other theories have been advanced, as for instance by Grönemann, *Astr. Nachr.*, 1874-75, and the reason of this is, I believe, that hitherto no direct proof had been obtained demonstrating its true nature.

But the experiments at Luosmavaara in 1871, *and at Oratunturi and Pietarintunturi in* 1882, *clearly and undeniably prove that the aurora borealis is an electric phenomenon.*

The science of the physical conditions of the globe has hitherto, particularly as regards the electric and magnetic ones, simply advanced by observing the effects of these great forces of nature, without however any successful attempt having ever been made to influence or call them forth either directly or indirectly. My experiments now, however, prove that *aurora borealis may be produced in nature* by a simple contrivance assisting the electric current flowing from the atmosphere to the earth. And although the efforts of man must always be limited in comparison with the grand products of nature, the conclusions which may be drawn from the same are not the less instructive.

In a question wherein the theoretical deductions, supported only by a few indirect proofs, have but slowly advanced, *absolute certainty* has now been obtained, and this result should induce future students of the aurora borealis not to devote attention to the "light" phenomenon itself, but to the investigation of those wonderful forces of nature the existence of which it so "lucidly" demonstrates. We have, of course, much to learn from the light also, but far more, I believe, from the electric forces which create it.

It is, however, far from my intention to insist that the apparatus invented by me is the best or that the method followed may not be improved on; still it has certainly one advantage, viz. that of being effective. It is, of course, evident that the drawbacks under which the experiments suffered—as, for instance, weak wires and defective insulators—must be remedied, and it appears to me that the theory which is the basis of M. Mascart's insulator would be particularly suited to the apparatus. The galvanometer should also be altered so as to consist of a *great* number of well insulated coils, in order better to regulate the deflexions, and the experiments should be made in a warm room. As the electrometrical method hitherto used gives only the electric tension at a certain point, it would, it appears to me, form a good meter for measuring the electric state of the surrounding atmosphere. The galvanometer deflexions depend certainly on the electric potential, as well as on the variable conducting power of the air; but it can, as will be seen from my experiments, be measured and even divided by using a constant galvanic element. The electric condition thus measured will give us *an idea* of the strength of the electric current, which in a certain place descends to the earth, and of the electric changes which take place in the atmosphere.

From the experiments with the terrestrial current described above it seems very probable that the current is closely related to the electricity in the auroral belt. The terrestrial current is, as is generally known, related to the magnetic variations, which is most conclusively shown by Mr. Airy's curves (*Phil. Trans.*, vol. cxxxviii. p. 465). In Sodankylä disturbances of the terrestrial current were always followed by a magnetic one. The exact result has of course not yet been calculated, but a glance at the figures returned is sufficient to show this. Mr. Airy's researches have caused these questions: (1) Are the variations in the terrestrial currents more numerous than the corresponding magnetic ones? (2) Do the terrestrial variations occur about half an hour from the corresponding magnetic disturbances?

We have from the experience gained attempted to explain these peculiarities, viz. by the hypo hesis that the earth forms, so to say, the core in a flexible bobbin, represented by the terrestrial current circulating around her. In the first place, many of the changes to which the terrestrial current is subject could not affect the magnetic moment of the core, *i.e.* the earth; and, in the second place, the current acts directly on the instruments whereby the magnetic variations are measured; and in these circumstances we must find the explanation of the first-named peculiarity. With regard to the very remarkable difference in time of about *half an hour*, this is the exact time elapsing before the variations of the terrestrial current can affect the magnetic moment of the earth. It is, by the bye, only necessary to compare the duration of induction currents produced in bobbins with different iron cores, to observe that *half an hour* might well pass before the current became perceptible, *if the earth constituted the core.* In Polar regions the electric current descending from the atmosphere to the earth may also contribute to the variations which are measured by our instruments.

In accordance with this theory, therefore, the *electricity* which descends into the auroral belt is the *primary* cause of the greatest part of the terrestrial current, and, through this, of the many variations of the magnetic elements. There are also others, as the diurnal changes in the temperature on the earth's surface, but *the chief* cause is, in my opinion, the electric current from the atmosphere.

In my belief, therefore, the possibility of explaining the peculiarities of this phenomenon lies in a thorough and complete knowledge of the current from the atmosphere.

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(To be continued.)

THE FLORA OF ANCIENT EGYPT[1]

THE discovery made by Emil Brugsch Bey on July 6, 1881, in the vault of a king of the twentieth dynasty is of the greatest importance to botany in consequence of the large number of species of plants contained in the offerings and funeral repasts and in the wreaths which adorned the illustrious dead. Among them are several which were not known to belong to ancient Egypt. I have begun the study of the remains of these plants taken from the breasts of the most celebrated kings of Egypt and of such inestimable value to science. Deputed by Mr. Maspero to arrange these relics for the Egyptological Museum of Boulak, I have classified them according to the high personages for whom they were intended. On the eight cardboards which I have the honour to send you in the name of Mr. Maspero, you have a part of the funeral wreaths belonging to Ramses II., Amenhotep I., and Aahmes I.

