, sphenoidal, and ethmoidal sinuses; and the membrane which lines these sinuses is of a structure different from that which lines the inside of the nostrils: it has a finer texture, is sinooth and transparent: it adheres weakly to the bones, and serves them as a periosteum.

The parts on which the olfactory membrane expands constitute the nasal fossæ. Before and at the top, they are formed by the bones of the nose; on the sides, by the super-maxillary, lacrymal, and ethmoid bones, and by the inferior turbinated bones; behind by the sphenoid; at the bottom by the super-maxillary bones, and those of the palate. They are divided also longitudinally in the middle by the vomer, and the perpendicular plate of the ethmoid, and before by the cartilage by which these bones are continued: this plate is very often warped.

The nasal fossæ are not very apparent in infancy, and do not attain to their complete size till the period of full growth; at which time they are nearly three inches in extent from before backwards,

wards, and two inches from the top to the bottom.

The lateral sides of the nasal fossæ approach each other at the top, and diverge at the bottom.

The narrow summit of the nostrils exhibits an arch of three planes. The anterior, which is inclined forwards, constitutes the arch of the nose; the middle one, which is horizontal, exhibits the orifice of the ethmoidal holes; and the posterior corresponds to the aperture of the sphenoidal sinuses.

On the lateral sides of the nasal fossæ there are three turbinated bones, two of which belong to the ethmoid bone: the inferior one, for the most part, is free.

The *superior turbinated bone* adheres to the arch of the nasal fossæ, and is separated from the middle one by a large groove, the *superior meatus*. This groove exhibits before, the aperture of the posterior ethmoidal cells; and behind, the sphenopalatin foramen.

The *middle turbinated bone*, larger than the preceding, swells out before, and terminates in a point behind; it is separated from the lower one by a broad groove, called the *middle meatus*. Before, this groove exhibits the common aperture of the ethmoidal cells, and of the frontal sinuses; and in its middle part an aperture, which proceeds into the maxillary sinuses.

The *inferior turbinated bone*, less twisted and wider than the other two, has below it a large furrow, called the *inferior meatus*, which exhibits before the aperture of the nasal canal.

To the bones, which constitute the anterior aperture of the nostrils, are affixed two cartilages, which form the arch and alæ of the nose; and another which produces, before, the middle portion. These cartilages are covered on the outside by the skin, and on the inside by the olfactory membrane: in that part, this membrane is thinner and less villous than in the rest of its extent, and it exhibits there some very fine hairs.

The cartilages of the nose are moved by the occipito-frontian, super-maxillo-nasian, the great super-maxillo-labian, and the alveolo-nasian muscles, the uses of which are common to the other parts.

The posterior aperture of the nasal fossæ corresponds to the back part of the mouth; and, at the moment of deglutition, is closed by the velum palati.

The sinuses expand with age, and give more extent to the face. The two frontal sinuses are divided, in the middle, by a longitudinal partition for the most part warped. Their extent varies a great deal; sometimes they occupy the whole frontal region, and sometimes they are scarcely apparent.

The two sphenoidal sinuses are hollowed out in
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the body of the sphenoid, the whole extent of which they sometimes occupy, and they open behind the superior turbinated bone.

The two maxillary sinuses are the largest; they occupy the whole thickness of the super-maxillary bone; they affect a triangular form, and open into the middle meatus.

The four ethmoidal cells correspond to the top and sides of the nasal fossæ, and have a communication with each other. The two exterior open into the middle meatus, with the frontal sinus; the two posterior proceed into the superior meatus.

SYSTEM OF DIGESTION.

287. *THE system of digestion in animals.* The system of digestion consists chiefly of a membranous bag, the sides of which secrete a particular juice. The aliment, introduced into this bag, is there transformed into a kind of pulp, which contains the nutritive juice. This juice is distributed to the different parts of the body, where it becomes mixed with the blood, and the residuum is discharged.

Some animals have merely an alimentary bag with one aperture. In the greater number, the apparatus of digestion consists of one canal with an aperture for entrance, and another for escape. This apparatus, however, is rarely so simple: it is rendered complex by several dilatations, and consists of different pieces.

In some animals the alimentary canal exhibits small dilatations; but in others these dilatations are of considerable size, and constitute stomachs. When animals have a distinct stomach, the name of œsophagus is given to that part of the alimentary canal which proceeds into it; and that of intestine to the one which proceeds from it.

The juice of the alimentary canal appears to be the only one which in some animals serves for digestion;

tion ; but in the greater number this canal also receives the liquors secreted by the liver and by the pancreas.

The entrance into the œsophagus is sometimes a simple aperture ; but, for the most part, this entrance is a mouth, formed of jaws, and furnished with teeth, a tongue, salivary glands, &c.

288. *Jaws* are found in crustaceous animals, insects, and in several of the mollusca ; but in these animals they exhibit a peculiar structure, which has very little relation to that of the same parts in the mammalia. In some zoophytes, such as the sea hedge-hog and sea-nettle, there are found also an organ of mastication, and teeth moveable by the means of muscles.

All vertebral animals are provided with two jaws* : in birds, fishes, and serpents, they are both moveable. In some reptiles, as the crocodile and the lizard, and in all the mammalia, the lower one alone is moveable.

In the mammalia, the lower jaw exhibits a condyle, which is articulated in a cavity of the temporal bone.

In fishes, reptiles, and birds, the jaw and mandible are each furnished with a cavity ; and these two cavities receive an intermediate bone (*square bone*), which serves as the means of union, and supplies the place of a condyle.

* Crabs have four, five, and sometimes ten pairs of jaws.

In all vertebral animals, the jaws move vertically and horizontally; in insects they move transversally.

In serpents, the jaws, which are moveable from above downwards, can be separated also in a lateral direction, which produces an aperture capable of receiving an object of prey larger than their whole body.

Some fishes have jaws which, without any movement of the head, can be carried suddenly forwards to catch their prey; as is the case in the ray, the shark, and some reptiles.

In the mammalia, the condyles are of greater or less breadth and flattened; in ruminating animals, their transverse diameter is greatest; in the rodentia it is greatest from before backwards; and in man, the ape, &c. it is greatest in an oblique direction. In animals which do not masticate, the condyles are not very apparent; in the large carnivorous animals they are very strong, and are lodged in deep cavities, in which they are inclosed and retained by a roll and an osseous capsule.

The muscles which move the jaws vary with respect to their number in the different classes of animals. In the mammalia, these parts are elevated by four muscles, and depressed by a greater number. The former are: the crotaphite, the masseter, and the two pterygoidian; the latter are attached to the os hyoides, the base of the cranium, and to the sternum.

sternum. Of these, the digastric of man and of apes is monogastric in carnivorous animals. In most of the carnivorous animals, such as the hyena and the tiger, the crotaphite muscles extend as far as the summit of the cranium, where they are fixed to a strong osseous ridge. The masseter, which is very large, is attached to a prominent and extensive zygomatic arch. These two muscles, in these animals, move the jaws from above downwards; and in graminivorous make them perform lateral movements.

Quadrupeds have lips which serve to close the mouth, and to retain the aliments; in man, they contribute also to speech and to the action of the physiognomy.

289. *Teeth.* Fishes, reptiles, and the mammalia, have jaws provided with teeth, implanted in the bodies of the maxillary bones, or retained only in the gums.

Fishes have teeth not only in the jaws, but also in the palate, the throat, on the bones which bear the branchiæ and the tongue, and even on the tongue itself. If this disposition is favourable to mastication, it cannot be so for tasting. In these animals the teeth, which affect different forms, are supported by an osseous tubercle covered with a membrane. When this membrane is destroyed, the tooth and tubercle drop out, and the place of both is afterwards supplied by others.

In the mammalia, the teeth are of three kinds : the sharp ones in front are called incisors ; naturalists always give the name of incisors to those implanted in the inter-maxillary bone ; others cut into several faces correspond to the angles of the lips, and are the angular teeth ; and the large flat ones, placed backwards and on the sides of the mouth, are the grinders or molar teeth.

In some animals, the teeth are so large, and of so singular a conformation, that they cannot be distinguished by that name : such are the tusks of the narval and the hippopotamus ; those which proceed from the mouth of the wild boar, and those which fall back even on the head of the barbyroussa.

The grinders exist in all animals furnished with teeth. The presence of the rest is not constant : grinders only are found in the edentia ; incisor teeth are wanting in the sloth, and angular teeth in the rodentia. Ruminating animals have incisive teeth only in the lower jaw. The three kinds are observed in the solipeda, several of the pachydermata, the carnivorous, the quadrumana, and in man. In the last place, the ant-eaters are destitute of them.

Several animals, such as the solipeda, have a part of their jaws without teeth, *interdentium*. It is in this part that the bit of the horse is placed.

In the hare, the fox, and often in children, the
incisors

incisors are ferrated ; in bats, these indentations are sometimes so deep, that they resemble the teeth of a comb ; in the rodentia they are long and curved ; the *didelphis marotarsus* has the angular teeth shorter than the rest ; in most apes the angular teeth begin to be lengthened, and in the large carnivorous animals they are so long that they cross each other, and are received in the indentations which they mutually present.

The large surface of the grinders has various configurations ; in carnivorous animals it is covered with points in one or more rows ; in the pachydermata it is tuberculous, and in the large graminivorous exhibits salient lines : these lines in the ruminantia form several crescents, and in the folipeda a double festoon.

Carnivorous animals, the quadrumana and man have the teeth formed of an osseous substance, covered on the outside by a coating of enamel. In the folipeda and ruminantia the teeth consist of an osseous substance, enveloped in the membranous follicle which originally contained them. The bodies of the teeth are covered with an enamel of a golden yellow colour : the membranous follicle ossifies, and forms around the teeth a very hard cortical covering.

In the elephant and the hippopotamus, when young, they are *composed* of vertical laminae, placed on each other without adhesion. These
osseous

osseous laminæ, cut unequally at the summit, soon unite by means of an enamelly juice, which insinuates itself between them, and they then form a solid tooth composed of plates of enamel and osseous plates.

By the effect of mastication, the edge of the osseous planes soon becomes worn, and in the course of a few years the surface of the teeth is covered with salient and unequal lines of enamel. This disposition, analogous to that of millstones, is exceedingly proper for mastication.

In the *oryzærope* the teeth have the porosity of reeds: they are soft, and can be easily cut.

The name of *root* is given to that part of the teeth which is inserted in the jaw; the part without is called the *crown*; and the stricture which often separates these two parts is called the *neck*.

The single teeth are hollow during the first years of their growth; the cavity lined with a thin membrane, over which the vessels and nerves are spread, is filled with a gelatinous substance, and becomes partly closed up with age.

The part first produced is the body of the tooth; it soon shows itself without, and begins to be worn before the root has attained to its full growth. When it has ceased to grow, the capacity of the alveolus decreases, and is gradually filled up; the root is destroyed in the same proportion, and the tooth thus worn at both ends becomes very short

at an advanced age: it then turns loose in the socket, and at last drops out.

In the ruminantia and folipeda the body of the tooth is sometimes completely worn out, and the roots are separated. In these animals the decay of the teeth is much more rapid than in the carnivorous; in man, this decay takes place in a very striking manner. The wearing out of the teeth, which goes on in a constant and regular manner, serves to indicate with precision the age of the folipeda and ruminantia.

In a great number of animals, a part of the teeth drop out, and their place is supplied by others.

Some fishes, such as the shark, have their teeth inserted in the flesh, and susceptible of being renewed four or five times: these new teeth are concealed behind those the places of which they are intended to supply. The same disposition is observed in some reptiles, as may be seen by the venomous dart of the viper.

In the mammalia, a part of the teeth drop out at a determinate period; the germs of those which succeed are placed behind the first. In the crocodile, the teeth are conical and hollow, and receive in their cavities those which are to succeed them.

The roots of the teeth which drop out are speedily destroyed; they become loose in the sockets,

sockets, and are forced out by those which assume their place. This second dentition serves to indicate the age of the animals.

290. The *tongue* is a muscle which affects different forms : in some of the mammalia it is broad and short ; in several birds it is long and narrow ; in most serpents and several lizards it is forked.

In most of the mammalia the tongue is covered by a mucous membrane, furnished with nervous papillæ proper for perceiving the impression of flavours. In several reptiles, it is covered by a scaly substance, and in some fishes it is furnished with teeth.

The tongue serves for mastication, for deglutition, for the voice, and for speech. It is fixed to the os hyoides by muscles, and the point of it is generally directed forwards : in the batrachians, however, it is turned backwards. To the os hyoides, which is free and suspended in the back part of the throat, the muscles of the pharynx and of the jaw are affixed. It appears, for the most part, under the form of a portion of a cartilaginous cylinder ; but in several animals this form varies.

The tongue, in general, possesses great mobility ; in most animals it can be conveyed beyond the mouth, and by reptiles in a very remarkable manner.

In the green wood-pecker, the tongue, which is contained in a membranous sheath, and armed

at

at the point with hooks, can be extended beyond the bill of the animal to a greater length than that of its body : it is lengthened and drawn back by a very curious organic disposition.

291. In fishes the mouth communicates with the œsophagus, and with the aperture of the branchiæ; in animals with lungs, it proceeds to the œsophagus, the pharynx, and the nostrils.

In these animals, which perform real mastication, the inside of the mouth is moistened not only by the secretion of the mucous membrane, which lines that cavity, but also by the saliva secreted from several glands.

In carnivorous animals, the saliva under certain circumstances assumes a very venomous quality. This property is found in the production of a gland of the viper, and in an analogous liquor of some insects.

The œsophagus is a musculo-membranous canal, lined with a mucous membrane: its length varies as that of the neck; it proceeds to the stomach.

292. *The stomach* is a dilatation of the alimentary canal. In very ravenous fishes, and most serpents, this dilatation scarcely exists. In the carnivorous mammalia the stomach is single, and not very capacious; in the graminivorous it is larger; in birds it is double, and often triple; in the

the ruminantia it is quadruple ; in cetaceous animals there are five in succession.

The stomachs of insects have a great analogy with those of red-blooded animals. In butterflies the stomach is merely a dilatation scarcely sensible, or does not exist at all ; in other insects the stomach is single, double, or multiple. In those which feed on the juice of flowers, such as bees, the single stomach is large ; in insects which suck blood, or feed on animal matters, it is of less extent. Double stomachs belong, in particular, to carnivorous insects, such as the coleoptera of that genus : in these insects, the first stomach is muscular, like the gizzard of birds, and the second membranous : in some there is also a sort of crop. Multiple stomachs are found in insects which exercise a kind of rumination, as is the case with locusts.

The numerous class of insects, with respect to this part, exhibit an organization exceedingly curious and complex ; but we must confine ourselves chiefly to red-blooded animals.

The stomach of carnivorous, and particularly of herbivorous animals, which do not ruminate, exhibits also one or more dilatations ; but for the most part there are two. In herbivorous animals these dilatations are very large ; in the polyphaga they are less, and in the carnivorous small. In
the

the last, the stomach appears to be only an intestinal dilatation, which has little obliquity ; it is in general wrinkled, and can be considerably distended to receive an ample repast.

The sides of the stomach are for the most part of a musculo-membranous nature ; and the interior part of them is always covered with a mucous membrane.

In birds, which have two and for the most part three stomachs, the first, called the *crop*, is a membranous bag, in which seeds remain and become soft ; the second, *ventriculus succenturiatus*, is thicker, but of less size ; it is furnished with a great many mucous glands which secrete abundance of digestive juice. It was the juice of this stomach which Spallanzani employed in his ingenious experiments on the gastric juice. The third, or *gizzard*, is formed of two very thick muscles ; the cavity of it is not larger than the ventricle, but the thickness of it makes it appear much more voluminous on the outside. The two muscles of the gizzard exhibit, on two faces, a very strong round tendon, from which the muscular fibres extend in a diverging form. The cavity of this stomach is lined with a very thick mucous membrane, which may be easily separated, and which is susceptible of regeneration. The gizzard possesses a very strong contractile force : its action seems to supply the place of mastication.

Granivorous

Granivorous birds, in general, swallow small pebbles, and the strong and varied contraction of the gizzard on the seeds, mixed with these hard bodies, effects in this manner their trituration by repeated friction. In the stomach of the ostrich and the cassowary several pounds of pebbles are often found intermixed with bits of glass, iron, &c. In carnivorous birds the gizzard is much thinner : in those which feed on fish or worms there is scarcely any. These birds have no crop ; and the ventricle which is their principal stomach is generally very large.

The gastric apparatus of the mollusca cephalopoda and gasteropoda has some analogy with that of birds. They have a gizzard preceded by a crop. The stomach of the volutæ as well as of crabs is furnished with two osseous pieces proper for trituration.

In the bivalva, such as the mytilus, the alimentary canal traverses the liver, and is dilated in its thickness to form a stomach. Some of these animals, such as the oyster, have a second stomach.

Ruminating animals have four stomachs, the aggregate of which exhibits a very remarkable system of digestion.

The first, *ventriculus*, called *paunch* by the vulgar, is exceedingly large, and occupies a great part of the abdominal capacity ; it exhibits inferiorly a longitudinal re-entering fold, which divides

vides it into two principal cavities; its interior surface is furnished with large projecting conical glands. The second stomach, the *honeycomb*, *bonnet*, or *king's hood*, is round and much smaller; it is separated from the former by a membranous partition in the form of a horse-shoe, above which these two stomachs have a communication with each other. The inside of the *bonnet* exhibits deep cells of different forms, analogous to the cells of a bee-hive.

The œsophagus communicates with these two stomachs towards their upper part, where it forms an inverted gutter, the thick edges of which can approach each other to form a duct.

This gutter, continued with the œsophagus, consists of two folds, which advance in a parallel direction as far as the third stomach, where they intersect each other at an acute angle, and prevent the entrance of coarse aliment. In this part the gutter exhibits furrows, which are continued with the membranous laminæ that form the third stomach: *omasum* or *manyplies*.

The omasum, of an ovoid form, and somewhat larger than the *bonnet*, is divided, in the direction of its two orifices, by a great many membranous partitions, which produce furrows deep and narrow, particularly towards their middle.

The superior furrows are deeper and much more crooked than the inferior; the inside of these fur-

rows is furnished with rugous glands covered with papillæ. The orifices of this stomach are much lower than its body : the anterior, on the left, corresponds to the *bonnet*, and the posterior, on the right, to the *abomasum* or fourth stomach.

The omasum proceeds into the superior part of the last stomach, the *abomasum*, which is much larger than the preceding two, but less voluminous than the paunch : it is situated under the omasum, between the bonnet and the paunch : it is shaped like the bag of a bag-pipe.

The aperture which forms a communication between the omasum and the abomasum is furnished with a valvula which prevents the return of the aliments. The interior part of this cavity is lined with a thick mucous membrane, which forms several longitudinal folds. This stomach is continued with the duodenum by a pyloric orifice higher than the preceding.

The aliments coarsely chewed at first are formed into balls, and conveyed speedily into the bottom of the left cavity of the paunch, from which they proceed to the bottom of the cavity on the right, and place themselves immediately below the œsophagian aperture, in the order of their entrance.

These aliments become soft and penetrated with juices. When the animal has taken a proper quantity, and is in a state of rest and of good health, it has the faculty of making them ascend
into

into the mouth, where they are again masticated : for this purpose a portion of the grafs contained in the paunch passes into the œsophagus; the part which is most masticated falls into the bonnet, and the coarsest penetrated with juices is reduced to a ball, and returns to the mouth. When the latter phænomenon takes place, it is observed that the animal extends its neck, makes a strong inspiration, and by the simultaneous action of the sides of the paunch, of the abdomen, the diaphragm, and the œsophagus, it causes the ball to re-ascend with rapidity along the œsophagian canal. When it reaches the mouth it is chewed again much more slowly, and with great care ; and the animal seems to find in these alimentary balls, penetrated with juices, a flavour which renders the mastication of them agreeable.

Rumination, therefore, is produced only by the first stomach. The alimentary balls, triturated and reduced to a fine pulp, re-descend along the œsophagus, and pass into the gutter ; the coarsest fall into the bonnet, the rest remain between the furrows of the omasum, and the most liquid proceed directly into the abomasum.

The action of the bonnet prepares the aliments for being received into the omasum, which softens them, and renders them sufficiently liquid to pass into the abomasum, where real digestion is performed.

When ruminating animals drink, or take very liquid aliment, and during lactation, these fluid substances are conveyed through the œsophagus into the gutter, the edges of which unite to form a duct, and they proceed directly into the omasum, from which they pass into the abomasum.

The paunch of the camel exhibits a peculiar dilatation, furnished with salient laminæ, like the omasum, and in which it can preserve, for a very long time, a large quantity of water.

293. *The intestines.* That part of the alimentary canal, which is below the stomach, varies both with respect to its length and to its diameter.

In animals, the length of the intestines is in the inverse ratio of the nutritive quality of the aliments on which they feed.

In some very ravenous fishes, such as the ray, the intestine is shorter than the body. In the carnivorous mammalia, it is twice or thrice that length; in the herbivorous mammalia with a single stomach, it is equal to ten or twelve times that of the body.

The capacity of the abdomen, in graminivorous animals, is for this reason much greater; while in the carnivorous the contrary is the case.

In reptiles, the intestines are of the same width throughout their whole extent; in birds, the width goes on decreasing towards the rectum.

In the mammalia, the intestines are slender in the first part of the alimentary canal, and large in the latter.

The large intestines often exhibit fleshy circular bands, which produce constrictions, and make them appear as if swelled up.

The intestinal canal, in different parts of its extent, has one or more lateral appendices *en cul-de-sac* : *cæcum*.

In reptiles the cæcum is wanting. The mammalia have one ; birds have two ; and fishes have often a very great number.

