THE

TECHNOLOGIST.

A MONTHLY RECORD OF

Science Applied to Art and Manufacture.

EDITED BY

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THE TECHNOLOGIST.

THE YELLOW DYE STUFFS OF CHINA AND INDIA.

BY M. C. COOKE.

Attention having been called to the dyes of China and India, by several inquiries, from individuals engaged in the art of dyeing silken fabrics, it has been deemed advisable to submit a few observations, with a view, not only to the diffusion of the present information, but to solicit additions thereto, so as to render our knowledge more complete. Some of the dye stuffs, to which allusion will be made, are already known to British commerce, whilst others might readily be obtained, if found, upon experiment, to meet the requirements of the home dyer. Those which are enumerated are, doubtless, but a portion of such as are in common use; but around this enumeration, as a nucleus, can be grouped any further information which may from time to time be collected. The subject itself is not unworthy of the consideration of our dyers at home, or of travellers abroad, who possess facilities for obtaining further details. Accident brought into notice the *green dye* of China; and inquiry may develope other, and equally important facts.

Kiang-Hoang.—This dye stuff is the root or rhizome of *Curcuma longa*, L., known to commerce under the name of *Turmeric*. It affords the yellow dye most in use in China; it is the cheapest, but is also affirmed to be the least durable. Turmeric is very common in the provinces of Fokien, Houang-toung, Kouang-si, Sse-tchouen, &c. In Canton the fresh roots cost about five dollars per picul ($133\frac{1}{3}$ lbs.). The Chinese turmeric is of excellent quality, and realises a good price in the English market. In dyeing with this substance it is first reduced to powder, on which boiling water is poured. It is then stirred, and allowed to stand awhile, and the liquor is afterwards poured off. A small glass of citron-juice is added for every catty (or one pound five ounces) of turmeric powder, and about five pounds of powder is required to dye two pounds and a half of silk. Some dyers prefer the use of vinegar to citron-juice, whilst others use no acid at all. *Hoang-ten* is sometimes used, in combination with the *Kiang-hoang*, to render the colour more permanent.

HOANG-TEN is the root or stem of a plant which is said to resemble the Indian reed. As sold to the dyers, it consists of small twisted vine-like pieces of from a third to half an inch in diameter, of a bitter taste, and with a thin, shrivelled, reddish-brown bark. Inwardly it is of a fine yellow colour.

Don J. de Azaola, of Manilla, thought that this substance might be the root of a shrub, known to botanists as *Menispermum Cocculus*, L. But M. Rondot is more inclined to believe it the stems of *Fibraurea tinctoria*, Lour. The description of that plant by Loureiro accords very well with the substance used in China. He also states that the stems of that plant yield by boiling a yellow colour, which, though not very brilliant, is fast. In the *Account of China* this plant is also referred to as yielding a yellow dye stuff. Loureiro affirms that the Chinese name of this substance is *tien-sien-tan*, whilst that of the Cochin Chinese is *cay-vang-dang*. The Chinese characters, which are rendered *Hoang-ten*, are pronounced in Cochin Chinese *vang-dang*. Hence, there is every probability that the *Hoang-ten* of the Chinese is the produce of *Fibraurea tinctoria*.

For dyeing, this substance is either used by itself, or in combination with turmeric powder, for the purpose of fixing the colour of the latter. The *Hoang-ten* is left to macerate in cold water for three or four days. The cloth is then dipped, without the use of any mordant. Hitherto, we are not aware that this substance has been introduced into Europe.

HOANG-PE-PI is the bark of a tree, called *hoang-pé-mou* (*Pterocarpus flavus*, Lour.), a kind of yellow Sanders-wood, or an allied tree, which is found in the province of Sse-tchouen. This bark is in use by the Canton dyers, costs about twopence per pound. It is left to macerate in water for three or four days, is used cold, without any mordant, and it produces a colour of a reddish yellow. This dye stuff is also alluded to by Loureiro and Father Collas. The next substance is sometimes used as a substitute, but is less esteemed.

SIAO-PE is a kind of Barberry bark, the produce of *Berberis Thunbergii*, which is used in Canton for dyeing yellow, and probably resembles the Barberry bark of our own country in its tinctorial properties. It is not greatly esteemed in China.

TI-HOANG is another yellow dye stuff, which is obtained from the root of a plant, named by Dr. Hoffman *Rhamnesia sinensis*.* The leaves are large, rough, and thick; the flowers are striped in red and violet; the seeds are grey, and are contained in a capsule; "the root is as yellow as that of a carrot." This plant grows almost everywhere in China, and its use for dyeing purposes is nearly universal. We cannot at present

* With a genus of this name we confess ourselves unacquainted. It is probably a typographical error.—*Editor.*

affirm whether it is used both for silk and cotton, or principally for the latter. The roots, which are held in greatest esteem, come from the province of Honan.

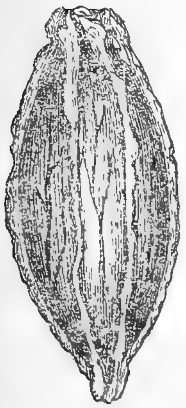
HOAI-HOA.—The flowers of this tree are largely used in China. It is known to botanists as the *Sophora Japonica*, Linn., and was first introduced to the notice of Europeans, as a dye stuff, in 1846. Samples were procured and subjected to examination by Dr. Henon, of Lyons, who was the first to discover that this yellow dye stuff consisted of the undeveloped flower buds of the tree we have named. In 1851 Dr. Th. Martius received this substance from Hamburg, under the name of *Wai-fa*, by whom it was also examined. This tree is said to be abundant both in the north and south of China. It is cultivated between twenty-three and forty degrees north latitude; but chiefly in the province of Fokien, and in the northerly provinces of Honan and Shantung. Father Cibot states, "The flowers are generally employed; it is grown everywhere without care, and yields a very fine yellow. When on the point of blowing, they are gathered, separated from the calyx, and dried in the rays of a hot sun; or, still better, in an iron pan, when they are turned, as if they were to be roasted. They are then moistened with the juice of other flowers, piled in a heap, and strewed with salt. When thoroughly manipulated, they are formed into balls, and set to dry in a northern aspect. Some people, instead of salt, use lime, or content themselves with sprinkling it over their flowers, after reducing it to a fine powder." According to Messrs. Fortune and Hoffmann, the flower furnishes a yellow dye. Dr. Lindley says the seed vessel affords a yellow or orange. Dr. Th. Martius remarks that the mixture of flower-buds and fragments of stems described by him are used to dye a fine yellow the silken stuffs intended for the vestments of the Mandarins.

The mixture alluded to by Dr. Th. Martius consist of dried flower-buds, with about an equal proportion of little stalks and sticks. The buds are mostly very young, one-eighth to one-fourth of an inch long, oval, and pointed at the peduncular extremity; they are of a dark greyish green, and almost devoid of taste, imparting to water a fine yellow colour. In 1853 Professor Stein, of Dresden, experimented on this dye stuff. A dyer, in Canton, thus describes his process of using *hoai-hoa:* "Take boiling water, put in the *hoai-hoa*, and leave it for some time. After a while the colour and the odour are both developed. Pour off; the sediment is of no use. Take this water; add cold water to reduce its temperature; add lime water, and dip the cloth in the bath thus prepared. Let the cloth be well shaken, and then rinsed in pure water. After being rinsed, the cloth will be found dyed a fair yellow. A little alum is required to complete the process. Put the cloth, first of all, in some alum water, for twenty-four hours; then dip, and the process is complete.

The reporters on this dye, to the Agricultural Society of Lyons, state that "the yellow colour is very analogous to that of woad, but it is not so well suited to produce light yellows, as straw coloured, &c., which are poor, and disagreeable to the eye. In orange yellows, as the gold button, this objection becomes an advantage ; and the rich full colour possesses a degree of solidity superior to that obtained from a mixture of woad and annotto. Alkalis redden the tint. Acids bleach. The bichromate of potash instantly reddens the solution, as well as dyed silk, giving them a light mahogany tint."

The Board of Trade submitted this substance for examination to Mr. John Mercer, an account of the result being contained in the first report of the Department of Science and Art. This gentleman states that the pure yellow colouring matter greatly resembles that of the Persian berries.

The *Hoai-hoa* or *Wai-fa* has not yet been imported into Britain for commercial purposes. A specimen, received from Dr. Martius, may be found in the museum of the Pharmaceutical Society, Bloomsbury-square ; and, we doubt not, it would prove advantageous for a small quantity to be obtained from China as an experiment.



HOANG-TCHI (nat. size).

HOANG-TCHI.—This dye stuff consists of the fruits of a species of *Gardenia*—most probably *Gardenia grandiflora*, Lour., and is, with the next article, extensively used as a dye stuff in China. These, or similar fruits of the Gardenia, were shown in the Great Exhibition of 1851, and they have since been imported into Germany and Holland under the name of "wongshy." During the past year a quantity arrived in London under the name of Gardine; but, hitherto, they have not met with a purchaser. The capsules are from one and a half to two inches long, and half an inch broad, oblong ovate, furnished with the dried six-lobed calyx at one end, and tapering to a point at the other. The surface has from six to eight longitudinal ribs. The shell is hard and brittle, with an odour like honey and saffron. The interior appears suffused with a yellow colouring matter. Externally they are of a red-brown colour. They yield to water a yellow colour, to alcohol a fiery reddish yellow, and to ether a brownish yellow colour. The extract dyes wool of a beautiful orange, without mordant. Silk, without mordant, becomes of a fiery yellow like gold. Cotton is best dyed in it with the tin mordant. The colours resist the influence of soap. Professor Stein states that, by previously using lime water as a mordant, and soaking in the boiling liquid, a beautiful yellow colour is obtained. By the addition of potashes the colour may be modified. Acid baths change these colours to Aurora red. This yellow dye is highly valued in China. the brilliancy and fastness of it being greatly extolled at Canton and Ningpo. It is affirmed to be employed at Pekin for the yellow dresses of the Emperor and his family. To grass cloths and cotton, which are to be dyed scarlet, &c., with safflower, it increases the intensity and fastness of the colour. This scarlet, which is tolerably fast when exposed to the air and the sun, is said to equal that of cochineal, and to be obtained without mordant. Bancroft was surprised to find that it resisted the most powerful acid much more effectually than some colours considered more durable. Concentrated sulphuric acid hardly affects it; strong chlorhydric acid changes it to orange, azotic acid to yellow. This colouring matter has recently been the subject of experiment by M. Von Orth and Professor Rochleder.

TCHAN-TSI.—These are also the fruits of a species of Gardenia *(Gardenia florida)*. They are ovoid, and not so large as the preceding. This kind comes chiefly from Ningpo and Shanghae, and is more esteemed than the other, which is plentiful about Canton.

KWA-WI.—A third kind, probably the fruits of *Gardenia radicans*, appears to be in use for a similar purpose in Japan, and perhaps in some parts of the Chinese empire. The fruit of this species is smaller, and nearly round. There is still some uncertainty as to whether the botanical species are correctly assigned to these local names. The colouring matter obtained by Professor Rochleder from the fruits he calls *Crocine*. In its decomposition by muriatic or sulphuric acid, a body is obtained, to which he gives the name of *Crocetine*. This is a true dye stuff. Tissues, mordanted with tin salt, are dyed dingy greenish yellow by it; but when treated with water containing ammonia, acquire a brilliant golden yellow colour, which resists exposure to light and air. More minute particulars of these results may be found translated in the *Pharmaceutical Journal*, Vol. XVII., p. 626.

THE YELLOW DYES OF INDIA.

Those now to be enumerated must not be considered as a complete list of the yellow dye stuffs of India, but only such as are of primary importance, and best known.

CAPILLA-RUNG.—The pubescence covering the capsules of a large tree (*Rottlera tinctoria*), is collected for sale in Mysore, where it is used for dyeing silk of an orange colour. The tree is widely spread over the Madras Presidency, and large supplies might easily be obtained. The colouring matter does not require a mordant, all that is necessary being to mix it with water containing about half its weight of carbonate of soda. "On silk the colour is a rich flame or orange tint of great beauty and extreme stability." The material, as supplied, contains between seventy and eighty per cent. of colouring matter. Professor Anderson, of Glasgow, examined and reported on this dye in 1855.* To dye orange, the following method is adopted at Madras: "Make a mixture of Fuller's earth and Cupla powder (*Capilla rung)*; add a small quantity of alum, and boil the silk (which has been previously bleached and dyed red) for two hours; when cold, squeeze and dry, an orange colour will be produced."

The *Capilla rung* may be obtained in London, it being used medicinally under the name of Kamala, under which name it is fully described by Daniel Hanbury, Esq., in the *Pharmaceutical Journal*, with especial reference to its medicinal properties. * "Kamala, as found in the Indian bazaars,

* "Edinburgh Philosophical Journal," April, 1855.

† Messrs. Brown & Co., Chemists, of Liverpool-street, City, have, we understand, a large quantity of this drug in stock in the docks.—*Editor*.

has the aspect of a brick-red powder, possessing, from its structure, that peculiar mobile character which we notice in Lycopodium and Lupuline. It also agrees with Lycopodium in the difficulty with which it is mixed with water, and in the manner in which it ignites when thrown into the air over the flame of a candle. Examined with a lens, or still better with the compound microscope, it is seen to consist of garnet red, semi-transparent, roundish granules, more or less mixed with minute stellate hairs, and the remains of stalks, leaves, &c. The latter substances are easily removed by careful sifting, the drug thereby acquiring a brighter red colour and more uniform appearance."

Kamala is insoluble in cold water, and nearly so in boiling water. It is soluble in a solution of an alkaline carbonate, and still more so in one of caustic alkali, a deep red solution being in either case produced. Professor Anderson found the chemical composition to be as follows :—

Resinous colouring matters	78·19
Albuminous matters	7·34
Cellulose, &c.	7·14
Water	3·49
Ash	3·84
Volatile oil	trace
Volatile colouring matter	?
	100·00

"Kamala is used throughout India as a dye for silk, its colour being extracted by boiling it in a solution of carbonate of soda. The root of the tree is said to be also used in dyeing." The best Kamala in the Madras market comes from the Jivadi hills, between South Arcot and Salem.

Pupli Chuckay.—The bark of the Pupli root is used in Mysore and elsewhere, as yielding an orange dye. It is treated with alum, Myrabolans, &c. It is produced by a Rhamnaceous plant, (*Ventilago Maderaspatana*), many of which furnish a yellow dye. This dye stuff is in very common use in India, and we think it deserves a trial at home. Hitherto it has never been imported. The roots are collected by the Yanadis, a rude tribe who live in the jungles of the Nellore district, and subsist by collecting honey, wax, drugs, dyes, and other natural products. The Pupli is seldom used alone, but generally as an adjunct, with chay root, to produce a rich chocolate colour, or, if with galls, a black.

Annatto.—This material is also used in India for dyeing orange. The method adopted at Madras is thus described : "Tie a quantity of Annatto seeds in a piece of cloth, soak it in water for twelve hours, squeeze the colouring matter out in a basin of fresh water ; add cocoa-nut water, lime juice, and alum powder ; steep the yarn in the mixture for four hours, and then boil it for half-an-hour ; squeeze, and let it dry, when a deep orange colour will be produced." This material is used extensively by washermen in the Northern Circars for giving the reddish tinge to the *dhotees*, or men's waist cloth, worn by all classes of the population. The orange-coloured garments of Jangams, Fakirs, Byragis, and other religious mendicants, are dyed with this substance.

ALIAKOO, or *Casan alay*.—A small tree, common in the jungles of the Carnatic, *Memecylon tinctorium*, the wood of which is used for firewood, and the leaves brought into the markets in large quantities for dyeing purposes. A cold infusion of the leaves yield a yellow dye. Crimson dye is also said to be obtained from them. Specimens of these leaves may be seen in the museum of the East India House. It was exhibited, under different names, from various parts of India, at the Industrial Exhibitions of Madras. The flowers are also reputed to be used for the same purpose. They are obtained from Nellore, Tanjore, Salem, and Pondicherry. Those obtained from Salem are considered the best. This dye stuff is very cheap, but by itself the colour is evanescent.

KADOOKAI (*Terminalia Chebula*). THANIKAI (*Terminalia Belerica*), (*Terminalia citrina*).—These three kinds of Myrabolans, yield, with alum, a good durable yellow, and with salts of iron a black colour. They are a very common dye stuff in India, and have been so from time immemorial. It is not long since they were introduced into Great Britain for tanning purposes, and now a large quantity are annually imported. The flowers of the first species are used as a dye in Travancore. This is the ordinary myrabolan of commerce. The second kind are generally sold under the name of *Bastard myrabolans*, or *Bedda nuts*. The last we have not met with in commerce. The fruits of other species of Terminalia have been spoken of as being used for dyeing in some parts of India; but our information concerning them is too uncertain for present publication.