The wreaths of Ramses II. were renewed towards the end of the twentieth dynasty (1100 or 1200 B.C.), or at the time of the twenty-first dynasty (1000 B.C.). The king of that period, according to records inscribed on the coffins and translated by Mr. Maspero, caused a new coffin to be made for the great Ramses, the one in which he had first been placed having been accidentally destroyed. In this new coffin were several yards of wreaths, which Mr. Maspero handed to me. I have examined them all and ascertained their composition.

The wreaths of Ramses II. are formed of the leaves of *Mimusops Schimperi*, Hochst., either folded or torn in

[1] "Memoir on the Discovery at Deir-el-Bahari in Relation to the Ancient Flora of Egypt," by G. Schweinfurth. [This article, written in French, was communicated to Sir Joseph D. Hooker by Dr. Schweinfurth, together with a set of the wreaths, flowers, &c., described therein. These objects were exhibited at the annual *soirée* of the Royal Society on the 25th ult., and are now on view in No. 3 Museum, Royal Gardens, Kew. With regard to the orthography of the names of the Egyptian kings, that employed by some of the leading Egyptologists of this country has been adopted in this translation. Thus Amenhotep has been substituted for what looks like Amenhotpan in Dr. Schweinfurth's manuscript.—W. B. HEMSLEY.]

See "La Trouvaille de Deir-el-Bahari." 20 photogr. par M. E Brugsch. Texte par G. Maspero. (Le Caire: chez F. Maurès et Cie. 1881.)

two and stitched together, and serving as clasps for the sepals and petals of *Nymphæa cærulea*, Savi, and *Nymphæa Lotus*, Hook., the whole strung on strips of the leaves of the date palm. Besides the wreaths, there were in the coffin at the side of the body, and fastened between the bands encircling the mummy, whole flowers of *Nymphæa cærulea* on stalks eighteen or twenty inches long. The water-lilies thus scattered separately on the mummy were all of the blue-flowered species. An examination of these entire flowers and the sepals and petals in the wreaths, whether of the white or of the blue-flowered species, leaves no doubt whatever respecting their identity with the living plants so common in ditches at the present day, especially in Lower Egypt, where they blossom from July to November.

The *Nymphæa cærulea*, Savi, which figures on all the ancient monuments of Egypt and among the offerings painted on the walls of the temples is often recognisable from the blue colour of its petals. In the temple of Ramses II. at Abydos the colour is remarkably well preserved, and besides there is always a leaf associated with each cluster of flowers, clearly demonstrating by its entire (not toothed) margin that the species represented is *N. cærulea* and not *N. Lotus*. The latter, whose sepals and petals occur abundantly in the wreaths taken from the coffins of Ramses II. and Amenhotep I., has not been found by me on the ancient monuments, though Unger records an instance at Beni Hassan where the white flower could be recognised. With regard to the question to which of the species the old name Lotus properly belongs, I have been able to ascertain the following facts. No design on the ancient monuments is referable to *Nelumbium*; neither the fruits nor the leaves, so easily characterised, are recognisable. Further, no remains of *Nelumbium* have been found either in the coffins or among the offerings and funeral repasts deposited in the vaults of the Pharaohs. The Lotus was not referred to *Nelumbium* until a very much later epoch. This plant has not been found among the wild plants of any part of Africa. It is eminently Asiatic, and was perhaps not introduced into Egypt before the Persian invasion. At the time of Ramadus it was probably cultivated every-