The cæcum of the mammalia is placed at the commencement of the large intestines ; in carnivorous animals it is very short ; in the gramini-vorous it is much larger ; and in the rodentia, it has often more extent than the stomach.

In man and some apes, the cæcum, which is short, has at its extremity a small *vermiform appendix*.

Birds have often two cæcums on the sides of the rectum.

Some fishes have no cæcum ; while others have a prodigious number, placed in general near the pylorus : they are thick and glandular, and seem to be organs which secrete a liquor proper for digestion.

The intestine terminates, for the most part, in an aperture furnished with a sphincter.

The anus is wanting in the zoophytes, which have only one aperture for the alimentary canal: it is commonly placed at the extremity of the trunk or the tail; but in the mollusca it is found on the sides of the neck.

The whole of the alimentary canal is lined with a mucous membrane, which secretes a digestive juice.

The intestines receive also, for digestion, the bile secreted by the liver, and the liquor produced by the pancreas.

294. The *liver* exists in all vertebral animals, and in all the mollusca; in insects it appears under the form of a vascular reticulation.

The size of the liver appears, in general, to be in the inverse ratio of that of the organ of respiration.

In all animals the liver occupies a great part of the abdomen; the venous blood it receives is that which returns from almost all the abdominal viscera; the veins of all these viscera unite into a very large trunk (*the vena portæ*), which proceeds into the liver.

The most important use of the hepatic apparatus is, not to secrete a small quantity of bile, but to receive a great part of the venous blood, and to make it undergo peculiar changes; so that the history of the liver belongs rather to circulation than to digestion. However, as the bile is a liquor
of

of great importance to digestion, the organ which secretes it is here worthy of attention.

The liver exhibits five orders of vessels : 1st, the large arterious vein, the *sub-hepatic* or *vena portæ*, which conveys its blood to the liver ; 2d, a small artery, the *hepatic* ; 3d, the large vein which conveys back the blood, the *super-hepatic* ; 4th, the biliary vessels ; 5th, the lymphatic vessels.

The canals which carry the bile from every part of the liver unite into one or more *hepatic* ducts, which open into the intestinal canal near the pylorus, and very rarely into the stomach.

A part of the bile often proceeds to and remains in a bladder annexed to the liver.

In the mollusca there is no bladder ; it is wanting also in some of the mammalia, such as the stag and horse ; in fishes it is found sometimes in the inside of the hepatic organ.

The bile is carried to the bladder two ways : 1st, it is conveyed directly from the liver by peculiar ducts, the *hepato-cystic*, as is the case in birds ; 2d, the hepatic canal has a communication with a peculiar *cystic* duct, along which a part of the bile flows back to proceed to the bladder, as is the case in the mammalia.

In the first case, the bile proceeds directly from the bladder to the intestine by the *ductus choledochus* ; in the second, it re-descends from the cystic duct to pass into the *ductus choledochus*.

295. The *spleen* is found in all red-blooded animals; the blood which returns from it proceeds to the liver: no other use of it is known than that of furnishing all its blood to the hepatic apparatus.

296. The *pancreas* is a glandular body which secretes a liquor analogous to the saliva; this liquor proceeds into the intestine by a particular duct, which opens near the *ductus choledochus*.

The pancreas is found in almost all animals which have a liver; it is wanting, however, in the mollusca, and in all fishes which have a great number of cœcums.

Birds have two or three pancreases, which pour their liquor into the intestine by peculiar ducts.

297. *Peritonæum*. The gastric and other organs contained in the abdomen are enveloped by a double membrane, called the peritonæum.

In the mammalia, the peritonæum is of a vascular texture, lax, transparent and greasy: in fishes, it is of a close texture and opaque, has a brilliant metallic appearance, and is covered with a black varnish.

The exterior membrane of the peritonæum lines the sides of the lower belly; the interior seems to be prolonged different ways to envelop each organ, and to retain it in a determinate position.

The

The portion of the peritonæum which covers the intestines, forms, after it has enveloped them, a loose and smooth membrane, which keeps them fixed to the vertebral column : *the mesentery*.

The peritonæum produces also a large membranous fold, which covers like an apron the anterior part of the intestines: the *epiploon* (omentum).

In man, the epiploon descends as far as the abdomen, and on the bladder; in apes, which have an open inguinal ring, it falls back towards the pelvis, and forms a second covering.

Animals subject to winter-sleep have several epiploons, which become charged with fat: this fat seems to serve for their nutrition during their state of torpor.

Birds have no epiploon; their large membranous and ærian bags become charged with fat.

298. SYSTEM OF DIGESTION IN MAN. In man, the system of digestion holds a mean place, in several respects, between that of carnivorous and that of graminivorous animals.

The sides of the mouth are formed, above and before, by the maxillary bones, and behind by the palatine bones, the pterygoid apophyses, and the guttural fossa; below, by the under jaw and the teeth.

299. *The teeth*. Man has two incisive teeth, one angular (*cuspidatus*), two small and three large molar teeth, on each side of each jaw.

In

In the embryo, the rudiments of the teeth are scarcely apparent ; they are nothing then but a mucilage confounded with the other parts ; and do not expand till towards the fourth month of gestation : at that period they present themselves under the form of a follicle or membranous bag, traversed by a very great number of vessels, and filled with a gelatinous mucus.

The follicles of the incisors first appear, then those of the angular teeth, and in the last place the great and small molares. These follicles, which are of an ovoid form, adherent to the alveoli, are at first reddish ; they then become white, assume a cartilaginous consistence, and expand by a point of ossification. The surface which corresponds to the body of the tooth begins to be covered with a thin cortical coating of enamel.

Towards the sixth or eighth month after birth, the lower incisor teeth and the superior pass through the gums, and show themselves without ; the angular teeth appear towards the end of the first year, and the small molares at the end of the second.

Behind the follicles of these first twenty teeth there are others of a similar kind, which gradually increase, and about the sixth or seventh year * assume the place of the first. At that period the roots of the first teeth, in a great measure destroyed,

* All these periods are subject to much variation.

become

become loose, and the teeth drop out*. The second teeth assume the place of the first, nearly in the same order as that in which they appear: the first small molar tooth of the first dentition is succeeded by two others, which become the two small molares. The last four appear at a period exceedingly variable, often towards the twentieth year; and sometimes they remain in the alveoli, or do not issue from them till a very advanced age.

The dentes molares have four roots; the rest have only one.

At the period when the teeth appear without the gums, the short truncated roots are hollow; and their canal communicates with a large cavity which is found in the middle of the body of the tooth. These cavities are lined with a membrane covered with nerves and vessels; and they are filled with a gelatinous juice.

The teeth are formed of a compact, osseous substance, of the same nature as that of the other bones; the bodies of them are covered even below the gums by a coating of enamel, which is thicker at the summit, and of a brilliant milk white colour. This enamel is phosphate of lime disposed in regular striæ, which seem to proceed from the centre to the circumference.

* When they begin to shake, it is often necessary to extract them, that their presence may not oblige the others to assume a bad position.

As man approaches the period of full growth, the roots of the teeth lengthen, and soon increase to their full extent; the enamel then becomes blueish, and the tooth acquires greater hardness.

The teeth become worn in a sensible manner by the friction of mastication; the incisors, often indented or notched, exhibit towards the fifteenth year a sharp edge. From the twentieth to the thirtieth the cavity of the teeth sensibly diminishes; the enamel assumes a grayish tint; the tubercles of the molar teeth subside, and the other teeth continue to be worn; the roots are shortened, and towards the forty-fifth year the teeth have lost a fourth part of their height.

By the progress of age, the enamel assumes a yellowish tint, and proceeds no further than to the gums; the cavities of the teeth are obstructed and filled up with a yellow osseous matter. They continue to wear away by mastication; and the tooth which has lost two thirds of its height, about the age of sixty or seventy, exhibits only a circle of enamel at its circumference, and a large yellow spot in the middle. The root continues to be destroyed, the socket becomes shallower, and the tooth, loosened, at length drops out.

300. *Inside of the mouth.* Every part of the mouth is covered by a membrane which is continued with the skin of the gums and of the lips. This membrane proceeds backwards before a great
number

number of small muscles, and is reflected on the tongue, which it entirely envelops. Below that part it forms a fold, which is fixed to the middle of the interior surface of the jaw, and constitutes the frænum of the tongue.

The membrane which envelops all these parts is thin, smooth and moist; it is thicker at the arch of the palate than on the tongue, where it is interspersed with papillæ of different sizes and forms.

The smaller papillæ are numerous; of a conical figure, placed close to each other, and terminate in a point: they give to the tongue a velvety appearance.

These papillæ are interspersed with others less numerous, of a larger size, and shaped like a mushroom; towards the root of the tongue, there are observed from eight to sixteen larger and softish tuberculous papillæ, disposed in one or in two rows in the form of a V, the point of which is turned backwards.

All these papillæ appear to be a nervous and vascular expansion; they are in an essential manner the seat of the *organ of taste*.

301. The tongue (*glossa*) is formed of long muscular fibres, which terminate in a point on one side, and are confounded behind with the fibres of several other muscles.

The tongue, by contracting, may be shortened; and its point may be bent.

The

The other muscles, continued with the tongue, are attached to different points of the bones of the cranium, and to a particular bone suspended in the middle of the muscles affixed to it: this bone is called the *os hyoides*.

302. The *os hyoides* has the form of a bow; its body, or the anterior part of it, is broad; it is articulated on the sides with a thin extended prolongation, the *great horn*, which proceeds directly backwards. Above the articulation of the great horns with the body of the bone are articulated two other prolongations, the *lesser horns*; which are turned upwards, and often remain very short.

This bone is suspended by the muscles, between the angles of the jaws; it is retained behind by a ligament, which, proceeding from the extremity of the large horns, is attached to the styloid apophysis.

303. Before and on the sides of the *os hyoides* is attached a thin, flat, quadrilateral muscle, which ascends before; and proceeds to the sides of the root of the tongue. It draws the root of that organ downwards and backwards, or pulls the *os hyoides* upwards and forwards. **HYO-GLOSSIAN.**

304. To the middle of the interior surface of the lower jaw, towards its genian apophysis, is affixed a broad muscle, flattened transversely, and of a triangular form; this muscle is separated from its fellow before, only by a cellular tissue: both these muscles

proceed downwards and backwards, becoming broader; after which they are confounded together, and their fibres unite to those of the tongue. This muscle can carry the tongue forwards and beyond the mouth, as well as backwards and downwards: it can also bend it on itself. GENIO-GLOSSIAN.

305. To the styloid apophysis is affixed a small muscle, which proceeds downwards and forwards; it becomes thin and flat, and terminates on the sides of the tongue from its root till towards the tip of it. This muscle, with its fellow, moves the tongue upwards and backwards. STYLO-GLOSSIAN.

The tongue, which is fixed to the os hyoides, is moved by the muscles affixed to that bone.

306. On the sides of the interior face of the lower jaw, along an oblique line, is affixed, by an aponeurotic expansion, a thin broad muscle, the anterior short fibres of which proceed downwards and backwards, the posterior inwards, and both unite to affix themselves, by short aponeuroses, to the os hyoides: it moves that bone upwards and forwards, and depresses the jaw. MYLO-HYOIDIAN.

307. To the genian apophysis is affixed a small thin muscle, which descends behind, and is inserted before the middle of the os hyoides: it raises the jaw by carrying it forwards, or depresses it. GENIO-HYOIDIAN.

308. To

308. To the styloid apophysis is affixed a thin slender muscle, which descends forwards and inwards, and is inserted on the sides of the bodies of the os hyoides. Near this point it divides, and suffers to pass through its thickness the tendon of another muscle, the *mastoido-genian*. It moves the os hyoides upwards and backwards. **STYLO-HYOIDIAN.**

309. To the upper part of the sternum behind, and near the clavicle, is affixed a long thin muscle, which proceeds upwards, approaches its fellow near the larynx, and is inserted in the inferior edge of the body of the os hyoides, which it lowers. **STERNO-HYOIDIAN.**

310. On the upper edge of the scapula, near the indentation observed in it, is inserted a thin slender muscle, which passes behind the clavicle, ascends on the inside, and is affixed at the bottom and on the side of the body of the os hyoides, which it depresses. **SCAPULO-HYOIDIAN.**

All these muscles render the tongue susceptible of being moved in almost every direction.

311. From the lateral parts of the root of the tongue arises a small muscle, which proceeds towards several others situated at the back part of the vault of the palate. The aggregate of these muscles forms, above the tongue, an arch, which constitutes the entrance of the alimentary canal:

it

it has been distinguished by the name of the *velum palati*.

The membrane of the mouth is extended over these muscles, and forms, in the middle of them, a round fungous fold, which terminates in a point, and is suspended from the summit of the arch: it is called the *uvula*. The muscles covered by this membrane extend even into this fold, and move the *uvula*.

The muscles which form the *velum palati* produce two layers on each side, placed one before the other, and separated by a space which contains a gland. These two layers are called the *anterior* and *posterior pillars*.

312. From the sides of the root of the tongue arises a small muscle, which proceeds to the anterior pillar of the velum palati: by contracting it lessens the aperture of the velum. GLOSSO-STAPHYLINE.

313. To the petrous portion of the temporal bone, near the guttural conduit of the ear, is affixed a small round muscle, which descends, becomes broader, and proceeds to the substance of the velum palati and of the uvula. It raises the summit of the velum behind, and carries it before the entrance of the nostrils, which may be then shut during the time of deglutition. PETRO-STAPHYLINE.

314. To the base of the pterygoid apophysis is

attached a thin flat muscle, which descends along its interior wing : it terminates in a tendon, which is reflected around the spine of the pterygoid apophysis ; it then proceeds inwards, adheres to an asperity of the plane portion of the palatine bone, and unites with its fellow. This muscle, which is found on the exterior side of the preceding, raises and extends the velum palati. **PTERYGO-STAPHYLINE.**

315. To the middle and bottom of the arch of the palate is affixed a small muscle, which descends behind ; is confounded with its fellow, and proceeds to the uvula, which it raises and shortens. **PALATO-STAPHYLINE.**

316. The mouth is continually moistened by a viscous fluid, secreted from an indefinite number of glandulous follicles, found in the sides of that cavity, which pour it out through a great many small pores.

These glands have acquired names from their position ; such as the palatine, lingual, molar, labial and buccal.

But during mastication the mouth receives, in great abundance, a less viscous liquor, secreted by several large glands, and which is poured into the mouth through particular ducts.

317. Below the ear, and before the mastoid apophysis, is a large gland which appears to be composed of lobules, or small glands united into

lobes by a cellular membrane. Each small gland is furnished with an excretory tube: these tubes unite, and form a duct, which descends before, traverses the *bucco-labian* muscle, and opens towards the second or third of the superior molar teeth. This gland is called the *parotid*, and its duct the *parotidian* (the *salivary of Steno*).

318. The interior surface of the maxillary bone contains, near its angles, another round gland, of less size than the preceding, but of the same structure: it has also an excretory duct, which passes below the *mylo-hyoidian* muscle, is accompanied with a series of small glands, and opens into the mouth close to the frænum of the tongue. This gland is called the maxillary, and its duct the *inferior salivary of Wharton*.

319. Below the tongue is found a small gland, from which proceed a great number of excretory ducts that open on the lower side of the mouth. *Sub-lingual gland*.

320. Between the pillars of the velum palati is another ovoid gland, which pours the saliva through several holes. *Tonfillæ (amygdalæ)*.

321. *The pharynx*. The mouth has a communication behind with a large cavity, from which it is separated by the velum palati. This cavity (the back part of the mouth, gullet, or pharynx) is continued upwards with the back part of the nostrils,

and the guttural conduits of the ear ; it then proceeds downwards and backwards.

The pharynx exhibits before, in the middle of its passage, and below the os hyoides, the entrance of a canal which conducts to the lungs : the *larynx*.

The aperture of the larynx, *glottis*, is shut by a sort of semi-circular, cartilaginous, elastic valve (*epiglottis*), affixed before towards the root of the tongue, and which proceeds obliquely upwards.

The epiglottis is depressed towards the aperture of the *glottis*, by the passage of aliment, the falling back of the tongue, and the elevation of the larynx at the time of deglutition.

The pharynx descends behind the larynx, and continues with the œsophagus ; it is lined by a smooth membrane, furnished with a great number of glandulous follicles. Its sides are formed by different layers of muscular fibres. The longitudinal fibres are attached superiorly to different points of the base of the cranium ; in the back part, before the large occipital foramen ; on the sides, to the styloid and pterygoid apophyses ; and before, towards the middle of the interior face of the jaw. Below, the muscular fibres are affixed to the os hyoides and to the cartilage of the larynx : *thyroid*.

Several layers of these fibres are transverse and oblique ; they cross each other behind by a more compact

compact tissue, which forms a *median line*. This disposition allows the pharynx to be shortened, and to be contracted in every point.

To the styloid apophysis is affixed a round muscle, which descends and expands over the sides of the pharynx: it contributes to raise that part.

STYLO-PHARYNGIAN.

The pharynx rests against the trachelian region of the rachis, on the muscles which cover it; and is separated from it only by a lax cellular tissue, which is never greasy.

The pharynx becomes narrower at its lower part, which corresponds to about the sixth vertebra of the neck; it then continues in a single canal, which proceeds to the stomach: *the œsophagus*.

322. The *œsophagus* is lined with a mucous membrane, analogous to that of the pharynx: its sides are formed by two layers of pale muscular fibres: the exterior, which is thicker, has its fibres longitudinal: those of the interior layer are thinner, and disposed in a circular or spiral form: they can shorten or contract that cavity.

The *œsophagus* descends a little to the left, before the bodies of the last cervical vertebræ; it then penetrates into the breast, and inclines gently to the right, along the bodies of the dorsal vertebræ; it then traverses the diaphragm behind, and terminates in the abdomen by a wide aperture, *the œsophagian*, which is continued with the stomach.

323. The *stomach*, somewhat wide at first, is contained in the left hypochondre: it is considerably dilated, and is folded back on itself, forming a large convexity: *the greater curvature*: it then proceeds transversally to the right into the epigastric region, where it becomes narrower, and exhibits a small convexity: *the lesser curvature*; after which it terminates in an aperture inclined downwards and to the right. *Pylorus*.

The stomach, therefore, exhibits the form of a cone folded back on itself, and situated in a transverse, oblique direction below the diaphragm. It has two apertures. One of them, the *œsophagian*, is directed upwards, forwards, and to the left: the other, the *pyloric*, which is smaller, is turned downwards, backwards, and to the right. It therefore exhibits two curvatures, from the one orifice to the other: one of these, which is small, is turned upwards and backwards; the other, which is larger, is turned downwards and forwards. The two apertures of the stomach are very near each other in the foetus, which renders it, in some measure, spherical. In the state of plenitude it moves upwards: its large curvature is entirely before, and its less behind.

The stomach is every where covered by a *serous* membrane, furnished by the peritonæum. The part of this membrane which covers the gastric organ before, is united to that which covers it behind,

hind, towards the lesser and greater curvatures, where these membranes are applied one to the other, and form a vascular, plaited and adipose expansion. The fold which is towards the small curvature (*lesser epiploon*) comes from the portion of the peritonæum which covers the liver: that formed towards the large curvature (*the great epiploon*) is very extensive; it descends before the abdomen, and covers a great part of the intestines.

When the stomach is distended by the presence of aliment, the laminae of which these folds are formed towards the curvatures of the stomach separate, and permit that organ to assume great amplitude.

Below the peritonæal membrane, the sides of the stomach exhibit two layers of muscular fibres: the exterior extend from the one aperture to the other; those which are below assume a circular and transverse direction.

In the last place, the stomach exhibits interiorly a thick *mucous* membrane, full of villosities, which give it a velvety appearance; it has in the inside folds which disappear in the state of dilatation.

The sides of the stomach become much thicker towards the pyloric aperture, where the interior membrane forms a thick membranous roll, which contains muscular fibres in the form of a ring: this roll produces a sort of *pyloric valvula*.

324. *The intestines.* The stomach is then con-

tinued with the intestinal canal. This canal is twisted, folded back on itself, and is narrow at the top : *small intestines* : towards the anal extremity it is larger : the *large intestines* : its length is about six or seven times that of the body.

The first part of the intestine, *the duodenum*, which is continued with the stomach, is susceptible of great dilatation ; it describes different curves, and is in part unprovided with a peritonæal membrane. It has one and often two small apertures at the distance of some inches below the pylorus : this portion proceeds backwards, downwards, and to the right ; then ascends, and continues with a long portion of the intestines : the *jejunum* and the *ileum*. These intestines form a great number of circumvolutions, and occupy the whole anterior, middle, and lateral part of the abdomen.

The *small* intestines are continued with the large intestines, first by a short thick portion called the *cæcum* ; it is situated in the right iliac region, and at its entrance is furnished with a circular membranous valvula, which opposes the return of the fæcal matters : this portion of intestine has a lateral *appendix*, the cavity of which, called the *cæcal*, terminates like the finger of a glove : the *cæcum*.