TURMERIC.—The powder of the rhizome of this plant (*Curcuma longa*) is used in India for dyeing. At Madras the following processes are said to be adopted: "Mix turmeric powder in water, soak the bleached yarn in this mixture, and dry; soak the yarn again in *Coosumba* (safflower) mixture, and an orange colour will be produced." For yellow: "The turmeric powder is mixed with water, the yarn soaked therein for twenty-four hours; it is squeezed and dried. This operation is repeated for four successive days; then the yarn is soaked again in a solution of turmeric powder, with alum, morning and evening; the yarn is squeezed and dried, when a bright yellow colour is produced." To produce a straw colour: "Soak the yarn in a solution of turmeric powder and water four or five times; squeeze and steep the yarn again in a solution of lime juice and fresh water for about an hour. Squeeze it well, and, when dry, a straw colour will be produced."

Calysaccion longifolium.

SURINGEE.—The flower buds of *Calysaccion longifolium* are collected for dyeing silk. The tree is plentiful in the Parell and Worlee Hills, Bombay, Kennery jungles, on the Ghauts, and throughout the Concans. The male tree is called *Woondy*, the female *Poonag*. Both are also known by the names of *Suringee* and *Gordeoondy*. These flower buds are of a clove brown colour, and not larger than those of the clove, which they somewhat resemble, except that the large fleshy calyx of the latter is replaced by a slender flower-stem or peduncle. Dr. Cleghorn states that "the flowers are yellowish and deciduous, very fragrant, and produced in clusters below the leaves. I have seen the fallen flowers collected and sold in the bazaars, for the sake of their fragrance, under the name of *Soohgee-hoo*." This corresponds with the Malabar name *Surgiha* of Roxburgh, and the *Suriga* of Buchanan. In 1850 a parcel of these flower buds were imported into London under the name of *Nag-kassar*. About twelve months

FLOWER BUDS. (nt.size)

since I met with them on sale at an herbalists on Tower-hill; but the owner found them a dead stock, as he knew nothing either of their properties or uses, and I was the only one who had purchased any for the sake of experiment.

TISSO FLOWERS.—The flowers of *Butea frondosa*, and probably under the same name, those of *Butea superba*, are used as a yellow dye in India. They were, on one occasion, imported into Liverpool, under the name of *Kessaree* flowers, but are not an article of European commerce. With alum they give a yellow dye, which, with the addition of a little soda, turns to orange.

MALAPOO FLOWERS.—Small dried flowers under this name are obtained from Salem. They are the produce of *Cedrela Toona*, and yield a yellow dye, with alum. This dye is only in use locally, but appears to be worthy of further attention.

AVARAI-PU.—The yellow flowers of *Cassia auriculata* are used in some parts of India as a dye stuff. The process adopted has not been described.

HURSINGHAR.—The flowers of *Nyctanthes arbor-tristis* are used in India for dyeing yellow or orange. This plant scents the gardens with its delicious perfume, only during the night. In the morning the ground is covered with its short-lived flowers. These are collected, strung on threads, and worn entwined in the hair of the women.

JACK WOOD.—In the Island of Ceylon the duramen of the wood of the Jack (*Artocarpus integrifolia*) is used to dye the robes of the Buddhist priests yellow.

WONIWOL, *or Bangwellgetta.*—The dried leaves and roots of *Menispermum fenestratum*, Gærtn., are in common use by the Cinghalese for dyeing yellow. They are known locally in India by the name of "tree turmeric," and produce a useful colour. Only on the Western Coast do they appear to be in use for dyeing, except in the Island of Ceylon.

TIAKLOU.—A yellow dye is obtained in the Neilgherries from *Berberis Asiatica.* As long since as 1838, Mr. E. Solly called attention to the Berberry barks of India as sources of a yellow dye stuff. In a paper read before the Asiatic Society, he described the various species of Berberry, which grow in India, mentioning many of their localities, and stated that, from experiments made by him on specimens of Berberry root, received from Ceylon, he was convinced that the Asiatic root would prove an article of considerable value to dyers. He described the colour as being disseminated throughout the whole of the wood, bark, and roots; and suggested that experiments should be made on the relative quantity and colour in each of those parts respectively. Mr. Solly suggested that, as the root does not contain more than seventeen per cent. of useful colour, it might prove more convenient to import the watery extract, instead of the whole root or stem, which plan would diminish the cost of the dye. The extract is well known to the natives of India, and is the *horzis* or *rusot* of their medical writers, and might, doubtless, be easily prepared in large quantities. The bark of *Euonymus tingens* is used in some parts of India in dyeing, on account of the yellow colouring matter which it affords.

UKKULBEER.—The bark and woody portions of the root of *Datisca cannabina* have long been known and used as a yellow dye in Cashmere. A specimen was exhibited from that locality at the Great Exhibition of 1851. It is said to be in great esteem for dyeing silks. Dr. Royle also referred to it in his report on the Paris Exhibition. One of the colours most admired by some artists at that exhibition was a kind of lemon yellow, as seen in some silk scarves from the Punjab. It is more than probable that this colour was produced by *Ukkulbeer*, as Dr. Stenhouse discovered *Datiscine* in its analysis.

Two kinds of leaves are exhibited in the East India House Museum under the names of *Dhon* and *Usburg*, which are used in India for dyeing purposes.

It is our intention to supplement this paper on a future occasion by an enumeration of the chief *blue* and *red* dye stuffs of China and India.

THE TRADE IN QUICKSILVER.

THIS metal, differing from all others, in being semi-fluid, until subjected to an intense degree of cold—39°—when it becomes solid, is extensively employed in the amalgamation of the noble metals; in water-gilding, the making of vermillion; silvering mirrors, the backs of looking-glasses, for barometers, thermometers, and in medicine. Quicksilver is a substance of paramount value to science. Mercury dissolves all the metals except iron, forming amalgams with them. The nitrate of mercury is employed for the *secretage* of rabbit and hare-skins; that is, for communicating to the fur of these and other quadrupeds the faculty of felting which they do not naturally possess.

Quicksilver was formerly imported into this country in sheep-skins, from which the wool had been removed—of several thicknesses. It has sometimes come from China in the joints or internodes of the bamboo, about a foot long, and three inches across, closed with rosin. These ready-made bottles, which held about 20lbs., were covered with linen cloth, cemented on. Of late years it is shipped in wrought-iron bottles. These iron flasks or bottles, which weigh about 25lbs. each, are made in England. They hold about 76lbs. of quicksilver. The quicksilver is dipped up with ladles, and poured into the bottles through an ordinary tin funnel. The opening or neck of the bottle is then stopped with a close fitting screw, put in with a vice, so as to make it as tight as possible.

Owing to the increased consumption of this article in the arts, and to the stoppage, by injunction, of the great New Almaden Mines, at San Jo... about sixty miles from San Francisco, which produced 30,000 iron flasks of 76½lbs. each annually, the price of quicksilver has greatly advanced throughout the world. Abundant supplies were formerly to be had at two shillings the pound, now it is difficult to obtain, and small lots only can be had at nearly double the former price.

There is a large consumption in California, where it is indispensable in separating the gold from the pounded quartz rock. The consumption in that State is estimated at 3,000 flasks per annum, which is about equal to the present production of the Santa Clara Mines, which adjoin the New Almaden Mines, and have been vigorously worked for about three years by a Baltimore company. This mine is increasing in richness, and it is expected will soon be able to double its production. The cinnabar, or ore of mercury, is reduced at the Santa Clara Mine in cast-iron retorts, which, experience has demonstrated to be better adapted to the purpose than the old-fashioned brick furnaces, where a large part of the mercury was lost by absorption and evaporation. Until the New Almaden Mines are re-worked, the supply of quicksilver must be less than the demand, and higher prices will no doubt continue. Some descriptive details of the quicksilver mines of Old and New Almaden will be found in Vol. XIV. of the *Pharmaceutical Journal*, p. 373.

The exports of quicksilver from California have amounted to the following number of flasks :—

1854	20,963	1857	25,400
1855	29,917	1858	24,132
1856	23,024	1859	3,399

The New Almaden Mine was closed by an injunction issued from the United States District Court, at the instance of the Government, in October, 1858; and there is little probability of its being again worked until the question of title is settled. The Guadaloupe Mine, in the immediate neighbourhood of the New Almaden, yielded, in 1858, 1,892 flasks. A new mine was also opened in that year, about 130 miles to the south-east of San Francisco; and it is probable from these two mines enough quicksilver will be extracted to supply the wants of the State.

The following have been the imports and re-exports of quicksilver into the United Kingdom for the last fourteen years :—

	Imports, lbs.	Exports, lbs.
1846	1,841,280	1,597,120
1847	2,542,400	1,518,164
1848	1,568,000	895,650
1849	2,682,592	1,252,608
1850	355,079	1,014,492
1851	27,370	876,631

	Imports, lbs.	Exports, lbs.
1852	2,113,186	783,401
1853	1,868,120	1,107,131
1854	2,535,860	900,270
1855	3,217,217	1,606,321
1856	576,824	1,334,451
1857	475,093	1,407,400
1858	320,723	756,802
1859	3,160,368	2,335,936

Formerly we used to receive large quantities from Spain; thus, in 1853, 1,481,703lbs. came in from Spain, and 2,451,483lbs. in 1854. A good deal of quicksilver is shipped to France, Russia, the East Indies, and Peru.

ON THE MANUFACTURE OF DATE SUGAR IN BENGAL.

BY S. H. ROBINSON, OF CALCUTTA.

Phœnix, the genus to which the Date Palm belongs, comprises nine known species, of which six are indigenous in India, and are distinguished as: 1, *acaulis;* 2, *Ouseleyana;* 3, *pedunculata;* 4, *farinifera;* 5, *sylvestris* or *dactylifera;* 6, *paludosa.* Of these, No. 4 produces sago of an inferior quality; and the leaves of all the species furnish materials for mats or thatch for houses. The sugar yielding variety, *Phœnix sylvestris*, is known as the wild date of Bengal: *Phœnix dactylifera* is the name given to the true Date Palm of Arabia and Africa; but as it appears to be undistinguishable from the Bengal variety, except in size and vigour of growth, there seems little doubt that any apparent difference is due only to superior cultivation and variety of climate or soil; and it being always a cultivated tree in Bengal, the specific name *sylvestris* may have been originally given, owing to its inferiority in size to the African or Arabian tree, with which European botanists were more early familiar.

The Date Palm, when not stunted in its growth by the extraction of its juice for sugar, is a very handsome tree, rising in Bengal from thirty to forty feet in height, with a dense crown of leaves spreading in a hemispherical form from its summit. These leaves are from ten to fifteen feet long, and composed of numerous leaflets or pinnules about eighteen inches long. The trunk is rough, from the adherence of the bases of the falling leaves: this serves to distinguish it at a glance from the smooth-trunked cocoa-nut palm, which in its leaves only it resembles. Like all of the *Phœnix* genus the trees are diœcious, and the fruit hangs in dense bunches from the centre of the crown of the female tree; it flowers about April or May, and the fruit ripens in July or August; the latter is, however, of a very inferior description in Bengal, and is seldom gathered except for its seed, from which the young trees are raised. The fruit, indeed, consists more of seed than of pulp, and altogether is only about one-fourth the size of the Arabian kind brought annually to Calcutta for sale, and, when fresh imported, a rich and favourite fruit there. This inferiority of the Bengal fruit may no doubt be attributed to the entire neglect of its improvement there from time immemorial, and, perhaps, in some measure, to the practice of tapping the trees for their sap, so universally followed in the districts around Calcutta, its principal range of growth.

The Date tree is met with in almost every part of Bengal Proper, but it flourishes most congenially, and is found plentifully only in the alluvial soils which cover its south-eastern portion, excepting only such tracts as suffer entire submersion annually from the overflow of their rivers, as is common in portions of the Dacca, Mymunsing, and Sunderbund districts. The extent of country best suited for its growth, and over which it is found most plentifully as above indicated, may therefore be taken as within an area stretching east and west about 200 miles, and north and south about 100 miles, and comprehending by a rough estimate about 9,000 square miles—within an irregular triangular space.

The practice of extracting its juice, however, for the production of sugar, extends at present over a much smaller area, probably not more than two-thirds of the above described space; and if we consider further, how small a portion of these favourite date districts even are as yet occupied by date tree cultivation, the room for its future extension, even if confined to these tracts alone, appears a wide one indeed. If we trace an irregular parallelogram, stretching eastward from Kishengunge, in the Nuddea district, to Backergunge, and from Mahduppore, in Furreedpore district southward to the borders of the Sunderbunds, we shall find a space of about 100 miles long, by 80 broad, and comprehending the district of Jessore, with portions of Furreedpore, Nuddea, and Burrisaul, to which the product of Date sugar is mainly confined, although the goor—or the first raw produce made by boiling down the juice—is found commonly manufactured for native consumption on the spot, in many localities situated beyond these assumed limits.

Throughout the present Date tract, the quantity and quality of the sugar produced vary considerably. The high and dry lands of parts of Kishnaghur and Pubna yield a strong well-crystallised product, though less in quantity than from trees of the Jessore and Sunderbunds soils; in which, with a more rapid growth of the tree, a greater flow of sap, and a less rich, though still good and grainy sugar, is produced. The cultivation in these districts is accompanied by a great advantage, in the cheap and abundant supply of fuel for boiling the juice and refining the sugar; and there is probably no part of Bengal where the cultivation may be extended, with more profit than in the more elevated lands of the Sunderbund grants.

The young plants are raised from seed sown during the rains, and are ready for planting out in the following April or May, after the first showers of the season have moistened the ground sufficiently. Before the date sugars became important as a staple for export, and the cultivation extended, the trees were seldom seen planted elsewhere than along the hedge-rows or boundaries of the fields, or on other spots where they did not interfere with the growth of cereals or other field crops. Gradually as date produce became more valuable, systematic plantations appeared, and fields were set with trees ten and fifteen feet apart, but without much regard to order or regularity of distance. After planting, no manuring or further expense was incurred, except, perhaps, in supplying fresh plants in place of those destroyed by cattle.

The spaces between the trees are generally occupied by oil-seed or other dry weather crops, and thus the cost of a native plantation is reduced, whilst the trees benefit by the ploughing, which loosens the earth, and the ground is kept free from weeds.

At the expiry of the fifth year from the planting of the young tree in the field, it is ready to be tapped for its juice. This is the average time allowed, though it may be varied a year sooner or later by the difference of soil and climate. The first year a young tree is tapped, it is reckoned to yield only half the usual quantity of juice produced by a full-grown tree; for the second year of tapping it is reckoned to yield three-fourths of full average quantity; and it is not till the third year of bearing that it is considered as in full yield.

The process of tapping and extracting the juice commences about the first of November. Some days previously the lower leaves of the crown are stripped off all round, and a few extra leaves from the side of the tree intended to be tapped. On the part thus denuded a triangular incision is made with a knife about an inch deep, so as to penetrate through the cortex, and divide the sap vessels; each side of the triangle measuring about six inches, with one point downwards, in which is inserted a piece of grooved bamboo, along which the sap trickles, and from thence drops into an earthen pot suspended underneath it by a string. The pots are suspended in the evening, and removed very early the following morning, ere the sun has sufficient power to warm the juice, which would cause it immediately to ferment, and destroy its quality of crystallising into sugar.

A plantation is always divided by the cultivator into seven equal sections, and one such section is cut afresh daily. The cutting is made in the afternoon, and the pot suspended as above mentioned. Next morning the pot is found to contain, from a full grown tree, ten seers of juice, the second morning four seers, and the third morning two seers of juice; the quantity exuding afterwards is so small, that no pot is suspended for the next four days. On the evening of the seventh day it again comes to the turn of this section of trees to be cut, which is effected by a thin slice being pared from the triangular face, which, by again dividing the sap vessels, causes the juice to flow afresh as at first. Each section is thus cut in succession, and the process is repeated throughout the goor season, which usually terminates about the 15th February, after which the heat of the weather causes the juice to ferment so rapidly, that it is no more convertible into sugar, and consequently not worth the labour of extraction and evaporation of its water, as molasses only would be the product. Juice produced during the day-time of the cold season is of similar quality, and for the same reason is allowed to run to waste.

Daily at sunrise, throughout the goor season, the industrious ryot may be seen climbing his trees, and collecting at a convenient spot beneath them the earthen pots containing the juice yielded during the past night. Under a rude shed, covered with the leaves of the date tree itself, and erected under the shade of the plantation, is prepared the boiling apparatus to serve for the goor season. It consists of a hole of about three feet in diameter sunk about two feet in the ground, over which are supported by mud arches, four thin earthen pans of a semi-globular shape, and eighteen inches in diameter; the hole itself is the furnace, and has two appertures on opposite sides for feeding in the fuel, and for escape of the smoke. The fire is lit as soon as the juice is collected, and poured into the four pans, which are kept constantly supplied with fresh juice as the water evaporates, until the whole produce of the morning is boiled down to the required density. As the contents of each pan become sufficiently boiled, they are ladled out into other earthen pots or jars, of various sizes, from five to twenty seers of contents, according to local custom, and in these the boiled extract cools, crystallises into a hard compound of granulated sugar and molasses, and is brought to market for sale as *goor*.