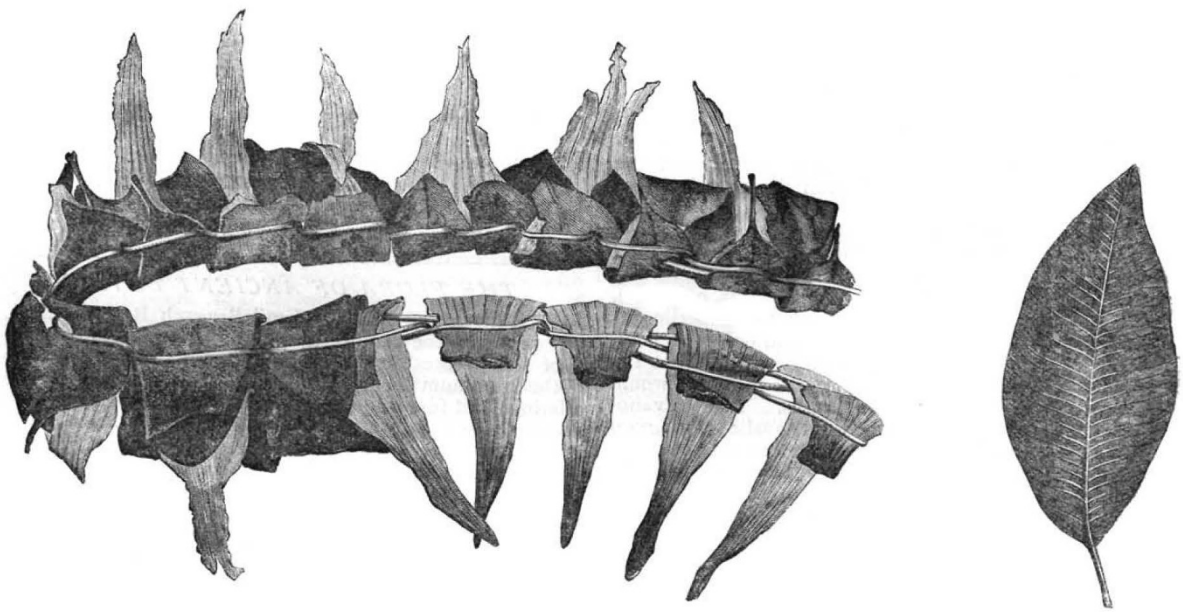

FIG. 1.—Portion of a Funeral Wreath from the tomb of Ramses II. (1000 to 1200 B.C.), composed of the folded leaves of *Mimusops Schimperi* and the petals of *Nymphæa cærulea*, Savi, stitched together with strips of the leaves of the Date Palm. A separate leaf of *Mimusops Schimperi*.

where in Egypt, for we often find it in the mosaics, sculptures, &c., of that period, associated with papyrus and animals characteristic of the Nile, and easily recognised by its fruit.

The most ancient writer who treats of the Egyptian Lotus in such a way as to leave no doubt that he meant the *Nelumbium*, and not a species of *Nymphæa*, is Herodotus (lib. ii. cap. 92); after him Theophrastus ("Hist. Plant." lib. iv.), and then Strabo, while Pliny (lib. xiii.) clearly alludes to a *Nymphæa* in a comparison of the fruit with the capsule of a poppy.

The *Mimusops* was evidently a sacred tree to the ancient Egyptians. The fruits, or the stones of the fruits, which had been eaten, are often found in the funeral repasts in the vaults; and the leaves not only occur in the wreaths of the ancient empire but likewise in those of later times, even down to the Græco-Roman epoch, as specimens in the Leyden Museum testify.

The fruit of *Mimusops* found in Egyptian tombs[1] exactly resembles—except that the stones are a little thicker—that of *M. Kummel*, Bruce, a species spread throughout Abyssinia and the region of the Upper Nile; yet no species of the genus is found wild in Egypt. The leaves forming the wreaths in question should belong to the same species as the fruits found in the tombs. Nevertheless, in comparing them with numerous specimens of *Mimusops Kummel*, I did not meet with the perfect identity one would have expected from the resemblance of the fruits. In Central Africa, and especially in Abyssinia, an allied species, *M. Schimperi*, exists, the leaves of which are much more like those of the wreaths. A longer, and especially a slenderer, weaker petiole, and a more acute, less abruptly acuminate blade characterise these leaves. With regard to the fruit of *M. Schimperi*, I have not had an opportunity of studying it. Moreover the two species under consideration are not sufficiently established as distinct species. But an anatomical character came to my aid. Dr. Westermaier of Berlin has ascertained that the leaves of *Mimusops Schimperi* and of *M. Elengi*, L., have a double layer of epidermal cells, a character they possess in common with the leaves from the ancient tombs; whereas in the leaves of *M. Kummel* there is only a single epidermal layer of cells.

[1] The ancient fruits, however, have usually a thicker stone, the three angles of which appear to be more prominent than in that of *M. Kummel*, Bruce.

Should this distinctive character be constant in the two African species, there is a double reason for naming the ancient *Mimusops M. Schimperi*. The fruit of *M. Elengi* is very distinct from that found in the tombs. I think it very likely that this species, of which we so often find the fruits and leaves in the tombs of the ancient Egyptians, may be the *Persea* of the old authors, which modern botanists have erroneously referred to *Balanites* and *Diospyros mespiliformis*.[1] The latter has not hitherto been found in the ancient tombs; neither does it occur depicted on the monuments. Diodorus (i. p. 34) has transmitted to us a valuable tradition concerning the *Persea*. He states that it was introduced into Egypt with the first colonists coming from Ethiopia, which clearly implies that the ancient authors regarded it as having been introduced from the regions of the Upper Nile and not as belonging to the indigenous flora. *Balanites*, however, grows wild in the valleys of the Eastern Thebaid and on the borders of the Red Sea, and in Nubia this shrub is of general dispersion. True its fruit has been found in the funeral repasts in the tombs, yet that of the *Mimusops* has been found much more frequently, and, in support of my hypothesis, the thick leaves of the *Balanites* are always wanting in the wreaths.

