perature of the year being the same in the sixth degree of N. lat. and the thirty-first is remarkable, as showing the great extent to which climate may be modified by locality.

ROBERT EVEREST.

XLI.—*Report of the Results of Researches in Physiological Botany made in the year* 1839. By F. J. MEYEN, M.D., Professor of Botany in the University of Berlin*.

Observations on the presence of certain assimilated and secreted substances in Plants, continued from p. 257.

M. HUNEFELD† has with great diligence attempted to prove the presence of amylum in the flowers of plants; he found it in the flowers of *Calendula officinalis,* in which plant it has been already proved to exist by other chemists. M. Hünefeld then mentions thirty other plants in whose flowers he discovered amylum with more or less distinctness; whether however, he adds, the amylum of flowers always becomes blue by iodine, he must still leave undetermined; in the flowers of *Calendula* it becomes blue, but in the others the colour was more of a dark green. It appeared probable to M. Hünefeld, that it was the yellow colour of the flowers only which caused this green tint; but he has left this important point undetermined, although it were easy to settle by a good microscope. He contradicts himself in his statements, for globules in the flowers which are not coloured blue by iodine cannot be considered as amylum. Amylum, even that from mosses, is always coloured blue; and even when it becomes brown by iodine, it is modified amylum. M. Hünefeld mentions *Tropæolum majus* as one of the few plants which contain amylum in the stem; this however is a tolerably common phænomenon. Decoctions of the flowers of *Calendula, Tropæolum, Helianthus,* &c. exhibited no trace of amylum, which is easily explained by the microscopical examination of the parts thus treated; the amylum swells within the cells, but does not pass through their walls.

M. P. Savi‡ of Pisa has published some observations on the physical phænomenon seen in the leaves of *Schinus Molle*

* Translated by Henry Croft, Esq., teacher of Chemistry in London.

† Erdmann's and Marchand's Journal für praktische Chemie, 1839, 1er band, p. 87—90.

‡ Memorie Valdarnesi per cura del Dott. Corinaldi. Pisa, 1839, p. 42—48.

when cast on water, in order to prove the falsity of DeCandolle's ('Phys. Veget.' i. p. 38.) view of this subject. M. Savi says, when small pieces of the green organs of *Schinus,* or of any other of the *Terebinthaceæ,* are thrown upon water, they are seen to move quickly, and as it were backwards, for a determinate time on a short space, and in a direction constantly opposite to their fractured surface; and at the same time is observed near this fractured surface an intermittent expansion of a fluid which extends over the surface of the water in fine circular iridescent rings, and drives away all small bodies floating on its surface.

M. DeCandolle supposed that the intermittent emission of the volatile oil out of the leaves of that plant might be produced merely by some contraction of the cells containing the sap, but M. Savi correctly states that the peculiar sap emitted [It is a liquid resin.—*Mey.*] is, in the case of *Schinus,* contained, not in cells, but in vessels. By *vessels* M. Savi understands the resin-passages, which I have found to be very similar, both in their structure and course, in *Schinus* and other *Terebinthaceæ,* to the resin-passages of the *Coniferæ.* They are long canals which run lengthways, both in the bark of the leaf-stalk and of the stem, and also in the leaflets, and now and then give off branches; in the bark particularly they are of so large a size, that the efflux of the still liquid resin is quite natural.

If, says M. Savi, we examine a fine section of the bark of *Schinus,* the peculiar vessels are seen therein as fine indefinitely long tubes with complete thick and very transparent walls [*i. e.* a whole layer of cells.—*Mey.*], in which (if by the section they have not already emptied the sap which they previously secreted and contained) the sap is seen in the form of different-sized globular drops, but closely packed together, which flow slowly out at the sides where the vessel has been torn and where the evacuation takes place. From this one may conclude: 1. That if the phænomenon were an effect of the contractility of the tissue, the action could not be ascribed to the walls of the cells, because the exuded sap is contained in vessels [Harzgangen, *Mey.*]. 2. That the reaction against the force with which the liquid streams out of the leaves is not the cause of their rapid and intermittent motion, for the exudation takes places very slowly and regularly. 3. That the fibres of the bark of *Schinus* consist of proper vessels; a fact which may serve as a confirmation of Mirbel's hypothesis, viz. that the bast of plants consists of proper vessels and parenchym. [I cannot ratify the above statement of M. Savi.—*Mey.*] 4. That the sap of these vessels in *Schi-*