The subsequent processes by which the goor is deprived more or less of its molasses and impurities, and the drier and more merchantable kinds of sugar are prepared for market, will now be briefly described. These processes are always conducted by a distinct class of operators, who purchase the goor from the cultivators, and bring it to various stages of purity and dryness under different denominations.

1st. Khaur is made by filling the goor into coarse sacks or gunny bags, and pressing them between bamboos lashed together, or beneath heavy weights, until thirty or forty per cent. of the entire weight is forced out in the shape of molasses. The residue is then mixed, packed in clean bags, and is ready for sale.

2nd. Fine Khaur or Nimphool is made by repeating the above process for making khaur; the only difference being that the khaur is sprinkled and mixed with water before subjecting it to the second packing and pressure. This causes a further portion of the molasses to be washed and separated from the mass, and the product is lighter coloured and finer than the khaur, and about fifty per cent. only of the original weight of goor remains. A third application of the same process is sometimes resorted to, which carries away another five per cent. of the original weight, and leaves a residue still drier and lighter coloured than the ordinary nimphool.

In all nimphool and khaur sugars, however, a certain portion of water or moisture remains, it being never subjected to any sun-drying or other process for evaporating the water, and this renders it liable to deliquesce and sweating through the bags in which it is usually packed. This is specially the case in damp weather, and loss of colour and acidity follow in a few weeks.

3rd. Dullooah, or Doloo, is made by filling the ghoor into round baskets or conical earthen vessels, holding two to three maunds each. The baskets being of an open fabric, and the cones made with a hole at the apex, the molasses drains from the goor into a vessel placed beneath, the process being encouraged by a stratum of three or four inches thick of a wet grass or aquatic weed called "seala" placed on the surface of the goor. The moisture from this attenuates the molasses in the goor, and assists the draining. As soon as the weed is dry it is removed, and the upper stratum of the goor, now deprived of its molasses, is scraped off with a knife to the depth of two or three inches; and a fresh top of "seala" or wet weed is applied. When dry, a further portion of sugar is cut off as before, and this is repeated until the basket or cone is emptied. The sugar, as scraped off, is exposed in the sun on mats to dry, and is then mixed and packed for sale; and is, when well made, a dry, light, sand-coloured dullooah. Thirty to forty per cent. of produce, varying with the quality of the goor, is made in this way from a given quantity of the latter. The resulting molasses having by the operation of the weed a small portion of the sugar-crystal melted with it, is subjected to a boiling to evaporate the water, and an inferior, weak grained, and dark-coloured goor is the result. This is again subjected to the weed draining as before, and a further portion of ten to fifteen per cent. weight of the original goor is obtained. Dullooahs, if well dried before being packed, may be kept without deteriorating for several months if the weather be dry; but they always imbibe moisture, and sustain consequent injury from the damp air of the rainy season in Bengal.

4th. Pucka Cheenee, or Gurpatta, is the native refined sugar, made by subjecting khaur to a process somewhat resembling that of the English refiner. The khaur is melted in water to the consistency of thin syrup, which is then placed over a fire in an earthen pan, and brought to boiling point, the defecation being assisted by potash temper and sprinkling in of cold water. After scumming, it is filtered through a cotton cloth, and the clarified syrup is then boiled briskly until the water is evaporated to such a degree as to allow the sugar to form a hard crystal as it cools. It is then poured into an earthen cone, and, when cold, the plug is withdrawn, and the syrup allowed to drain from it, assisted, as in the dullooah process, by the application of the damp weed or seala. As it becomes whitened by the latter, it is scraped off, sun-dried, and packed for sale. The syrup, as it collects from the cones, is boiled up with fresh goor, and produces, by the same process, an inferior or second quality of gurpatta, and the syrups of the latter are once more boiled alone, and produce a still inferior weak and reddish sugar called by the manufacturers "jerunnee," which is literally "lasts." Gurpatta, if well made, and pure from mixture with other kinds, as of a bright and clean aspect, fine and dry; and, if protected from the weather, will keep without injury throughout the rainy season. The ordinary yield of gurpatta from good goor is reckoned as follows: three maunds of good goor yield of—

	mds.	srs.
First or white gurpatta	0	20
Inferior or mixed ditto...	0	10
Syrups or jerunnee	0	10
Molasses...	1	28
Loss...	0	12
Total, Maunds	3	0

5th. Dobarah is a quality superior to gurpatta, being a good white, dry, and well crystallised sugar. The process is similar to that of the gurpatta; but the material used being dullooa instead of khaur, a purer sugar is obtained, which much resembles the crushed refined sugar of the European refiner.

THE SPONGE FISHERY OF THE OTTOMAN ARCHIPELAGO.

The principal article of export from the Ottoman Archipelago is sponge. Within the last few years the number of boats employed in the fishery has increased a third, while the number of men has nearly doubled. Average number of boats employed by each island in the sponge fishery:—

Islands.	Formerly.	In 1858.
Calymnos	120	254
Symi	120	190
Halki	60	65
Castel Rosso	40	40
Leros	30	30
Stampalia	10	12
Telos	—	7
Cassos	—	2
Total	380	600

As there are seven men to each boat, the number of men employed now is 4,200, against 2,960 formerly. Of the 600 boats employed in 1858, 70 fished on the coasts of Rhodes, 150 on the coasts of Candia, 180 on the coasts of Syria, and 200 on the coasts of Barbary.

The island of Calymnos is the chief of the sponge fishing islands in the

Ottoman Archipelago. The sponge fishing grounds are on the coast of Candia, Syria, and Barbary. The average depth at which sponges are found is thirty fathoms; those of an inferior quality are found at lesser depths. The sponge fishing boats in the island of Calymnos amount to 260, employing 1,600 men and boys. These boats, called scafi, are on an average six tons each, carrying from six to seven, and sometimes eight men, of whom two are rowers.

The proceeds of the sponge are divided into shares, the divers receiving a whole share, and the rowers two-thirds of a share. The diver, who goes head-foremost into the water, takes with him a triangular-shaped stone, to which a strong line is tied to a hole in one of its corners, to assist him in his descent, and to direct him, like a rudder, to any particular spot.

On reaching the bottom, he tears off a number of sponges from the rock, gives a pull at the line, when he and the sponges in his arms, are drawn up by the rowers. A good diver will make from eight to ten dives during the day.

The sponge is covered with a thin, tough, black cuticle, inside of which there is a white liquid like milk, and of the same consistence. The sponge in this state presents a very different appearance to what it does when freed from these extraneous substances. The annual value of the sponges taken by the Calymniotes amounts to about £25,000. The finest are sent to Great Britain, the common and coarser to France, Austria, and Constantinople.

There are nineteen boats, employing 120 divers, engaged in the fishery from Castel Rosso. But the sponge fishery there is declining, as the natives find it more profitable to engage themselves as seamen in the regular trading vessels. The amount derived from sponges is calculated at about £2,500 a year, the half of what it was a few years ago.

The only article of export from the island of Astropalia is sponge, to the value of about £1,500 a year. There are twelve sponge fishing boats, with 100 divers. During the months of May to September, only very old men, women, and children, are to be found on the island of Symi. All the able-bodied part of the male population being at this season at the sponge fishery. 190 boats are employed in it, with nearly 1,500 men. The merchants of the island usually go themselves to Marseilles, or Trieste, in their own vessels, of which they now possess eighteen, of from 100 to 300 tons, to sell the sponges fished by their countrymen, to the value of about £15,000 a year; bringing back from those places various articles, part of which they send to the neighbouring islands.

The sponge fishing on the coast of Latakia is carried on during three or four months, according to the weather. A small fleet of sponge fishing boats, of from fifteen to twenty tons, manned each by six or ten hands, including the divers, are daily occupied in this severe but successful commercial pursuit.

Sponges exported from the Port of Rhodes :—

Quality.	1856.		1857.	
	Quantity.	Value.	Quantity.	Value.
	cwts.	£	cwts.	£
Fine	302	34,872	294	51,282
Common	1,100	25,385	1,195	24,974
Coarse	333	4,487	393	479

The sponge fishery on the coasts of Rhodes, which had gradually diminished to a few boats, was actively resumed in 1858, seventy boats having gone there for the purpose, when the Governor-General immediately established a duty of twenty per cent. on all sponges taken on the coast; but, upon the divers threatening to go elsewhere, the duty was commuted for a fixed sum of £3 on each boat.

A duty of twenty per cent. is levied on all sponges taken on the coasts of Candia; but the divers are gradually leaving that island for the coasts of Barbary, where no duty is exacted, although their boats have to be carried there in vessels, and brought back in them to their respective islands, at a great expense; whereas, they could proceed to Candia in their boats themselves. It is not so much of the duty itself that these poor people complain, as of its irregular and rapacious manner of exaction.

The inhabitants of the island of Halki, who are active, hardy, and enterprising, occupy themselves almost entirely in the sponge fishery, which has doubled within the last ten years. They send out annually sixty boats to it, manned with 450 divers. The export of sponges is calculated to reach about £8,000 annually. They pay an export duty of one per cent. The Tiliotes (island of Piskopi), who only began a few years ago to fish for sponges, have already four boats for the purpose, with thirty divers. From the active, enterprising character of these people, there is no doubt that this branch of commerce will increase.

About 9,000 okes of fine sponges are annually exported to Great Britain from the different islands. The sponges are of three qualities; namely, fine, common, and coarse. In the fine sponges there is but one in ten of the first or superior quality; the rest are of a second or inferior fine quality. In the common sponges there is one in four of a first quality; the rest are of a second common quality. In the coarse, one-half are of a first quality, and the other half of a second coarse quality. Thus it will be seen that the fine, common, and coarse kinds of sponges may be divided into two qualities each. Formerly the divers used to sell their sponges by weight, to increase which they put sand in them, a practice which they still continue, though now sold by quantity.

The following are the market prices, and the values, in round numbers, of the sponges sold during five years:—

	Prices per Oke of $2\frac{3}{4}$lb.			Value of each quality sold.			
	Fine.	Comn.	Coarse.	Fine.	Common.	Coarse.	Total.
	Piastres	Piastres	Piastres	£	£	£	£
1854	200	40	28	30,000	20,000	4,000	54,000
1855	220	40	40	33,000	22,000	5,000	60,000
1856	300	60	35	35,000	25,500	4,500	65,000
1857	300	65	35	51,000	25,000	5,000	81,000
1858	325	100	30	35,000	50,000	5,000	90,000

Of the sponges purchased in these islands, about two-thirds of the fine, one quarter of the common, and one quarter of the coarse (all of the first qualities), are sent to London; half of the best common quality to France (none of the other qualities are imported to that country); one-eighth of the fine, and one-eighth of the common, and many of the coarse (all second quality), to Trieste. The refuse of the fine, common, and coarse sponges are sent to Constantinople. Lately, a few good fine sponges have been sent to the United States of America.

The prices of the fine sponges were from twenty-five to thirty per cent., and those of the common thirty to thirty-five per cent. dearer in 1858 than in former years. This increase was owing to the competition of the many European sponge merchants, who had come there latterly, in person, to make their purchases.* 2,745 cases and sacks of sponge, valued at 4,105,600 piastres were shipped from Smyrna in 1857.

The fisheries of the Gulf of Volo (Thessaly) form a source of local wealth. Sponges of the best quality are annually taken to the value of £2,000.

The following figures from the official returns show the total quantities and value of Turkey sponge imported during six years. It is received principally through the four channels of France, Greece, Turkey Proper, and Austrian Italy, and sometimes from Malta and Egypt. We shall take another opportunity to speak of the more common Bahamas and American sponge. It may be added that the average computed or official value is no fair criterion of price. There has, however, been a steady advance in price of late years. In 1854 the computed or official value was 6s. 3d. per pound; in 1858, 11s. 3d.; but the selling price of the best is 21s. per lb.

Imports of Sponge into the United Kingdom:—

	Quantity. lbs.	Value. £
1853	205,924	
1854	224,787	70,246
1855	329,985	140,164
1856	313,287	172,308
1857	318,676	164,650
1858	287,681	157,751

P. L. S.

* Report of Mr. Campbell, British Consul at Rhodes.

NOTES ON THE PERMANENT EXHIBITION OF ALGERIAN AND OTHER FRENCH COLONIAL PRODUCTS IN PARIS.

BY EUGENE RIMMEL.

THE Palace of Industry, built in Paris in 1855, for the Great International Exhibition, has since been appropriated to cattle shows, flower shows, and various occasional artistical and industrial exhibitions. A very interesting collection of French colonial produce is now on view in one of the galleries, and is announced to be a permanent exhibition. For this measure the French Government deserves to be commended, for by that means the manufacturing consumer will be made aware of many natural riches which he may turn to good account, and the producer abroad will be enabled to find a readier market for the results of his labour.

In the first rank stands, naturally, Algeria; and the beautiful and varied products of that colony show what resources may be derived from that fruitful soil, by proper management and increased colonisation. They comprise breadstuffs, cotton, wool, silk, flax, hemp, textile fibres of various sorts, woods for building purposes and for cabinet work, wines, oils, fruits, tobacco, dye-stuffs, spices and essences, metals, marbles, and many other articles of less importance.

To commence with *corn:* the quality exhibited, and the quantity produced, bid fair to render Algeria, in a short time, the granary of France, as it was once that of the Romans. The exportation of corn to France, three years ago, reached two million hectolitres, and it will probably increase every year. Algerian corn contains more than an average proportion of gluten, which makes it very nutritious, and renders it particularly available for the manufacture of Italian pastes, a great quantity of which is consumed in France and the South of Europe. Several manufactories of that article have been already established in Algeria, and one of them, belonging to Mr. Lavie, of Constantine, has carried off a large gold medal for the quality of the pastes exhibited.

Cotton is a new branch of industry in Algeria, and, if we may judge by the specimens exhibited, will probably become very successful. These samples differ much in quality, varying from the commonest to the finest; but the most likely to prove remunerative is the Georgian long-staple, of which a very fine specimen is exhibited by M. Ferré, of St. Denis du Sig, who obtained a large gold medal for it. It appears that of that particular sort alone there is an annual excess of demand over the quantity usually produced by the United States of about two million kilogrammes. This deficiency in the supply cannot but increase every year with the consumption; whilst the production, which has hitherto been confined to Sea Island, cannot be extended much beyond its present limits. It will, therefore, well repay speculators to undertake this cultivation, in a climate so well adapted for it. The following table will show the gradual increase in the exports of cotton from Algeria to France since 1852 :—Quantity exported in

1852	4,303 kilos.	1857	93,170 kilos.
1853	18,932 „	1858	104,357 „
1854	85,710 „		

In 1852 the cotton fields covered a space of 45 hectares (112 acres), giving employment to 109 persons, while in 1858 they occupied 2,058 hectares (5,145 acres), cultivated by 1,095 persons. A great drawback, however, has still to be overcome, and that is, the price of production, which exceeds at present that of the cotton sent us by America; but this arises, in a great measure, from its being in the hands of small farmers, who do not possess sufficient means to work the plantations on a proper scale; and large capitalists, or powerful companies, embarking into it, would not meet with the same difficulty.

Of *wool* very fine specimens are shown by several colonists, and principally by M. Du Pré St. Maur, who possesses an estate of 2,500 hectares, cultivated in a manner which might serve as a pattern to others. It was this gentleman who first introduced the Merino sheep into Algeria; and through this and the crossings with the Berber, or native breed, some very fine wool is produced, principally in the province of Oran. In this class may be ranged a beautiful cloth, manufactured from camel hair, by M. Davin, who received a gold medal for it. It is very light and warm, and has almost the softness of fur. It appears that this fabric is in great favour among the Arabs, who prefer it to any other material. The climate of Algeria is particularly well suited to the silk-worm; it has escaped there the disease which created such ravages lately in France and Italy. Some rough *silk* is exhibited, and also some manufactures from it to show the quality, which seems good. The production has, however, been hitherto rather limited, but is gradually extending. Messrs. Chazel and Reidon, who have established a silk mill, worked by steam, on the banks of the Oued-Kniss, received a gold medal as an encouragement. A very beautiful vegetable silk is also exhibited, which is extracted from the fibres of the *Asclepias volubilis.*

Of *flax* and *hemp* there is a great variety principally from the province of Constantine. Some of the finest specimens have been produced by seeds imported from Riga. There is, besides, a vast number of textile fibres, extracted from various trees and plants, the principal of which are the dwarf palm (*Chamœrops humilis*), a most prolific tree, which produces cloth, cordage, paper, tow, a sort of vegetable wool, and hair; the white nettle (*Urtica nivea*), which gives a very fine thread; the agave, or aloe; divers sorts of Yuccas; Indian hemp (*Cannabis indica*), and various other plants, indigenous to the soil of Algeria. Paper pulp is also obtained from two plants called Diss, and Alfa, which grow wild in great abundance.

Among the rich collection of *woods* exhibited, the most beautiful is, undoubtedly, the Thuya (*Thuja articulata*), which is much sought after by Parisian cabinet-makers, on account of its splendid colour and veining. The following woods are also deserving of notice: the Barbary fig (*Cactus Opuntia*), curiously veined, but rather narrow; the Cypress (*Cupressus pyramidalis*), with a close fine grain; the cedar wood (*Pinus Cedrus*), possessing a very sweet odour, different from that of the Virginian, or of the Lebanon cedar; several sorts of Pistachio trees, the finest of which is the *Pistachia terebinthus*, the olive tree, the lemon tree, and others too long to enumerate.