According to Theophrastus, the *Persea* had a black wood, and he compares the flowers with those of the apple-tree. I do not know the wood of the *Mimusops* sufficiently, but with regard to the flowers it must be admitted that no ancient authors ever made a more unmistakable comparison, while the flowers of the *Balanites* have nothing in common with those of the apple. Pliny (lib. xiii. p. 9) does not speak of the *Persea*, but of the *Persica*, and the only surprising thing in it is that he treats it as indigenous in Egypt. He mentions, too, the peculiarity of the Egyptian variety of the peach-tree, which consists in its persistent foliage. Even now in the middle of winter we see the peach-trees in blossom while still carrying their leaves. The same author (lib. xv. p. 13) expressly points out the difference between the *Persica* and the *Persea*. On Egyptian monuments we often see a tree diagrammatically represented, though the distichous, elliptical, acute leaves are evident. This tree, sacred to Hathor or Isis, and often drawn with these divinities, probably represent the *Mimusops* in question. The fruit of *Mimusops Kummel*, of Central Africa, resembles in appearance as well as in taste that of the wild rose; and it may be that under cultivation a still more palatable fruit could be obtained. Indeed, the fruit of specimens of this species collected in Abyssinia appears to be much more pulpy.

All the wreaths of the find at Deir-el-Bahari are of one and the same pattern. The leaves are folded lengthwise in the middle,[1] then folded again in the contrary direction over a string or strip about $\frac{1}{6}$ in. wide, of a leaf of the date-palm. In the fold of each leaf, single flowers, or parts of flowers (sepals and petals), are inserted in

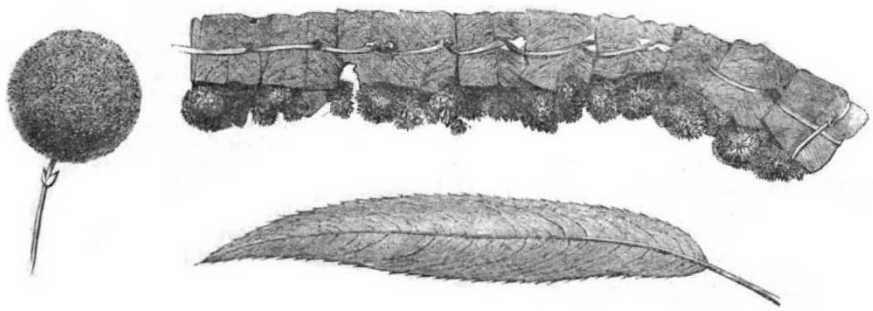

FIG. 2.—Portion of a Funeral Wreath from the tomb of Amenhotep I. (1300 to 1700 B.C.), composed of the folded leaves of *Salix safsaf* and the flower-heads of *Acacia Nilotica* strung together with strips of the leaves of the Date Palm. A separate leaf of the *Salix* (the teeth represented too sharp) and a flower-head of the *Acacia*.

such a manner that they are fixed in the leaf as in a pair of pincers. Then with a finer strip of the date-leaf than the central one, they are stitched through and securely fastened together in long rows side by side, and all pointing in the same direction. These wreaths are arranged in semicircles on the breast of the mummy, so that their disposition is like one sees in the necklaces of the present day. Their thinness rendered them suitable for using in large numbers, and sometimes they occur in several layers one above the other, filling up the limited space between the mummy and the lid of the coffin.

It is probable that it is to this kind of wreath that Pliny alludes (lib. xxi. p. 2) as the "so-called Egyptian wreaths," of which Plutarch and Athenius praised the beauty. Unfortunately these wreaths, which, with ordinary care, might have been removed entire from the mummy when the coffin was first opened, were broken and reduced to powder in several places. The specimens I send you attached to cardboard are the most perfect that I could procure after those selected for the Museum of Boulak. On placing them in boiling or cold water, according to the species, the leaves, &c., recover their original flexibility, especially in *Nymphæa cærulea*; and with proper precaution one succeeds in spreading them out and drying them again effectually. The fragility of these objects is only due to the extreme state of dryness they have reached during the thirty to thirty-five centuries they have lain in the tombs. It is at the same time the principal factor in their wonderful preservation.

The wreaths of the other kings of this vault I have at present only partially examined. From their general appearance, however, as well as from the flowers and leaves of which they are composed, which also indicate a different season[2] of the year, one would be justified in attributing them to a different period from that during which the wreaths of Ramses II. were renewed. If they really date from the time when the bodies of the kings of the eighteenth dynasty were first deposited in the vault, we have here to do with specimens four or five centuries older than the wreaths of Ramses II. In any case these objects are at least contemporaneous with the time commonly assigned to the Trojan war, if not several centuries more ancient.

The wreaths of Amenhotep I. (who was found during

[1] Kunth took the stones of *Mimusops* found by Passalacqua to be this plant.

[It may be mentioned that Kunth published his determinations of the relics found by Passalacqua in the *Annales des Sciences Naturelles*, viii. (1826) p. 418. Unfortunately it is not known to what period they belonged. Among them were seeds of a palm, *Areca* (?) *Passalacquæ*, Kunth, which was subsequently identified by Unger with *Hyphæne Argun*, Mart., a palm which inhabits some of the valleys of the Nubian desert in the bend of the Nile between Korosko and Abou Hammed.—W. B. H.]

[1] Or when they were too large they were torn in two.