nus is mixed with water [to which I also cannot agree.—*Mey.*], and thereby the drops are prevented from coalescing into one single mass. From this fact one might also conclude that the juices which separate within these vessels are of two different kinds, or that the sap, by its action on the plant, is changed partially into one more liquid and transparent, which has exactly the appearance of lymph. 5. Lastly, that the walls of the vessels press, by their elasticity, on the sap which they contain and drive it towards the opening, just in the same manner as a bladder or a gut which is filled very full with water, lets it escape as soon as a puncture is made in its side. M. Savi proceeds to say, that the second phænomenon abovementioned is easily observed when a small quantity of the resinous sap of *Schinus* is poured on the surface of water; we see directly that the sap expands with great celerity into a thin plate or layer; if small pieces of the dried leaves of any plant be then thrown on this thin oily plate, they are seen to be driven about as by strong impulses, and to move backwards from the spot on which they were thrown. This property of expanding itself is common not only to the liquid resin of *Schinus*, but also to all the *Terebinthaceæ*, *Euphorbiaceæ*, *Urticeæ*, *Asclepiadeæ*, and also, according to Carradori, to the fatty and volatile oils. The latter ascribes this property to the attractive force which is exerted upon the above fluids by water, by which each drop of the liquid on the surface is forced to extend itself as far as the cohesive power of the fluid will allow. M. Savi speaks at length on this point; but the existing facts are quite sufficient to prove that this motion of the *Schinus* leaves on water is not to be explained by a contractility of the tissue. Finally, I must remark, that the phænomenon with the green parts of *Schinus* does not always show itself, but only when the plant is in luxuriant growth.

A paper by Prof. Lindley* was read before the Linnean Society on the anatomy of the roots of the *Ophrydeæ*, in which he shows, that salep which is prepared from the roots of certain *Ophrydeæ* does not consist chiefly of amylum, as is generally supposed by authors of the present day (?), but that it is composed of a substance like bassorin. After Dr. Lindley has mentioned the opinions of the most recent authors, he gives the results of his own microscopical investigations; from which it appears that the tubes of the *Ophrydeæ* universally contain long cartilaginous nodules of a mucilaginous substance which is not coloured by iodine, and also some amylum globules

* Phil. Mag., vol. xiv. p. 462.

which are contained in the parenchym surrounding the nodules. The tubers of several South American *Ophrydeæ* when dried have the appearance of a bag filled with pebbles, or as if the epidermis had contracted over the hard interior body. A transverse section of a fresh root of *Satyrium pallidum* explains the above appearance : the hard nodules, as transparent as water, are mingled together with the soft parenchym, and they are twenty times as large as the neighbouring cells. These nodules are easily separable, and appear as hard as horn; on section they appear perfectly homogeneous; cold water has scarcely any effect upon them, but in hot water they become tumid, and are partly changed into a transparent jelly. An aqueous solution of iodine has no visible effect on them in their natural state. On charring some slices of salep, Dr. Lindley found that these apparently homogeneous nodules consisted of very minute cells, filled with a substance of the same refractive power as themselves. Finally, Dr. Lindley declares, that the error of considering salep to consist chiefly of starch, arose from the mode of preparation. The tubers of the *Orchideæ* are first parboiled and then dried; by this means the starch which surrounds the nodules is dissolved, and on drying is precipitated upon their surface, and hence they become blue when treated with iodine. Dr. Lindley's statements with regard to the structure of these roots are so very peculiar, that I felt it necessary to examine the subject myself. The examination of two kinds of salep-roots, as also comparative observations of a fresh tuber of *Orchis militaris*, soon showed, that in the structure of the Orchideous roots there is nothing differing from the general rule. Those hard horny nodules are nothing more than hardened masses of tragacanth gum which fill the individual cells, which in this case are often of a large size ; Berzelius had already referred the salep mucilage to tragacanth gum, and in different *Orchideæ* this substance appears to differ only according to its several degrees of hardness. In the cells of the roots of *Orchideæ* is universally observed the presence of a cellular nucleus, and round this is formed a thick mucilaginous mass, as also a greater or smaller number of minute, nearly round globules, which are generally coloured yellowish brown by iodine, but sometimes bluish. The mass of this thick mucilage, as also that of the globules, continually increases within the cells, and in those tubers which can be advantageously used for the preparation of salep, the contents of the single, often very large, cells assume a gelatinous consistency, and on drying become as hard as horn, and may then easily be mistaken for nodules. I have now before me some sections of dried salep-roots which contain within this hardened mucilage a large quantity of starch, for the whole substance is coloured violet by iodine, and indeed throughout the whole mass, which does not accord with Lindley's observations. All the cells are filled with balls of tragacanth gum; some of them are ten or fifteen times larger than the neighbouring ones, but there are no cells which contain solely amylum grains; but out of a great number of sections, single large gum nodules may be found, in which the globules, similar to those of starch, may be easily distinguished lying round the old nucleus in the interior of the nodule.