A new source of prosperity for the colony is likely to arise from the cultivation of the vine, which is now carried on to a great extent in Algeria, covering a space of 4,674 hectares. A large gold medal has been awarded to M. Dumas, of Medieh, for his wines; a gold medal to M. Rouire, of Mascara; and silver and bronze medals to various other vine growers in the provinces of Algiers, Constantine, and Oran.

Olive oil seems likely to become one of the staple productions of Algeria. There are already about 60,000 hectares planted with olive trees, which there attain much larger dimensions than they do in France; and the value of the exports, which was above three millions of francs three years ago, will soon reach a much higher sum. M. Garro, of Algiers, received a gold medal for some very fine specimens. Algeria produces also other vegetable oils, such as almond oil, ground nut oil, &c.

The *fruits* exhibited comprise almonds, sweet and bitter, some of them very fine; dates, figs, raisins, lemons, bananas, and caroubes, a sweet but rather coarse leguminous fruit, which is excellent food for cattle, and which yields good alcohol by distillation.

Tobacco, in a manufactured and unmanufactured state, is exhibited by different colonists, the largest and finest collection being that of the "Algiers Company of Tobacco Planters," to whom a large gold medal has been deservedly awarded. This industry is quite recent in the colony, for ten years ago Algeria did not produce any tobacco; but the soil is so well suited to its growth, that it now exports annually that commodity to France to the amount of eight millions of francs. The French Government, in order to encourage its cultivation, has engaged to take six millions of kilos per annum, as soon as the country can produce it, and the Agricultural Society of Algiers has prevailed on the planters to unite together to provide the necessary expenses for the erection and management of the establishments required for preparing tobacco, on a large scale, for exportation; so that there is every prospect of Algeria becoming, in a short time, one of the principal places of production for that article. Algeria produces, also, a great variety of materials for dyeing and tanning, —among the former the more remarkable are cochineal, indigo, madder (*Rubia tinctorum*), safflower (*Carthamus tinctorum*), gall nuts, and some very fine specimens of henna (*Lawsonia inermis*), an excellent tinctorial plant indigenous to the African soil. Of the latter the most curious is the bulb of the *Scilla maritima* a plant growing wild in great profusion, which has only lately been turned to a useful account by M. Coopmann, of Constantine, who has produced with it some apparently very good leather.

India-rubber, pimento, pepper, coriander, cumin, castor seeds (*Ricinus communis*), and other products of tropical climates, are likewise grown in Algeria, but most of them to a limited extent. It is doubtful whether they would compete in price with similar articles from other countries. There is, however, one particular branch in which they are likely to excel, and that is the distillation of essential oils for perfumery purposes. Algeria abounds with sweet-scented flowers and aromatic plants of powerful fragrance, which are mostly found growing wild, and can be brought to great perfection by a proper system of cultivation. Among the essences exhibited are those of Neroly, petit-grain, and bigarrade (the first produced from the flowers, the second from the leaves, and the third from the rind of the fruit of the *Citrus bigaradia*, or bitter orange tree), melarosa, nessri, or musk rose, peppermint, geranium (*Pelargonium odoratissimum*), lemon, orange, fennel, sage, wormwood (used principally for liqueurs), rosemary, aniseed, marjoram, origanum, spear-mint, lavender, &c. The flower fields of Grasse, Cannes, and Nice, which have hitherto supplied the entire world with the principal perfumery materials, cannot now meet the demands of an increasing consumption, and Algeria is admirably situated to fill up the best part of the deficiency. Four distillers of essences have been awarded prize medals, which shows the desire of the French Government to encourage that industry, and, from the high prices obtained, it must prove remunerative to those who embark in it with proper knowledge and spirit. To conclude the list of vegetable productions, I may mention *Cork*, which is found in abundance in some of the Algerian forests, and Sorgho (*Holcus saccharatus*), a sort of millet cane, from the sap of the stalk of which sugar and alcohol are obtained, whilst the tops are largely used for brooms.

Algeria is almost as rich in *mineral* as it is in vegetable treasures. It possesses iron, copper, lead, antimony, arsenic, and even silver and gold mines; besides some fine marble quarries. The principal of those is at Djebel-Filfila, and was well known by the Romans, who worked it, until they were driven out of Africa by the Vandals. It produces several sorts of *marble*, and among others a fine white statuary marble, thought by some equal, if not superior, in grain to the best Carrara, whilst it possesses the semi-transparency of the Parian. The most beautiful of all, however, is the onyx marble, or oriental alabaster, extracted from a quarry called Ain-Tabalek, which was also well known to the Romans, who made from it cups, pillars, baths, and other artistical works, some of which may still be seen among the antiquities of the Vatican. The history of this quarry is somewhat curious. Its existence had been completely buried in oblivion for ages past, when M. Delmonte, a sculptor of Oran, discovered it by mere chance some ten years ago. He offered sixty francs for it, which were eagerly accepted by the Arab who owned the waste land which covered it; and he sold it again, a short time after, to a Paris banker, for 100,000 francs. It thus came into the hands of a company who work it on a large scale, under the name of Pallu and Co. The works made from it, which are exhibited, comprise vases, clocks, mantel-pieces, and various smaller objects, all of a beautiful transparent colour, with red, green, or grey veins. The price of this onyx is now three or four times that of ordinary marble; but as this quarry is easy to work, and of an extent which renders it almost inexhaustible, it will no doubt much decrease in price, as soon as proper means of communication are established.

The limits of your space will not allow me to do more than briefly glance at the products of other French colonies, which, although less in number, are equally interesting.

Martinique and Guadaloupe send some fine specimens of coffee, cocoa, sugar, tapioca, arrowroot, cotton, tobacco, rum, cochineal, spices of every description, and a good collection of vegetable oils, comprising the oil of ben (*Moringa pterygosperma*), ground nuts (*Arachis hypogæa*), croton seeds, *pignon d'inde* (*Croton Tiglium*), galba nuts (*Calophyllum Calaba*), and bancool nuts (*Aleurites triloba*). Of textile fibres, the principal sorts exhibited are the abaca (*Musa textilis*), aloe (*Agave Americana*), balisier (*Helsonia caribæa*), and a very glossy vegetable silk, extracted from the *Beaumontia grandiflora*. To this list we must add a fine assortment of liqueurs for which those islands are celebrated, and a species of native tea, obtained from the *Capraria biflora*.

French Guyana, besides the usual productions of tropical countries, exhibits a gum called *Baluta*, partaking of the properties of india-rubber and gutta percha, some fine woods, and a large assortment of cotton, which article is also contributed by Guadaloupe, Pondichery, and Reunion. A curious sweet-scented gum, called Elemi or Guyana incense, extracted from the *Icica viridiflora*, serves to show what precious materials for perfumery might be derived from those gifted countries, if colonists would only take the trouble of collecting them.

The French settlements in West Africa exhibit principally palm oil, cocoa-nut oil, castor oil, and a curious concrete oil cake, called Dika butter, extracted from the seeds of the *Mangifera gabonensis*.*

The island of Reunion (or Bourbon), sends some very fine coffee, sugar, cocoa, rum, tobacco, fancy woods, and a beautiful specimen of vanilla.

From that little corner, retained by the French in India, called Pondicherry, they have managed to send an extensive collection of specimens, comprising, among other things, oils extracted from the seeds of the *Cucumis sativa*, *Cucurbita maxima*, and *Bassia longifolia* (Illipe nuts). The collection of textile fibres is interesting, and includes the *Bromelia ananas*, *Calotropis gigantea*, *Sanseveria Zeylanica*, *Eriodendron anfractuosum*, and

* We gave an account of this curious product, known under the name of Dica, or Odika bread, in the *Journal of the Society of Arts*, for November 25, 1859, and presented specimens of it to the Pharmaceutical Society's Museum, the South Kensington Museum, and the Industrial Museum of the Crystal Palace.—*Editor*.

various species of yuccas. A very tolerable paper is also exhibited, made from the fibres of the *Crotalaria juncea.*

Nossi-Bé (Madagascar) sends a curious fabric made by the native women from the leaves of the *Raphia*, a sort of bamboo-palm; and even the small island of Tahiti contributes its mite, in the shape of the meal of the bread-tree (*Artocarpus incisa*), spices, fibres, and some elegant ornaments, made from a very beautiful straw called Pia, and others from the young leaves of the cocoa-nut palm.

Besides the above, each colony has supplied a complete assortment of the costumes, arms, instruments, and other curiosities, peculiar to the natives of its soil; thus forming a most instructive and interesting museum.

The list of prizes awarded amounts to 323, divided as follows: 10 large gold medals, 38 gold medals, 96 silver medals, 105 bronze medals, 26 highly honourable mentions, and 44 honourable mentions. It is satisfactory to find among the Algerian colonists rewarded, 11 Arabs, which shows that the natives are now turning their serious attention to the arts of peace.

I cannot conclude this short review without expressing a hope that we may take a leaf from our neighbour's book, and strive to establish at home, likewise, a permanent Colonial Museum. It is true that we have already specimens of colonial produce exhibited at the South Kensington, Kew, and East Indian Museums; but those collections are more scientific than commercial, and, besides, they are too incomplete and disconnected to produce a satisfactory result. With the immense extent and varied products of our colonies, we could form a far more important and interesting museum than the French have done; and it would establish a permanent connecting link between the manufacturer and the colonist, which is now wanting. There will shortly be a good opportunity for realising this plan. The International Exhibition, promoted by the Society of Arts, to take place in 1862, will bring together a complete collection of colonial produce. Let it be afterwards formed into a permanent museum, adding to it, from time to time such new products as may be discovered or improved upon, in our various colonies; and we may soon expect to have one of the most interesting exhibitions in the world. It may be also thought advisable to affix the market price to each article; but this and all other arrangements I leave to more competent judges than myself. I merely venture to throw out the hint, and shall be very happy to see it taken up by persons who have sufficient influence and knowledge to carry it out in a proper manner.

A GOOD, WHOLESOME, AND CHEAP SUBSTITUTE FOR COFFEE.

BY LEONARD WRAY.

Great as the consumption of coffee is in Europe and the Americas, it has become so necessary in every household, that the demand continues to increase, and very full prices are maintained. The largely extended plantations in the Brazils, in Ceylon, in Cuba, and in other suitable localities, profitably opened up every day, altogether fail to keep down prices, and will long continue to offer the strong inducement of *large profits !*

Taking advantage of this great public want, the unscrupulous and fraudulent trader foists upon the easily-duped masses of consumers vast quantities of unwholesome and pernicious stuff, mixed in certain proportions with coffee ; and, although the law has interposed in the case of *Chicory*, forbidding, under penalties, its being sold mixed with coffee, unless especially so labelled and declared, yet who can tell the thousand and one mixtures that are still made and sold with it ?

It may be said that all this can be prevented by purchasing only unground coffee, in a roasted state, ready for grinding ; but there are those (to be reckoned by hundreds of thousands of families), who, having no means of grinding this roasted coffee, are compelled to buy that which is already ground, or go without altogether. What abominations do these (in too many cases), not drink then under the much abused name of *Coffee ?*

These reflections are forced upon my mind every time I enter a coffee-house, and am called upon to put *faith* in the purity of the "dish of coffee" set before me ; and at divers other times and seasons, when applying the question in a more general sense, to the public at large, I have then asked myself whether some really good and cheap substitute may not be found which people may use, either alone or mixed with coffee, and with which the incorrigibly dishonest tradesman may adulterate his coffee without injuring the health (in addition to robbing the pockets) of his customers. We know that coffee-*leaves* have been suggested, of *late years*, as a new and very brilliant idea ; and from my own experience, in 1832 and 1833, I can testify to the very wholesome and even agreeable nature of the infusion or decoction made from them. The negroes upon West Indian coffee plantations used to employ them for that purpose, and full many a time have I also tasted the infusion they made from them.

Unluckily, however, these said leaves grown on *coffee trees*, and they do not abound in Great Britain, although a few very tolerable specimens may be seen alive at the Crystal Palace, and at Kew Gardens. *Chicory*, like tobacco, is an abomination, unwholesome and deleterious ! and, as such, it may be used and abused, and may even have its advocates.

But the substitute, which appears to be really and truly a good, wholesome, and useful one, is the root of the common *Dandelion*, one of the hardiest and most prevalent weeds in England.* My attention was first

* Our friend and correspondent seems to forget that dandelion is a near ally of the chicory, which he abuses, belonging to the same sub-order, Cichoraceæ. The cultivated root ought, by consequence, to be superior to the wild root, and probably is, when obtained genuine ; it is sold at fourpence the pound. In the *Pharmaceutical Journal* for this month (August), we have written an article "on the Cultivation and Commerce of Chicory." The milky juice of the dandelion, in the form of extract, has been used medicinally as a diuretic and alterative. In France the roots and leaves are eaten with bread and butter. On an occasion when locusts had devoured the harvest in the island of Minorca the inhabitants subsisted on this root.—*Editor*.

directed to it some time ago, when reading over that charming and interesting work, "*Roughing it in the Bush*," by my amiable friend, Mrs. Moodie, of Canada. The *experience* of that most excellent and highly gifted lady, adds the greatest possible value to the testimony of others in favour of the Dandelion root; and nothing can be more concise and simple than the account she gives of its qualities, and the mode of preparing it for use. She writes as follows:—

"The first year we came to this country (Canada), I met with an account of dandelion coffee, given by a Dr. Harrison, of Edinburgh, who earnestly recommended it as an article for general use:—'It possesses,' he says, all the fine flavour and exhilarating properties of coffee, without any of its deleterious effects. The plant, being of a soporific nature, the infusion made from it, when drunk at night, produces a tendency to sleep, instead of exciting wakefulness, and may safely be used as a cheap and wholesome substitute for the Arabian berry, being equal in substance and flavour to the best Mocha coffee.' I was much struck with this paragraph at the time, and for several years felt a great desire to try the doctor's coffee; but something or other always came in the way, and it was put off till another opportunity. During the fall of 1835, I was assisting my husband in taking up a crop of potatoes in the field; and, observing a vast number of dandelion roots among the potatoes, it brought the dandelion coffee back to my memory, and I determined to try some for our supper. Without saying anything to my husband, I threw aside some of the roots, and when we left work, collecting a sufficient number for the experiment, I carefully washed them quite clean, without depriving them of the fine brown skin which covers them, and which contains the aromatic flavour, which so nearly resembles coffee that it is difficult to distinguish it from it while roasting. I cut my roots into small pieces, the size of a kidney bean, and roasted them on an iron baking-pan in the stove-oven, until they were as brown and crisp as coffee. I then ground it, and transferred a small cupful of the powder to the coffee-pot, pouring upon it scalding water, and boiling it for a few minutes briskly over the fire. The result was beyond my expectations. It proved excellent, and far superior to the common coffee we procured at the stores. To persons residing in the bush, and to whom tea and coffee are expensive luxuries, the knowledge of this valuable property, in a plant scattered so abundantly through their fields, would prove highly beneficial. *For years we used no other article;* and the Indians who came to our house gladly adopted the root, and made me show them the whole process of manufacturing it. Experience taught me that the root of the dandelion is not so good when dug in the Spring, as it is in the Autumn. I tried it in the Spring, but the juice of the plant, having contributed to the production of leaves and flowers, was weak, and destitute of the fine, bitter flavour, so peculiar to coffee. The time of gathering in the potato crop, is also the time for collecting and drying the roots of the dandelion; and as they always abound in the same hills (in Canada), both may be accomplished at the same time. Those who want to keep a quantity for winter use, may wash and cut up the roots, and dry them on boards in the sun. They will keep good for years, and can be roasted when required for consumption.'"

This is Mrs. Moodie's account of this plant, in its application, as a substitute for coffee; and it must be observed, that she so writes of it, after using it in her family for *many years!*

The dandelion is within the reach of anyone who has the smallest patch of ground; and, as an article for general sale, it could unquestionably be sold (roasted and ground) at threepence per pound! Should anyone doubt this, let him remember that brown sugar, which frequently sells at this price, is a *manufactured* article, produced at considerable cost, and brought from countries many thousands of miles off, having to pay a duty besides!

I do, then, earnestly recommend that a fair trial should be given to this well-vouched for substitute for coffee!

CAPE MASTIC.

BY L. PAPPE, M.D.

Euryops multifidus, D. C., shrubby; stem smooth; very branchy. Branches alternate, divaricating; leaves glabrous, linear, entire at the base, bifid or multifid above; peduncles alternate, axillary, much longer than the leaves, one-headed; ligulæ oblong, yellow; achænia villose.