[2] The records to which I have alluded indicate the day and the month; and these flowers will one day serve to fix the season with which the month of that epoch coincides. The Carthamus could only be had from the end of March to the middle of May; the Water-lilies from July to November; while the young leaves of Salix indicate the spring. The Acacia and Sesbania flower at all seasons.

the twentieth dynasty still intact in his coffin, and who, according to Brugsch, preceded Ramses II. by three centuries) are more varied. Among them are some composed, like those of Ramses II., of the leaves of *Mimusops* and the sepals and petals of the two species of *Nymphæa;* while others are formed of the leaves of *Salix safsaf*, Forsk., which serve as clasps for the little balls of flowers of *Acacia Nilotica*, Del., portions of the heads of flowers of *Carthamus tinctorius*, L., or the separate petals of *Alcea ficifolia*, Cav.

Nobody could recognise either the *Salix* or the *Alcea* among the hundred Egyptian species of plants enumerated by Pliny, or in the writings of other ancient authors; whereas the *Acacia* and the *Carthamus* occur under the names of *Acanthos* and *Cnicus*. Concerning the former, Pliny (lib. xiii. p. 19) mentions the employment of its wood in boat-building, the use of its gum, of its pods in tanning; he speaks of the spines, even, which are found on the leaves; in short he indicates the distinctive feature of the species, adding that the flowers are effective in wreaths. Several of the old authors treat of this tree. With regard to the *Cnicus* or *Knekos* (Pliny, xxi. p. 53) it is only recognisable by the indication that it is spiny, that its large white seeds yield an oil, and that there are in Egypt both wild and cultivated species, which is true. The flowers of *Carthamus* found in the wreaths of Amenhotep I. have retained their red colour, and resemble those of the species cultivated everywhere in Egypt at the present day. The colour, as in recent herbarium specimens, has changed from cadmium red to a brownish red or orange. In water the colouring matter is rapidly excreted, and we behold these flowers of some thirty to thirty-five centuries ago intensely colouring the liquid in the phial containing them.[1] All four of the plants which I have just mentioned have now for the first time been actually found in an ancient Egyptian tomb. The leaves of *Salix safsaf*, which form the greater part of the wreaths of Amenhotep I. and Aahmes I., do not differ in the least from those of the present day, and the species is common in Egypt. They are young—that is to say small and pale—thus indicating an early season of the year. In this respect they are in contradiction with the blue and white petals of *Nymphæa* found in the same coffin, though not, it should be stated, in the same wreaths as the *Salix*, but in the wreaths with leaves of *Mimusops*. The latter very closely resemble those found on the mummy of Ramses II. Perhaps at the time of the removal of the kings of the eighteenth and nineteenth dynasties from one vault to another, and finally to the place of concealment at Deir-el-Bahari, when a new coffin was made for Ramses II.—perhaps, I say, they renewed a part of the wreaths of the other kings, or having ascertained the condition of the mummies (whether under the twentieth or under the twenty-first dynasty), they added some new wreaths to the original ones. This would explain the presence in the same coffin of flowers belonging to different seasons of the year.

Salix safsaf, which occurs in a wild state on the banks of the Nile in Nubia, is in Egypt proper only a riverine fugitive, like many other plants, whose real home is in the south. Away from the river it only exists on sufferance, chiefly near wells and canals. To my mind it is an example of the wild flora which agriculture has caused to disappear. *Alcea ficifolia*, Cav., is now found in Egypt only in the ancient Arabian gardens of Cairo and other towns—that is to say, in gardens dating before the introduction of European horticulture by Barillet in 1869, where it grows almost wild as a weed. I have found it in a wild state in Syria and the Lebanon. Boissier, in his "Flora Orientalis," has not clearly defined it, and gives one or two other forms (*A. lavateræfolia*) as distinct species, which they are not. The petals of the *Alcea* contained in the wreaths of Amenhotep I. leave no doubt that they belong to the species named. Their shape, the distribution of the veins, and especially the hairy callosity on the inner surface of the claw, as well as the size even, confirm the identity of the species. Moreover one perceives in the petals of the ancient wreaths traces of a purplish tint corresponding to the crimson of the living plant. The ancients probably esteemed this plant alike for its beauty and its medicinal properties.

I have examined a head of flowers of *Acacia Nilotica* coming from one of the wreaths, and I found that the flowers agreed in the minutest details with fresh ones, with the characters of which I am sufficiently familiar. The proportions of the peduncle, the position of the annular bract, the shape of the bracteoles, the calyx, the petals, and stamens of each flower do not exhibit the slightest differences. This tree, which is planted or tolerated by man all over Egypt, is nowhere completely wild except on the White Nile between 11° and 12° N. lat., where it constitutes large riverine forests.