Very remarkable is the fact, that most of the walls of these large cells containing gum appear as if composed of smaller cells, by which these membranes often assume a very beautiful appearance; on closer examination I found that this apparent net of cells consisted of superficial deposits, similar to the cell-like formations on the surface of pollen grains. Even in very young tubers traces of these formations may be seen on the *inner* surface of the membranes of those large parenchym cells which are rich in gum.

M. E. Meyer* read a paper to the Physico-Œconomic Society of Königsberg on the 18th of September, 1839, on amylum, in which he explains fully the appearance and structure of the amylum grains according to former observations, and mentions their use; he, however, incorrectly states that it is not yet clearly determined whether the layers of the globules are deposited from without, for the genesis of the globules with which we are acquainted shows this quite clearly. M. Meyer communicates an interesting fact, viz. that in the summer of 1838, on account of the excessive moisture in that part of the country, that rare malformation, the production of tubers on the parts of the potatoe plant which are in the air, was very abundant; this malformation extended itself over whole fields, and M. Meyer saw some specimens which were covered to the top with tuberculous swollen sprouts, and were partly covered with real tubers. The statement, that potatoes possess the largest grains of starch yet known, is probably only a slip of the pen; but it is a curious statement, that the pith of plants never contains amylum, as also that the stems of Palms and *Cycadeæ* never have pith, whence it would result that sago could not be prepared from their pith.

M. Fr. Tornabene Casinese† has written a treatise on the

* Frorieps Neue Notizen, Nos. 253, 254, Nov. 1839.

† Sull' humore crystallino nelle foglie seminali delle piante. Memoria sopra alcuni fatti di anatomia e fisiologia vegetale. Catania, 1838. 4to, p. 3—28.

"crystalline moisture" or fluid in the cotyledons. He says he has observed, that at certain hours in the day, as also about midday, a transparent fluid of a silvery lustre is found on the surface of the cotyledons, which he calls the "crystalline moisture." The drops of this fluid are so small that they are only to be seen by the microscope, sometimes, however, by the naked eye. These shining points are not to be confounded with those described by Saussure, nor with the glands of other authors, &c., but this crystalline moisture is a liquid which is found on all cotyledons, as on the species of *Mesembryanthemum,* and particularly on *M. crystallinum.*

The spiral tubes are destined, according to M. Casinese, to allow the descent of a fluid, which, by means of the enlivening action of light, is drawn by the leaves through the stomata. The spiral tubes are therefore organs of respiration; and from the meeting of the saps of these descending and other ascending vessels which takes place in the leaves, a chemical process ensues, *i. e.* the oxygenized part or oxygen becomes free, and makes its appearance on the transparent silvery epidermis, and this is the "crystalline moisture"!! M. Casinese says a great deal concerning this moisture, as also about the functions of the different elementary organs of vegetables; however, it is evident that he has commenced his study of vegetable anatomy by the help of some old, and, at the same time, very bad books; among the writings of later authors, those of Turpin seem to have interested him most, and he therefore calls him "The Immortal."

M. Fr. Göbel* has given a very valuable chemical examination of the principal *Halophytes* of the Caspian steppe with regard to the quantity of potash and soda they contain: the research was undertaken, partly in order to learn whether the quantities of potash and soda vary with the age of the plants, and partly to settle the question whether plants are capable of converting the one alkali into the other. The principal results are as follows:—

The young plants give a much larger quantity of impure soda than the old fully developed ones, but the *substances soluble* in water contained in the rough soda do not differ much from one another in quantity.