From the stem and branches of this little shrub, which grows plentifully near the Olifant's River, in the district of Clanwilliam, Cape of Good Hope, exudes a yellowish semi-transparent resinous substance, which, in every respect, resembles the *Mastic* of the Pharmacopæia, and seems to possess the same properties. The existence of this gummiferous shrub has been known for many years, and was noticed by Mr. Burchell, who, in his Travels I., p. 259, mentions it in these words:—

"The inhabitants of the Roggeveld, when in want of resin, use as a substitute a gum, which exudes from different shrubs, which they call *Harpuis-bosch* (Resin-bush). Of this gum a considerable quantity may be collected."

In the present scarcity of *Mastic* it would be worth the trial to obtain a quantity of this resin from the Cape, and ascertain whether it will answer the purposes of the expensive and scarce resin.

PAPER AND RAGS IN CHINA.

BY D. J. MACGOWAN, M.D.

The graceful and useful bamboo is the source of paper supply in China. The paper made from its culms is sufficient to meet the demands of the Chinese. It is, for the most part, of a quality unfit for European books and newspapers. In some places the article is manufactured with such care as to answer even for foreign writing-paper. The Anglo-Chinese newspapers, however, find it best to import their material from England. The paper mulberry also contributes to the paper demand in China, and so does rice-straw. Do you ask what becomes of the cast-off, or, rather, fallen-off garments of the uncounted millions of China? The world of letters can derive no aid from Chinese rags, until leather becomes more abundant in that country. Crispin claims them all for soles; the shoes of China have soles an inch thick, formed of suitably prepared rags, faced with a thin strip of leather.

YELLOW POPPY SEED OIL.

M. Cloez, of Paris, has recently made known the result of some experiments relative to the Yellow Horned Poppy, *Glaucium luteum*, Scop., which is found on some parts of our shores. It is common all round the Mediterranean, and up the Western Coast of Europe to Scandinavia. It expands its handsome yellow flowers during July and August, which are succeeded by elongated capsules, containing a large number of minute seeds. These seeds lose only 8 per cent. of water when dried in an oven; and, after drying, contain 42½ per cent. of a siccative oil, which can be used as an aliment, or for burning. In its ordinary state the seed yields, by pressure, thirty-two per cent. of this oil. The marc, or residue, constitutes a valuable manure, giving, on analysis, six per cent. of nitrogen, and an ash, amounting to 14½ per cent., rich in phosphate of lime. This oil, without doubt, resembles greatly the poppy-seed oil, obtained from *Papaver somniferum*, and the plant might be cultivated for the sake of its seeds on our sandy shores, where nothing else remunerative can be produced; but we question whether it would yield anything like as much seed per acre as the opium poppy, and, therefore, whether it would pay to cultivate it for that purpose. M. Cloez's results, however, are worthy of being recorded.

METROPOLITAN TECHNOLOGICAL MUSEUMS.

South Kensington Museum (Animal and Food Products, and Building Materials). Free, Mondays, Tuesdays, and Saturdays. Wednesdays and and Thursdays, 6d. each. Ten to Four, and Seven to Ten.

Museum of Practical Geology, *Jermyn-street* (Mineral Products). Free, daily, Fridays excepted, Ten to Four.

Museum of Economic Botany, *Kew Gardens* (Vegetable Products). Free, daily, One to Six.

Industrial Museum, *Crystal Palace* (Animal, Vegetable, and Mineral Products). Free to Visitors of the Palace.

Museum of the Pharmaceutical Society, *Bloomsbury-square* (Medicinal Products). Free to Members and their Friends.

EAST INDIA HOUSE MUSEUM, *Leadenhall-street* (East Indian Products). Free on Mondays, Tuesdays, and Fridays; by Tickets, on Wednesday and Thursday, Ten to Three.

ECONOMIC MUSEUM, *Perryn House, Twickenham*, (Domestic Economy). Open on Wednesday, between Two and Five, gratuitously. Admission, by Tickets, obtainable from the Society of Arts.

MUSEUM OF THE BOTANICAL SOCIETY, *Regent's-park* (Vegetable Productions). Admission by Member's order.

⁂ We shall be glad to receive short notices of the Museums of this character in the Provinces, in order to complete our list.

Reviews.

The Seven Sisters of Sleep: A Popular History of the Seven Narcotics of the World. By M. C. COOKE. James Blackwood.

WHILE Mr. Cooke has endeavoured to popularise a heavy subject, and has certainly succeeded in making a most readable book, full of anecdote and information not generally accessible, he has, at the same time, not lost sight of the instructive and more important statistical and general information bearing upon the production and consumption of the narcotics. Did our space permit, we could cull many most interesting details from this volume, but we must content ourselves with giving our readers a hearty recommendation to purchase the work, and they will find a large amount of most singular detail, collected from a variety of sources, and presented in a pleasant, gossiping form, which will certainly remove all drowsiness, whatever the title may indicate. The information on the use of cocar, hemp, fungi, earth-eating, &c., is, for the most part, entirely new to the general public.

The Uses of Animals, as applied to the Industry of Man. By E. LANKESTER, M D., F.R.S Parts 1 to 4. R. Hardwicke.

WE are glad to find that Dr. Lankester is placing before the public in a permanent and cheap form, for general diffusion, the excellent lectures which, in his official capacity, as scientific referee and general superintendent of the Animal and Food Collections, he has been delivering at the South Kensington Museum. Dr. Lankester has been so long known to the scientific world, as a lecturer and thoroughly competent illustrator of commercial products, that anything from his pen is valuable, and whatever he does is done well. The parts before us treat of silk, wool, leather, and bone, their composition and uses; and whether for schools or for adults, they will be found the most recent and best text-books of reference.

PUBLICATIONS RECEIVED.

Report on the Cultivation of Cotton in Egypt. By Thos. K. Fowler. Published by the Cotton Supply Association, Manchester.

The Cotton Supply Reporter. No. 46.

Mensuration made Easy; or, the Decimal System for the Million. By Chas. Hoare Sixth thousand. Effingham Wilson.

The London Medical Review. No. 1.

L'Algerie, Agricole, Commerciale, Industriale. Par M. A. Noirot.

RECENT WORKS ON TECHNOLOGICAL SUBJECTS.

Redding.—" French Wines and Vineyards." 3s. 6d. Houlston & Wright.

Ruse & Straker.—" Printing and its Accessories, together with 156 samples of English and Foreign Papers. 21s. Straker & Son.

Salmon Fishing in Canada. By a Resident. 10s. 6d. Longmans.

Commerce and Manufactures of Foreign Countries. Ireland & Co.

Chemistry, Theoretical, Practical, and Analytical, as applied and relating to Arts and Manufactures. By Dr. Sheridan. Muspratt. 2 vols. 67s. W. Mackenzie.

Lankester.—The Uses of Animals, as applied to the Industry of Man. By E. Lankester, F.R.S. Parts 1 to 5. Robert Hardwicke.

WORKS ANNOUNCED.

Knapp's Technology. 4th volume. Bailliere.
Medical Zoology. By M. Moquin Tandon. Bailliere.

South Kensington Museum.—A Select Committee of the House of Commons on the subject of the South Kensington Museum, has been sitting, consisting of the following members: — Mr. Hutt, Mr. Blackburn, Mr. John Locke, Mr. Stirling, Mr. Kinnaird, Lord W. Graham, Sir J. Shelley, Mr. Alderman Cubitt, Mr. Joseph Locke, Mr. J. Cole, Mr. Hankey, Mr. Adderley, Mr. Beamish, Mr. G. C. Bentinck, and Mr. Lowe. Although the numerous attractions of this Museum have lifted it far above all other similar institutions in public favour, yet it still experiences opposition and hindrance in certain quarters. It has, however, taken too deep a root to be easily demolished, and the various inquiries and discussions rather tend to benefit than to injure its progress and utility. Mr. Henry Cole, the general superintendent of the museum, in his evidence before the committee, stated that the total cost to the public of the Collections of Ornamental Art, now deposited in the South Kensington Museum, amounts to £38,269. The value of gifts and loans liberally contributed by the public were estimated at £460,000. Including the cost of land, buildings, and the other collections, the South Kensington Museum has cost the public £167,805; and Mr. Cole affirmed, that such had been the economy of the proceedings, that if Parliament desired to abolish the Museum, he was prepared to find responsible parties who would pay all that it had cost, with £5 per cent. interest. Although much remains yet to be done in the development, fittings, and arrangement of the several departments of the Museum, when the funds are available, the fact that nearly half a million persons visited it last year, is a proof of how generally it is appreciated by the public at large.

Inauguration of the Economic Museum of Botany at Oxford.—During the past year an interesting feature has been added, by the zeal of Dr. Daubeny and his assistant, Mr. Baxter, sen., to the botanic establishment of this University—the various specimens illustrative of the structure, functions, and uses of vegetables, together with the products, useful or ornamental, which have been obtained by art from their several parts, having been arranged in a separate apartment, on the plan of the remarkable Museum established at Kew, in connection with the Royal Botanic Garden, under the superintendence of Sir William Hooker; and on the 23rd May, a *soirée* was given by Dr. Daubeny, to commemorate the opening of the museum.—A Bill has been passed through Parliament, enabling the Commissioners of Public Works to acquire further property in or adjoining Argyle-square, Edinburgh, for the erection of the Industrial Museum for Scotland. We are glad to find that the lamented death of Professor George Wilson is not causing any stoppage in the progress of this National Museum of Industry in the North.

THE TECHNOLOGIST.

OBSERVATIONS ON THE CULTIVATION OF THE VANILLA PLANT.*

[*Translated from the French of M. David Floris, of Réunion.*]

THE Vanilla is a creeping plant which flourishes best in hot climates. There are two kinds in this colony, which are easily distinguished; the little Vanilla, which generally spreads out, was originally brought from Mexico, and is of the best quality; and the great Vanilla, with large thick leaves of inferior quality, and from which the pods fall off, before they become ripe.

* M. Floris, in a preface to his treatise, says:—"A long experience in the cultivation and preparation of Vanilla—recollections of the encouragement and rewards conferred on me by the Government of this colony and by its chief city—and particularly my earnest desire to be useful to my countrymen—induce me to believe in the propriety of offering to the public the result of my numerous and persevering experiments in the cultivation of the Vanilla plant, and in the preparation of its products.

"My wish is, that all engaged in the cultivation of Vanilla may be successful with their plantations and products—convinced as I am that the price of Vanilla cannot be maintained in the French markets, unless we apply ourselves to the preparation of an article of a superior description. A single pod of Vanilla carefully cultivated, gathered in due season, and skilfully prepared, will necessarily possess more perfume than several pods together of an inferior description, and the commercial community quickly learn to appreciate this fact. It has, then, become important for our interests to examine carefully our system of cultivation and preparation, so that our products may not suffer from carelessness in their preparation for the market.

"I had the pleasure of being made acquainted with the origin of the Vanilla plant in Bourbon. It was introduced into this colony in 1817, by M. Marchand, an old horticulturist. I was then in command of the vessel in which he took his passage from Mauritius to Bourbon, on his arrival from France; and I had on board two large glazed cases, in which were enclosed various plants which M. Marchand brought with him into the colony. It is to M. Marchand, then, that we are indebted for the introduction of this valuable and productive plant, and to M. Freon we owe our knowledge of its propagation.

"It may be no less interesting to know that we owe the discovery of the fecundation of the Vanilla plant to a Creole named Edmond, a gardener living with M. Bellier-Beaumont, a resident of Sainte-Suzanne; and that it was to this particular discovery that we owe the increase of the cultivation of Vanilla, at a period when our island was suffering from a severe drought."

The Vanilla is propagated from slips or suckers, planted at the feet of trees up which they are intended to train, or along walls or open pallisades.

These slips or suckers should have at least three knuckles or joints (*nœuds*); they may have as many as four or five joints, or may be even longer, according to the capacity of the trees for training, and the shelter they may be capable of affording.

A plantation of 2,400 slips or suckers, made by me in the month of May in the year 1856, the plants being from ten to twelve feet in length, produced fruit in the same year, and remains in full bearing at this moment. But I ought to acknowledge that these plants had buds which began to germinate immediately. All trees are good for training, with the exception of those which change their bark; the best sort are the Mango, the Blackwood, the Dragon's-blood, the Jack tree, and the Indian pine, &c., &c. But the Indian pine should not be the only tree selected, on account of the fall of its leaves, which occurs just at the time the Vanilla plant is in bearing: the full power of the sun's rays falling on the plant and on its fruit does much harm to both. It will be found preferable to plant the Indian pine between the mango or jack, or other kinds of trees whose leaves will serve to shelter the Vanilla plant during the time of year the shade of the former tree fails.

These training and sheltering trees ought to be planted at a distance of five feet by four feet, from east to west, or six feet by five, according to the extent of the ground. They may even be planted at the distance of six feet by six feet, and would then look more like a plantation.

The system of five feet by four, which I have adopted in my new plantation, with Dragon's-blood trees, is that to which I give the preference. It is necessary to train these plants from tree to tree, still keeping from east to west, to avoid too large a collection on the same training tree, also to drive a strong stake between the trees to support the plants, and prevent their being shaken, either by the wind, or by the fall of branches upon the interlaced plants. The fall of branches may be prevented, if care be taken to prune the trees regularly.

In plantations of Vanilla, already formed, and in which the training trees are at greater distances, we must shorten the plants when they grow too high—the clusters may be gleaned to the height of a man from the natural forks; or, better still, by nailing strong cleats to the trees which have not such forks, in order to reach these plants easily at arm's length, to facilitate their fecundation. It happens, however, that the forks of some trees are so high, that it is necessary to use a ladder.

The months which are considered the best for planting Vanilla are March, April, and May. Planters may also profit by the months of September, October, November, and December, care being taken to water the plants, should they become too dry during these months.

The trees selected for training and sheltering ought to afford sufficient shade before the young plants are put down. In the event, however, of its being necessary to plant, before the requisite shade is available, the young plants must be covered, palm leaves being the best for this purpose, and they will require to be watered much more frequently than would be necessary if they had their natural shelter. The young plants should be put in the earth. In the event of the slip or sucker being too long, some of the knuckles or joints (*nœuds*) must be buried in the earth; one joint when the slip has three, two when it has four, and four or five when you have a very long plant. These slips or suckers should be buried in the earth, their tendrils hooked up on the side of the tree, and well supported with two or more flat bands, according to their length.

Round string or cord should not be used, because it is found to stifle or choke the plant. The leaf of the cocoa-nut tree affords the best support for this purpose. If the weather is dry, or partially so, it will be necessary—it may be indispensably necessary—to prepare the soil intended for a plantation. Manure would be injurious. Young plants with roots, for example, that may have been planted with manure are likely to become rotten.

Vegetable manure is not so heating, composed of the leaves from the Blackwood tree, or other kinds of thick leaves. This manure is very good, if it be not preferable, but it rots the roots of the Vanilla plant, and particularly the more tender and delicate roots of the young plants. It is necessary that new plants should be regularly watered for some time after they are planted, more particularly in dry localities. Plants of Vanilla, if put in the earth in the depth of winter, lose their hearts, and often perish.

The earth should be trodden down over each plant after it has been watered, to avoid the action of the air, which is very prejudicial. If a Vanilla plantation has been made on land adjacent to the sea shore, it will be necessary to shelter it well from the salt sea air, which will burn up the plants, and render them sickly or withered. The pruning of the training and sheltering trees should be so managed as to allow for half the day as much sun as shade, and even more sun than shade.

The pods that have too much shade are long, soft, and slender, and are difficult to ripen; while, on the contrary, when they are judiciously exposed to the sun, they become thick, round, firm, and contain much more aroma. As regards the character of the land, the sheltered side is preferable, in order that the Vanilla plants should not be exposed to the wind, and that they may receive more warmth.

A circle of flints or stones around each training tree is indispensable, to retain the manure placed on the soil; afterwards the evaporation may be avoided by means of flat stones, to keep the plants cool, to prevent the rain water from uncovering the roots, and, besides, to preserve them from animals. The manure placed under these stones is renewed once a year, a little while before the plants begin to bud.

The slips or suckers may be placed in a seed bed, in a plot of ground that has been dug up, and that is partially in the shade, at the distance of five or six inches from one another, at the side of protecting stakes, up which the new shoots climb readily.

On the Fecundation of the Vanilla Flower.—In the Vanilla flower, the male is separated from the female by a thin skin or pellicle, which hinders the natural fecundation. We must, therefore, after the flower is completely open, raise this skin with a small instrument, and, with a slight pressure of the thumb and fore-finger, favour the communication.

The process of fecundation is in operation from between eight and nine o'clock in the morning till three o'clock in the afternoon, and may be extended to four or five o'clock ; but the pods that are not fecundated till so late never acquire the length and thickness of those fecundated earlier in the day. The instrument which serves to perform this operation is generally three or four inches long, thin, and must neither be sharp, or cutting, nor triangular ; it would in such case wound the flower, or cause the pollen to fall (the coloured dust in the anther), or else quite destroy the male.

The cotons or nics (according to the terms employed in Réunion) of the palm tree, or the cocoa-nut tree, are used in preference as instruments for assisting the process of fecundation.