This short portion of intestine is continued with one much longer called the *colon* : the latter is of the same size, and is twisted around all the small guts : it rises from the right iliac region, traverses
the

the abdomen, below the stomach, descends along the left side, is reflected on the prælumbo-trochanterian muscle, and is continued with the last part of the intestinal canal. The latter, called the *rectum*, is large, short, and upright, and terminates by a muscle, the annular fibres of which close exactly its aperture. *Interior sphincter of the anus.*

A thin muscle is placed in the cellular tissue, which lines the anus : it is inserted in the coccyx, by one of its extremities, and at the other is confounded with the bulbo-urethral or cavernous muscle : by its action it tends to close the anus. **COCYGIO-ANIAN**, *exterior sphincter.*

A large thin muscle forms the bottom of the pelvian cavity : it is affixed at the top, behind the pubis, to the upper part of the sub-pubian hole, and the spine of the ischium ; and below to the sides of the coccyx : it then unites with that on the opposite side, by an aponeurotic line, and embraces the lateral parts. It elevates the anus. **SUB-PUBIO-COCCYGIAN**, *elevator of the anus.* The structure of the sides of the intestinal canal is analogous to that of the sides of the stomach. The intestines are covered by the serous membrane, which envelops all the viscera of the abdomen : *peritonæum.*

This peritonæal membrane, after having enveloped the intestinal canal, is reflected backwards, and forms a double wrinkled, vascular, adipose expansion of the breadth of the hand, and much shorter

shorter than that canal: it is affixed before the bodies of the dorsal and lumbar vertebræ, and thus secures the intestines. A part of this membranous expansion retains all the small intestines in a bundle in the middle of the abdomen: *mesentery*: the other part confines the large intestines around the former: *meso-colon*. The double membrane of the mesentery is susceptible of being separated near the intestines, when the latter acquire more amplitude.

Below the serous membrane of the intestines is a double layer of very thin muscular fibres: the exterior longitudinal ones are disposed in separate bands; the interior ones, which are circular, are also very thin. The longitudinal layers, which are little susceptible of extension, confine the sides of the canal, and produce those gibbosities which are observed in the large intestines.

The outside of the alimentary canal is furnished with a mucous membrane, analogous to that of the stomach. At the entrance of the duodenum is observed one or two small apertures, which pour into the intestine the product of the secretion of the liver and of the pancreas.

325. The *liver* is a glandulous organ of a considerable size; it occupies a great part of the abdomen, and is situated in the right hypochondre, the epigastric region, and a part of the left hypochondre, below the diaphragm, &c. This organ
receives

receives the venous blood, which comes from the principal viscera of the abdomen. The blood by traversing this gland undergoes important changes; it is freed from those greasy and albuminous molecules which it contained in excess: these substances, by their combination with a small quantity of soda, form the bile, which proceeds from every point of the liver by a peculiar order of vessels.

If it be considered that the liver is the heaviest of all the organs, and that the great quantity of venous blood which it continually receives, undergoes in this organ the most important changes, it may be readily conceived that a minute description of its vascular structure belongs rather to the system of circulation than to that of digestion. We shall, therefore, introduce here only what relates to the excretion of the small quantity of bile produced by the materials taken from the large quantity of blood which passes through the liver. The bile is excreted in all points from the hepatic organ by ramifications, rami, and branches, which decreasing in number, and increasing in calibre, unite together, and issue from its transverse furrow by two or three trunks, which terminate in one duct called the *hepatic*.

The hepatic duct, after proceeding a certain way to the left, communicates with another duct, *the cystic*, which is reflected upwards and to the left, at a very acute angle, and proceeds to the gall-bladder.

bladder. These two ducts form, by their union, a larger duct, called the *ductus choledochus*, which proceeds to the left, and opens into the duodenum.

The *cystic duct*, which is an inch in length, is terminated by a dilatation that constitutes the gall-bladder.

This pyriform vesicle is lodged in a depression of the gastric face of the right lobe of the liver; it touches the colon, the commencement of the duodenum, and the pancreas.

The exterior tunic of it is formed by a prolongation of the peritonæum, in every part of it which does not adhere to the liver; the interior side is villous, interspersed with folds, and exhibits all the characters of the *mucous* membranes.

The *ductus choledochus* is a continuation of the hepatic and cystic ducts; its length is about three finger-breadths; it descends, on the left, before the sub-hepatic vein; is inserted obliquely between the tunics of the duodenum; often receives in that part the pancreatic duct; and at length pierces the villous tunic of the intestine, two finger-breadths below the pylorus.

The structure of the hepatic, cystic, and choledoch ducts is nearly the same as that of the gall-bladder.

326. The *bile*, which proceeds from all parts of the liver, runs along the hepatic duct, as far as the *ductus choledochus*; the latter pours it into the

the duodenum: but when it does not flow into the duodenum, it may flow back by the cystic duct, and be deposited in the gall-bladder, where it acquires more consistence, and assumes a darker colour.

The bile is a liquid of a greenish yellow colour, fat, and soft to the touch, viscous, exceedingly bitter, miscible with water like soap, and soluble in oils, alcohol, and ether.

The chemical composition of the bile may be ascertained by the following mode of analysis: Pour dilute sulphuric acid over this animal liquor, and expose it to heat. You must then observe whether precipitation takes place, and whether a saline substance remains in the liquor: the precipitate must be separated by filtration.

The liquor, when properly evaporated, will give crystals of sulphate of soda. Then treat the precipitate with alcohol, which will dissolve a part of it: the other is to be separated by the filter. If the alcohol be evaporated, a pure oily matter will be deposited: the other part of the precipitate, which remains on the filter, is albumen.

Hence it results that bile is essentially formed of albumen, oil, and soda, in a kind of saponaceous state.

Different salts also are found in the bile, in small quantity, and particularly phosphate of soda.

The bile very often produces concretions in the gall-bladder.

327. *Bilious concretions* are sometimes very numerous; they affect, for the most part, a tetraëdral pyramidal form, and, when there are several, become polyëdra by friction. They are brown, green, or yellow; exceedingly light, and burn, emitting a thick smoke.

They affect three modes of composition. Some are irregular, and consist of grains united around a nucleus: others are angular, and produced by concentric strata of different densities, and often very compact. The last kind are ovoid, exceedingly hard, covered by a white coating, are brilliant, and appear to be crystallized: this kind are insoluble in alcohol; they are formed of adipocera; the rest are of the nature of bile.

328. *The spleen.* The blood which proceeds to the liver by the sub-hepatic vein comes in part from the spleen; this viscus, which has an ovoid form, is of a blueish red colour. It is placed lengthwise in the left hypochondre, and is covered by the peritonæum, the folds of which fix it to the diaphragm, the stomach, and the mesocolon.

The spleen is convex on the outside, and somewhat concave within, where it exhibits a longitudinal scissure filled with fat. The artery which proceeds to this organ (the left branch of the sub-gastric or cœliac trunk) is very large, twisted, and penetrates into its substance near the scissure.

The

The venous trunk, which returns from that organ, is united to the mesenteric vein; and both form the sub-hepatic vein, *vena portæ*, which proceeds to the liver.

No other use is yet known of the spleen, than that of conveying all its venous blood to the hepatic organ.

329. The *pancreas* is an oblong gland, very much analogous to the salivary glands. It is placed, in a transverse direction, in the left hypochondre, below the stomach, between the liver and the spleen, on the posterior aperture of the two membranes of the meso-colon, which cover it before: behind it is enveloped only by cellular tissue.

The pancreas is of a pale rose colour, and appears to be formed of lobes enveloped by a cellular membrane. These lobes are an assemblage of lobules and glands indefinitely divided, and are also covered by a stratum of cellular membrane.

Across the middle of the pancreas runs a duct, on the sides of which some exceedingly fine secreting ducts terminate. The pancreatic duct proceeds to the right, and opens into the ductus choledochus, or very near it, in the duodenum.

The fluid secreted by this gland appears to be very analogous to saliva.

30. The *peritonæum*, which, as already said, envelops the whole viscera of the abdomen, and
the

the sides of that cavity, forms a common covering. Its structure is such, that anatomists compare it to a membranous bag every where shut. The cavity of this bag forms the space comprehended between the intestines and the sides of the abdomen. This cavity, the sides of which are contiguous, contains nothing but serous matter.

The exterior face of this bag lines before, and laterally, the interior sides of the abdomen; and behind it envelops, in its numerous folds, the viscera contained in that cavity.

The ligaments which fix the viscera of the abdomen to the neighbouring parts, are, in a great measure, only folds of the peritonæum.

SYSTEM OF CIRCULATION.

331. **IN** circulation, the blood, proceeding from a certain point, is conveyed by one order of vessels to all the parts of the body, and distributes to them the materials necessary for the different changes which are there continually taking place: it is then conveyed back to the point from which it proceeded, by one or two orders of vessels.

In this course, the blood passes either in whole or in part through peculiar organs, which tend in an essential manner to maintain it in a proper state of temperature and of liquidity, or to free it from the residuums of organization, with which it is charged, or in the last place to restore to it those essential materials which it has lost. All these organs necessarily compose a part of the system of circulation.

332. **CIRCULATION.** In plants and zoophytes no distinction is remarked in the order of circulation, or in the vessels: the fluids seem to proceed to the different parts by a kind of suction or absorption.

Insects have a long dorsal transparent vessel endowed with peristaltic motion: the relation of this vessel to the other parts is not known: be-

sides, the transparency of all the organs of these animals renders it impossible to ascertain their intimate structure, and we are still unacquainted with the nature of their circulation. There are observed, however, in these animals organs of secretion for the bile, seminal liquor, &c. which seem to be formed of floating vascular packets.

In the worm and leech, a dorsal vessel which performs the office of a heart is observed.

In crustaceous animals, such as crabs, the monocus or water-flea, &c. the heart receives the blood which returns from the branchiæ, and distributes it to every part of the body; but it is never seen to return to the branchiæ.

In the bivalves, the blood proceeds into an auricle, which pours it into a ventricle, whence it issues by an aorta.

Muscles exhibit a very singular organization: they have two very large transparent auricles, and the intestinal canal passes through the heart.

In the aplysia, the blood, which comes from the branchiæ, unites in a vein the sides of which become arterial. This vessel then performs the office of an aorta.

Slugs have on each side of the body two contractible apertures, which communicate with two pulmonary cavities, over which the veins are spread. These cavities terminate in an intestinal canal: the blood, after traversing the pulmonary organ,

organ, unites in a vein which proceeds into an auricle; whence it passes into a ventricle furnished with valvulæ; and from this ventricle it issues by an aorta, which distributes it to all the parts of the animal.

In the *sepia*, a large vein divides itself into two branches, which proceed to two auricles furnished with a valvula. These two auricles are separated, and furnish an artery which is distributed to each branchia. The blood comes from the branchiæ by two veins, which unite in a common trunk; and this trunk proceeds to a solitary ventricle, from which the blood issues through an arterial aorta.

333. In the different classes of animals here mentioned, the blood appears under the form of a serous liquid, more or less whitish, and seldom red. It seems to return from the different parts in the same manner in which it was conveyed thither; that is to say, by one order of vessels. But in the other classes of animals, which we are about to examine, the blood is red; it is distributed to all the parts by one vascular system (the arteries), and returns by two orders of vessels: one of them (the veins) brings the greater part of the blood to a red state; the other, much less apparent (the lymphatic vessels), collects the serous residuums, and the product of digestion which it pours into the veins.

In fishes, two *venæ cavæ* pour the blood into

an auricle, whence it passes into a ventricle furnished with two semilunar valvulæ (one at its entrance and the other at the place of exit). The blood issues from this ventricle through an artery which divides itself into four branches on each side. These arteries are distributed to the branchiæ. Each branchial artery ascends along each lamina of the branchiæ: when it arrives towards the middle of them it divides itself into two rami, one on the right and the other on the left: each of these rami then divides into two others, one of which descends, and the other ascends, the whole length of the lamina. The last branches furnish a great number of very short ones, which proceed across and cover the whole surface of the lamina. The blood returns by veins, which in uniting follow the same order as the arteries do in dividing. The union of these veins forms a large dorsal vessel, which performs the office of an aorta.

In reptiles, the lungs receive only a part of the blood. In animals of this class subject to metamorphosis, such as frogs, fyrens, and salamanders, two venæ cavæ pour the blood into an auricle furnished with valvulæ, whence it issues by an artery furnished also with a valvula. This artery, which divides itself, conveys the greater part of the blood to a ventricle; the other part proceeds to the pulmonary organ, from which it returns by the veins to the same ventricle; and it then issues from that cavity to distribute itself to all the organs.

In

In the state of tadpole (without paws and lungs) these animals have on each side of the neck a branchia in the form of a plume, which receives the blood; but as these animals increase in growth the branchiæ become obstructed, wither, and drop off along with the tail: at the same time the lungs expand, and pulmonary respiration takes place.

The tortoise has two auricles and two ventricles, which communicate with each other. Three venæ cavæ pour the blood into one auricle, furnished with valvulæ, whence it passes into a ventricle to be distributed to the pulmonary organ: it then returns by veins to an auricle, and passes into the second ventricle. This second ventricle has a communication with the former, by an aperture closed by a valvula. This aperture corresponds to the arterial aorta, and the arterial blood proceeds directly thither without mixing much with the venous blood, though these two sorts of blood are together in the same cavity.

In the mammalia and birds, the blood proceeds to an auricle which pours it into a ventricle furnished with valvulæ. From this ventricle it passes through the lungs, and returns by veins which convey it to a second auricle, whence it passes into a second ventricle provided with valvulæ: it issues from this cavity by the aorta, which distributes it to the different parts.

In the state of fœtus, the mammalia and birds

exhibit another order of circulation. The blood poured into the pulmonary auricle passes, in part, into the aortic auricle, by an aperture furnished with a valvula (*foramen ovale*). The remainder of the blood flows into the pulmonary ventricle, whence it issues by the artery of the same name. At that place a part of the blood passes through a duct, which establishes a communication between that artery and the aorta (arterial duct); the rest traverses the lungs, and returns by the veins. The latter passes through the aortic auricle and ventricle, and mixes in the aorta with that which proceeds directly thither through the arterial duct.

The circulation in the foetus of the mammalia and of birds resembles that of reptiles, as only a part of the blood passes through the lungs.

In cetaceous and amphibious animals, the aperture which forms a communication between the two auricles, closes more slowly; but at length it always becomes obstructed, as in the mammalia and birds.

334. It is observed in all classes of animals, and even in plants, that the nutritive fluid, or the blood, has a temperature peculiar to itself. In the greater part of animals this temperature is not much different from that of the medium in which they habitually live; but it is constant, and does not directly follow the variations of these mediums.

In

In animals with lungs, through which the whole of the blood passes, such as the mammalia and birds, the temperature of the blood is much higher than that of the atmosphere of temperate climates. This temperature, which is about 40 degrees of the centigrade thermometer, varies only a degree or two in the most opposite latitudes.

335. The principal changes which the blood experiences, during its circulation, take place while it passes into the kidneys, the liver, and in particular through the organs of respiration.

336. URINARY SYSTEM. The blood is freed from its excess of aqueous parts, and from different saline substances, by means of the kidneys.

All red-blooded animals have kidneys ; white-blooded have nothing analogous.

The kidneys are nearly of the same relative size in all animals ; they are however more voluminous in birds.

The renal system, in general, consists of one large gland on each side. The urine secreted from every point of this gland issues from it by small ducts, which proceed to a common canal, called the *ureter*, as in fishes, reptiles, and birds.

In most of the mammalia, the urine, which proceeds from every point of the kidneys, oozes through small funnel-like capsules : several of these capsules unite, and proceed into small com-

mon reservoirs or basons, from which the urine afterwards passes into the ureter.

The kidney, sometimes, is composed of several small glands united without reservoirs, each having its particular ureter; as is the case in the bear, otter, and cetaceous animals.

The ureters either convey the urine directly outwards, or pour it into a bladder; from which it afterwards issues by a second canal, called the *urethra*.

Birds have no bladder: the ureters proceed into a cavity, common to the excrements and the eggs, *cloaca*; and issue through the anus*.

A bladder is found in fishes, in reptiles, and in the mammalia. In fishes it is situated behind the rectum; in reptiles it is placed before, and is sometimes double, as in frogs: in these two classes of animals the urine proceeds to the rectum.

In all the mammalia the bladder is placed before the rectum; and the canal of the urethra passes through the parts of generation.

337. HEPATIC SYSTEM. The blood, on its passage into the liver, is freed from several substances, and in particular from fat and albuminous matters which it contains in excess.

The liver seems to exist in insects under the form of a vascular reticulation: it is found in the

* In the ostrich, the ureter proceeds directly outwards, near the aperture of the sphincter ani, and behind the cloaca.

. , mollusca

mollusca and in all vertebral animals. Its size in general is in the inverse ratio of that of the organ of respiration ; which has induced some to believe that these two organs have analogous functions, and that they can, in some measure, supply the place of each other in their action on the blood.

The liver, in general, is exceedingly large in the mollusca ; very voluminous and oily in fishes, but smaller in the mammalia and birds. It is observed in the fœtus of the last two classes of animals, that the liver, comparatively speaking, is of a considerable size, and that the size decreases after birth in proportion as the organ of respiration is expanded.

The liver, in general, is divided, to a greater or less depth, into two or more lobes.

The venous blood, proceeding into the hepatic organ, is that which returns from the principal abdominal viscera by veins that unite into a large trunk, the *sub-hepatic vein* or *vena portæ*. On its passage through all the abdominal viscera, which in general are covered with fat, the blood becomes charged with adipose and albuminous matters, of which it is in part deprived in the liver. The bile, which results from this particular excretion, becomes afterwards one of the most powerful agents of digestion.

The blood, when it has thus passed through the liver, and been freed from a part of the substances

combined with it in excess, returns by numerous veins, which unite and proceed into the vena cava.

338. SYSTEM OF RESPIRATION. It is in the organ of respiration, in particular, that the blood undergoes the most remarkable changes; it is there that it is at last freed from the substances foreign to its composition, and acquires the principles it has lost by distributing itself to the different organs. It is in this organ that the blood passes completely from the venous to the arterial state, and acquires all the qualities necessary to fit it for a new circulation.

The system of respiration brings the blood constantly into relation with the circumambient fluid. There are three sorts of respiratory organs: the tracheæ, branchiæ, and lungs.

339. *Tracheæ*. In the cortical part of vegetables, but still better in the ligneous, are observed small thin laminæ, twisted into a spiral form, and lengthened out like a spiral spring. These tracheæ may be easily seen on half breaking by flexion a young twig. It has been supposed that the circumvolutions of these laminæ must form a hollow cylinder, and that they constitute air-vessels: this hypothesis is not supported by proofs.

Tracheæ, or elastic transparent filaments, disposed in a spiral form and susceptible of being unrolled,

rolled, are observed also in different parts of insects.

In several of these animals, such as flies, bees, the cock-chaffer, and beetle, are observed two holes or wide cells, which end at two reservoirs: the air which fills these reservoirs passes into the tracheæ.

In these animals, the tracheæ are subdivided, and distribute themselves to every part of the body; they have a brilliant silvery appearance, and often produce a wonderful effect on their different organs.

340. *Branchiæ*. Branchiæ are found in the tadpoles of reptiles susceptible of metamorphosis, aquatic mollusca, and fishes.

Reptiles in the state of tadpole have on each side branchiæ in the form of a plume: in proportion as the animal expands and acquires perfection, these branchiæ become obstructed, wither, fall off with the tail, and their place is supplied by the lungs.

All crustaceous animals, from the coleoptera to crabs, have branchiæ in the form of laminæ.

Aphrodite worms have branchiæ in the form of laminæ or of a plume; other insects have tubes proper for inhaling the air.

In the acephalous mollusca, the branchiæ are of different forms; they are situated either around an aperture, which serves as a mouth, as in the bivalves,

bivalves, or around the anus as in the doris, or around the body as in the aplysiæ, &c.

In the gasteropoda, flugs, and snails, the branchiæ are situated in a large cavity below the neck.

In the cephalopoda, the branchiæ, which consist of laminae, are placed in a cavity on the sides of the belly.

In fishes, the branchiæ are composed of laminae, the number of which, in general, is four on each side. The laminae are formed of long narrow leaves placed at the side of each other, like the teeth of a comb, and are united by a thin membrane to the half of their height. Each lamina is composed of cartilaginous pedicles united side by side, for three fourths of their length.

The laminae of the branchiæ are supported by a small hollow bone, on which rests the tongue, and which is articulated at the basis of the cranium.

341. *Lungs.* In some *reptiles* the lungs consist only of a large membranous cavity, the inferior face of which is covered by vessels, as is the case in the salamander*. But, in general, the lungs of

* Theameleon has only a large plaited pulmonary cavity, which it can swell up and distend to such a degree, that it considerably increases the volume of its body: it then becomes transparent, and assumes different tints. A similar conformation is observed in the marbled lizard.

reptiles are a spongy body, the cells of which are almost always visible to the naked eye. These lungs are inclosed in a sort of pleura, and float in the common cavity of the trunk, which has no diaphragm. The air penetrates into their lungs by a larynx, without an epiglottis. The aperture of the glottis is narrow in serpents, and broad in frogs and toads. The males of the latter have membranous bags, which become filled with air when they emit cries.

The mammalia have on each side of the breast a lung formed of a very fine spongy tissue.

The sanguine vessels overspread and expand over the sides of the small cells of this tissue; and the air penetrates into the interior part of them by numerous ramifications of branchial ducts.

Each lung is enveloped and remains free in a membrane (pleura), which adheres to the sides of the thorax. The two pleuras produce between them a space which lodges the heart, the œsophagus, the aorta and the thymus.

The air penetrates to the lungs by two bronchial ducts, which are ramified in the inside: these two ducts are the division of the tracheal artery.

The tracheal artery and the bronchiæ are formed of cartilaginous rings, incomplete behind, and united by a membrane. This trachea is continued with the larynx, which is a cartilaginous dilatation.

The

The larynx communicates with the lower part of the pharynx, by an aperture (*glottis*) covered with a cartilaginous lamina (*epiglottis*). This lamina falls down on the glottis, during the passage of the aliments; it serves also to make the air vibrate when it issues with force from the lungs, and is the principal cause of the sounds produced by animals.