The wreaths which were found in the coffin of Aahmes I., the great founder of the eighteenth dynasty (1700 B.C., according to Brugsch), are the most varied, and astonish the eyes with the bright colours they have retained. They are partly composed of leaves of the Egyptian willow (*Salix safsaf*), containing separate flowers of *Delphinium orientale*, Gay, of *Sesbania Ægyptiaca*, Pers., petals of *Alcea ficifolia*, or flower-heads of *Acacia Nilotica;* and partly of the leaves of *Mimusops*, serving as clasps for the petals of the two species of *Nymphæa*, like the wreaths of Ramses II. and Amenhotep I. The *Delphinium* and the *Sesbania* had not hitherto been authenticated from ancient Egypt. The colours of their flowers are admirably preserved, the deep violet of the former being especially striking, but the specimens I have communicated to you in a phial of alcohol have lost their colour, just as fresh flowers of our time would. *Delphinium orientale* is now spread over a very wide area of the Mediterranean region. The two nearest localities to Egypt where it has been found are Algeria and Northern Syria, near Raldoun. It is not impossible that it still occurs in some parts of Egypt, while it is equally possible that it was cultivated by the ancient Egyptians as an ornamental plant. In the event of our being able to prove that some of the wreaths of Aahmes I. and Amenhotep I. were removed at the time of the twentieth dynasty, together with those of Ramses II., we should be justified in the assumption that this plant and *Alcea ficifolia* were introduced through the conquest of Syria. A minute analysis of the flowers, and comparison with those from various localities, leaves no doubt that they are of the species mentioned; and if I had had access to a larger number of flowers of the plant of the present period, I am certain that I should have been able to have exactly matched the ancient ones. The differences that I was able to detect between the ancient flowers and recent ones from Algeria, the Caucasus, Phrygia, and Lycia, kindly supplied by Mr. E. Boissier, may be set forth in a few words. In the first place there are two narrow linear bracteoles exceeding the peduncle in length, and reflexed; then the ovary is less pubescent, and the sepals are narrower and less acute. With regard to the bract, the thickened peduncle, the shape, number, and disposition of the stamens, the stigma, and especially the single petals, I have seen recent flowers in which these organs are absolutely identical. It will be seen that the characters in which they differ are only of individual value. Further, the species in question, commonly cultivated at the present time, comprises a considerable range of forms. Thus there are varieties in which the single petal is merely three-lobed, whilst in others the intermediate lobe is again divided. Both conditions occur in the ancient flowers. These flowers are so well

[1] Unger ("Botanische Streifzüge," p. 113) mentions that a chemist named Thomson had proved that the red dye in the mummy bandages was derived from *Carthamus*.

preserved that under the influence of boiling water the spur of the posterior sepal is easily separated from that of the petal projecting into it. That is to say, the latter may be extracted without injury. The numerous details of the petal, its intricate venation, the coloured glands on the margins, the claw with two lateral folds—all correspond to recent specimens. The colour of the ancient flowers is rather a deep bluish violet than a reddish violet, as in the plant of our time.

I have also carefully analysed the flowers of *Sesbania Ægyptiaca*, from the wreaths of Aahmes I. They belong to the typical form of the shrub, which still springs up on the borders of cultivated fields and on roadsides in Egypt, though it is not really spontaneous below the Soudan. The flowers are so perfectly preserved that the minutest detail did not escape my scrutiny. Submitted to the action of boiling water they scarcely differed from flowers taken from my herbarium. One circumstance shows how hurriedly these funeral wreaths were made. The flower torn from its pedicel and pinched with the finger nails always retains only a part of the calyx cut through the middle.

In the find at Deir-el-Bahari other objects besides the wreaths were found for the first time. Thus in the coffin of the priest Nibsoni, of the twentieth dynasty, the leaves of *Citrullus vulgaris* were scattered between the body of the mummy and the sides of the coffin; and flowers of *Nymphæa cærulea* were found fixed beneath the outer bandages of the same mummy. The Egyptian Museum of Berlin already possessed seeds of this *Citrullus* in the collection of Passalacqua, though the epoch to which the collection belongs is unknown. *Citrullus vulgaris* is found wild in the greater part of Central Africa,[1] and its fruit is smaller than that of the cultivated race, and less palatable, though otherwise like it. Among the broken remains in question I found one whole leaf, which enabled me to fully study its specific characters. Placed in cold water it recovered its original flexibility, so that it could be spread out flat and dried again. The chlorophyll was perfectly preserved, and what was curious, it was absorbed by the water to such a degree, that the glass of water in which the leaf and portions of leaves were placed became of an intense green colour. The problem to solve was whether the leaves were those of the water-melon or those of the colocynth, a species spread over the whole desert region, and only differing from the former, which has long hairs on the young fruit, by the complete nudity and spongy nature of its bitter fruit with a hard rind, and by the seeds. The leaves of the water-melon often very closely resemble those of the colocynth, especially in the variety called *Gjurma* (*Gyurma*) in Egypt, which bears fruit no larger than that of the colocynth, though it is always sweet. Nevertheless the large leaves of elongated outline and having less numerous lobes, are rare in the colocynth, and only in places well watered by rains. There is an association of characters in the leaves from the mummy of Nibsoni, that enable one to refer them to varieties of the cultivated water-melon, rather than to the wild colocynth. I have compared them with a long series of specimens of the water-melon from all parts of the Nilotic region, and with a no less numerous series of specimens of the colocynth; and I have come to the conclusion that they may be regarded as belonging to the former species. The uses of the two species would render them equally admissible in a coffin of ancient Egypt. As a funeral offering an alimentary plant might serve as well as a medicinal one. Still the fact that there are seeds of the water-melon in the Berlin Museum from an ancient tomb supports my first supposition. The leaves found on Nibsoni are about a palm long, and of a pinnatisect form, with obtuse lobes. If these leaves were distinctly hairy there would be no doubt of their belonging to the water-melon. Yet, as already mentioned, there is a variety widely spread in Egypt which has not the long and numerous hairs attached to the tubercles with which the leaves are covered, but merely short bristles, which is also the case in the colocynth.