In the case of *Halimocnemis crassifolia* it appears that during growth a part of the chloride of sodium is converted into carbonate and sulphate of soda, as is seen by analysis. The young plants of *Salsola clavifolia* contain no chloride of

* Reise in die Steppen des südlichen Russlands, von Göbel, Claus und Bergmann. Dorpat, 1838. 4to. Zweiter Theil, p. 108—138.

sodium, but considerable quantities of chloride of potassium; while in the old plants there is less chloride of potassium, but a nearly equivalent quantity of chloride of sodium. The quantity of carbonate of soda is nearly equal in both young and old plants. The young plants of *Salsola brachiata* also contain less chloride of sodium than the old ones, while the quantity of carbonate of soda remains the same.

M. Göbel thinks it is perfectly immaterial whether young or old plants are used for procuring soda, for the quantity of carbonate of soda is the same in both cases. The plants might therefore be burnt at any time, and the value of the impure soda would not materially differ. The analyses of *Halimocnemis crassifolia*, *Salsola clavifolia* and *brachiata*, both in their young and old state, show "that the quantity of soda has remained nearly constant in all." The quantity of potash is always greater in the young plants than in the old ones, and strikingly so in *Salsola clavifolia*; so that one might really be led to believe, "that in the course of the vegetative process potash is metamorphosed into soda, or, at least, is got rid of in some manner or other." If this were correct, it would certainly be a wonderful discovery, but I may be allowed to propose a question which is not answered in M. Göbel's treatise: Were the old specimens of the three above-mentioned plants (which M. Göbel did not collect himself) from exactly the same spot as that from which, in the same manner, M. Göbel gathered the young ones? Probably this was not the case, and as all these salts are extracted from the soil, a difference therein will of course make a change in the results of the analyses. We must therefore consider this metamorphosis of one substance into the other as yet unproved. M. Göbel also states, that in other plants the quantity of potash is larger in the young than in the old ones. With respect to the relative value of the Halophytes for the fabrication of soda, M. Göbel gives the following list:—1. *Salsola clavifolia*, young dried individuals, 42 per cent.; 2. *Halimocnemum caspium*, young specimens, 22·9 per cent.; 3. *Salsola Kali*, young specimens, 25 per cent.; 4. *Kochia sedoides*, old specimens, 9·16 per cent.; 5. *Salsola brachiata*, young specimens, 33 per cent.; 6. *Halimocnemis crassifolia*, young specimens, 30 per cent.; 7. *Tamarix laxa*, young specimens, 33·6 per cent.; *Anabasis aphylla*, young specimens, 19 per cent., &c.

On the movement of Saps in Plants.

The so often advertised prize-essay of M. C. H. Schultz *

* Extr. des Mém. de l'Acad. des Sciences, tom. vii. des savants étrangers. 1839.

has at length appeared; it is written without any regard to the literature which already exists on this subject, so that probably many persons who are not so perfectly acquainted with the literature of vegetable physiology may be deceived by the supposed novelty of the numerous observations here brought forward.

The work would certainly have been very valuable if it had been printed directly; but now, at a time when the more delicate anatomy has made such great advances, and since the genesis of almost all the elementary organs of plants is tolerably well known, we look in vain in this treatise for all those true improvements of our science; but, on the other hand, the number of the actually incorrect observations (which may easily be shown) is so very large, that I might fill whole pages with an enumeration of them. M. Schultz has purposely separated all the vessels which are figured from the plants by maceration, and of course there must thus arise a great number of mistakes in the figures; indeed several of them must be considered as ideal sketches, not as representations of nature.

The purpose of this treatise is—to prove the existence of a peculiar vascular system in plants in which the circulation of a peculiar sap, viz. the lacteous sap (Milchsaft) or latex, takes place: M. Schultz denominates this circulation "Cyclosis," but every one who is acquainted with the subject will probably find this new name quite unnecessary.

On the existence of this circulation of the latex it is well known there has been much discussion, and my readers will remember that the subject has often been mentioned in the former Reports*; there are however, unfortunately, but few botanists who regarded the observations on this subject with an impartial eye, and I believe that M. Schultz and myself are the only ones who have always endeavoured to prove its existence. In different notices I have circumstantially described how the experiment is to be made with a good microscope, in order to discern the circulation in uninjured plants; but some elder botanists, who saw clearly that Schultz's view was not correct, *would not* see this movement; indeed the opposition to the new theory went so far, that when one wished to show it them they made off, and for several days were not visible.