The larynx, in all the mammalia, is formed of five cartilages, viz. the thyroid, the cricoid, the two arithenoids, and the epiglottis. But in some animals of this order it exhibits very remarkable peculiarities, calculated to produce a variety of sounds*.

In the mammalia, the larynx is generally moved by four or five pairs of muscles, proper for lengthening or shortening the trachea; and for dilating or contracting the trachea and the glottis.

In *birds*, the lungs are much more extensive; they are not inclosed in a pleura, but adhere to

* In the orang-outang the ventricles of the glottis are pierced with an aperture, which terminates in two membranous bags. Mandrills have a membranous bag, the aperture of which is at the root of the epiglottis. In the howling ape, the os hyoides is shaped like an osseous box of the size of the fist. The aſs, at the extremity of each ventricle, has a hole corresponding to a particular bag. The larynx of the swine exhibits in its length a deep sinus. The air expired with force enters into these different cavities, and produces different sounds. The horse, near the thyroid cartilage, has a triangular membrane, placed in a transverse direction, which by quivering is capable of producing neighing.

the

the sides of the thorax by a loose cellular tissue: These lungs communicate with several membranous bags, situated chiefly in the abdomen, which seem to be formed by a fold of the peritonæum. They are generally six in number, placed longitudinally between the intestines and the abdominal viscera: three also are found in the breast, and two under the axillæ.

The lungs have a communication with these bags by particular apertures; and the bags themselves are continued with other cavities of less size, which are in the thighs, the wings, the substance of the bones of the cranium, in the cavities of the long bones, and even in that of the tubes of the feathers.

In birds, the larynx is composed of six or four osseous pieces: the principal one is analogous to the cricoid cartilage of the mammalia; but they have none which correspond to the thyroid and arythenoid cartilages: they have also no epiglottis. The only function of this larynx is to open and shut the aperture of the glottis. The edges of its aperture are furnished with cartilaginous points proper for preventing the entrance of the aliments.

The tracheal artery is formed of complete rings: inferiorly the two apertures of its bronchial bifurcation exhibit, on their sides, a projecting membrane, which in part closes them. This moveable membrane performs the office of an epiglottis; it

causes the air to vibrate in its passage, and in this place the sound is formed: this apparatus constitutes the inferior larynx of birds.

The rings of the bronchiæ are incomplete, and vary both in their size and figure. The inferior larynx of birds, in many of these animals, has no proper muscles: several of the latter are furnished with ossæous or membranous dilatations. Some birds have a muscle which is inserted in several of the half-rings of the bronchia. Others have three pairs of muscles, as is the case with perroquets: in singing-birds and in several others there are five pairs. All these muscles are disposed in such a manner as to produce indefinite variations in the dimensions of the larynx and of the bronchiæ.

342. *In man*, the apparatus of circulation exhibits an auricle, which receives the blood returning from all parts by the veins and the lymphatic vessels. This auricle pours it into a ventricle, which transmits the whole of it to the pulmonary organ. The blood then returns to another auricle and a ventricle, from which it is expelled through the aorta, to be distributed to every point of the organization by means of the arteries.

In this double and successive circulation, through all parts of the body, and through all those of the lungs, it is observed that the blood undergoes very remarkable changes from several of the organs.

During

During its arterial circulation, it frees itself from its excess of heat by the assistance of the skin; and from its excess of aqueous parts, by means of the kidneys. On its return through the veins, it is freed from albuminous and adipose substances in the liver. On its passage in the lungs, it gives off carbonic acid gas, and takes up oxygen gas. In the last place, the serous matter, which returns by the lymphatic vessels, and the product of digestion conveyed by the chyloferous vessels, experience essential changes on their passage through the lymphatic glands.

The system of circulation is thus composed, not only of cavities or vessels which serve for conveying the blood to every part of the body, but also of organs, which, during its passage, make it undergo changes of great importance to the order of the organic functions. In our description of this complex system of organs, we shall therefore follow the progress we have indicated in this short view of the parts of which it is composed.

343. The arterial system exhibits a ramified expansion, of which the aorta is the trunk. The successive and indefinite ramifications which seem to proceed from this trunk, are divided in such a manner, that there is no part of the organization to which they do not penetrate, and to which they do not convey the repairing fluid they contain. The arterial system, as it divides, increases in capacity;

and the blood, which finds itself more at freedom, must flow with less rapidity as it passes from the large arteries into the small ones.

The arteries exhibit frequent anastomoses, and are exceedingly flexuous, especially in the parts susceptible of extension, such as the viscera of the abdomen:

The sides of the arteries are of a close texture, compact, elastic, and little susceptible of extension. Their thickness is comparatively greater in the small arteries than in the large ones. They seem to consist of three tunics, the exterior one of which is cellular, soft, and very loose: the middle one is thicker, and consists of a close yellowish tissue, little susceptible of extension: the interior one is only a very thin and exceedingly smooth membrane.

The blood contained in the arteries is spumous, florid, and of a bright red colour; it appears to be somewhat warmer and lighter than the venous blood, and has not the brown tint of the latter.

The arteries, after dividing and subdividing themselves into exceedingly fine and delicate ramusculi, which proceed to every part of the organs, at last completely disappear to the eye, even when assisted by the best microscope, so that their manner of termination is totally unknown.

344. During the arterial circulation, the excess of the heat of the blood is carried off by the secre-

tion of the skin, reduced into vapour at the surface of the body : its excess of aqueous parts is expelled, together with several saline substances, by the urinary secretion.

When the blood and all the parts which it moistens have too great a quantity of free caloric, arising either from a high temperature of the atmosphere, or from too violent exercise of the muscular system, or from some peculiar morbid excitement, the cutaneous organ enters into action and secretes abundance of perspirable matter, the evaporation of which at the surface of the body lowers the temperature, and always maintains it at about the same degree. This abundant perspiration frees the blood also from a quantity of aqueous matters, more or less considerable; it carries off also a little albumen, and several saline substances.

The skin properly so called (*dermis, cutis vera*) consists of a thick, close and whitish tissue; it appears to be produced by the lymphatic and sanguine vessels crossing each other, and by a large quantity of nerves. The nerves expand at the surface of the dermis, in very fine papillæ, which seem to constitute the organ of touching. The dermis adheres to the parts which it covers by a loose cellular tissue.

Above the dermis is found a viscous, softish, and somewhat thick substance, called the mucous tis-

fue (*rete mucosum, corpus reticulare, mucus malpighianus*). This substance is of different colours among different nations, and is the cause of the diversity of colour in the skin.

The mucous tissue is covered by a thin membrane, dry and transparent, which constitutes the *epidermis* or cuticle. This membrane forms a covering, in some measure inorganic, proper for securing the parts immediately beneath it from the impression of external bodies.

The skin exhibits, in its substance, small glands, which secrete an unctuous humour, with which the whole surface of the skin is, as it were, varnished: these glands are more abundant in the parts furnished with hair. In the last place, the skin contains the bulbs or radicles of the hairs and bristles, with which these different parts are covered. This kind of cutaneous vegetation takes place with much more energy in animals, whose bodies are habitually naked; and in them this part of the cutaneous organ, whether composed of scales, feathers, wool, or hair, supplies them with a thick covering, and becomes to them a very important apparatus of excretion.

345. When the blood, by the digestion of too large a quantity of drink, has received an excess of aqueous parts, it is freed from this excess by urinary secretion. At the same time the kidneys secrete different saline substances, and particularly
 matter

a matter (*urée*) the presence of which characterizes the urine of man.

The kidneys are situated one on each side in the region of the loins. Above them, and behind the peritonæum, is a *glandulous body*, shaped like a flattened hemisphere, of a yellowish brown colour, but larger and redder in infancy.

This *super-renal gland* receives a number of vessels and nerves; it is enveloped by fat, and appears to be composed of lobules covered by cellular tissue: in the inside it exhibits a capsule or *cavity* of the same form as the gland, and which at the bottom has a small fold in the form of a ridge. The sides of this cavity are applied to each other; they have the appearance of mucous membranes, and secrete a yellowish liquid. The use of this organ is unknown.

The kidneys are of a reddish brown colour; they have pretty nearly the form of a kidney-bean: they are smooth in adults; unequal and rough in infants.

They are placed lengthwise on the edges of the vertebral column, and correspond to the extent of the bodies of the last two dorsal vertebræ, and the first two lumbar. They are covered before by the peritonæum, and rest behind against the square of the loins. The right kidney is situated below the liver, and the left below the spleen. The concave edge corresponds inwardly, and receives the vessels and the nerves.

The kidney is immediately enveloped by a smooth, compact membrane, which adheres closely to it, and which is covered by a thick stratum of an adipose tissue. It receives a very large artery (the renal), which comes from the abdominal aorta. The orifice of the two renal arteries is such, that it can admit the eighth part of the blood which issues from the aorta.

The kidney, when cleft lengthwise, exhibits a first exterior stratum (the cortical) of a dark red colour, about two lines in thickness, consisting of a compact tissue. From this tissue arise, in different points, fibres or small tubes, of a paler red, which converge internally in small bundles, and terminate in the form of *papillæ*: the number of these *papillæ* varies between twelve and eighteen. The exterior compact tissue is continued between the bundles of these fibres or tubes.

Each of these *papillæ* opens into a membranous and greasy capsule in the form of a funnel. These funnels unite into several trunks, which end at a common reservoir or small basin.

It appears that the urine is secreted in the compact tissue of the surface of the kidney, that it flows through the tubulated bodies, oozes from the *papillæ*, and is poured into the particular capsules which proceed to the basin.

Towards the centre of the interior edge of the kidney, the basin opens into a very large membranous duct (*ureter*), which descends behind the peritonæum

ritonæum along the, lumbo-trochantinian muscle, and proceeds into the lesser pelvis below, behind, and on the sides of the bladder.

The ureter is formed of a white, compact, and strong membrane, the interior sides of which have the appearance of mucous membranes.

The bladder, which is capable of containing a little more than a quart, has a round form, somewhat flattened at the bottom; and terminates at the summit in a blunt point: in the female it is somewhat flattened from before backwards; and in infants is more lengthened from the top downwards. In the male it is situated in the lesser pelvis, between the pubis and the rectum; and in the female between the pubis and the matrix: it is covered at the top and behind by the peritonæum, the expansion of which supplies it, below and behind, with some ligaments, by which it is fixed to the neighbouring parts.

The bladder has, at the top, a ligament formed of three cords, which proceed to the navel, raising up the peritonæum; two of these cords are produced by the obstructed umbilical arteries; the last by a duct which, in the foetus, proceeded from the bladder to the umbilical cord (*urachus*). This hollow organ still adheres anteriorly to the posterior part of the pubis, by a compact cellular tissue in the form of a ligament.

The sides of the bladder exhibit outwardly several layers of muscular fibres, which cross each other, and proceed in all directions; these fibres are covered behind by the peritonæum, and in the rest of their extent by a cellular tissue. The ureters proceed below, behind, and on the sides of the bladder; they are dispersed in the substance of its sides, and proceed to the interior part of it.

The interior surface of the bladder is formed of a thick, villous membrane, furnished with a great number of folds. Below and before, this organ exhibits an aperture (*neck*), the sides of which are very thick; behind this aperture, the bottom of the bladder has a triangular space (*trigone*) of a closer tissue, and exceedingly irritable. The interior angle of this trigone is continued in the lower part of the aperture of the neck, by a small round tubercle: the other two correspond to the apertures of the ureters.

The exterior aperture of the bladder is continued by a very long duct, the *urethra*, which in man runs along the yard: in the female it is shorter, and terminates at the summit of the vagina.

346. The urine varies very much according to circumstances, in regard to its quantity, its colour, and its smell. In general, it is thicker the more slowly it flows, and the longer it has remained in the bladder: that voided immediately after meals,
and

and that, in particular, which results from an excess of alcoholised beverage, is exceedingly clear, and contains scarcely any thing but water.

The human urine has been carefully analysed by the modern chemists. We shall here give a short view of the principal experiments by which its composition has been ascertained.

This animal liquor always contains *urée*; *uric acid*; an *animal matter* insoluble in alcohol; free *phosphoric acid*; *phosphates* of *lime*, of *soda*, of *ammonia*, and of *magnesia*; *muriates* of *soda* and of *ammonia*: the *sulphates* of *potash* and of *soda* are also sometimes found in it. The urine of children always contains *benzoic acid*. The presence of the first ten substances is ascertained by the following means:

The presence of *free phosphoric acid* is ascertained by pouring urine into tincture of turnsole.

If the *phosphate of lime* be separated by ammonia, this alkali will saturate the free phosphoric acid, and the phosphate of lime will be precipitated.

By evaporating, to the consistence of syrup, urine treated by ammonia and then filtered, and afterwards combining it with alcohol, the *urée* and the *muriate of ammonia* will be dissolved. The *muriate of ammonia* may be decomposed by barytes, and it is then exposed to heat to expel the ammonia. If it be again treated with alcohol, and if the matter be evaporated to dryness, nothing will be dissolved but the *urée*. Ammonia may be still
poured

poured over the residuum, and after the liquor has been filtered it may be concentrated by evaporation. If muriatic or any other acid be then poured into it, the *uric* acid will be precipitated in white flakes, which, when thrown on the filter, assume the form of scales.

Dissolve in water the residuum of the former experiment, and after filtrating the liquor subject it to evaporation. You will then obtain, by crystallization, *muriate* and *phosphate* of *soda*, combined, in whole or in part, with phosphate of ammonia.

These salts may be obtained also by evaporating new urine: in proportion as the evaporation is effected, the liquor becomes turbid by the precipitation of the *phosphate of lime*, because there is extricated ammonia, which saturates the free phosphoric acid that held this salt in solution. If the liquor be then filtered, and the evaporation be continued, the different salts will crystallize: the *ammoniacal salt* in cubical crystals, on account of the *urée* with which it is combined, and the marine salt in octaëdra for the same reason; the phosphate of soda, which is combined in whole or in part with the phosphate of ammonia, crystallizes in rhombuses.

The presence of the ammoniaco-magnesian phosphate may be ascertained two ways: 1st, if the urine be left at rest, this *salt* will very often be observed in white crystalline laminæ; 2d, if potash be poured into the urine, *phosphate of lime* and

and of *magnesia* will be precipitated; by treating this precipitate with acetous acid, acetite of *magnesia* will be formed; and if this acetite be decomposed by potash, the *magnesia* will be separated.

The *animal matter*, which constantly exists in urine, is insoluble in alcohol: the nature of it has not yet been properly ascertained.

If urine contains also the *sulphates of soda* and of *potash*, they may be obtained in the same manner by crystallization. In the last place, if it contains *benzoic acid*, as is the case with that of children, it must be evaporated almost to the consistence of syrup; if it be then introduced into a retort, with a sufficient quantity of weak muriatic acid, and be exposed to distillation, the *benzoic acid* will pass over into the receiver.

Urine contains also sometimes gelatin, albumen, oxalate of lime and of ammonia; but all these substances are found only very rarely.

In some diseases the urine contains a great deal of gelatin: the presence of it may be ascertained by the insoluble precipitate which it forms with tannin.

What characterizes the urine of man, in an essential manner, is the presence of urée and of the uric acid. These substances are found only in this liquid. Urée produces, in a great measure, all the phænomena which urine exhibits; it crystallizes in laminæ like the muriate of barytes; it combines

combines with the nitric acid, and forms an insoluble compound. When a solution of urée in water is boiled, there is disengaged a very large quantity of ammonia, which arises from the decomposition of that substance.

Urine, by the precipitation of the substances it holds in solution, is susceptible of forming calculous concretions. Urinary calculi are found in the kidneys, along the ureters, in the bladder, and even in the canal of the urethra.

The introduction of a foreign body into the bladder often determines the formation of a calculus, to which it serves as a nucleus.

The different human calculi are formed of the following substances: *phosphate of lime, ammoniaco-magnesian phosphate, uric acid, urate of ammonia, oxalate of lime, carbonate of lime, and silica*: these matters are pure or mixed, and almost always disposed in strata.

Calculi of phosphate of lime, of ammoniaco-magnesian phosphate, and of carbonate of lime, are white; those of phosphate of lime are never crystallized, and form a magma with sulphuric acid; those of ammoniaco-magnesian phosphate are always crystallized in brilliant laminæ, and dissolve completely in sulphuric acid; those of carbonate of lime crystallize generally in close filaments; they dissolve entirely in the nitric and muriatic acids, with which they effervesce: the last kind are very rare.

Calculi

Calculi of urate of ammonia are of a yellowish gray colour; they dissolve completely in potash, with a disengagement of ammonia; those formed by pure uric acid are more or less yellow, and dissolve also in potash, but without a disengagement of ammonia.

Calculi of oxalate of lime are always more or less black and tuberculous; and hence they have been called *muraux*, on account of their supposed resemblance to a mulberry: by calcination they give quick-lime, or carbonate of lime.

Calculi which exhibit *silex* affect also the mulberry form; they are soluble in acids, give no lime, and are not altered by calcination. *Silex* has never been found but in two calculi, and even then it was covered, first by oxalate of lime, and then by uric acid.

Calculi formed only of phosphate of lime, or ammoniaco-magnesian phosphate, are rarely found; these two salts are almost always mixed.

Calculi of pure uric acid are very often found; and some of urate of ammonia equally pure; but the uric acid, for the most part, is accompanied by urate of ammonia.

It is not uncommon to find calculi of pure oxalate of lime; but this salt in general serves as a nucleus to the other calculi.

When a calculus is composed of phosphate of lime, ammoniaco-magnesian phosphate, uric acid,
urate

urate of ammonia, and oxalate of lime, these matters are almost always disposed in the following order: oxalate of lime in the centre, next urate of ammonia, then uric acid, and in the last place phosphate of lime mixed with, and sometimes covered by, ammoniaco-magnesian phosphate.

These results of the analysis of urine and human calculi are a very short extract from the most ingenious series of experiments ever made on animal substances. This labour, for which we are indebted to Fourcroy, Vauquelin, and Thenar, while it conveys useful information to the medical practitioner in regard to the nature of urinary calculi, will furnish hints for discovering the proper means to prevent the ravage occasioned by calculous affections. None however but physicians who are good chemists will be really desirous to take advantage of these means, or can properly employ them.

347. The blood, after having distributed itself to all the organs by means of numerous arterial ramifications, and their indefinite divisions, and after having every where conveyed the materials necessary for the different secretions, and for effecting the continual changes which take place in every part of the organization, returns by two orders of vessels, the veins and the lymphatics.

The veins bring back the greater part of the blood; and in particular that which has undergone the least change,

change, and which still retains its red colour. The means of the communication which exists between the extremities of the arteries and the first radicles of the veins cannot be observed; they are concealed from us on account of their infinite minuteness, and have hitherto eluded our microscopic researches. It is known, however, that under certain circumstances the blood seems to pass directly from the arteries into the veins, without undergoing any remarkable changes.

The sides of the veins are much thinner than those of the arteries. Their structure, examined in the large trunks, is composed of three tunics, the middle one of which appears to be vascular. The venous vessels are also more numerous, larger, and more extensible, than the arterial: it is estimated that the capacity of the veins is to that of the arteries as nine to four. The interior of the veins exhibits membranous folds in the form of valves; these valvulous folds, which oppose the return of the blood, are for the most part disposed in pairs, and are not found in the small veins nor in the large trunks: the veins which convey the blood from the viscera contained in the large cavities, and those which are situated at a considerable depth between the muscles, are also unprovided with them. The veins in their progress follow a direction contrary to that of the arteries, and are not very flexuous. Their anastomoses are
also

also less frequent: it is to be observed, that in uniting they decrease in size; the blood, which is then more confined, must circulate with greater velocity.

The veins which bring back the blood from the inferior limbs and from all the parts of the abdomen unite into a large venous trunk, which ascends towards the heart (*vena cava ascendens*). Those which bring back the blood from the head, from the superior limbs, and from the thorax, unite also into a large trunk, which descends towards that organ (*vena cava descendens*.) These two large veins open into a sinus, *auricle*, with the small vein which conveys back the blood from the heart.

348. The lymphatic vessels are exceedingly thin and transparent; their sides seem to be formed of two laminæ, which, notwithstanding their thinness, are remarkably strong. Their radiculæ arise at the surface of the membranes, and open into all the cellules or cavities by pores or villosities, which seem to possess a power of suction. The lymphatics absorb the aqueous fluids dispersed throughout all the tissues, and the serous residuums produced by the changes which are continually effected in every part of the organization. These vessels are highly contractile, and exhibit frequent anastomoses; in general they accompany the veins; like them, are disposed in two strata,
one

one superficial and the other profound, and are furnished with valves which prevent the return of their fluid.

The lymphatic vessels are exceedingly numerous: by their inextricable intersections they produce plexus, and seem even to form the whole tissue of the white organs.

The lymphatics, after a certain passage, meet with small glands, which they enter. The serous fluids and the chyle which they carry thither are there assimilated, and, having undergone a sort of digestion, issue from these small glands by larger and less numerous vessels. The lymphatics continue to advance towards the thorax, traversing the glands which they meet with; and the lymph in these glandulous organs acquires new characters of animalization.

The lymphatic glands are small and very numerous; they vary in their form and consistence; they are observed more evidently towards the bend of the large articulations, in the abdomen, the neck, and around the organs of secretion.

In proportion as the lymphatics unite, and the rami form branches, their absolute capacity decreases, the fluid is more confined, and must circulate with more rapidity.