This variety of water melon, which I have named *colocynthoides*, is the *Gyurma* of the Egyptians, and is cultivated in dry neglected ground in Upper Egypt. It is probably the primitive condition of the species before it had reached its present state of perfection. The leaves of the *Gyurma* are sometimes hairy, as in the water-melon, sometimes only provided with short deciduous bristles, as in the colocynth. The leaves from the coffin of Nibsoni exhibit only the latter condition. It may be that they have lost a great part of these deciduous hairs during the long period that has elapsed. I found one character, however, that the *Gyurma* has in common with those in question. There are on the petiole, and especially on the under surface of the leaf in the middle, among the round tubercles with which it is beset, other tubercles or callosities of an elongated linear form and arranged in rows corresponding to the secondary veins. On these leaves, as well as on those of the *Gyurma*, these elongated tubercles are much more prominent than they are in the colocynth. Moreover the numerous specimens that I have compared of the last have all of them leaves more densely furnished with the round tubercles than is the case with those of the water-melon, of the *Gyurma*, and the ancient leaves.

The secret vault of Deir-el-Bahari, besides the coffins of so many illustrious kings, also contained numerous funeral offerings deposited there by the later kings of the twenty-first dynasty who used this collective tomb, so well concealed by the topographical conditions. Among these offerings I was able to recognise dates, raisins, and pomegranates. There was also a basket filled with a lichen (*Parmelia furfuracea*, Ach.) which at the present day is sold in the bazaar of drugs in every town of Egypt. It is now called "Chèba" (Sheba), and is used to leaven and flavour the Arabian bread. Medicinally, also, it is in great request. The presence of a lichen of solely Greek origin, mixed with the species named, and which also occurs in the modern drug, excludes all doubt as to its being a commercial product. *Ramalina Græca*, Muell., Arg., which was mixed with the *Parmelia*, has only been found in the islands of the Greek Archipelago, and the Arab merchants regard that country as the source of their drug. As there is no locality in Egypt where *Parmelia furfuracea* could grow, the only explanation of its presence in the offerings of the twenty-first dynasty (1000 B.C.) is that it was derived from Abyssinia or Greece. In the latter case the find at Deir-el-Bahari would prove the existence of commercial intercourse with Greece at about the time of the Trojan war. Among the *Parmelia* (which was perhaps the *Sphagnos* of Pliny) were fragments of *Usnea plicata*,[1] Hoffmg, and the straw of a grass (*Gymnanthelis lonigera*, Anders.) of Nubia, which at the present day is used by the natives as a remedy against affections of the chest and stomach. On searching through the copious remains of this plant I succeeded in finding a few well-preserved flower-spikes, which I carefully examined and determined beyond doubt to belong to the species mentioned. In Arabic it is called "*máhareb*." The odour even of this grass was preserved to a certain extent in the mixture of the offering. The fragrant secretion is of the same nature as that of the allied section *Schœnanthus* of *Andropogon* of India. Besides the lichens and the grass, this offering contained the hairy buds of some *Composita*, probably an *Artemisia*, with pinnatisect leaves; tendrils of some *Cucurbitacea*; seeds of the coriander; and numerous berries and seeds of the eastern Juniper (*Juniperus Phœnecia*). Inasmuch as we have here to do with plants coming from opposite regions of Africa and from Europe or Asia, it was

[1] I have gathered it in that state in the islands of the White Nile.

[1] Dr. J. Mueller of Geneva undertook the naming of the lichens.

not an easy matter to pronounce an opinion on the *Cucurbitacea* and the *Composita* mentioned. The coriander is a plant of early cultivation in Egypt, being mentioned by Pliny as one of the best products of the country. The berries and seeds of the juniper (the latter free in consequence of the decomposition of the former) could only have been derived from Syria or the Greek Islands. I carefully compared them with the allied species, including the Abyssinian *Juniperus excelsa* (which has larger berries and much thicker seeds, to the number of six), and there can be no doubt that they belong to *J. Phœnicea*, L. Kunth had previously determined this species in the collection of Passalacqua.

Among the fragments of the offerings and repasts found scattered on the floor of the vault of Deir-el-Bahari when it was first inspected by Brugsch Bey (some of the objects had already been disturbed by Arab robbers) was a tuber of *Cyperus esculentus*, L., some specimens of which from ancient Egypt are also preserved in the Berlin Museum. It is common in a wild state, and generally cultivated in the country.