After having served for these purposes, and in order to find them the next morning, they should be stuck among the leaves of the Vanilla. Light ladders are used to reach the flowers which cannot be reached by hand, to assist their fecundation. The flowers ought not to be pressed too hard ; and this operation ought always to be done with much care, and by practised hands.

The flowers of the Vanilla begin to appear from June, and fecundation takes place in September. In the more elevated and colder regions, the plant flowers later, and the pods ripen much slower. The earliest flowers should be fecundated first in preference ; and the others may be pulled off, after being well assured that five or six pods which have been preserved are selected.

It is usual to leave generally five or six pods in each cluster when the Vanilla plant is heavily laden with flowers, if it is wished to obtain fine fruit. But it sometimes happens that a fine plant yields several clusters ; in that case, we have only to fecundate eight, or ten, or even twelve flowers, as the plant may be able to nourish more fruit.

The Harvest, or gathering of the Crop.—The crop of the Vanilla plant is gathered when the pods have become properly ripe. We learn the pods are ripe when their stalks commence to turn yellow, and when they assume a yellow tinge, a new indication which points out when the pods should be gathered. The pods gathered too green are dried with difficulty, are subject to mouldiness, and sometimes rot when the weather is too wet. Some of the greenest even become white, and are good for nothing.

It is important that the gathering of the crop should be carefully looked after, and that it should be done by intelligent persons.

The gathering of the crop should be proceeded with every two or three days, in order to prevent the most forward pods from bursting open. It happens, however, in spite of these precautions, that we meet with one here and there, hidden among the leaves, that has been forgotten. These pods that have been overlooked may be easily found by the delicate odour they exhale. The pods that burst open are generally the finest and best: but they must be closed up again (by the reunion of their two edges), the result of a delicate operation. The open part of the pod must be soaked in lukewarm water, and the edges being brought together, the pod is bound round strongly with filets of silk. Thus prepared, the pods are hung up in the air to be thoroughly dried, by means of the silk bound round them, which serves to keep the opening closed. We might even omit the warm water, when the part that had burst is closed, to assist the process of drying.

The silk filets may be rewound two or three times, by degrees, as the pods diminish in size as they become dry.

Notwithstanding the superior aroma of the burst pods, on account of their having been perfectly ripe, they become round from the pressure of the silk wound around them; but they are not appreciated, commercially speaking. Merchants are not accustomed to the sight of the article in this condition.

The silk filets (named above) should be made flat, and may be used for several years. The pods to be gathered whole, should be held by the top, and separated from the bunch by pressing them sharply on one side. Some persons take hold of the pod by the middle, or by the stalk, and draw it towards them; it happens then that the Vanilla is broken, and frequently the entire bunch is broken off, green and ripe pods together. Others gather their crop by using their nails; but they thus prevent uniformity in the size of the packets, and throw difficulties in the way of disposing of the article. At the end of the gathering, the latest pods ripening at the same time, the whole bunch should be gathered at once.

On the Preparation of the Pods.—At each gathering, after the pods have been detached from the clusters, and placed in a basket, the basket is dipped for eighteen or twenty seconds in a vessel of hot, but not boiling, water. It would be preferable to scald the Vanilla separately, but only for fifteen seconds. To know when the water is sufficiently warm, try, by dipping in a finger, if the heat is just as much as can be borne for a second or two; or watch for the moment when a thick steam arises from the water, just as the water produces a kind of sound, which happens a few seconds before the water attains the boiling point and ebullition begins.

After this the pods are immediately removed from the basket, and placed on dry grass, mats, or gunnies, where they may drain dry.

About a quarter of an hour after this operation the pods should be put out in the sun, upon tables previously prepared with woollen coverings, or blankets, where they may remain for six or eight days, or even longer, until they become brown and faded.

Every evening they should be collected together, and placed in boxes carefully covered with woollen cloths, in order that they may be sweated. When they become faded and brown, from exposure to the sun, they must be placed in the shade, in an airy locality, still remaining on the tables with the woollen coverings, in order to hasten the drying, to prevent their becoming mouldy, and particularly that they may, though dry, retain the suppleness in the market.

These pods remain on the tables until perfectly dry.

During the time they are exposed to the sun, between two and three o'clock every afternoon, while the pods are still hot, it will be necessary to squeeze them strongly between the fingers, to flatten them a little, and to induce the essential oil and the seed (*semence*), which are in great abundance in the lower end, to spread equally throughout the pods. They must be thus prepared in order to render them more pliant and more glossy; in fact, in order to give them the appearance required in commerce. This operation should take place a few days after the pods have been exposed to the sun, when they have become sufficiently faded, but always before the pods are removed to the drying place.

We may learn easily to distinguish when the pods are dry, for they will become black, or almost of a chocolate colour, and when no signs of moisture are apparent at the heel of the pod, the part which is always the last to dry.

The dry pods are picked out, and placed in tin boxes, when they become sufficiently dry and pliant. This work may be done every two or three days, and it becomes sometimes necessary to do it every day, according to the number of hands employed, and particularly at the end of crop time. The pods are then made up into packets, and, to insure the packets being of the same length, it will be necessary to shorten the dry stalks of a great many of them. Each packet contains fifty pods, tied round the middle, or, in preference, a little more towards the stalk end: they would open without this precaution. The packets may be tied round with strong fine twine.

Packing the Vanilla.—The Vanilla pods are packed into tin boxes, made according to the length of the pods and size of the packets, which alters with the number they contain. Each box should contain sixty packets, or six rows of ten packets each, placed one above the other.

This system of packing is the same as that in use in Mexico, and is accepted by merchants with regard to this article.

Each tin box should have a label, stating the number of pods, the length of the pods, the nett weight, and the tare weight of the box. The boxes are then, if intended for the French market, stowed in wooden cases, to prevent the tin boxes from getting rusty. It is better, and perhaps necessary, to surround the tin boxes with sawdust.

The "Givre," or Rime.—The "givre," or frosting (of crystals white and sparkling, consisting of benzoic acid), forms on the pods when they have been kept in well closed vessels three or four months after they have been prepared for packing. Many merchants give the preference to Vanilla covered with this crystallization; some do not care about it; others, again, require that as soon as the article arrives in France, they should have the means of producing this formation before the Vanilla is exposed to the air.

I think it does not belong to us to decide such a delicate point; but we should not prevent this exudation from forming naturally on the pods, lest we might perhaps be helping a process likely to injure the beauty of the pods or their perfume.

The producers of a large quantity of Vanilla will find it necessary for its exposure to the sun to have large tables, formed on pickets of wood driven into the earth, above which may easily be placed light structures of poles, or wood of small scantling, so that, in case of rain, they may support tarpaulins or oil cloths over the tables. By the time the Vanilla becomes quite dry it is nearly five months old. A Vanilla plantation that produces (500 kilogrammes) 10 cwts., according to my calculations, may be kept in good order by ten workpeople, who will have plenty to do when the season of fecundity arrives. These labourers will probably be employed on other work during the year besides the Vanilla plantation.

The plantation requires to be renewed every eight or ten years. But this in a great measure depends on the size of the slips or suckers originally planted; and, besides, much depends on the locality where the plantation may be formed.

There are numerous other minor details of things that should be observed, but I believe I may dispense with mentioning them, as the foregoing observations will be found to contain all that is essential to be known of the management of the Vanilla plant to insure a good result.

[The cultivation of Vanilla is spreading, and some of very superior quality has been grown in Ceylon by one or two planters. Some sample pods from the Botanic Gardens at Peradenia lately fetched 65s. to 105s. per lb. The Vanilla plant is a native of the island of St. Domingo, where it climbs to the tops of the highest trees, and is somewhat extensively cultivated in Mexico, in the vicinity of Vera Cruz. The Mexicans have three classes of the pods, which they distinguish in commerce by the names of *pomposa* (inflated or swelled), *lis*, and *simironda*.

In the department of Suchitepequez, in Guatemala, Vanilla is to be found; also in the mountains of the Pueblo of Pasaco, in the district of Santa Rosa. It exists in a wild state. In Suchitepequez they have commenced cultivating it. Owing to unskilfulness in curing, it has not yet arrived at a proper state to form an article of commerce.

The amount of Vanilla imported and consumed in the United States, principally for flavouring cakes, ice-creams, &c., is stated to exceed 5,000lbs. It might probably be grown to advantage in some parts of the Southern States, with a very little protection during the colder months of the year, and perhaps in hot-houses at the North, as is now done on the Continent.

The following have been the imports of Vanilla into the United Kingdom in the last four years:—

	lbs.	Official Computed Value.
1855	973	—
1856	4,579	—
1857	7,543	£33,132
1858	3,034	9,611

Besides its use by the confectioners and perfumers, Vanilla is largely consumed by Messrs. J. S. Fry & Sons, the large cocoa manufacturers, of Bristol, for flavouring chocolate. The Spaniards and Italians are especially fond of Vanilla].—Editor.

ON THE COLLECTION AND PREPARATION FOR MARKET OF THE BECHE DE MER OR TRIPANG IN THE PACIFIC.

BY CAPTAIN ANDREW CHEYNE.

As my chief object in visiting the different islands in the Western Pacific was for the purpose of forming establishments for collecting and curing beche de mer for the China market, I shall give a description of the different species, together with remarks on collecting and curing it, being the result of five years' experience in that particular branch of trade.

There are many kinds of beche de mer (species of the genus *Holuthuria*) found on coral reefs in the Pacific Ocean; but only ten of these varieties are marketable in China, each being distinguished by well known names. As they vary in price from six to thirty-five Spanish dollars per picul ($133\frac{1}{3}$ lbs.), it becomes a matter of great importance to obtain the superior qualities. The slug when cured presents quite a different appearance to what it does when caught; and no person but one well acquainted with the trade would be able to ascertain which were the first quality, by comparing the raw slug with a cured one. Again, the success of a voyage depends greatly on the knowledge possessed by the person in charge of the localities in which the superior sorts are to be found, together with much experience in the mode of fishing and curing them.

The superior qualities are known by the following names in the Sooloo and Manila markets:—1. Bangkolungan; 2. Keeskeesan; 3. Talepan; 4. Munang; each presenting a different appearance, and found in different depths of water on the reefs.

1. Bangkolungan, when caught, is from eleven to fifteen inches in length, of an oval shape, brown on the back, and the belly white and crusted with lime, with a row of teats on each side the belly. It is hard, rigid, and scarcely possesses any power of locomotion. It has, however, the power of expanding and contracting itself at pleasure. This quality is found on the inner edge of coral reefs, in from two to ten fathoms water, and on a bottom of coral and sand. It can only be procured by diving.

2. Keeskeesan is from six to twelve inches in length, of an oval shape, quite black, and smooth on the back, with a dark greyish belly, and *one* row of teats on each side. When contracted, it is similar in shape to a land tortoise. This quality is found in shallow water, on the top of coral reefs, and on a bottom of coral and sand. Bangkolungan and Keeskeesan fetch about the same price; and the latter being the most plentiful and easiest caught, ought of course to be the kind most sought after.

3. Talepan varies in length from nine inches to two feet, and presents the most remarkable appearance of any of the species of beche de mer. It is found on all parts of the reefs, but chiefly in from two to three fathoms

water. It is of a dark red colour, and narrower in proportion than the before-mentioned kinds. The whole back is covered with large red prickles, which render it easily distinguishable from any of the other kinds. It is much softer than the black, and more difficult to cure.

4. Munang is of a small size, seldom exceeding eight inches in length, of an oval shape, quite black, and smooth; has no teats or other excrescences, and is found in shallow water on the coral flats, and often among turtle grass near the shore. This is the kind which the American vessels chiefly procure at the Feejee Islands. It is worth from fifteen to twenty-five dollar per picul in the China market.

These four varieties form the superior qualities of the slug, and the following are the middling and inferior sorts:—5. Sapatos China, is of a reddish brown colour, and about the same size as the Munang. It presents a wrinkled surface, and is found adhering to the coral rocks on the top of the reefs. 6. Lowlowan, is of various lengths, black, wrinkled, and narrow. It is found on various parts of the reefs. 7. Balati blanco, is about nine inches in length, of an oval shape, and a white and orange colour; and may be easily known by its voiding a white adhesive substance, which adheres to the fingers when handled. It is found generally on the inner edge of reefs, and on a sandy bottom. Moonlight nights are the best time for collecting this sort, as they generally bury themselves in the sand during the day. 8. Matan is of the same species and habits as No. 7, and only differs from it in colour, which is grey, brown, and white speckled. 9. Hangenan, is generally about a foot in length, of a grey or greenish colour, wrinkled, and is found on the lagoon side of coral reefs. 10. Sapatos grande, is about twelve or fifteen inches in length, and of a brown and white colour, wrinkled, and very inferior.

The following remarks on boiling beche de mer are the result of a number of experiments made by me at different times. Bangkolungan and Keeskeesan will require to be boiled about five minutes, or more, if the pot is nearly full; they must be well stirred, and should be taken out when thoroughly heated through, by which time they will feel quite hard and elastic. The cut part of the fish, when properly boiled, should be of a blue and amber colour, and feel firm like Indian rubber. If the pot is only half full, they will require to boil fully ten minutes before the cut part becomes of the blue and amber colour. The Talepan and Munang require to be boiled fully ten minutes. The Munang dries very quickly; but the Talepan is very difficult to cure, and often requires two boilings before it will dry. The Sapatos China requires to be boiled about fifteen minutes; if properly boiled, it will dry very quickly. The Balati Blanco and Matan need very little boiling, say three or four minutes if the pot is nearly full. They should be taken out as soon as they shrink, and are thoroughly heated through. The Hangenan should be boiled about twenty minutes. This sort must be very carefully handled when raw, as it will break in pieces if held any time in the hand. It appears to me that there are two ways of boiling beche de mer equally good. The first is to take them out when boiled about a minute, or as soon as they shrink and feel hard; the other method is to boil them as before stated; but in boiling either way, the fish ought, if properly cooked, to dry like a boiled egg immediately on being taken out of the pot. If curing a large quantity at a time, I should prefer boiling them slightly at first; and when half dry, I would reboil them. This method I have tried, and find it makes the beche de mer look much better, and less wrinkled when dry. Although they require a little more time in drying if reboiled, yet I am convinced they would sell better. Beche de mer dried in the sun fetches a higher price than that dried over a wood fire. But this method would not answer in curing a ship's cargo, as they take fully twenty days to dry; whereas by smoking them they are well cured in four days.

Much skill is required in drying biche de mer, as well as in boiling it, as too much heat will cause it to blister, and get porous, like sponge; whereas, too little heat again will make it spoil, and get putrid within twenty-four hours after being boiled. There is, likewise, great care and method requisite in conducting the gutting; for if this be not properly attended to, by keeping the fish in warm water, and from exposure to the sun, it will, when raw, soon subside into a blubbery mass, and become putrid in a few hours after being caught.

A vessel fitting out for a beche de mer voyage should be well manned and armed, and have good strong boarding nettings, with waterproof arm-chests for the tops, sufficiently large to hold a dozen muskets each. She will require to have a number of large pots or boilers on board, similar to whalers try-pots; and skimmers, ladles, fire-rakes, shovels, buckets, tubs, cross-cut saws, and axes, and, if procurable, a quantity of bricks to place the pots on, as the stones found on coral islands will not stand the fire.

The first thing to be done on arrival at an island where the slug is plentiful, is to erect a large curing-house on shore, about ninety feet in length, thirty feet in breadth, and the sides about ten feet in height. These houses are generally built of island materials, and thatched with mats, made by the natives, of cocoa-nut leaves; the thatch must be well put on, so as to prevent the rain from penetrating. The sides are likewise covered in with these mats, and a small door should be left in each end. Platforms, or *batters*, for drying the slug on, are then erected along one side of the house. They should run the whole length, and be about eight feet in breadth; the lower one about breast high from the ground, and the upper three feet above that. The frames are generally made of cocoa-nut trees, or pandanus, and covered with two or three layers of split bamboo, or reeds, seized close, so as to form a sort of network for the fish to lay on. Much care and skill is required in the construction of these *batters*, or platforms, so as to prevent the beche de mer from burning, which it would be liable to, were they not properly fitted. A trench, about six feet in breadth, and two in depth, is then dug the whole length of the *batters* for the fires. Tubs are placed at short distances along the side of the trench, filled with salt water, and a good supply of buckets kept in readiness, to prevent the fires from blazing up and burning the fish, or platforms, as well as to regulate the degree of heat necessary for drying the slug.

The process of curing is this:—The beche de mer is first gutted, then boiled in those large pots; and, after being well washed in fresh water, carried into the curing-house, in small tubs, or baskets, and emptied on the lower *batter*, where it is spread out (about five inches thick) to dry. The trench is then filled with firewood, and when the *batter* is full of fish, the fires are lighted, and the drying process commences. From this time the fires must be kept constantly going, day and night, with a careful officer and regular watch to attend to it. On the afternoon of the following day the fires are extinguished for a short time, and the fish shifted to the upper *batter*, having been first examined, and splints of wood put into those which may not be drying properly. When this is done, the lower *batter* is again filled from the pots, the fires immediately lighted, and the drying process continued as before. The fish on the *lower batter* must be turned frequently during the first twelve hours. On the second day (the fires having been extinguished as before) the slug on the upper *batter* is shifted close over to one end, to make room for those on the lower *batter* again; and so on, as before, for the two following days, by which time the first day's fish will be properly cured. It is then taken off the batter, and, after having been carefully examined, and those not dry put up again, the quantity cured is sent on board the vessel, and stowed away in bags. But should the ship be long in procuring a cargo, it will require to be dried over again every three months, in the sun, on platforms erected over the deck, as it soon gets damp, unless when packed in air-tight casks.