The result of the successive union of all the lymphatics is two trunks, which discharge themselves into a vein situated under the clavicle. Of

these two trunks, the largest, the most extensive, and sometimes the only one apparent, arises in the abdomen, on the left side of the vertebral column, towards the middle of the lumbar region, where it exhibits sometimes a sort of dilatation (reservoir of the chyle), and receives the lymphatic vessels of the inferior limbs, those of the organs contained in the pelvic and abdominal cavities, and those of the sides of these cavities. This lymphatic trunk traverses the diaphragm with the aorta, and penetrates into the thorax (thoracic duct): it ascends on the sides of the bodies of the vertebræ, in the substance of the posterior mediastinum; and when it reaches the cervical region it bends to the left, and opens into the sub-clavian vein of that side. This thoracic duct receives, in different points of its extent, the lymphatics which proceed from the right side of the head, the neck, and the breast, and from the thoracic limb of that side. When the left thoracic duct exists alone, it receives the lymphatics of the right side.

The right lymphatic trunk is observed on the side of the last vertebræ of the neck. This small trunk (the brachio-cephalic) receives the lymphatics which return from the right side of the head, the neck, and the breast, and those of the right thoracic limb: it opens into the sub-clavian vein of that side.

349. The arterial blood, in distributing itself to every

every part, and traversing every point of the organization, undergoes a sort of alteration : it loses some substances essential to its composition, and becomes charged with several foreign matters. It is in this state that it returns by the veins and the lymphatic vessels.

The lymphatics, in their progress, traverse the numerous lymphatic glands already mentioned. The lymph and the chyle experience in these glands a peculiar assimilation, and undergo important changes, before they unite with the venous blood.

The venous blood, in its partial passage through the liver, begins to be divested of its foreign substances, and is completely freed from them in the lungs : it there acquires those materials which were taken from it, and resumes the qualities of arterial blood, to serve for a new circulation.

We shall here describe the different organs through which the venous blood passes before it penetrates to the aorta.

350. The veins which bring back the blood from the principal viscera of the abdomen unite into a large trunk which proceeds into the liver.

The liver is a gland of considerable size, and of a dark red colour, situated in the right hypochondre, the epigastric region, and a part of the left hypochondre ; below the diaphragm, to which it is contiguous superiorly, and above the stomach

and the intestines : it is more voluminous towards the right side ; is smooth and convex at the top and before, concave and unequal at the bottom and behind. At the lower part and before it exhibits a sharp edge, in the middle of which is a slight depression that divides it into two lobes, of which that on the right is larger. This gland has also a small lobe at the bottom and behind (*lobulus Spigelii*).

The liver is covered throughout its whole extent by the peritonæum : this membrane is reflected from different points of its surface, and its double fold forms several ligaments, by which it is fixed to the neighbouring parts. One, which is very large, arises from above the middle of the convexity of the liver, and proceeds to the navel and the centre of the diaphragm (*suspensor ligament*). It receives before, the umbilical vein, which is obstructed after birth, and becomes ligamentous. The peritonæum produces on the sides two expansions, which form two *lateral ligaments*. It adheres also behind the diaphragm by the cellular tissue (*coronary ligament*.)

The hepatic organ receives its blood from a small artery (right branch of the *cœliac*) and a very large vein (*sub-hepatic* or *vena portæ*). The blood of the small artery seems destined for the particular nourishment of the liver : the ligature of this vessel in animals does not interrupt the secretion of the bile.

The

The sub-hepatic vein or *vena portæ* is formed by two trunks (the splenic and mesenteric), which bring back the blood from the stomach, the epiploon, the intestines, the mesentery, the pancreas, and the spleen. This large vein proceeds into the liver towards the middle of its depression, *transverse scissure*, which is observed on its concave face, where it forms a large sinus, and then distributes itself to the right and the left: it then divides and subdivides itself indefinitely in the substance of that viscus. The divisions of this vein accompany those of the artery, the nerves of the liver, and the ducts which bring back the bile.

The sub-hepatic vein is enveloped from its origin by a prolongation of the peritonæum; this prolongation accompanies the three orders of vessels, as well as the nerves, and forms of them a sort of common capsule (*capsula Glissonii*), from which proceed very fine membranous partitions interposed between these parts. The sub-hepatic vein, with its divisions, discharges the office of an artery to the liver, since it furnishes it with almost all the blood it receives: it is observed that the sides of this vein are thick, and that it has no valves in the inside.

The nerves of the liver (branches of the pneumogastric and trisplanchnic) unite and form a plexus (the hepatic), which accompanies the bili-

ary ducts, and the vessels which carry the blood thither.

The blood is distributed throughout the whole substance of the hepatic organ, where it frees itself from the albuminous and oily matters which it contains in excess. The combination of these substances with a small quantity of soda forms a saponaceous liquor, which excretes from every point of the liver, through particular ducts, and is conveyed into the duodenum, where it becomes one of the most powerful agents of digestion.

The venous blood, after being freed from the materials of the bile, returns by veins and lymphatic vessels.

The veins (sub-hepatic) bring back the blood from every part of the liver, pursuing a direction perpendicular to the vessels which carry it thither: their sides are thin, and without valves. From the union of their numerous rami arise three branches, which proceed from the three lobes of that gland: these three veins form a trunk, which proceeds into the vena cava.

The lymphatic vessels of the liver are very numerous in the substance of that viscus, and particularly at its surface. Those of the gastric side unite into some trunks, which proceed into glands situated near the hepatic ducts: those of the diaphragmatic side unite along the suspensor
ligament

ligament of the liver, traverse the diaphragm, and proceed into the large chyliferous duct (the thoracic).

351. The venous blood, after undergoing some changes on its partial passage through the liver, and after receiving all the fluids brought by the lymphatic and chyliferous vessels, unites into two large veins, which proceed into a sinus called the *sinus of the venæ cavæ* (pulmonary or right auricle.)

This sinus is situated at the upper part of the heart, on the right, and somewhat behind; it is shaped like the segment of a sphere, and exhibits a small appendix.

Its interior surface is furrowed by carneous pillars, which adhere to its sides.

At the top and before is the orifice of the superior vena cava; that of the inferior vena cava is situated below and behind; it is larger than the former, and furnished with a valve shaped like a crescent, which prevents the blood from flowing back: in general this valve is incomplete, and seems to be in part torn or pierced: it is more apparent in the foetus, and directs all the blood of the inferior vena cava towards the foramen ovale. Before this valve is the aperture of the vein of the heart (the coronary), which is also furnished with a valvular fold.

The sinus of the venæ cavæ corresponds within to that of the pulmonary veins, from which it is

separated by a carneous partition : on this partition is observed a small oval fossa, which in the foetus is a hole of the same form ; the greatest diameter of this hole is four or five lines, and it is furnished with a semilunar valve, which corresponds to the sinus of the pulmonary veins.

After birth, this valve is pressed closely to the aperture by the blood which arrives in greater abundance in that sinus from the lungs ; it adheres to it, and the foramen ovale is soon completely obstructed : it has however been found open at an advanced age.

The sinus of the venæ cavæ communicates with the pulmonary ventricle by a round aperture. Its tendinous circumference is furnished with a valve, produced by a membrane cut into three triangular portions of unequal size, which terminate in a point (*valvulæ tricuspidæ, triglochines*). To these membranous portions are attached, by their free edge, tendinous or carneous filaments, which proceed from the sides of the ventricle. The action of this valve is to prevent the blood from flowing back into the auricle during the contraction of the ventricle.

The pulmonary ventricle has the form of a solid triangle ; its interior face exhibits a great number of carneous pillars, adherent or free, and of different sizes. The greater part of these pillars are directed from the base to the apex, and others cross the latter in an oblique direction.

The

The pulmonary orifice of the ventricle is furnished in its circumference with three femilunar valves (figmoid). These valves, when dilated, have been compared to three pigeon-baskets the convex faces of which touch each other: they exactly close the aperture, and prevent the reflux of the blood from the pulmonary artery into the ventricle.

The pulmonary artery, after a short passage, divides itself into two branches, which proceed to the two lungs. In the foetus, these two branches are very small; but the pulmonary artery has a direct communication with the aorta by a canal. The blood which arrives from the ventricle, being able to penetrate only in small quantity into the lungs compressed and not yet dilated by respiration, proceeds directly into the aorta by this *arterial canal*; but, after birth, the pulmonary arteries expand; the whole blood passes into them; and the arterial canal, which slowly becomes obstructed, first towards the aorta, is changed into a ligament during the first years of life.

352. The LUNGS are placed in the two cavities of the breast, the form of which they nearly retain; they are convex and smooth on the outside, and excavated towards the heart, which they embrace. They are broad; are flat and have sharp edges below, and are narrower and rounded at the top and behind.

The

The right lung is composed of three lobes, and the left of two. They are of a dark red colour in the fœtus; of a purple red in infancy; become of an ash white colour in adults, and are interspersed with blueish spots, which with age increase in number and intensity.

In the fœtus, the lungs are close, compact, and heavier than water; but, when they have been distended by air during respiration, they retain a great part of that air after death: they continue light, spongy, and float in water.

The cellules of the lungs (the bronchial) are exceedingly small: the last membranous ramifications of the bronchiæ terminate in the inside of them.

The bronchial ramifications of the two lungs arise from two trunks, produced by the tracheal artery at its termination: the superior aperture of the tracheal artery is the larynx.

The larynx is a cartilaginous dilatation situated at the bottom of the pharynx, and before the œsophagus. The principal cartilage which enters into the formation of it is situated below the os hyoides; it has been compared to a buckler, on which account it is called the *thyroid*. It is broad and round before, and in the middle exhibits a vertical line: it is incomplete behind, and its lateral faces terminate at the top and bottom in angles or *horns*, which are prolonged backwards: the superior ones are thinner and longer.

Below the thyroid cartilage is another annular cartilage (the cricoid), narrow before and broad behind, which is articulated with the inferior horns of the thyroid.

Above the posterior edge of the cricoid cartilage, in the space left by the thyroid behind, there are two small triangular cartilages, twisted somewhat round, so as to represent the portion of a funnel (arytæmoid): the broad bases of them rest upon and are articulated with the cricoid; their summit, which is thin and narrow, is directed inwards.

In the last place, the larynx above its superior aperture (glottis) exhibits a cartilage (epiglottis), which is thin, broad and round; its base is united before to the os hyoides, and on the sides to the thyroid and arytæmoid cartilages, by lax ligaments; its summit falls down behind on the aperture of the glottis, during the passage of the aliments. At the *entrance* of that aperture it forms a sort of pipe, which makes the air vibrate on its passage, and produces sound.

All these cartilages are united by ligaments, which concur to form a very flexible cavity: these ligaments produce, by their folds in the interior of the larynx, two deep excavations (*lateral ventricles*).

The cartilaginous pieces which form the larynx are moved by means of several pairs of small muscles. One extends from the superior edge of the cricoid

cricoid cartilage to the inferior edge of the thyroid, on the lateral parts of these cartilages: *crico-thyroidian*.

Another is inserted in the posterior part of the cricoid cartilage, and is fixed at the base of the arytaenoid cartilages: *crico-arytaenoidian*.

From above the sides of the cricoid cartilage, and behind the thyroid, arises a muscle which is inserted before the arytaenoid cartilages: *lateral crico-arytaenoidian*.

From the interior face of the thyroid cartilage arises a small muscle, which proceeds backwards and upwards, towards the arytaenoid cartilage: *thyro-arytaenoidian*.

In the last place, a small single muscle covers the two arytaenoidal cartilages behind: *arytaenoidian*.

The combined action of these muscles can lengthen or shorten, dilate or contract the capacity of the larynx, and produce a variation in the aperture of the glottis.

Besides these small muscles, which tend to move the different pieces of the larynx, there are two others, which can lower or raise the whole of it. Of these muscles, one is inserted in the interior face of the first piece of the sternum, below the stylo-hyoidian, and proceeds to the oblique line observed on the thyroid cartilage. This muscle tends to lower the larynx: *sterno-thyroidian*.

Another, of a smaller size, is attached on the

thyroid cartilage, above the preceding, and proceeds to the os hyoides. This muscle can raise the larynx, when the os hyoides is fixed: *hyo-thyroidian*.

The larynx which is lined with a mucous membrane is surrounded by several glands: the principal of these glands, which is broad and flat, is situated before the *thyroid* cartilage, by the name of which it is distinguished; before the cricoid and the upper part of the trachea. The particular use of the product of its secretion is not known. A series of small glands is observed also before the arytaenoid cartilages, and a small glandulous body on the epiglottis.

The larynx is continued inferiorly with the trachea, which descends before the œsophagus, to the height of the second dorsal vertebra.

This conduit is composed of cartilaginous rings united by loose intermediate ligaments: their number varies between sixteen and twenty. They are incomplete behind, and the vacuity is filled up by a longitudinal ligament.

The structure of the trachea is such, that its length and diameter can be easily varied: the cavity of it is lined, like the larynx, by a mucous membrane furnished with small glands.

Inferiorly, the trachea is divided into two trunks, which are the commencement of the bronchiæ:
the

the shorter one proceeds to the right lung, and the other to the left.

In penetrating into the lungs, the bronchiæ are divided into rami, and subdivided into ramifications, exceedingly delicate in every point of that organ.

The texture of the bronchiæ is the same as that of the trachea; but in proportion as the diameter of these conduits decreases, the rings of them become irregular, and at length disappear. The bronchial conduits are then membranous, and terminate in the numerous cells of the lungs. These cells have not a direct communication with each other, but only by the conduits of the bronchiæ.

In the interior part of the lungs, along the bronchial ramifications, are observed a great number of small glands, situated chiefly at the angles of their divisions (bronchial glands.)

353. The two divisions of the pulmonary artery, at their entrance into the lungs, subdivide themselves into three parts on the right, and into two on the left. These arteries accompany the bronchiæ, and follow them by subdividing in the same manner. Their last ramusculi penetrate into the bronchial cells, expand over the sides of them, and there anastomose directly with the capillary extremities of the veins.

The

The pulmonary veins follow also the divisions of the bronchiæ, and bring back the blood from every part of the lungs: the ramusculi unite to form rami; the rami to form branches; and the branches produce large veins for each lung, which pour the blood into the sinus: *sinus of the pulmonary veins* (left auricle or aorta).

354. This sinus (auricle) is smaller than the preceding; it is situated at the posterior and left part of the heart. In the state of dilatation it affects a cubic form, with an indented prolongation at the top and on the outside: *auricular appendix*. The interior face of it is smooth: it exhibits, behind, the orifice of the four pulmonary veins; in the inside, it corresponds to the sinus of the venæ cavæ, and in the fœtus exhibits the foramen ovale: at the top and on the outside is found the cavity of the appendix. Before, the sinus communicates with the aortic ventricle by an aperture, the circumference of which is tendinous. This aperture is furnished behind with a membranous valve, cut into two sharp-pointed portions (*valvulæ mitrales*), to which are attached tendinous and fleshy fibres inserted in the sides of the ventricle. This valve prevents the blood from flowing back when the ventricle contracts.

The left or aortic ventricle is situated before the sinus of that side; and on the left side of the pulmonary ventricle it is smaller, and of a form analogous

logous to that of the latter ; but its sides are much thicker : its interior face is furnished with carneous pillars, like the right ventricle.

At the top and on the right is found the orifice of the aortic artery, which is furnished with a triple valve (sigmoid), similar to that which is found at the entrance of the pulmonary artery.

355. The heart and the lungs are contained in the cavity of the thorax. The interior sides of this cavity are lined with a membrane, which is reflected on each lung, and forms a particular covering to them, called the *pleura*.

To have a proper idea of the disposition of this membrane, it will be necessary to follow it in its different folds.

The *pleura*, after covering the sides of the thorax and the diaphragm, is reflected, before, along the middle of the sternum, with that of the opposite side, and forms the two laminæ of the anterior mediastinum, between which the heart is lodged. When it arrives behind that organ, and before the pulmonary vessels, it is reflected on itself, and covers the interior face of the lungs, and then their exterior face. When it reaches the base of that organ, it is united to that of the opposite side, and again separates to produce the posterior mediastinum. The *pleura* then continues on the lateral parts of the vertebral column with that which lines the sides of the thorax.

In

In the anterior mediastinum are found the heart and the *thymus gland*; in the posterior, the aorta, the œsophagus, the thoracic canal, and the præ-lumbo-thoracic vein.

356. The *thymus*, of which we have not yet spoken (in the calf it is distinguished by the name of *sweetbread*), is a voluminous gland, which in the foetus is soft and reddish; in children it decreases and becomes yellow; with age it continues to lose some of its bulk, assumes more consistence, and becomes of a dark yellow colour; in old age it disappears almost entirely. In children it secretes a milky humour, the excretory ducts of which are not yet known. We are still ignorant with respect to the use of this organ.

357. The pleura seems to be formed of only one membrane; it adheres by a cellular tissue to the sides of the thorax, and to the surface of the lungs, which it covers. Its interior surface is applied to itself without adhesion, by the contact of the lungs with the sides of the thorax. This surface is smooth, and secretes abundance of serous matter, with which it is continually lubricated.

358. The heart is enveloped also by a peculiar membrane, called the *pericardium*, thick, and of a compact texture. It is formed of two folds, the exterior of which, after enveloping the heart, is continued on the large vessels: it adheres at the

bottom to the diaphragm, and in the rest of its extent to the mediastinum. The interior fold, when it reaches the large vessels, is reflected on the heart, and is thus placed in contact with itself: its smooth surface secretes abundance of serous matter, which continually moistens the heart and pericardium.

359. The blood is a red viscous fluid of a saline flavour. On the first view it appears to be composed of a limpid fluid, having floating in it red *moleculæ*, respecting the nature of which a great deal has been written. The red globules of the blood have been seen under a lenticular form, and pierced with a hole in the middle, &c. It has been judged that they are scarcely the eight hundredth part of a line in diameter.

The temperature of the blood is nearly forty degrees of the centigrade thermometer (104° Fahr.). That contained in the arteries is of a bright red colour, and appears to be warmer than that of the veins.

The blood when newly drawn from a vein exhales an aqueous, odorous, and putrescible vapour; that of the veins seems to disengage azote, and that of the arteries oxygen.

Chemical analysis of the blood shows that it consists of three principal substances, *fibrous matter*, *albumen*, and *colouring matter*. There are
found

found in it also different salts which are pure soda, phosphate of lime, phosphates of soda and of ammonia, and muriates of soda and of ammonia.

To analyse the blood, it must first be left at rest; it then separates into two parts, one solid, called the *crassamentum*, or *cake*; and the other liquid, called the *serum* or *lymph*.

The *crassamentum* is more or less red; it contains fibrous matter, colouring matter, and albumen.

If a pound of *crassamentum*, wrapped up in a piece of linen, be suspended under the cock of a cistern, so as to be subjected to a continual stream of water, it is observed that the water gradually carries off the colouring matter, and a part of the albumen; and at the end of twelve or fifteen hours nothing remains but the white fibrous matter.

To separate the colouring matter from the albumen, which is found mixed with the former in the water, the water must be boiled; the albumen then coagulates, and carries with it the colouring matter. This matter is then obtained by calcination, mixed only with a small quantity of the phosphate of lime. The colouring matter, after this process, gives only phosphate of iron with excess of oxide. The waters employed for washing lose their colour by boiling; they retain only a yellowish white tinge, and hold nothing in solution but a very small quantity of the soluble salts which, as already said, are found in blood.

The serum, which is of a yellowish white colour, is viscous and perfectly limpid; it turns syrup of violets green, in consequence of the caustic soda which it contains. When nitrate of silver is poured into serum, it produces an abundant flaky precipitate, which dissolves only in part in pure nitric acid: this proves that the precipitate is partly owing to muriate of silver which has been formed. Serum, when mixed with lime water or a soluble calcareous salt, suffers to be precipitated phosphate of lime. In the last place, serum, when heated, forms itself into a mass by the concretion of the albumen.

Serum then is composed of water holding in solution: albumen, soda, phosphates of soda and of ammonia, muriates of soda and of ammonia. This liquor is perfectly analogous to the white of an egg.

Though the lymph has not yet been well analysed, it is however known that it has a great analogy to the blood, and none to milk: it separates spontaneously into a serous part and a small curd: the latter contains fibrous matter.

360. The blood, in returning from every part of the lungs, is collected by four veins which pour it into a sinus: *sinus of the pulmonary veins* (left or aortic auricle).

From this sinus it passes into the left ventricle, and is propelled thence into the aorta.

The

The aorta in its passage furnishes a very great number of arterial branches, the subdivisions of which are distributed to every part.

On its issuing from the heart, it gives out, on the right and left, the small cardiac artery (*coronary*), which is reflected on that organ, and is distributed to the ventricle and sinus belonging to its side. These two arteries penetrate the whole substance of the heart, and anastomose in several places.

At the summit of its curve, the aorta furnishes two large branches on each side: it furnishes them directly from the left side; but from the right side gives out in general only one large branch, which is divided.

Of these two branches, one is distributed to the head, *the cephalic*, and the other to the thoracic member: *the brachial*.

361. THE CEPHALIC (*primitive carotid artery*) ascends obliquely without, on the sides of the tracheal artery, and at the height of the larynx is divided into two branches.

Of these two branches, one is distributed to the neck, the face, and the exterior part of the cranium, *the maxillo-facial*; the other, traversing the temporal bone, proceeds to the brain: *anterior cerebral*.

362. THE MAXILLO-FACIAL (*exterior carotid artery*) ascends on the sides of the neck as far as the neck of the condyle of the maxillary

bone; and in its passage furnishes eight principal branches.

The first arises near the origin of the maxillo-facial, and descends, within and before, towards the summit of the thyroid gland, on which it expands: a ramus penetrates the larynx, *the laryngian*, between the os hyoides and the cricoid cartilage, another proceeds into the interval which separates the cricoid and thyroid cartilages. This artery, in its passage, distributes itself to the neighbouring parts, and exhibits frequent anastomoses: *the superior thyroidian* *.