In bringing this enumeration to a close I have only to mention the finding of a bundle of the grass called *Halfa* by the Egyptians (not the *Halfa* of Tripoli and Algeria), *Septochloa bipinnata*, Hochst., syn. *Eragrostis cynosuroides*, Retz. This bundle probably formed part of an offering representing the productions of the black and fertile soil of the valley of the Nile, of which this grass was a good sample.

ON THE CHEMICAL CHARACTERS OF THE VENOM OF SERPENTS

DRS. WEIR MITCHELL and E. T. Reichart, of Philadelphia, are now engaged in an inquiry into the chemical composition and characters of snake poison, which promises to yield important results and to supply information long wanted on an aspect of the subject which has made little progress since Prince Louis Lucien Bonaparte published his discovery of an active principle in viper venom, which he considered to be the sole cause of its toxic properties, and to which he gave the name of Echidnine or Viperine. He described the mode of separation of this principle in a paper read before the "Unione degli Scienziate Italiani" at Lucca in the year 1843.

The investigations of Drs. W. Mitchell and Reichart relate chiefly to crotaline snake poison, but include a partial analysis of some dried cobra (colubrine) poison sent to them by Mr. V. Richards from India.

Difference in the mode of action of the colubrine and viperine virus was pointed out by me many years ago in India, when I observed that viperine poison destroys the coagulability of the blood in animals, causes hæmorrhage, and has peculiar effects on the nervous system differing from the cobra's (colubrine) venom, which does not destroy the coagulability of the blood, nor cause so much hæmorrhage.

Dr. Wall of the Bengal Medical Service has added much to our information on the subject, and has defined the different modes of action of the venom of the principal Indian poisonous snakes.

The Philadelphia observers came to the conclusion that the venom of the crotaline snakes with which they have chiefly operated can be subjected to the action of the boiling temperature of water without completely losing its poisonous power. The toxicity of the venom, however, of the *Crotalus adamanteus* seems to be destroyed by a temperature below 176° F. Mitchell some years ago showed that the venom of *Crotalus durissus* is not destroyed by boiling, and they remark on the curious fact that the venom of *C. adamanteus* should thus differ from the venom of other snakes.

The symptoms caused by the venom of the different snakes with which they have operated do not, they say, differ radically save in degree, but there are certain symptoms which they think make it probable that further investigation will enable them to point out certain differences by which it will be possible to discriminate one form of poisoning from the other. This is in accordance with what has already been done by observers in India, and notably by Dr. Wall.

The investigations of Drs. Weir Mitchell and Reichart so far, lead them to conclude that the poison of the cobra is the most active, next the copperhead, then the moccasin, and lastly the rattlesnake; but their researches on this head are not yet complete.

They are unable to confirm the statement of Gautier of Paris that an alkaloid resembling a ptomaine exists in cobra poison; or that of Prof. Wolcott Gibbs, that the poison of crotalus yields an alkaloid; but they have satisfied themselves that the venom contains three distinct proteid bodies, two of which are soluble in distilled water, one which is not soluble. These bodies have certain properties and reactions, which are detailed in their monograph on the subject.

Hitherto observers have regarded the venom of different snakes as each representing a single poison, but it appears from these researches that, of the three proteids before mentioned, one is analogous to peptone and is a putrefacient poison, another is allied to globulin, and is a most fatal poison, probably attacking the respiratory centres and destroying the power of the blood to clot, while the third resembles albumen, and is probably innocuous. The separation of the two poisons necessitates a long and elaborate series of researches, the results of which will be subsequently reported.

They have also ascertained that the poison of the Rattlesnake (*Crotalus adamanteus*), Copperhead (*Trigonocephalus contortrix*), and Moccasin (*Toxicophis piscivorus*), are destroyed by bromine, iodine, hydrobromic acid (33 per cent.), sodium hydrate, and potassium permanganate. It is to be hoped that these important and valuable researches will be continued until the true chemical nature of these poisons be completely made known.

J. FAYRER

NOTES

AT a meeting of the subscribers to the Balfour Memorial Fund, held at Cambridge on the 26th inst., it was stated that 8309*l.* had been promised, all except 100*l.* of which had been paid. Of this 8078*l.* had been invested, yielding an annual income of 284*l.* 10*s.*, which it was hoped further subscriptions would raise to 300*l.* Among the regulations agreed to were the following:—The income of the fund shall be applied (1) to endow a Studentship the holder of which shall devote himself to original research in biology, especially animal morphology; (2) to further by occasional grants of money, original research in the same subject. The Student shall not necessarily be a member of the University, and during his tenure of the Studentship shall devote himself to original biological inquiry, and shall not systematically follow any business or profession or engage in any educational or other work which in the opinion of those charged with the administration of the fund would interfere with his original inquiries. The place and nature of the studies of the Student shall be subject to the approval of the managers provided that the Student shall be bound to pursue his studies within the University during at least three terms during his tenure of the Studentship, unless the managers shall, with the approval of the Board, dispense with this requirement for special reasons. The managers shall take such steps as they may think necessary to satisfy themselves as to the diligence and progress of the Student, and may require from him any reports or other information on the subject of his studies which they may think desirable. The Studentship