M. Schultz has in this treatise done all in his power to prove that the latex moves in a peculiar system of vessels, like the blood of animals in the capillary vessels, and he has given a quantity of figures from different plants to illustrate their mode of anastomosing. Notwithstanding all this, one may read, in the Regensburg Botanical Journal of 1839, p. 277,

* See Mr. W. Francis's translation, London, 1839, p. 33.

that this subject was talked over at the meeting at Freiburg, and that several botanists, as M. Treviranus, Von Martius, &c. declared that they had seen this motion of the latex only in *injured* plants. M. de St. Hilaire, who was present, was asked whether the members of the French Academy had convinced themselves of the correctness of M. Schultz's statements, and he replied, that "For the present they had only translated the paper, but had as yet formed no judgement thereupon."

Rather contradictory to the above are several of the statements made by M. Schultz in a late paper on the results of his work, in which, among others, he very modestly says, "We will satisfy ourselves with having made the beginning, and with having pointed out the principles of a determinate direction of the science, the further development of which the judgement of the French Academy will promote not less than the publication of the memoir."

There are two things which it appears to me, from my own observations, M. Schultz has represented very incorrectly, viz. the three hypothetical stages of development of the vessels of the latex, the contracted (vasa laticis contracta), the expanded (vasa laticis expansa), and the articulated (vasa laticis articulata); and moreover the bringing together of the most different formations under the common name of the latex-vessels, or "vessels of the vital sap."

The contracted latex-vessels are said to form the youngest state of the vessels, and in them there is the greatest vital activity; they possess (it is said) the power of expanding and contracting themselves, and indeed to such an extent, that they almost disappear [!]. In the expanded latex-vessels the expansion predominates, but they still possess a contractile power. At a later period, by means of the interrupted contracted parts of the latex-vessels, they become articulated, and the contracted and expanded parts have now become permanent.

From my own observations, I must declare the whole description of the different stages of development of the latex-vessels to be entirely false: the latex-vessels can neither contract nor expand; and that the articulation is not caused by contraction, may be seen by a simple observation of such cells as lie one above the other and are filled with latex. Indeed the whole description is so strange, that I did not know for several years what M. Schultz meant by his contracted latex-vessels, until he published the remarkable treatise mentioned in the former Report, p. 74. Herein it was seen that M. Schultz had denominated "contracted latex-vessels" those fine currents of gum which are so often seen in the cells of plants, both in the Fungi and the Phanerogams, and which are to be classed together with the rotating currents of the *Charæ, Vallisneriæ*, &c. This treatise, under the title of 'Nouvelles observations sur la circulation dans les plantes,' is printed as an appendix to the above prize-paper; and, in the 'Botanical Register' for 1839, p. 48, there is an extract from this important work of M. Schultz, under the title of 'Circulation of the blood in plants.' The author of this extract is anonymous, probably because he very well knew that in this subject he was not capable of forming any judgement; the title alone shows evidently that he knows nothing at all about the matter.

The second point in this prize-paper to which I cannot agree, is the bringing together of the most different formations under the one name of latex-vessels. M. Schultz believes that he has discovered that the bark as well as the wood contains a peculiar vascular system, which forms the central point of every development. In the ligneous fascicles of the monocotyledons, M. Schultz considers the soft long cells which are filled with a mucilaginous fluid, and which Mohl calls *vasa propria*, as latex-vessels; though it is so very easy, even in succulent plants of this kind, to observe the true latex-vessels near the ligneous bundles, and which have no similarity to those in the interior of the bundles. M. Schultz even considered the small cells of the ferns which are filled with starch as latex-vessels; they surround the fascicle of spiral tubes, and are deposited on the inner surface of the bast-tubes, &c. M. Schultz has by no means correctly understood the peculiarity of the latex-vessels of the *Euphorbiaceæ*, which, as I have long since shown, possess the structure of the bast-tubes of the *Apocyneæ* and *Asclepiadeæ*, and also occupy the place of the bast-tubes (which are wanting in the *Euphorbiaceæ*), and still contain latex, while the bast-tubes of the *Apocyneæ*, which do not ramify, contain but very little latex; but here there is a true vascular system a little on the outside of the bast-tubes, whose stems exhibit anastomoses, and contain only a little opake latex.

[To be continued.]

XLII.—*Additional Particulars respecting* Antechinus Stuartii, *a new Marsupial Quadruped.* By W. S. MacLeay, Esq., F.L.S., &c.

To Richard Taylor, Esq.

Dear Sir,

Since I wrote you* concerning what I had reason at that time to think might possibly prove to be a new quadruped

* See our preceding Number, p. 241.