The second issues above the preceding; it proceeds inwards, towards the os hyoides, passes between the hyo-glossian and the genio-glossian muscles, distributing itself to the muscles attached to that bone; where it divides: one part passes between the genio-glossian and the mylo-hyoidian muscles, and proceeds to the root of the tongue, where it advances in a serpentine direction, below and on the sides of that organ, as far as the point of it. The other is directed towards the back of the tongue, and expands at the root of it: *the lingual*. This artery furnishes the *sub-lingual*, the *super-lingual*, and a *hyoidian ramus*.

The third is observed below the lingual. It is small, ascends on the sides, and a little behind the

* We shall not mention the numerous varieties observed in the origin and distribution of the arteries, we shall exhibit only the most constant state.

pharynx, and proceeds to the pharynx and the guttural conduit of the ear, distributing itself to the neighbouring parts: a ramus penetrates into the cranium, through the posterior foramen lacerum, and constitutes the posterior meningian: *inferior pharyngian*.

The fourth arises above the lingual. It ascends along the superior part of the pharynx, and passes over the maxillary gland, near the angle of the jaw. In its passage, it furnishes the musculo-palatine, the tonsillary, and the sub-maxillary. It proceeds before, along the interior face of that bone, is then reflected outwards, ascends on its exterior face, near the anterior edge of the zygomatic-maxillian, and proceeds to the commissura of the lips, after giving out the inferior labial. In that place this artery furnishes two rami, which expand in the thickness of the lips; it then ascends along the cheek, on the sides of the nose, at the summit of which it terminates, anastomosing with the sub-orbital: *the labial*.

The *labial*, in this long passage, furnishes the musculo-palatine, the sub-maxillary, the tonsillary, the inferior labial, the two labial coronary, and some rami.

The fifth issues from the maxillo-facial, almost opposite to the lingual. It ascends obliquely behind, under the sterno-, cervico-, and trachelo-mastoidian muscles; passes between the mastoid apophysis and the transverse apophysis of the atlas,

and ascends under the integuments as far as the occiput, where it expands in numerous rami: *the occipital*.

The sixth, which is very small, arises in the substance of the parotid gland. It proceeds backwards, above that gland, as far as the mastoid apophysis, where it furnishes a ramus, which penetrates into the ear by the stylo-mastoidian foramen (aqueduct of Fallopius), and distributes itself in the inside of that organ. This artery then divides on the sides of the mastoid apophysis: a branch proceeds before the ear, and another on the occiput: *posterior auricular*. This artery gives the *stylo-mastoidian*, the *tympanic*, and some muscular and cutaneous rami.

The maxillo-facial, at its termination behind the neck of the condyle of the jaw, divides into two branches, which are the last furnished by this artery.

The seventh continues in the direction of the maxillo-facial. At its origin it gives out a branch, which proceeds, before, on the parotid gland, the zygomatico-maxillan, the salival duct of Steno, and as far as the palpebralian muscle. The body of this artery then continues under the parotid gland, passes between the meatus auditorius, where it throws out a ramus to the anterior part of the ear and the condyle of the jaw: it then ascends behind the zygomatic arch, above the tem-
poro-

poro-maxillian muscle, in the substance of which it sends out a branch, and terminates in two rami, one of which expands on the forehead, and the other on the sides of the head: *the temporal*. This artery furnishes the *anterior auricular*, the *sub-zygomatic*, and the *superficial temporals*.

In the last place, the eighth rises towards the middle of the branch of the jaw-bone. It ascends along that bone, and the small pterygo-maxillian, and proceeds to the summit of the zygomatic fossa, towards the sphenomaxillary fissure: *the maxillo-buccal*.

In its passage, this artery furnishes several branches:

a. The first proceeds within, under the small pterygo-maxillian muscle, and penetrates into the cranium through the sphenospinous foramen, where it gives out some ramusculi, and divides into two rami, which expand on the meninx, and are lodged in the furrows observed on the sides of the interior part of the cranium: *middle meningian*.

b. Another descends anteriorly between the great pterygo-maxillian and the branch of the jaw; and proceeds in the dentary canal: the *maxillo-dentary*. Before it enters this canal, this artery furnishes a ramus to the mylo-hyoidian and the membrane of the mouth. It then passes through the dentary canal, giving out ramusculi which enter the alveoli
of

of the dentes molares. When it reaches the hole of the chin, it furnishes another small twig, which penetrates into the alveoli of the canine and incisor teeth: it then issues from that hole, and distributes itself to the muscles of the lower lip, anastomosing with the labial.

c. A branch passes under the small pterygo-maxillian muscle, to which it distributes itself, as well as to the great pterygo-maxillian: *the pterygoidian.*

d. Two branches are distributed chiefly in the bottom of the temporal fossæ: *the profound temporals.* One arises below the zygomatic arch, passes before the small pterygo-maxillian muscle, and gives out rami, which expand on the temporo-maxillian. The other proceeds in the furrows of the temporal fossa, below the temporo-maxillian. It generally gives out a ramus which passes before the condyle of the jaw, and is distributed to the zygomato-maxillian: *the masseterine.* These arteries anastomose with the superficial temporals.

e. The maxillo-buccal, before it penetrates to the bottom of the zygomatic fossa, furnishes also a branch which descends anteriorly on the maxillary bone: *super-maxillary.* It furnishes ramusculi which penetrate into the maxillary sinuses, and to the roots of the upper dentes molares: it then loses itself in the bucco-labian muscle,

cle, the membrane of the mouth, the neighbouring integuments, and anastomoses with the labial and the sub-orbital.

f. The maxillo-buccal, when it reaches the bottom of the zygomatic fossa, gives out a branch, which penetrates into the sub-orbital canal: *the sub-orbital*. Before it issues from this canal, it furnishes a ramus, which passes through the dentary canal, and distributes itself to the canine tooth and the incisors. It then issues through the inferior orbital hole, and distributes itself to the muscles of the nose and the lips, presenting frequent anastomoses. In its passage it sends out ramusculi, which penetrate into the orbit and the maxillary sinus.

g. It then sends out two rami, one of which passes through the pterygoidian canal, and the other through the pterygo-palatine foramen. Both these rami are distributed to the summit of the pharynx and the guttural conduit of the ear: *superior pharyngian*.

h. In the last place, the maxillo-buccal furnishes two rami, one of which descends along the posterior palatine canal, and distributes itself to the palate: the other passes through the sphenopalatine foramen, penetrates into the nasal fossæ, and divides into several ramusculi, which are distributed on the sides of that cavity: *palatine* and *pterygo-palatine*.

363. THE ANTERIOR CEREBRAL, *interior carotid*,

tid, is larger in infancy than the maxillo-facial: in adult age it becomes equal to it.

This artery ascends on the sides of the larynx and of the vertebral canal; it proceeds as far as the base of the cranium, making several inflections, without giving any rami, and penetrates into the cranium through the winding canal near the petrous portion of the os temporale. When it reaches that cavity, it passes on the side of the body of the os sphenoides; is then reflected upwards, turns round in the notch of the anterior clinoid apophysis, and traverses the meninx.

The anterior cerebral, immediately after traversing this membrane, gives out a branch, which enters the optic hole, and is distributed to the orbit: the *orbital*.

The ophthalmic artery penetrates into the orbit, below and on the exterior side of the ocular nerve, around which it turns; it passes below the superior muscle of the eye, and proceeds towards the interior side of that cavity.

In this short passage it furnishes several branches, namely:

a. The *lacrymal*, which advances along the exterior side of the orbit, is distributed to the exterior muscle of the eye, the orbito-palpebralian, the lacrymal gland, and the upper eye-lid. A ramus even traverses the os jugale, and expands on the cheek.

b. The *sub-irian* branches, which pierce the sclerótica in different places : they proceed between that membrane and the choroid, as far as the ciliar ring (*ligamentum ciliare*), where they are sub-divided into a great number of capillary vessels, which form anastomotic circles, exceedingly delicate, around the large and small circumference of the iris.

c. The two *ethmoidal* branches, which advance inwards, pass over the lobe of the eye, penetrate into the two interior orbitar holes, enter the cranium, and are reflected in the ethmoidal cells, through the crebriform plate of the os ethmoides.

d. The *central of the retina*, which penetrates into the optic nerve before it enters the orbit. This artery advances into the centre of that nerve, as far as the retina, on which it expands.

e. The *muscular*, which gives out two rami : one of these, which is larger and constant, is distributed to the inferior and lateral muscles of the eye ; the other proceeds into the superior, the interior, and the great oblique muscles of the eye.

f. The two *palpebralian*: these are directed towards the interior angle of the orbit, from which they are distributed to both eyelids, furnishing ramusculi to the neighbouring parts.

g. In the last place, the orbitar furnishes also some rami, which are distributed to the eyebrows, the forehead (the frontal), and to the nose
(the

(the nasal), and terminates by anastomosing with the labial.

The anterior cerebral artery, after having pierced the dura mater, and furnished the orbital, proceeds backwards under the brain, and then gives out a *communicating* branch, which anastomoses with the posterior cerebral. This small and pretty long branch furnishes, in its passage, ramusculi to the surrounding parts, and then sends out a ramus which is distributed to the choroid plexus.

The anterior cerebral artery is then divided into two branches. The smaller proceeds before: the *anterior lobar*; the other proceeds on the side, between the anterior and middle lobes of the brain: *middle lobar*.

The *anterior lobar* is reflected forwards, below the mesolobe, and by a short transverse branch communicates near its origin with its fellow. This artery, when it reaches the anterior part of the mesolobe, ascends before the brain, and is reflected on its surface. In this whole passage it furnishes numerous ramifications, which expand on the meningine, between all the anfractuositities of the brain, from which they penetrate into the interior parts of that organ.

The *middle lobar* takes a lateral direction below the brain. It passes between its anterior and middle lobes, and divides into several branches, which continue to advance between these parts, furnishing
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ing numerous rami to the choroid plexus, the meninge, and the neighbouring parts of the brain. These branches are then subdivided, and expand over the meninge, in the numerous folds which it forms on the lateral parts of the encephalic organ, and lose themselves in the interior of that organ.

364. THE BRACHIAL ARTERY extends from the aorta to the bending of the arm.

To facilitate the description of this artery, its extent is divided into three parts: 1st, that which is under the clavicle (sub-clavian); 2d, that which is under the arm-pit (axillary); 3d, that which corresponds to the arm (humeral).

365. THE SUB-CLAVIAN furnishes, in general, six branches:

The 1st proceeds to the brain, *the posterior cerebral* (vertebral); it rises along the neck, accompanying the inferior thyroidian, then enters the canal produced by the holes of the transverse apophyses of the vertebræ of the neck, and proceeds as far as the great occipital foramen, making several inflexions, especially at the top. In this passage, it sends out several rami to the vertebral canal and to the neighbouring muscles.

When it enters the cranium, it proceeds anteriorly on the sides of the rachidian prolongation, and gives out a great number of small rami, one of which is distributed to the posterior part of the meninx:

meninx: *the occipito-meningian*: two others descend, one before and the other behind that prolongation. The anterior extends as far as its extremity; the posterior terminates towards the lumbar region: *anterior and posterior median of the rachis* (anterior and posterior spinals).

The posterior cerebral artery then sends out a large ramus, which is distributed on the inferior face of the cerebellum: *inferior great cerebellous*.

The two posterior cerebral arteries then unite and form a trunk, which advances over the whole length of the mesencephalon: *the mesencephalic* (basiliar); this trunk furnishes two small rami, one behind, *inferior small cerebellous*; and the other before, near its termination: *small superior cerebellous*. They distribute themselves to the base of the mesencephalon and of the cerebellum.

The mesencephalic trunk then divides into two branches, *the posterior lobar*, which proceed on the sides. Each first furnishes a *communicating ramus*, which proceeds to the anterior cerebral artery and some other small rami. This artery then divides, and expands over the posterior lobes of the brain, distributing itself in its numerous anfractuosities.

It is to be observed, that the brain receives a large quantity of blood, since the calibre of the four cerebral trunks has been estimated at a sixth part of that of the aorta. This blood circulates in these vessels, forming at the base of the cranium

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an anastomotic circle, in such a manner that it would be possible to tie any one of the cerebral arteries without the circulation of the blood in the brain being interrupted.

The second descends into the breast, proceeds over the cartilages of the ribs, near the sternum, between the pleura and the inter-costal muscles. Between each inter-costal space it gives out two rami, which traverse the inter-costal muscles, those above the breast, and lose themselves in the mammellæ. It distributes itself also to the thymus gland, the mediastinum and the diaphragm. This artery then descends towards the bottom of the breast, furnishes a ramus to the sternal appendix, and some others which are lost in the substance of the muscles of the abdomen, anastomosing with the *epigastric* and the *sub-sternal* (interior mammillary). This artery furnishes *mediastine*, *sub-mammillary*, *inter-costal*, and *super-diaphragmatic* rami, and often a *thymic* and a *bronchial* ramus.

The third arises opposite to the sub-sternal, and ascends before and on the sides of the neck, furnishing a ramus to the muscles of that part: *ascending cervical*. It then passes under the cephalic, proceeds to the thyroid gland, and penetrates its substance. It there anastomoses with rami of that of the opposite side, and of the superior thyroidian. This artery distributes itself also to the

œsophagus, the larynx, and as far as the bottom of the pharynx: *inferior thyroidian*.

The fourth arises, for the most part, on the exterior side of the thyroidian. It proceeds upwards on the sides of the neck, passes between the transverse apophysis of the last cervical vertebra, and that of the first of the back, and ascends obliquely towards the occiput, furnishing rami to the muscles over which it passes: *trachelo-cervical* (posterior cervical.)

The fifth, *trachelo-scapular*, often forms two branches at its origin: one of these proceeds outwards and downwards, under the clavicle, and gives out several rami to the neighbouring parts. When it reaches the superior edge of the scapula, it passes under the superior super-scapulo-trochiterian, glides under the acromion apophysis, and loses itself in the inferior super-scapulo-trochiterian muscle: *superior scapular*.

The other, which is larger, takes an oblique direction upwards and outwards, under the sterno-mastoidian muscle, where it gives out a ramus which loses itself on the sides of the neck. It then divides into two branches: the first proceeds upwards, and distributes itself between the dorso-super-acromian and the trachelo-scapular muscle: the second proceeds towards the superior edge of the scapula, passing under the dorso-scapular muscle; it then descends

descends along the posterior edge of that bone, and divides itself, near its inferior angle, into several rami, which lose themselves in the sub-scapulo-trochanterian, the dorso-scapular, and the costo-scapular muscles: *the transverse cervical*.

The sixth issues from below the exterior extremity of the sub-clavian. It descends before the neck of the first rib, often of the second, and sometimes of the third, and furnishes several rami. Some of these are directed backwards, pass over the sides of the vertebræ, and lose themselves in the muscles of the neck and the back. The rest proceed outwards, along the inferior edge of the ribs, between the inter-costal muscles: some rami are distributed to the œsophagus and the bronchiæ: *superior inter-costal*.

366. THE AXILLARY is a continuation of the sub-clavian. It proceeds outwards, forming an arc in the hollow of the arm-pit: it extends from the first rib to the point where the large dorsal muscle is attached.

In this passage it furnishes five principal branches, the distribution of which is pretty constant; but they vary a great deal with respect to their origin, as several of these branches often arise from a common trunk.

The first arises before and in the middle of the axillary. It then immediately divides itself into

several rami, which proceed to and expand between the sterno-humerian and the costo-coracoidian muscles: *sterno-thoracic* (superior thoracic.)

The second issues close to the preceding. It descends below the sterno-humerian muscle, and divides into several rami, which are distributed to the costo-scapulian muscle, the inter-costians, and the mammilla: *costo-thoracic* (inferior thoracic).

The third arises near the preceding ones. It passes over the costo-coracoidian muscle, and furnishes several rami, which are lost in the sterno-humerian and costo-clavian muscles; it then continues between the sterno-humerian and the sub-acromio-humerian muscles, and in this passage furnishes a ramus, which expands on the articulation of the humerus with the scapula: *the super-scapular* (acromial).

The fourth descends posteriorly, below the point where the sub-scapulo-trochinian muscle is attached, and furnishes some small rami to that muscle, and to the cellular tissue of the arm-pit: it then divides into two branches: the inferior branch, which is smaller, *inferior scapular*, follows the inferior edge of the sub-scapulo-trochinian muscle, and loses itself in the costo-scapulian, the lumbo-humerian, and the scapulo-humerian.

The other, which is stronger, *exterior scapular*, is directed backwards, between the scapulo-humerian and the inferior super-scapulo-trochiterian muscles.

muscles, and divides into two rami. One of these rami passes over the anterior edge of the scapula, and loses itself in the inferior super-scapulo-trochiterian muscle, and another smaller is distributed to the sub-scapulo-trochinian : *sub-scapular* (common scapular).

The fifth issues from below the head of the humerus. It is often divided, at its origin, into two branches : one, the *anterior circumflex*, passes under the coraco-humerian, and the short portion of the scapulo-olecranian muscle, and expands before and around the articulation of the shoulder. The other, which is much larger, the *posterior circumflex*, passes behind the humerus, between the scapulo-humerian muscle and the inferior super-scapulo-trochiterian, below the sub-acromio-humerian ; gives out a great number of rami, and loses itself in turning round before and below the head of that bone : *scapulo-humeral*.

367. THE HUMERAL ARTERY is a continuation of the axillary ; it extends from the middle of the hollow of the arm-pit, as far as the middle of the bending of the arm. In this passage it furnishes above, towards the upper third of the humerus, a very large branch, the *exterior collateral*, which proceeds outwards, between the humero-cubitian and the scapulo-olecranian muscle, and divides itself into two branches. One of these branches distributes itself in the substance of the

scapulo-olecranian; the other, which is stronger, turns round behind the middle of the humerus, and descends along the exterior side of the arm, between the humero-super-radial, and the exterior portion of the scapulo-olecranian: it terminates around the articulation, anastomosing with the radial recurrent.

Below this collateral branch arises another, the *interior collateral*, which descends along the interior side of the arm, before the scapulo-olecranian muscle, and as far as the articulation:

The humeral artery then continues before the arm, along the interior edge of the scapulo-olecranian muscle, and before the humero-cubital, giving out to them frequent rami: *the muscular of the arm.*

In the last place, the humeral artery gives out near the articulation of the elbow two rami, one of which proceeding towards the epicondyle distributes itself to the neighbouring muscles, and anastomoses with the interior collateral and the cubital recurrent. The other proceeds towards the epitrochlea, and is distributed in the same manner as the interior: *collaterals of the articulation of the elbow.*

At the bending of the arm the humeral artery divides into two branches, one of which follows the *radial* edge of the fore-arm, and the other its *cubital* edge.

368. THE RADIAL ARTERY extends along the anterior and exterior face of the fore-arm, as far as the extremity of a part of the fingers. Near its origin it furnishes a branch, which is reflected towards the epicondyle, *recurrent of the epicondyle*, and is distributed to the muscles attached to that part, anastomosing with the exterior collateral of the arm. In its passage along the exterior edge of the fore-arm, the radial artery furnishes several rami to the neighbouring muscles: *muscular of the fore-arm*.

Near the articulation of the wrist, this artery divides into two branches, after giving out a small ramus before that articulation. One of these branches, the *radio-palmaris*, passes before the annular ligament of the carpus, gives out a ramus to the muscles of the thumb, and proceeds towards the palm of the hand. It there furnishes an artery, which anastomoses with the cubital arch, and then terminates in two rami: one of these loses itself on the radial side of the thumb; the other descends into the interval between the thumb and the index finger, and expands along the corresponding edges of these two fingers.

The other branch, furnished by the radial artery at its termination, proceeds to the exterior side of the articulation, the *radio-super-palmaris*; it gives out a ramus which proceeds in a transverse direction on the carpus, *dorsal of the carpus*, and an-

ther which proceeds to the radial side of the thumb.

The radial artery, when it reaches the interval between the two first bones of the metacarpus, separates into three branches. *One* of these branches glides in the substance of the metacarpophalangean muscle of the thumb; passes along the first bone of the metacarpus, and divides into two branches, which are distributed on the sides of the thumb. The *second* passes over the first dorsal inter-osseous muscle, along the radial edge of the second bone of the metacarpus. The *third*, which is much larger, advances between the carpiar extremities of the two first bones of the metacarpus; it turns round in the palm of the hand, and unites itself to a branch of the cubital to form the profound palmary arch. This arch furnishes, 1st, rami which are reflected before the carpus, to the ligaments of that part and to the muscles of the thumb; 2d, four rami which pass before the inter-osseous muscles, to which they distribute themselves as well as to the lumbricals, and terminate towards the heads of the bones of the metacarpus, anastomosing with the digital arteries; 3d, three rami, which pierce the second, third, and fourth dorsal inter-osseous muscles; distribute themselves to the super-palmary face, and each divide into two ramusculi, which lose themselves on the sides of the last four fingers.

369. THE CUBITAL ARTERY, which is larger than the radial, descends before, along the cubital edge of the fore-arm, as far as the fingers. Near its origin it gives out two branches, one of which passes before the epitrochlea, distributes itself to the neighbouring parts, and anastomoses with the collaterals of the cubitus. The other, which is larger, passes behind the epitrochlea, sends out several rami to the neighbouring muscles, and anastomoses with the inter-muscular of the arm : *the recurrent of the epitrochlea.*

The cubital then penetrates under the muscles attached to the epitrochlea, and furnishes two branches. One of these branches passes between the inter-osseous ligament and the muscles by which it is covered : the *anterior inter-osseous* : it furnishes a ramus which glides between the two layers of the muscles, and some others which are distributed to the muscles and to the periosteum. Inferiorly, this artery traverses the inter-osseous ligament, and terminates on the convexity of the hand, where it anastomoses with the dorsal of the carpus.