If the beche de mer is plentiful, and the natives bring it daily in large quantities, forty men will be requisite to perform the work of a house of the above size; and the pots will want two hands to attend them. These curing-houses consume a large quantity of firewood daily. When beche de mer is cured, and stowed away, great care should be taken to prevent it from getting wet, as one damp fish will speedily spoil a whole bag.

In conclusion, I may remark, that the process of curing the slug *properly*, is so difficult, and requires so much experience, that none but those who have been for years engaged in the trade would ever succeed in doing it.

A writer in the *Nautical Magazine* furnishes the following information on this subject:—

"The different varieties of this animal, which are very numerous among the eastern islands, have not yet been specifically separated by naturalists. Lamarck has described the whole as *Priapulus caudatus* (Hist. Nat. III., p. 77). The two specimens of beche de mer which are found upon the coast of New Holland, wherefore the Malays call it 'Trepan marega,'—marega being their name for the northern coast—are of inferior quality to what are found in the Eastern Archipelago. The better quality, the batu, is of a black colour, and is found in deep water; the other is of a grey or sandy hue, and is called 'passir' (sandy). The best kind is procured among the Arroo Islands, which is the principal fishery. The price varies according to the sort, from five to 100 rupees (10s. to £10) the picul. The 'trepan marega' is valued at about £4 sterling the picul. The beche de mer that are found on the reefs left dry by the tide, or in shoal water, whether of grey or black colour, are of very inferior quality to those that are fished for in five or six fathoms."

[Specimens of tripang, or beche de mer, may be seen in the Food Collection of the South Kensington Museum, in the Collection of the East India House, at the Museum of the College of Surgeons, and in the Shell Gallery of the British Museum. But very little scientific information on the species and varieties has yet been furnished. Indeed, the commercially-prepared state in which they are received renders identification or description very difficult. Of the Holothuriæ one species is collected and eaten by the poor inhabitants of the Neapolitan coast.

The *Sipunculus edulis* is also used as an article of food in China and Japan, and in parts of the West Indies. In New Guinea the tripang and similar marine slugs are cut up in small pieces and eaten raw with salt and limejuice. In Simmonds's *Colonial Magazine*, Vol. X. p. 189, I published detailed descriptive accounts from various authors of the trade, mode of catching, and curing the slug; and in my recent work on "The Curiosities of Food," I gave some further particulars of the fishery, and cited opinions relative to this Chinese food delicacy.]—EDITOR.

ON THE SCIENTIFIC CULTURE OF THE STRAWBERRY.

BY LEONARD WRAY.

AMONGST our British fruits the Strawberry holds a very high rank, and is justly esteemed both for the table and for preserves. A very large extent of land is appropriated to its culture, much capital is expended, and no small amount of "art" is exhibited in bringing this fruit before the public in its choicest condition.

Size, colour, and flavour have been studied very successfully, as the large and beautiful specimens which are exhibited at the various horticultural shows, and in the windows of our fruit-sellers, fully demonstrate. New varieties are eagerly sought for, and found, by the great strawberry growers, —as Myatt, Turner, Robertson, and a host of others; and the result of their intelligent labours we see, and fully appreciate, in those choice, new varieties—the "Oscar," the "Wizard of the North," the "Surprise," the "Empress Eugenie," the "Mammoth," the "Prolific Hautbois," &c., &c.

These are of the highest excellence; and, in our northern climate, can possibly not be surpassed, in point of size, colour, flavour, and juiciness—

points so assiduously aimed at by our great strawberry growers; but we may well inquire whether these varieties, or any of them, fulfil all those conditions, so necessary in a really perfect strawberry plant. In fact, we may, and must, ask the question, "Is Science brought to bear on the Art of strawberry culture in this country?"

We fear that we shall "offend the susceptibilities" of a great number of professionals and amateurs, when we express our opinion, that, in the culture of the strawberry in the United Kingdom, science has not been applied in aid of the art so liberally bestowed.

We take the ground, that so hardy a plant should certainly appertain more to open field culture, than to the elaborate and expensive horticulture of the garden. The former may be designated as a natural growth, under man's care and supervision; the latter is truly a forced and unnatural (*id est*, an artificial) existence, more suited to the requirements of a tender exotic than to the hardy strawberry.

Growing wild, close to the Falls of Montmorenci (near Quebec), we have seen and eaten its highly flavoured fruit, the intense frosts of Canada and Labrador hurting it not. In the sweltering regions of Charleston and Savannah (in South Carolina and Georgia) we have feasted upon it for many months in the year, the tropical heat doing it no harm. On the Alpine heights, and in the hot valleys of Spain, it meets us again. Far up on the Himalaya mountains, beyond "Nynee Tal," and even the highest abode of man, this kindly plant offers its tiny fruit to the weary and adventurous traveller. Down again in the heated vales of Cashmere, we find it expanded into a greater size, and remarkable for its lusciousness and aroma.

Why, then, is this plant treated in England like a weak and tender exotic? Why is it so pampered, so swathed, so swaddled, and its hardy habit so utterly ignored? It is because Science has not yet been applied to the art of growing this great gift of nature.

The productions of Myatt, Turner, and others are admirable in their way, and for the especial destination for which they are grown—viz., for the tables of Belgravia, and of the richer classes; but for the million, and for those great preserve-makers, Crosse and Blackwall, Batty and Co., and others, who supply millions of families with strawberry jam and jelly, in small and very thick-bottomed pots; their modes of culture are wholly unsuitable, and the supply furnished is totally inadequate to the demand.

Let us now examine into the causes of all this, and let us see if Science will not aid us in bringing about a very different state of things.

Botanists have been too much in the habit of promulgating the doctrine, that, in the strawberry flower, the male and female organs exist in a perfect state; whereas, generally speaking, this is by no means the case, for the sexual difference is peculiarly well marked in almost all varieties of strawberries.

Let us sow the seed of a strawberry, and we shall find, on a careful examination of the seedlings, that we have obtained *Staminates*, *Pistillates*, and *Hermaphrodites*; that is to say, *Staminates*, or male plants; *Pistillates*, or female plants—neither of which, by itself, will bear a single berry—and *Hermaphrodites*, or plants in which the male organs are perfect, and the female organs more or less imperfect. It is said, and has been particularly insisted on in respect to certain varieties (especially amongst the white kinds), that some of these hermaphrodites possess both the male and female organs in perfection; but, although entertaining a strong doubt upon that point ourselves, we are nevertheless quite aware, that, in particular instances, they do possess female organs very nearly perfect, sufficiently so, indeed, to lead to the common belief. On the other hand, we know that, in the great majority of cases, so very imperfect are the female organs in these hermaphrodites, that they seldom produce other than a very scanty crop of inferior and imperfect berries.

The most vigorous of all are the staminates, or pure males, abounding in large flowers, and sending out a profusion of runners; the pistillates flower very abundantly, but have small blossoms, and very few runners; the hermaphrodites bear a medium sized flower, and throw out numerous strong runners.

For the purposes of the high-priced strawberry grower, the better kinds of hermaphrodites may and do answer admirably well, seeing that their object is to obtain only a few very large-sized berries on each plant; but, place these same plants in an open field, deprive them of their finely prepared mould, and their hand-glasses, their artificial impregnation, and the unremitting care and watchfulness of their human attendants, and the truth would soon become apparent: they would be dead failures. In a word, for a general crop they are quite unsuitable.

About the year 1809, the celebrated horticulturist, Keen, from amongst his seedlings, picked out all those which had borne a heavy crop of fruit, and planted them in a bed by themselves, quite apart from those that had proved sterile, or had borne but lightly. Spring came, and with it his pet seedlings put forth a profusion of bloom, but his surprise was intense when he saw that there was no swelling whatever for fruit. His intelligent mind prompted a critical examination of the flowers, and then he discovered that the pistils, or female organs, were perfect, but that there were no stamens, or male organs; consequently, that his famous fruit-bearers were pistillates, or pure females. Having thus stumbled upon a very important discovery, his next step was to examine his other seedlings, and, finding that they possessed male organs in perfection, he plucked a number of their flowers, placed them in phials of water, and suspended these in different directions immediately over his bed of pistillates. His experiment was eminently successful; the pistillates began immediately to swell for fruit, and every blossom produced its berry.

These celebrated plants were known under the name of "Keen's seedling," but it is doubtful if they are in existence at this day, the variety so called now being a very favourite hermaphrodite, and not a pistillate. The reason for this is not difficult of explanation. Fine bearing pistillate plants are carefully removed from all others, and planted by themselves, perhaps, in some gentleman's garden, being regarded as a great treasure; the next season, abundance of blossom, but no fruit. This first miscarriage may be attributed to late frosts, slugs, &c., &c.; so another season is awaited, but the same result disgusts both master and gardener, and the poor unmated females are declared worthless, and are cast on the dungheap. In this manner profuse bearers are thrown away, and the partial bearing hermaphrodite takes their place, and gives rise to the universal complaint, "How badly my strawberries do bear! I had a fine show of bloom, very fine, but somehow or other I have had scarcely any fruit. It is provoking!" Yes, so it is—very provoking, indeed; and, knowing and feeling this, we are now endeavouring to diffuse a little information on the subject, hoping that our readers will circulate this information, as well as take advantage of it in their own practice.

After Keen, a Mons. Duchesne arrived at a similar knowledge of the sexual differences in the strawberry plant; but as far as the practice in England is and has been concerned, it really seems as if the discovery made and published by Keen had been entirely lost sight of. We have conversed with some of our largest and most eminent nurserymen and seedsmen, and have even ventured in our innocence to speak on the subject of staminates, pistillates, and hermaphrodites to the fruitsellers in Covent-garden Market and in the City; but the blank looks of some, and the honest confession of others that they really did not know anything about the matter, would lead us to the conviction, that, if these sexual differences are known and recognised at all in England, it must be by very few indeed. It may be that some of the strawberry growers possess this knowledge; but, if so, they keep it remarkably secret, perhaps that they may reap the greater (supposed) advantage from its exclusive practice, although we can scarcely imagine this. We were ourselves as ignorant on this subject as the English public at large, until we visited the town of Cincinnati, in the United States, and had the matter clearly explained to us by our highly esteemed friend Robert Buchanan, the celebrated wine grower of Cincinnati—a gentleman who, together with Nicholas Longworth, has done so much real good for his country. In Mr. Buchanan's instructive little *brochure* on "Grape Culture" is included some very interesting letters, statements, and reports upon the culture of the strawberry plant; and, as these afford most valuable information, we shall briefly allude to them.

It appears that a plain, uneducated market gardener, of the name of Abergust, removed some forty-six years ago from Philadelphia to Cincinnati, and went largely into the cultivation of the strawberry, in which he marvellously surpassed all his neighbours by means of a secret method of managing the culture, and which method he had most successfully practised at Philadelphia. So well did he keep his secret, that for very many years it was not even guessed at; and he supplied nine-tenths of all the strawberries consumed in Cincinnati, making thereby a very handsome competency. To give Mr. Longworth's own words, "While I could, from one-fourth of an acre, scarcely raise one bushel of strawberries, he (Abergust) would raise forty bushels. His fruit was much larger than any other brought to market, and commanded from 25 cents (1s.) to 37½ cents (1s. 6d.) per quart. His secret he kept to himself, and my attention was first led to the subject by a casual remark of his son's to me one day in my garden;—that I must get very little fruit, as my plants were all males. I then investigated the matter, and soon discovered that there were what he called male and female plants—a fact I communicated to our market gardeners. The result was that strawberries rapidly increased in our market, until as fine as Mr. Abergust's were sold at from three cents (three-halfpence) to ten cents (fivepence) per quart."

There can be little doubt that this gardener, Abergust, obtained his knowledge, either directly or indirectly, from Mr. Keen, who had promulgated the information he had acquired, some short time previously. Through Mr. Longworth, Keen's discovery and Abergust's secret was thoroughly ventilated in the United States, and is now universally known in that part of America, where strawberry growing is carried on to an extent little dreamed of in this country. One individual grower (Mr. Culbertson, of Cincinnati) sends to market sometimes 4,000 to 5,000 quarts a day, employing sixty persons to pick them. Numerous cases are known of 5,000 quarts per acre being obtained in one season; and it is held as an indubitable fact, that, by cultivating hermaphrodites (as we do in England) instead of pistillates, only from one-tenth to one-third of a crop can be obtained.

By far the largest and most delicious strawberries in the world, to our knowledge, are those of Chili; and we think plants and seeds from that country might advantageously be brought aud domesticated here. Certainly the finest strawberry plant we have ever seen is that of Mr. John Robertson, of Paisley, which is known under the name of "The Wizard of the North" (that is, supposing the authorised coloured drawing of the plant, in full bearing, to be a true and faithful representation). Sundry apparently respectable and trustworthy persons testify by letter to having seen it, with seventy-eight fine large fruit at one time upon a single plant.

Having obtained a good pistillate, one would be apt to suppose that we had the utmost we could reasonably hope for; but in this we should err very greatly indeed; for Mr. Charles Peabody, of Columbus, in Georgia, has clearly demonstrated that it is possible to obtain a succession of fruit from the same plants for many months in the year, instead of only one bearing. This most indefatigable gentleman has in truth reduced the culture of the strawberry to a perfect science. His is no small garden cultivation, but comprises many large fields, embracing a very considerable acreage, and justified by more than fifteen years' constant observation and experience. His plan deserves all possible attention and respect. He selects some good pistillate of an ever-bearing variety; and, to impregnate this, he also chooses a good, ever-bearing hermaphrodite, planting seven rows of pistillates, then one row of hermaphrodites, and so on throughout the field. For many years the varieties he employed were the Hovey's seedling pistillates, and the Early Scarlet hermaphrodites, both flowering regularly together, and both being ever-bearing. Recently he has widely disseminated a seedling of his own, and named after himself.

It is believed that all these valuable seedlings have been originally obtained by judicious crosses with the hardy, ever-bearing, or monthly, wild strawberry, such as the monthly alpine, or others of a similar type. Certain it is, that not only Mr. Peabody, but numerous other persons throughout the States, obtain by simple field culture a continuous bearing of fruit, from early spring, until the winter's frost sets in—a thing altogether unknown in this country, although quite as practicable here as there.

Mr. Peabody, in his statement, given in the "United States Agricultural Report," says :—

"It is now well known throughout the Southern States, that for many years I have cultivated the strawberry extensively, and have had from my beds a constant succession of fruit six months, and frequently ten months, in the year. While I am now writing (Dec. 24) one of my beds (of an acre) is loaded with ripe fruit, specimens of which I have sent to New Orleans, Montgomery, Charleston, New York, &c. This bed has scarcely produced a runner the past season, the causes of which will be found in my method of culture. I prefer a sandy soil—that is, a sandy loam with a good admixture of vegetable matter—in which the plants stand eight to ten inches apart. In the fall of the year I go over the field with sharp hoes, cutting up all runners, and leaving them on the ground to decay. Somewhat later, I cover the whole field with partially decomposed leaves from the woods or swamps; the rains of winter beat down these leaves; the fruit-germ finds its way through them, and the first mild weather of spring the blossoms appear. If I desired to obtain an abundance of leaves and strong runners all over my beds, I should employ animal manure; but as I want fruit, and no runners, I never use animal manure of any kind—nothing but leaf-mould, and an occasional sprinkling of wood-ashes. The leaf-mould keeps the ground cool and moist, and the fruit clean; and does not stimulate the roots to make runners. Whatever runners are made, cut off close; keep the ground clear of grass and weeds, and manure with leaf-mould. Beds thus formed and cultivated will, to my certain knowledge, continue productive for twelve years, and, I have every reason to believe, as much longer as this system of culture is continued. Strawberries so cultivated are remarkable for their lusciousness and rich aroma. A very continual watering, whilst bearing, is desirable—as the crop is wonderfully increased, both in quantity and quality, thereby."

Such is Mr. Peabody's mode of raising this delicious fruit; and although we have not the fine climate of Georgia, and may not expect fruit in an open field in December, yet we certainly can adopt the course of treatment that he so clearly points out to us. Our course, then, is to plant the best ever-bearing pistillate, and hermaphrodite impregnator; to use no manure but leaf-mould, or other suitable decayed vegetable matter, with an occasional sprinkling of wood-ashes; to keep all runners off; and to water very frequently during the time of fruiting.