The other, the *posterior inter-osseous*, traverses at the top the inter-osseous ligament, and gives out a branch, the *olecranian recurrent*, which is reflected between the olecranon and the epicondyle, in the substance of the epicondylo-cubitian muscle. It distributes itself to the neighbouring muscles, and
anastomoses

anastomoses with the exterior collateral artery. The posterior inter-osseous then continues between the two layers of the muscles of the super-palmary face of the fore-arm, to which it sends out a great number of rami, and terminates near the wrist, anastomosing with the anterior inter-osseous.

After furnishing these rami, the cubital artery penetrates, at the top, under the common epitrochlo-phalangean muscle, and issues towards the middle of the fore-arm, from which it then proceeds as far as the wrist: the *cubito-super-palmaris*. At this place it gives out several rami, one of which distributes itself over the hand, anastomosing with the dorsal of the carpus. Another transverse branch passes before the articulation, and anastomoses with a similar one furnished by the radial artery. A third branch passes under the tendons of the common epitrochlo-phalangean muscle, and of the common cubito-phalangean, and concurs to the formation of the profound palmary arch.

In the last place, the cubital artery descends into the palm of the hand, the *cubito-palmaris*, under the palmary aponeurosis, and forms a transverse arch from which arise four principal rami, sometimes five, and even six. The first passes over the muscles of the palmary face of the little finger, and terminates along its cubital edge; the second proceeds in the interval between the fourth
and

and fifth bones of the metacarpus, and separates into two rami, which terminate along the opposite edges of these two fingers; the third and fourth proceed, in like manner, to the summit of the other two intervals between the following fingers, and lose themselves along their opposite edges.

When the cubital furnishes one or two rami more, they terminate also on the sides of the index finger and the thumb. The superficial palmary arch is then formed entirely by the cubital, but for the most part the latter rami proceed from the radial.

The two rami, which proceed on the sides of each finger, anastomose with each other towards the nail-like extremity.

370. THE AORTA, after furnishing, towards its curvature, the cephalic and brachial arteries, is reflected directly downwards, and descends, a little to the left, before the bodies of the dorsal vertebræ, between the laminæ of the posterior mediastinum on the right side, and a little behind the œsophagus. It advances as far as the lower part of the breast, traverses the diaphragm between its two pillars, and penetrates into the abdomen, where it advances as far as the fourth lumbar vertebra.

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The *thoracic aorta*, during its passage, furnishes several small branches.

1st. It gives out one at the top, which expands on the posterior part of the pericardium : *posterior pericardian*.

2d. It furnishes, at the top and on each side, a branch which follows the distribution of the bronchiæ in the interior of the lungs : *the bronchial*. The right branch, which in general is the largest, arises often from the trunk of the first inter-costal : it turns round on the œsophagus, gives out to it some rami, and proceeds to the origin of the bronchiæ, where it separates into several rami, which are distributed on the ærian canals, and penetrate with them into the interior of the lungs. The left, which is often double, gives out rami to the œsophagus and the pericardium, and like the right distributes itself in the lungs.

3d. Before the aorta are observed three or four small branches, distributed along the œsophagus, and which send out some rami to the posterior mediastinum : *the œsophagian*.

4th. The aorta sends out two or three rami, which expand on the posterior mediastinum : *the posterior mediastine*.

5th. Behind, and on the sides of the aorta, there arise from nine to twelve branches, which proceed on the lateral parts of the bodies of the vertebræ, and are continued between the ribs : *the inter-costal*.

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These branches, when they arrive between the heads of the ribs, separate into two rami: some proceed backwards, and are distributed in the rachidian canal, and to the muscles of the back; the rest continue along the inferior edge of the ribs, and proceed to the inter-costian muscles and those of the thorax, exhibiting frequent anastomoses.

371. THE AORTA penetrates into the abdomen, through the aperture left between the two pillars of the diaphragm, and proceeds as far as towards the fourth vertebra of the loins, where it bifurcates.

The *abdominal aorta*, in its passage, furnishes branches which are distributed to the diaphragm, the stomach, the liver, and the spleen, the intestines, the super-renal capsules, to the kidneys, and the loins.

1st. At the top, the abdominal aorta furnishes, on the right and left, a branch which expands under the diaphragm: the *sub-diaphragmatic* (inferior diaphragmatic).

Each of these ascends before that muscle, gives out some rami to its pillars, to the liver (on the right side), and to the super-renal capsule. It then divides into two rami, one of which proceeds towards the middle of the diaphragm, and the other on the sides of that partition: they both exhibit frequent anastomoses.

2d. Before, it sends out a large trunk, which corresponds to the back part of the stomach: the

OPISTO-GASTRIC, and which divides into three branches. One of these proceeds to the stomach (the gastric), another to the liver (the hepatic), and the third to the spleen (the splenic).

The *gastric artery* proceeds towards the œsophagian orifice of the stomach, gives out different rami which surround that orifice, and others which ascend along the œsophagus: it then separates into several branches, which follow the small curvature of the stomach, and expand on the two sides of that organ, anastomosing with each other, and with the gastro-epiploic artery, right and left.

For the most part, it furnishes a branch which passes before the trunk of the vena portæ, penetrates into the left extremity of the transverse sulcus of the liver, and is distributed in its left lobe: *left lobar* (left gastro-hepatic).

The *hepatic artery* is larger than the preceding. Before it proceeds into the liver, it gives out different rami, one of which proceeds to the pylorus, and the small curvature of the stomach, *the gastro-pyloric*; others are distributed to the pancreas, *the pancreatic*, and to the commencement of the duodenum, *duodenal*. A large ramus passes under the pylorus, proceeds in the substance of the great epiploon, advances towards the great curvature of the stomach, *the right gastro-epiploic*, and expands on the sides of that viscus, exhibiting frequent anastomoses.

The hepatic, after furnishing these arteries, proceeds

ceeds to the right lobe of the liver, *right lobar*; and sends out a ramus, which divides itself on the sides of the gall-bladder, *the cystic*; continues towards the right extremity of the transverse sulcus, and loses itself in the substance of the liver.

The hepatic artery furnishes sometimes the left lobar.

The *splenic artery* is larger in adults than the hepatic; the contrary is the case in children: it proceeds to the left, in a furrow of the pancreas, and gives out several rami to that viscus, *the spleno-pancreatic*; it then sends out several rami which expand on the large cul-de-sac of the stomach: *the spleno-gastric*. Before it proceeds to the spleen, this artery gives out also a branch which advances to the left, below the stomach, enters the laminae of the large epiploon, *the left gastro-epiploic*, and furnishes rami, some of which proceed to the left extremity of the pancreas, and others to the epiploon: *left epiploic*. This branch then expands on the large curvature of the stomach, where it terminates, anastomosing with the right gastro-epiploic.

The splenic artery then proceeds to the spleen, and separates into five or six branches, which penetrate through the scissure, and distribute themselves in its substance.

3d. Before the abdominal aorta, and below the opisto-gastric, arises a large artery which distributes itself to the mesentery and the intestines: *the superior*

rior mesenteric. This artery descends obliquely, on the left, behind the pancreas, passes under the transverse meso-colon, returns to the right, and thus forms a curve between the laminae of the mesentery.

In this passage, it gives out, superiorly, some rami to the pancreas, *the pancreatic*; and others to the commencement of the duodenum, *the duodenal*. It then furnishes a large trunk, which expands in the duplicature of the meso-colon, *the meso-colic*, and divides into two branches, one of which proceeds along the ascending part of the colon, and the other along its transverse part. Both these branches anastomose with their collaterals, and with each other.

This mesenteric artery then furnishes another branch, which proceeds transversely under the liver, towards the right portion of the colon: *the right colic*. It proceeds in the duplicature of the meso-colon, and divides itself into several rami, which expand on the ascending portion of that intestine, anastomosing with the collaterals.

Lower down, and towards its termination, the superior mesenteric furnishes a branch which descends on the right, and proceeds to the cœcum, the ileum and the colon: *the ileo-colic*. This branch advances behind the right lamina of the mesentery, and furnishes two rami, one of which anastomoses with the right colic, and the other proceeds along a portion of the ileum. This
branch

branch then continues towards the cœcum, and furnishes a ramus to its appendix : *the cœcal*.

From the convexity of the superior mesenteric artery arise, on the left, a great number of rami (from twelve to fifteen). Each of these separates into two, which proceed in the folds of the mesentery, as far as the jejunum and the ileum. All these rami anastomose with the neighbouring ones, and form arches, whence arise other rami which unite with their collaterals to form smaller arches : this arrangement is repeated four and even five times. When these arches reach the intestines, they give birth to two right layers of ramusculi, which expand in the substance of the sides of the intestines, where they form a vascular reticulation, which covers the whole surface of them.

All the vessels distributed on the intestines exhibit, in general, a similar arrangement.

4th. The abdominal aorta gives out inferiorly, close to its bifurcation, an artery which is distributed to the meso-colon and to the meso-rectum : *inferior mesenteric*. This artery, near its origin, sends out a trunk which soon divides into two branches : the *first* proceeds towards the transverse portion of the colon, and furnishes two rami, one of which ascends before the kidney, and proceeds towards the transverse portion of the colon, where it terminates by uniting with a branch of the superior mesenteric, and forms there a remarkable

anastomosis: *that of Riolan*. The other follows the direction of the descending portion of the colon, and terminates by anastomosing inferiorly with the neighbouring rami: *left great colic* (superior and middle colic).

The *second*, which is not so large, proceeds towards the descending portion of the colon, and divides itself into two rami which anastomose with their collaterals: *the small left colic*. A third is distributed to the commencement of the sigmoid flexure of the colon, and anastomoses with its neighbours.

In the last place, the inferior mesenteric artery, after giving out some rami to the iliac part of the colon, descends on the right, penetrates into the lesser pelvis, distributes itself behind the rectum, and anastomoses with several of the neighbouring rami: *artery of the rectum*.

5th. The abdominal aorta, immediately after furnishing the superior mesenteric, gives out, on each side, a branch which divides into several rami. Some of these proceed to the pillars of the diaphragm, and others to the super-renal capsules, and the neighbouring adipose tissue: *the super-renal* (middle capsular).

6th. Below the latter arise one, two, and sometimes three, on each side of the aorta, which proceed transversally towards the kidneys, *the renal*, furnishing some ramusculi to the super-renal capsules, the neighbouring adipose tissue, and the ureter.

ureter. When these branches reach the kidneys, they divide into several rami, which lose themselves in the sinuosities of that viscus.

7th. Below the renal rami there arise, in general, on each side of the aorta, two long slender arteries, which proceed downwards in an oblique direction, along the psoas, giving out some small rami to the neighbouring parts. Each then issues from the abdomen, through the inguinal ring, descends along the testicular cord, and proceeds to the epididymis and the testicles: *the testicular* (spermatic).

In the female, this artery penetrates into the lesser pelvis, and distributes itself to the ovarium, giving out some rami to the broad ligaments, the conduits of the ovaria, and the lateral parts of the matrix: *artery of the ovarium*.

8th. The lateral and posterior parts of the abdominal aorta give birth, on each side, to four or five arteries, which proceed transversely on the bodies of the first four of the lumbar vertebræ. These arteries furnish some ramusculi to the neighbouring parts, and then divide into two rami. Some of these proceed backwards between the transverse apophyses, give out rami which penetrate into their rachidian canal, and lose themselves in the muscles of the back. The rest pass behind the prælumbo-trochantinian muscles, send out rami to the pillars of the diaphragm, and to the ilio-transversian; are reflected on the muscles of

the abdomen, and terminate by anastomosing with rami of the last inter-costals, of the sub-sternal and sub-pubian: *the lumbar*.

9th. Behind the abdominal aorta, and near its bifurcation, is an *odd* artery, which descends on the middle of the body of the last lumbar vertebra, before the middle part of the sacrum, and as far as the coccyx: *middle sacral*. In this passage it furnishes on each side a ramus, which proceeds in a cross direction on the body of the last vertebra, and anastomoses with the neighbouring parts. It then continues and gives out several rami on the sides of the sacrum.

372. The abdominal aorta, when it reaches towards the fourth lumbar vertebra, divides into two branches: PELVI-CRURALES (iliac). These two branches proceed downwards, and on the sides, near to the articulation of the sacrum with the bones of the ilium, where they again bifurcate, and furnish two other branches: one of these penetrates into the pelvis, THE PELVIAN; and the other proceeds to the abdominal limb: THE CRURAL.

In the foetus, the pelvi-crural separates also into two branches, one of which proceeds to the abdominal limb, and the other, which is much larger, penetrates into the pelvis. The latter gives birth to two branches furnished in general by the pelvian, but in that case they are only very delicate rami: the body of the artery runs along the
sides

sides of the bladder, and then proceeds to the umbilicus.

373. The PELVIAN ARTERY penetrates into the lesser pelvis, and gives birth to eight principal branches, or arterial bundles, which extend over its sides, and are distributed to the different organs it contains.

1st. At the top and behind, a branch which ascends on the side, and divides itself into two rami; the first proceeds on the lateral parts of the bodies of the last lumbar vertebræ, and is distributed on the prælumbo- and iliaco-trochantinian muscles, and enters into the rachidian canal. The second ascends outwardly, and distributes itself in the iliac fossa: *iliaco-muscular*.

2d. Several branches which proceed on the sides of the sacrum, furnish rami to that bone, and others which proceed, through the sacral holes, into the vertebral canal: *lateral sacral*.

3d. An artery which proceeds before, and on the sides of the pelvis, as far as the interior sub-pubio-trochantinian muscle: *the sub-pubio-femoral*. In this passage it sends some rami to the prælumbo- and ilio-trochantinian muscles, passes through the sub-pubian hole, traversing the interior sub-pubio-trochantinian, and gives two rami, one on the right and the other on the left, which distribute themselves upwards and inwards to the muscles of the thigh.

4th. Before, an artery very large in the foetus,

and in a great part obliterated in adults. In the latter, it furnishes some rami, which are distributed on the sides of the bladder, to the matrix, the vagina, &c.: *the umbilical*.

5th. Above the latter, some branches which proceed to the bladder, the rectum and the uterus. One of these branches passes between the bladder and the rectum, and distributes itself to these organs, to the prostate gland and the seminal vessels. In the female, this artery gives out a considerable branch which penetrates the broad ligament, runs along the sides of the matrix, and the Fallopian tube, proceeds to the ovarium, and anastomoses with the artery of that part. Another ramus is distributed to the vagina: *the vesico-prostatic* (uterine and vaginal vesicals).

6th. The pelvian artery, near its termination, gives out a large branch, which distributes itself to the muscles of the nates, *fessière* (posterior iliac). This branch furnishes, in the lesser pelvis, some rami to the rectum, and to the sacro-trochanterian muscle: it then issues from this cavity, passing by the summit of the ischiatic notch, and soon separates into several branches, which expand between the great and the lesser trochanterian and the sacro-femorian muscles.

7th. Below the preceding arises another artery, which gives some rami to the rectum, the bladder, and the uterus. It then issues from the pelvis above the sacro trochanterian muscle, towards the
lower

lower part of the ischiatic notch, and divides itself into several rami, which expand under the sacro-femorian muscle, towards the coccyx, the tuberosity of the ischium, and to the posterior muscles of the thigh : *the ischiatic*.

8th. In the last place, the pelvian artery gives a branch, which arises generally from a trunk common to the preceding. It issues from the pelvis, between the pubio-sub-umbilic and the ischio-coccygian muscles, advances on the interior face of the ischiatic tuberosity, and terminates at the organs of generation : *the sub-pelvian* (interior pudical).

In the pelvis, it furnishes rami to the bladder, and often a large ramus to the middle part of the rectum. On the outside of this cavity, it gives rami to the sacro-trochanterian and the sacro-femorian muscles ; it then furnishes two branches : one of these, which is superficial, passes over the tuberosity of the ischium, and proceeds to the scrotum : *the perinæal* : the other penetrates to a greater depth between the tuberosity of the ischium and the canal of the urethra, and gives rami to the muscles of the anus and of the perinæum : *ischio-perinæal* (transverse of the perinæum). When it reaches the lower part of the symphysis of the pubis, this branch divides itself into two other rami, one of which passes under the root of the cavernous body, proceeds over the back of the penis, and termi-

nates in the substance of the glans: the other loses itself in the cavernous body.

In the female, the perinæal artery loses itself in the large labia; and the profound one proceeds to the clitoris: *the ischio-clitorian*.

374. THE CRURAL ARTERY arises before the junction of the sacrum with the hip-bone; it proceeds towards the ilium, passes under the crural arch, descends first on the interior side of the femur, and then behind that bone, and terminates at the ham, where it separates into two branches, which are distributed to the leg and to the foot.

The crural artery, in order to facilitate the description of it, is divided into three portions: one corresponds to the pelvis, near the iliac fossæ (the iliac); another corresponds to the groin (the inguinal); and the third extends along the thigh (the femoral).

The ILIAC PORTION furnishes interiorly a branch which proceeds on the pubis, *sub-pubian* (epigastric), and is reflected under the sides of the abdomen, chiefly along the sterno-pubian, forming several anastomoses. It gives out a ramus, which accompanies the testicular cord as far as the testicles, and terminates below the sternum, anastomosing with the sub-sternal.

The other artery, furnished by the iliac portion, ascends interiorly as far as the anterior angle of the ilium, turns round on the edge of that bone, and

and expands in several rami in the muscles of the abdomen, and in the ilio-trochantinian, producing some anastomoses: *circumflex of the ilium* (anterior iliac).

The **INGUINAL PORTION** furnishes exteriorly some branches, which are ramified in the inguinal glands, the muscles and neighbouring integuments: *the inguinal* (tegumentous of the abdomen.)

Interiorly, this portion gives out two or three small branches, which are distributed to the region of the pubis, to the scrotum (*the scrotal*), or to the vulva, the *vulvar* (exterior pudical).

The **FEMORAL PORTION** gives to the upper part of the thigh a large branch, which penetrates between the triceps adductor and the tri-femoro-rotulian muscle, and is distributed behind the thigh: *the inter-muscular or profound of the thigh*. This artery furnishes, near its origin, two large rami, one of which proceeds inwards between the sub-pubio-femorian and the tendon of the præ-lumbo-trochantinian muscle, and terminates in several ramusculi, which are distributed to the muscles of the superior and interior part of the thigh, around the articulation, and to the exterior parts of generation: *the sub-trochantinian* (the interior circumflex).

The other descends exteriorly, passes between the ilio-prætibian and the ilio-rotulian muscles,
and

and divides itself into two rami, the first of which is reflected around the articulation, and loses itself in the muscles of the posterior part of the thigh: the second descends before the thigh, and expands between the ilio- and the trifemoro-rotulian: *the sub-trochanterian* (exterior circumflex).

The profound artery then descends, and gives out a great number of rami, which are distributed interiorly and posteriorly to the muscles of the thigh: it furnishes also a ramusculus, which penetrates into the thigh.

The femoral artery, after sending out the profound one, descends below the ilio-prætibian muscle, furnishing in its passage a great number of rami to the neighbouring muscles: the *muscular*. Towards the lower third of the thigh, it traverses the tendon of the third adductor, proceeds to the posterior part of the thigh, and descends along the ham behind the articulation, where it assumes the name of the **POPLITEAN**. In this short passage it furnishes four branches, two on each side, the one above the other: *the poplitean articular* (the superior and inferior articular).

Of the two superior, one (the interior) ascends within, passes above the interior condyle of the femur, and distributes itself to the articulation of the knee. In this passage, it gives rami to the neighbouring muscles, to the interior lateral ligament, the articular capsule, and upon the rotula. The
other

other (the exterior), which is more profound, ascends on the exterior condyle of the femur, and distributes itself to the articulation, sending out rami, which terminate, like the preceding, at the similar parts of the opposite side.

Below these branches, the poplitean artery produces several more rami, which proceed to the periosteum of the femur, and behind the articular capsule.

Of the two inferior branches furnished by the poplitean, the *exterior* arises below the poplito-tibian muscle, descends on the outside, and passes under the exterior lateral ligament of the articulation between the femur and the tibia. It furnishes rami to the poplito-tibian, to the tendons of the neighbouring muscles, and to the articulation, and divides into two rami, one of which passes behind and the other before the rotula.

The *interior* arises a little lower down; it is covered by the bifemoro-calcanian muscle, descends under the condyle of the tibia, and terminates on the interior side of the articulation and on the rotula, like the preceding. The four rami which terminate on the rotula form between them an anastomotic circle.

The poplitean artery, when it reaches below the condyles of the tibia, divides itself into two branches. One, which is profound, traverses superiorly the inter-osseous ligament, and descends
before

before the leg as far as the foot: *anterior tibial*. The other descends along the posterior part of the leg, as far as the sole of the foot: *posterior tibial*.

375. THE ANTERIOR TIBIAL passes between the tibia and the perone; traverses at the top the inter-osseous ligament; descends before the leg, between the tibio-super-tarsian and the common peronæo-super-phalangeal muscle of the toes, and expands on the foot.

After having pierced the inter-osseous ligament, this artery gives out a ramus which is reflected before the articulation, *recurrent of the knee*, and then furnishes a great number to the anterior muscles of the leg. When it arrives towards the lower third of the tibia, it issues from below the muscles, passes before that bone, and descends below the annular ligament, where it gives out a ramus, on each side of the articulation of the foot: *the malleolar*.

When it reaches the tarsus, *super-tarsian*, it divides itself into two branches, *one* of which proceeds outwards on the common calcaneo-super-phalangeal muscle, and forms a curvature. The concavity of this curvature furnishes some rami to the articulation of the bones of the tarsus. From its convexity three rami proceed, which advance towards the bones of the metatarsus: when they approach the heads of these bones, they divide themselves into two ramusculi which expand on
the

the sides of the toes. The *other*, which is larger, proceeds on the tarsus, as far as the os cuboides, where it gives out a branch which passes over the first inter-osseous muscle, and advances towards the anterior extremity of the first bone of the metatarsus, where it divides itself into two ramusculi, which lose themselves on the sides of the first and second toes.

The trunk of the anterior tibial penetrates between the heads of the first and second bone of the metatarsus, *super-metatarsian*, and divides itself into two branches: *one* of these branches anastomoses with the exterior plantaris, and concurs towards the formation of the plantar arch: the *other* distributes itself under the great toe.

376. THE POSTERIOR TIBIAL, at its origin, sends out a very large branch, which descends behind the perone: *the peronæal*. This artery is covered by the tibio-calcanean, and the peronæo-subphalangettian muscle of the great toe: it sends out a great number of rami, which are distributed to the muscles of the posterior and exterior part of the leg. The peronæal then descends between the extremities of the tibia and of the perone, and divides itself into two branches, one of which passes under the calcanean tendon, distributes itself around the articulation, and terminates on the exterior side of the foot by several anastomoses. The
other

other pierces the inter-osseous ligament, descends before the articulation of the tibia and the perone, and terminates in several rami, which proceed over the foot, anastomosing with the super-tarsian and the exterior malleolar.

The posterior tibial then descends behind the tibia, under the tibio-calcanean muscle, as far as the lower part of the leg, where it becomes superficial.

In its passage, it sends out a great number of rami to the muscles of the posterior part of the leg, and a ramus which penetrates into the tibia: *the medullary of the tibia*. When it reaches the interior side of the calcaneum, it divides itself into two branches: one of these branches follows the interior edge of the foot, the *interior plantaris*; sends out rami to the muscles of the great toe, and terminates on its interior side, anastomosing with super-metatarsian rami. The other, the *exterior plantaris*, which is larger, penetrates between the muscles of the sole of the foot, to which it distributes itself. When it approaches the fifth bone of the metatarsus, it is reflected inwards, and forms a curvature, the convexity of which is turned forwards. This curvature sends out some rami, which proceed backwards, and distribute themselves in the muscles, on the bones of the metatarsus. It furnishes three rami which ascend through the metatars-inter-

inter-phalagian muscles. It then sends out four larger rami, in the interval of the bones of the metatarsus; these rami, when they arrive between the heads of these bones, divide into two ramusculi, which expand on the sides of the toes.

All the rami which proceed on the sides of the toes anastomose at their extremities.

TABLE OF THE HEART AND ARTERIES.

377. THE blood, which returns from every part of the body, is conveyed to the heart by two large veins, the *venæ cavæ*: these veins pour it into a sinus, *sinus of the venæ cavæ*, (right or pulmonary auricle,) through two orifices, one at the top, the other at the bottom: the latter is furnished with a valve, or portion of valve, in the form of a crescent.

From this sinus the blood passes into the right or pulmonary ventricle, through a circular aperture furnished with a tricuspid valve. It issues from this ventricle by an orifice provided with a triple semi-lunar valve (sigmoid), and proceeds into the pulmonary artery.

The pulmonary artery, which contains venous blood, divides itself, after a short passage, into two trunks which proceed to the two lungs. The right trunk divides into three branches, and the left into two, each of which is divided and subdivided indefinitely, and terminates in exceedingly fine ramusculi, which proceed, on the sides of the last bronchial cells, into which the air penetrates during respiration. These arteriolæ, it is probable, anastomose with the veins which bring the blood from every part of the lungs.

The small veins unite to form venous rami, which produce branches, and the union of branches forms two large trunks for each lung.

The four pulmonary veins contain arterial blood; they proceed into a sinus, *sinus of the pulmonary veins* (left or aortic auricle), which is smaller than the preceding, and the sides of which are thicker.

From this sinus the blood passes into the left or aortic ventricle, through a round aperture furnished with a two-pointed valve (*valvula mitralis*). This valve is smaller and thicker than the preceding; it drives the blood into the aorta, whence it is distributed to all the parts, by means of numerous arteries which are divided and subdivided indefinitely.

The aorta, on issuing from the heart, proceeds in an oblique direction to the right; returns to the left, and forms a curvature, which terminates at the height of the third dorsal vertebra; it then
descends

TABLE OF THE HEART AND ARTERIES. 417

descends to the left, along the bodies of the dorsal vertebræ, passes between the pillars of the diaphragm, penetrates into the abdomen, and terminates at the height of the fourth lumbar vertebra, where it divides into two branches.

THE AORTA GIVES,

At its origin,

Two arteries, which are reflected on the heart,

NEW NAMES.	OLD NAMES.
The cardiac.	Coronary.

From each side of its curvature,

Two large trunks*, one of which is distributed to the head,

The cephalic.	Primitive carotid.
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and the other to the thoracic limb,

The brachial.	Sub-claviar.
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Along the thorax,

Several branches, which proceed

To the pericardium,

The posterior pericardian.	The same.
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To the bronchiæ,

The bronchial.	The same.
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To the œsophagus,

The œsophagian.	The same.
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To the mediastinum,

Posterior mediastine.	The same.
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Between the ribs,

The intercostal.	Inferior or aortic intercostal.
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In the abdomen branches which are distributed

To the abdominal face of the diaphragm,

The sub-diaphragmatic.	Inferior diaphragmatic.
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To the stomach, the liver, and the spleen,

The opisto-gastric.	Celiac trunk.
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To the mesentery and the intestines,

Sup. and infer. mesenteric.	The same.
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To the super-renal capsule,

The super-renal.	Middle capsular.
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* They proceed immediately from the left side; but on the right, the aorta, in general, furnishes only one trunk, which is divided.

To the kidneys,

NEW NAMES.	OLD NAMES.
The renal.	The same.

To the testicle or the ovarium,

The testicular.	The spermatic.
Artery of the ovarium.	

To the lumbar region,

The lumbar.	The same.
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To the sacrum,

Middle sacral.	The same.
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The aorta, at its termination, divides into two branches, which are distributed to the pelvis and to the abdominal limb,

The pelvi-crural.	Primitive or common iliac.
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THE AORTA AT ITS ORIGIN FURNISHES,

I. The CARDIAC arteries, one of which is inferior or right, and the other superior or left.

II. The CEPHALIC TRUNK, which divides into two branches at the height of the larynx; one of these branches is distributed to the exterior part of the head,

The maxillo-facial.	Exterior carotid.
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The other penetrates into the interior of the cranium,

The anterior cerebral.	Interior carotid.
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A. The MAXILLO-FACIAL gives eight principal branches:

1st. One is distributed to the thyroid gland, to the larynx, and to the os hyoides,

Superior thyroidian.	The same.
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It furnishes the laryngian and several rami.

2d. One proceeds to the tongue and to its different muscles,

The lingual.	The same.
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It gives the sub-lingual and a hyoidian ramus.

3d. One furnished to the pharynx and the velum palati,

Inferior pharyngian.	The same.
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It sends out the posterior meningian.

4th. One is distributed to the maxillary gland, to the jaws, to the commissuræ of the lips, and as far as the tip of the nose,

The labial.	Exterior maxillary.
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It

It gives out, the musculo-palatine, the sub-maxillary, the tonsillary, the inferior labial, the two coronary labial, and some rami.

5th. A branch which proceeds to the occiput,

NEW NAMES.

OLD NAMES.

The occipital. The same.

It furnishes muscular and cutaneous rami.

6th. One expands behind the ear, within that organ and on the occiput,

Posterior auricular. The same.

It gives out the stylo-mastoidian, the tympanic, some muscular and cutaneous rami.

7th. One distributes itself on the sides of the head to the parotid gland, before the ear, to the cheek, and to the integuments of the upper part of the head,

The temporal. The same.

It gives the anterior auricular, the sub-zygomatic (transverse of the face), and the superficial temporals.

8th. One proceeds to the meninx, to the teeth, to the muscles of the jaw, to the cheek, to the pharynx, to the velum palati, and to the nasal fossæ,

The maxillo-buccal. Interior maxillary.

It gives the middle meningian, the maxillo-dentary (inferior dentary), the pterygoidian, the profound temporals, the zygomato-maxillary (masseterine), the super-maxillary (buccal), the sub-orbital, the superior pharyngian, the palatine, and the sphenopalatine.

B. The ANTERIOR CEREBRAL penetrates into the cranium, and at its entrance gives a branch which proceeds in the orbit, distributing itself to the lacrymal gland, to the eye and to its muscles, to the eye-lids and in the nose,

The orbital. Ophthalmic.

Which gives the lacrymal, the sub-irian (ciliary), the ethmoidals, the central of the retina, the muscular, the palpebral, the frontal, and the nasal.

The anterior cerebral is afterwards distributed in the anterior and middle lobes of the brain :

It furnishes,

The communicating. The same.

Which gives some rami to the choroid plexus, choroidian,

NEW NAMES.

OLD NAMES.

The anterior lobar. *Artery of the corpus callosum.*
 The middle lobar.

III. The BRACHIAL TRUNK, which in its passage along the thoracic limb is divided into sub-clavian, axillary, and humeral.

A. The SUB-CLAVIAN furnishes six branches :

1st. One is distributed to the posterior part of the brain, to the cerebellum, and to the rachidian prolongation,

The posterior cerebral. *The vertebral.*

It furnishes,

The occipito-meningian. *Posterior meningian.*
 The anterior and posterior median of the rachis . *Anterior and posterior spinal.*
 The inferior large cerebellous. *Inferior of the cerebellum.*
 The me-encephalic. *The basiliary.*
 The posterior lobar. *The posterior or inferior of the cerebrum.*
 The inferior small cerebellous. *Inferior of the cerebellum.*
 The superior cerebellous. *Superior of the cerebellum.*

2d. One is distributed below the sternum, to the thymus, to the mediastinum, to the diaphragm, and to the parietes of the abdomen,

The sub-sternal. *Interior mamillary.*

It gives mediastine, sub-mamillary, inter-costal, super-diaphragmatic (superior diaphragmatic) rami,

Which furnish a thymic and bronchial ramus.

3d. One proceeds to the thyroid gland and to the muscles of the neck,

Inferior thyroidian. *The same.*

It furnishes the ascending cervical and several rami.

4th. One proceeds on the sides of the neck,

The trachelo-cervical. *Posterior profound cervical.*

5th. One is distributed to the muscles of the lateral parts of the neck and of the shoulder,

Trachelo-scapular. *Transverse cervical.*

It furnishes,

The superior scapulary.

6th. One proceeds beneath the first rib, and gives some rami to the œsophagus,

Superior inter-costal. *The same.*

B. The

B. The AXILLARY furnishes five principal branches:

1st. One branch is distributed to the pectoral muscles,

NEW NAMES.	OLD NAMES.
The sterno-thoracic.	<i>The superior thoracic.</i>

2d. Another to the costo-scapular and the inter-costian muscles, and to the breast,

The costo-thoracic.	<i>The inferior thoracic.</i>
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3d. One proceeds on the summit of the shoulder,

The super-scapular.	<i>Acromial.</i>
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4th. One proceeds to the muscles of the interior side of the scapula,

Sub-scapular.	<i>Common scapular.</i>
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5th. One is distributed around the articulation of the shoulder with the arm,

The scapulo-humeral.	<i>Anterior and posterior circumflex.</i>
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C. The HUMERAL ARTERY (brachial) furnishes three principal branches before it divides at the bend of the arm:

1st. One branch penetrates profoundly into the muscles of the arm,

The inter-muscular or profound.

It furnishes,

The interior and exterior collateral.

2d. Several rami are distributed to the muscles of the anterior part of the arm,

Muscular of the arm.

3d. Two rami proceed on the sides of the articulation of the elbow;

Collaterals of the articulation of the elbow.

The humeral artery, when it reaches the bend of the arm, divides into two branches,

The radial and the cubital.

A. The RADIAL furnishes four principal branches:

1st. One which is reflected towards the epicondyle,

Recurrent of the epicondyle.	<i>Radial recurrent.</i>
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2d. Rami which proceed to the radial side of the fore-arm,

The muscular of the fore-arm.

3d. A branch which is distributed in the palm of the hand to the last fingers, and which concurs towards the formation of the superficial palmar arch,

NEW NAMES.	OLD NAMES.
The radio-palmar,	<i>The palmar radial.</i>

4th. A branch which descends on the back of the hand, sends out a ramus to its palmar surface, and concurs towards the formation of the profound palmar arch,

Radio-super-palmar.	<i>Dorsal Radial.</i>
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B. The CUBITAL furnishes four principal branches :

1st. Two are reflected towards the epitrochlea where they are distributed,

Recurrent of the epitrochlea.	<i>Anterior and posterior cubital recurrent.</i>
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2d. Two are directed on the faces of the inter-osseous ligament,

The inter-osseous.	} <i>Anterior inter-osseous.</i> <i>Posterior inter-osseous.</i>

The posterior inter-osseous furnishes a branch which is reflected towards the olecranon,

Olecranian recurrent.	<i>Posterior radial recurrent.</i>
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3d. One is distributed to the back of the hand,

Cubito super-palmar.	<i>Cubital dorsal.</i>
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4th. One proceeds in the palm of the hand to the first three fingers, and forms in a great measure the superficial palmar arch,

The cubito-palmar.	<i>The palmar.</i>
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THE AORTA GIVES IN THE THORAX:

1st. A branch, which is distributed to the posterior part of the pericardium,

Posterior pericardian.

2d. Two arteries, which proceed to the bronchiæ and are ramified with them in the lungs,

The bronchic.	<i>Bronchial.</i>
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3d. Some rami, which are distributed to the œsophagus,

The œsophagian.	<i>The same.</i>
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4th. Some small arteries, which expand on the posterior part of the mediastinum,

Posterior mediastine.	<i>The same.</i>
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5th. From

5th. From nine to twelve branches, which divide between the heads of the ribs into two rami, one of which is distributed to the muscles of the back and the other to the inter-costal muscles,

NEW NAMES.	OLD NAMES.
The inter-costal.	Inferior or aortic intercostals.

THE AORTA FURNISHES IN THE ABDOMEN,

I. Two branches, which are distributed to the two sides of the abdominal surface of the diaphragm, and give some rami to the suprarenal capsules and to the liver,

Sub-diaphragmatic.	Inferior diaphragmatic.
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II. A large trunk situated beneath the stomach,

THE OPISTRO-GASTRIC.	Celiac.
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Which divides into three branches:

1st. One is distributed to the stomach,

The gastric.	Stomachic coronary.
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It furnishes sometimes

The left lobar of the liver.	Left gastro-hepatic.
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2d. The other proceeds to the liver,

The hepatic.

It gives rami,

To the pylorus,

The gastro-pyloric.	Pyloric.
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To the pancreas and the duodenum,

The pancreatico-duodenal.

To the stomach and the epiploon,

Right gastro-epiploic.	The same.
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To the gall bladder,

The cystic.

3d. The last proceeds to the spleen,

The splenic.	The same.
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And gives branches

To the pancreas,

The spleno-pancreatic.

To the stomach,

The spleno-gastric.	Short vessels.
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To the left side of the great epiploon,

NEW NAMES.

OLD NAMES.

Left gastro-epiploic.

III. A large branch, which is distributed to the mesentery of the small intestines, to these intestines and to the cæcum,

The superior mesenteric. *The same.*

It gives rami

To the pancreas,

The pancreatic.

To the duodenum,

The duodenal.

To the meso-colon,

The meso-colic.

To the right colon,

The right colic.

To the cæcum, the ilium, and the colon,

The ilio-colic.

To the cæcum,

The cæcal.

IV. A branch, which arises near the bifurcation of the aorta, and is distributed to the mesentery and the large intestines,

The inferior mesenteric. *The same.*

It furnishes,

The left great colic. $\left\{ \begin{array}{l} \text{Superior left colic.} \\ \text{Middle left colic.} \end{array} \right.$

The small left colic. $\left\{ \begin{array}{l} \text{Inferior left colic.} \end{array} \right.$

Artery of the rectum. $\left\{ \begin{array}{l} \text{Inferior left colic.} \end{array} \right.$

V. Two branches, which are distributed to the super-renal capsules and to the cellular tissue of the kidney,

The super-renal. *Middle capsular.*

VI. Two large branches, which proceed to the kidneys,

The renal. *The same.*

They furnish super-renal, adipose, and ureteric rami.

VII. Two small arteries, which proceed to the testicles or to the ovarium,

The testicular. *The spermatic.*

Artery of the ovarium.

VIII. Four or five arteries, which are distributed to the muscles of the loins and to the parietes of the abdomen,

NEW NAMES.	OLD NAMES.
The lumbar.	<i>The same.</i>

IX. An *odd* branch, which arises between the two divisions of the aorta and descends on the sacrum,

The middle sacral.

THE AORTA AT ITS TERMINATION DIVIDES INTO TWO TRUNKS:

THE PELVI-CRURAL. *The primitive iliac.*

The pelvi-crural artery, which arises at the height of the fourth lumbar vetebra, descends outwardly, and after a short passage divides into two branches; one of which is distributed in the pelvis,

THE PELVIAN. *Interior or hypogastric iliac.*

The other issues from the pelvis through the crural arch, and descends along the thigh,

THE CRURAL. *The same.*

A. The PELVIAN divides into eight principal branches or arterial bundles:

1st. A branch is distributed in the muscules of the iliac fossa,

The iliaco-muscular. *Ilio-lumbar.*

2d. Several proceed on the sides of the sacrum,

The lateral sacral. *The same.*

3d. One issues from the pelvis through the sub-pubian hole, and is distributed to the three adductors,

The sub-pubio-femoral. *Obturatorix.*

4th. Another, considerable in the fœtus and almost obliterated in adults, is distributed to the bladder, to the uterus, and to the vulvo-uterine conduit,

The umbilical. *The same.*

5th. One proceeds to the bladder, to the prostate gland, to the rectum, to the uterus, and to the vaginal conduit,

The vesico-prostatic. *Uterine and vaginal vesical.*

6th. Branch

6th. Branches which proceed to the muscles of the nates,

NEW NAMES.

OLD NAMES.

The fessieres. Posterior iliac.

7th. A branch passes under the sacro-femorian muscle, accompanies the sciatic nerve, and loses itself in the muscles of the posterior part of the thigh,

The ischiatic.

8th. The last is distributed to the organs of generation,

The sub-pelvic. The interior pudical.

The latter furnishes,

The perinaal. Transverse of the perinaeum.

The ischio-penian. Dorsal of the yard.

The ischio-clitorian. Artery of the clitoris.

B. The CRURAL divides into three portions: the iliac, inguinal, and femoral.

I. The ILIAC PORTION furnishes two branches, one of which is reflected on the sides of the abdomen, and loses itself in the muscles,

The super-pubic. Epigastric.

The other follows the direction of the ridge of the ilium, and loses itself in the muscles of the abdomen,

Circumflex of the ilium. Anterior iliac.

II. The INGUINAL PORTION furnishes branches, which are ramified to the glands of the groin and to the neighbouring cellular tissue,

The inguinal. Tegumentous of the abdomen.

And some branches, which proceed to the scrotum or to the vulva,

The scrotal. } Exterior pudical.
The vulvar. }

III. The FEMORAL PORTION gives:

1st. A large branch, which is distributed profoundly in the muscles of the thigh,

Inter-muscular or profound. Profound artery.

The

The latter furnishes from its upper part two branches, one of which proceeds inwards and turns round on the articulation of the femur,

NEW NAMES.	OLD NAMES.
Sub-trochantinian.	<i>Interior circumflex.</i>

The other loses itself on the exterior side of the articulation,

Sub-trochantinian.	<i>Exterior circumflex.</i>
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2d. Branches along the thigh,

The muscular.

3d. Four branches, two on each side, and one above the other, which are distributed to the articulation of the knee,

Popliteal articular.	<i>Superior and inferior articular.</i>
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The femoral, when it reaches the ham, divides itself into two branches :

The anterior and posterior tibial.

a. The ANTERIOR TIBIAL divides itself into four branches :

1st. One small one is reflected towards the knee,

Recurrent of the knee.

2d. Two proceed towards the sides of the articulation of the foot,

The malleolar.

3d. A branch is directed on the tarsus, and distributes itself to the muscles and bones of that part,

The super-tarsian.	<i>Artery of the tarsus.</i>
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4th. The last forms a curvature on the convexity of the foot,

The super-metatarsian.	<i>Artery of the metatarsus.</i>
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b. The POSTERIOR TIBIAL gives first two branches:

1st. One descends behind the perone, and is distributed to the muscles of the posterior part of the leg,

The peroneal.	<i>The peroneal.</i>
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2d. The other, which is very small, penetrates into the medullary canal of the tibia through its nourishing foramen,

Medullary of the tibia.	<i>Nourishing of the tibia.</i>
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At the lower part of the leg the posterior tibial divides itself into two branches:

1st. One follows the interior edge of the foot and terminates on the great toe,

NEW NAMES.	OLD NAMES.
Interior plantar.	. <i>The same.</i>

The other penetrates below the sole of the foot and forms the plantar arch, from which rami proceed to the muscles of the sole of the foot and to the toes,

Exterior plantar.	. . . <i>The same.</i>
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END OF THE FIRST VOLUME.