The best descriptions of strawberry for planting, generally, in England would be, in our opinion, "Hovey's seedling," the "Early Scarlet," "Longworth's prolific," "M'Avoy's superior," and the "Extra Red" (all

American varieties, the prolific, superior, and Extra Red being seedlings from Hovey's seedling by one of our best English hermaphrodites), if we could obtain them in this country; but unfortunately there are none to be had, unless imported from the United States. The English varieties appear to be all hermaphrodites, from the seed of which famous pistillates may be obtained by any who will take the trouble to attempt it.

Those particularly celebrated at this moment are the Oscar (of Mr. Chas. Turner, Royal Nurseries, Slough), the Wizard of the North (of Mr. J. Robertson, Linside Nursery, Paisley), the Empress Eugenie (of Mr. Myatt, of Deptford), and two or three well-known varieties. The Oscar is a particularly fine, well-flavoured, firm, and large-sized strawberry; and said to be a cross between the British Queen and Keen's seedling. The Wizard is said to be between the Elton pine and Keen's seedling, producing a large handsome berry and an abundant crop. The Empress Eugenie has been remarkably large this season, of a dark blood-red colour, very juicy, but rather soft, and with a very strong perfume, somewhat similar to the musk melon. We believe this is also called the "Crimson Queen."

We cannot ourselves feel any confidence in an alleged cross between one hermaphrodite and another, unless we are perfectly certain that the pollen of the one was applied to the bud of the other, previous to its opening; for almost simultaneously the pollen of its own stamens is matured, and the least motion causes it to fall upon the pistils, which they inclose, and self-impregnation ensues at once. If, however, the pollen from one kind be applied to the bud of the other, just before it opens, the subtle influence descends to the pistils, and impregnation is effected, surely and certainly, before the flower has yet opened, or its own stamens have had time to burst and shed their pollen. This is the opinion of Mr. Peabody, verified by some twenty years' experience, and we fully adopt his views upon this point. As a matter of course, pistillates being pure females, cannot impregnate themselves; their artificial impregnation is therefore perfectly easy, and the cross resulting is beyond doubt.

In conclusion we may remark, that (more or less) all hermaphrodite strawberry plants appear to become more and more imperfect as they get older, until, in some cases, they will not bear a single perfect berry; and we believe that even the very best hermaphrodite (however perfect it may appear when young) will, in a few years, exhibit this inherent tendency to infertility.

PAPER MATERIALS PATENTED SINCE THE YEAR A.D. 1800.

BY M. C. COOKE.

In the year 1800, Matthias Koops patented a method of extracting ink from printed and written paper, and re-converting such pulp into writing and printing paper. In the following year he also obtained a patent for manufacturing paper from hay, straw, thistles, waste and refuse of hemp and flax, and different kinds of wood and bark.

In 1824, Alexander Nesbitt, for making paper of "a certain kind of moss which grows in the low watering-places of Holland;" and in the same year Louis Lambert, for employing straw freed from knots.

In 1827, the Count de la Garde, for a method of employing the ligneous parts of the stalks of hemp and flax, nettles, hops, or such other textile plants.

In 1832, Peter Young, for making paper from the residue of mangold wurzel, after extracting the juice for the distillation of spirit.

In 1836, Frederick Burt Zincke, from the leaf of the pine-apple plant.

In 1837, Edmund Shaw, for using the envelopes or leaves which cover the ears of Indian corn.

In 1838, Miles Berry, for paper stuff from "the musa, plantain, or banana, the cannacorus plants, the ficus or fig-tree, the agave or aloe, the Karatos plants, the ananas or pine-apple, the cocoa or cocoa plant, the palmæ or palm tree, the macaw tree or plant, the phormium tenax, or New Zealand flax, the saccharum officinarum, or sugar cane, and in general all the textile plants which grow between the tropics."—James Vincent Desgrand, for making paper and pasteboard with wood reduced into a state of paste, and of the different sorts of wood, *that*, coming under the denomination of white wood, such as poplars, has been found to answer the best.—George Robert D'Harcourt, for making paper from the leaves and stalks of the aloe, the sheaths or covering leaves of the fruit or ear of the maize, otherwise Indian corn, the leaves and stalks of the rice plant; also, the bines or stems of the hop plant, the common field bean, the scarlet and French bean, the stalks or stems of the asparagus and potato plant, and all stalks, leaves, and bines of similar vegetable substances, with or without admixture of rags.—Morton Balmanno, from the bark of trees, and the bark of young shoots of trees; those herbaceous plants which partake of the nature of hemp or flax, having a skin or coating, such as hop-bine, &c.; those plants not having an outward skin or coating, or having it in a very slight degree, but having a fibre intermixed with the ligneous part, such as the stalks of potatoes, &c.; small roots of trees, shrubs, and plants, dead or dried leaves, exclusive of the leaves of maize or Indian corn.—Edward Cooper, from "cane trash, or megass."

In 1839, Henry Crosley, from "refuse tan," or "spent hops."—Hewick Zander, from horse dung, and mixed with straw of any kind, in such a state as the manure is taken from the stables, the pulp being mixed with the pulp of linen rags.—Thomas MacGauran, from hop-bine, either by itself, or mixed with any other suitable material.—Miles Berry, for the application of "Esparto," of the class of plants named "Stipa," genus "Graminaea," and commonly called "Esparto," or "Stipa tenacissima."

In 1843, Richard Archibald Brooman, for the convolvuli of the cissus genus, or family of plants. All the plants of this order may be used; but those known at Guadaloupe as "oua oua," or "baba," which is the "mimosa scandens of Linnæus," the "guidandina baudue," or "yeux à bourrique," or "yeux à bœuf," and the ledum, or marsh bindweed, will be found most suitable. The bark of the West Indian pear-tree, and herbes coupuntes, of the West Indian islands, are also referred to as applicable.

In 1846, Edmund Nerot, for the bark of the ozier and willow.

In 1852, Jean Antoine Farina, for preparing pulp from the plant called "spartum," or "winter broom."—Jean Theodore Coupier and Marie Amedée Charles Mellier, for reducing vegetable matters into pulp by means of a solution of hydrate of soda or potash. The vegetable matters named are straw, and barks of some trees, as willow, osier, chestnut, flax, waste cotton, waste tows of hemp, jute, or surate, and employing nitric acid in manufacturing pulp from shavings of pine, beech, ash, elm.—George Lloyd, for vegetable fibre, obtained from the fæces or solid excrement of herb-eating animals.—William Edward Newton, for copying paper, composed of Manilla fibre, or the equivalent thereof, such as of the cocoa-nut husk. —Joseph Alexander Westerman *(provisional protection)*, for producing paper and pasteboard from turf.—William Wilkinson, for the beards of barley, rye, and other like grain.

In 1853, Edward Maniere, for applying asbestos in the manufacture of paper.—Richard Archibald Brooman, for paper from wood and woody fibres by means of mechanical agents.—Jules Dehau, for employing the fibres of stipa tenacissima—Joseph Lallemand, for the manufacture of paper from peat.

In 1853, Arthur Warner, for the application of the fibrous parts of the palm-tree and leaf.—Francis Frederick Clossmann, for the application of the fibres of all the species of malvaceous plants, and especially those under the name of "Althaea officinalis."—Jacques Pierre Henri Vivien, for applying green, yellow, or dead leaves of all kinds of trees and shrubs.

In 1854, James Murdock, for applying a plant called spartum, or water broom.—Joseph Barling, for improvements in treating hop-bine, and rendering it applicable.—John Lilley, for a new material obtained by crushing from the heart or core of the plantain, banana, and other plants of the same species.—John Jeyes, for pulp from twitch or couch grass; for employing the refuse of tan yards.—John Evans, for a new manufacture from the waste refuse of the so-called Brazilian grass, arising from the manufacture of that material into plait or plaited hats.—Thomas Littleton Holt and William Charlton Forster *(prov. pro.)*, for making paper with refuse tan and refuse cocoa-nut fibre, and old rope or rags, in equal parts.—James Acland *(prov. pro.)*, for the fibrous portion of the roots of potato, parsnip, turnip; the roots, stems, and stalks of mangold wurzel, chicory, and rhubarb.—Thomas Littleton Holt and William Charlton *(prov. pro.)*, for taking clover, the hop stem, or hop-bine, Italian rye grass, either alone or combined with rags.—Israel Swindells *(prov. pro.)*, for digesting wood, such as waste cuttings of timber, loppings of trees, dyer's waste wood or spent wood, underwood, weeds, or vegetable matters in caustic alkali, and producing paper material therefrom.—Alfred Vincent Newton, for an improvement in the process of converting wood into paper.—Samuel Clift *(prov. pro.)*, for improvements in making paper from green grass, nettles, or dried grass or hay.—George Thatcher, for the employment of the fibre of the leaves of horse-radish.—Edward Gillman, for employing the leaves or fibrous portions of the phormium tenax, or New Zealand flax, the running or creeping plant called giagia, and the species of dracæna called ti, for the production of pulp.—Thomas George Taylor, for the application of the stalk of the hop plant.—John Coupland, for the preparation of pulp from clover, and grasses of all sorts, from fern, furze, weeds, and rushes, in some cases using a small proportion of flax.—Henry Trappes *(prov. pro.)*, for the preparation of leather to be used as a pulp for paper.—George Printy Wheeler and Samuel Bromhead (void), for pulp from the species of plants called "Iris," or the flower-de-luce, or flags, or leaves of flags of every description, known by botanists as a genus of plants of the class triandria and order monogynia, which grows in England, throughout Europe, in the East and West Indies, and many other climates, and are imported into Great Britain in mats, bags, and wrappers, as sugar mats, &c. —Gurgardin Achille, for the use of the arrow, or water arrow *(flèche, fleche d'eau,* and *flechière)*. The botanical names are *Ranunculus palustris* according to Tournefort, and *Sagittaria aquatica* according to Linnæus, of the family of the *butomeæ* or *alismaceæ* of Jussieu.—Henry Crossley, for spent tan or spent hops, mixed with fibrous materials, either animal or vegetable.—Samuel Elliott Hoskins, for the fibres obtained from the plant known by the name of *Cyperus longus*, of which the English name is "galingale."—Christopher Hill, for the stems and roots of horse-radish, the rush, and the flag, together with the vegetable remains of horse manure.—John Jeyes, for the stems of mustard and other plants of the same class.—William Rossiter and Matthew Edwin Bishop, for pulp from rope, shakings, canvass, tow, bagging, and other matters mixed with refuse tan, bark, &c.—Louis Vital Helin, for improvements in the manufacture of paper from straw.—Gustave Hermann Lilie, for the manufacture of paper from the thistle plant.—James Niven, for the application of the holyhock plant or plants, comprehended under the natural order "Malvaceæ."—Leon Castelain, for pulp from hay, straw, and similar substances.—Henry Diaper, for applying cocoa-nut kernel after expression of the oil to the manufacture of paper.—Charles Peterson, for the application of "the sea tree mallow, or lavateria arborea marina."—Auguste Edouard Loradoux Bellford, for applying down or cotton gathered from thistles, also moss and lichen plants.

In 1855, William Johnson, for improvements in the application of various substances containing woody fibre to the manufacture of white paper pulp, as, the inner bass of the lime tree and other tiliaceæ, the willow, birch, elder, the leaves of coniferæ; also heather and other ericaceæ, rushes and other juncaceæ, clover, lucerne, stalks of pease, broom, whin, and other leguminous plants (except the stalks of common leaves), sunflowers, Jerusalem artichokes, and other compositæ (except thistles), nettles and other urticeæ, turnips, mustard, and other cruciferæ; cucumbers and other cucurbitaceæ, mosses, licopodium, equisetum, ferns, reeds, canes, bamboos, water lilies, water weeds, anacharsis aloinastrum, and other water plants, rye grass, pampas grass, mya and other grasses, raspberry, blackberry, and other rosaceæ, malva, sida, and other malvaceæ (except altheæ, gossypium and corchorus), buckwheat, leaves of palms, sugar-cane, tillandsia, and other bromeliaceæ; maize and sorghum plant, madder and other rubiaceæ; anonaceæ, melastomaceæ, velloziæ panax, solanaceæ, cupheæ, rhamneæ, lychnophora, terebinthenaceæ, bombax, myrtacea, bignonaceæ, lilaceæ, artocarpeæ, the mulberry, pandanus, cecrops, dracena, polygaleæ, malpighiaceæ, convolvulaceæ, leaves of musaceæ, broussonetia, bœhmeria, amomum, manispermum, erytoxylon, gutlafereæ, ricinus, and other ruphorbiaceæ, asclepiadiæ, apocineæ, rutaceæ, phormium, iris, solaneæ, the stalk of the tobacco plant, cactus, papyrus, aloes, agave, labitæ, asparagus, juniper, rice-straw, mandioca plant, gramineæ. For certain pulps the refuse from breweries, bran, spent tan, and spent dyewoods, and seaweeds may be employed.—John Smith and James Hollingworth, for improvements in treating Surat jute, gunny, or sugar bagging.—Hippolyte Victor Pinondel De la Bertoche, for paper from asphodel root (void).—Francis Parker (*prov. pro.*), for the haulm or stalk of the potato plant.—Richard Archibald Brooman, for preparing the fibres of French beans, scarlet runners, &c. (void).—Alexander Brown, for applying the fern or bracken plant, or plants comprehended under the cryptogamic series.—James Niven, for the common broom plant and the whin plant, genista scoparium, and ulex Europæa (void).—John Cowley, and Daniel Peyton Sullivan, for improvements in the manufacture of paper from straw.—Jean Pechgris De Frontin, for pulps from the acacia tree, various kinds of lupins, the plant called bryonia, the stalks of the plant called topinamber or Jerusalem artichoke, and the stalks of the different kinds of heliotropium or sunflower.—John Henry Johnson, for employing the waste or residual beetroot.—Lazare Ochs, for the manufacture of certain kinds of paper from the refuse and cuttings of leather during the operation of tanning.—John Louis Jullion, for paper from the fibres of the banana and plantain plants, waste or pressed sugar cane, and the various water flags that abound in warm countries (void).—Francis Burke, for using the plantain, banana, and the aloe.—Giovanni Martenoli de Martinoi and Juan Francisco O. de Lara. The employment of seaweed.—Simon Eugene Gabriel Simon, for substituting in part plants of the family sparganium for rags.—Joshua Horton and Thomas Horton, for using spent tan.—Robert Martin and John Cowdery Martin, for improvements in obtaining pulp from wood.—William Armand Gilbee. The employment of dog's grass (void).—Francis Moll, for the employment of the stalks and stems of the potato, and the leaves or fibres of the fir tree, and other conifers.—Theophilus Henry Hastings Kelk, for the use of the bark of elm, of lime, of poplar, of willow, and of marshmallow, canes, or reeds, the leafstalk of horse-radish and the root of horse-radish, the shrubby cane or rod of marshmallow.—Richard Archibald Brooman, for employing the root of the asphodel plant.—John Lilley, for a plant, the growth of West Africa, and known at the Cameroons by the name of Medickey.—Frederic Lotteri, for the bark of trees of the morus family or class (void).—Charles Mabury Archer, for sea weeds and freshwater weeds.—Joseph Barling, for the root of the hop plant, humulus lupulus.—William George Plunkett and John Bower, for iris pseudacorus, commonly called the yellow flagger; the arctium burdana, or woollyheaded burdock; the tussilago farfara, or common coltsfoot; the beta vulgaris, red or white beet, or mangold wurzel and turnip leaves and stems.

In 1856, Claude Louis Parisel, for grass or hay, and similar plants used as forage, and also from weeds and other herbs.—Herman John Van Den Hout and Ebenezer Brown, for making pulp from shavings of leather mixed with ropes, rags, &c.—Lazare Ochs, for certain kinds of paper from the refuse of tanned leather.—Jacob Smith and John Luntley, for treating the sunflower plant (void).—John Cowley, for improvements in the manufacture of paper from straw, &c. (void).—James Niven, for the bark of the elm, or ulmus Europœa, and the lecistera formosa.—Herman John Van Den Hout, for currier's shavings of skins or hides with a certain percentage of pulp from rope, &c., or offals and cuttings of all kinds of leather, mixed with textile materials.—William Denny Ruck and Victor Touche, for using the stem and leaves of sugar cane, Indian corn, and bulrushes, and the material called bass or bast.—Charles Armand Messager-Abit, for treating the plants ligneum spartium, stipa tenacissima, chamærops humilis, and the plants of the genera genista and stipa.—John Cowley, improvements in manufacture, from straw, &c.—Thomas Routledge, treatment of esparto and other raw fibres.—Joshua Horton and Thomas Horton (*prov. pro.*), for using spent tan.—Robert Hanham Collyer, using the residue and substances extracted from the genus beta, that is, beetroot, mangel wurzel, &c.—Adolphe Aubril, application of the residue of the bryony root.

In 1857, Frederick Burnett Houghton, treatment of fibres by heat and pressure.—Lewis Hope, applying the inner bark of the birch and maple.—Louis Jean Marie Siblet, for an improved pulp for paper, by mixing in certain proportions—chloride of lime, alum, carbonated colours, linseed oil, gum copal, acetate of lead, turpentine, essential oil of turpentine, nut oil, cotton, flax, white lead, wheaten flour.—Peter Wicks and Thomas Goulston Ghislin, applying Junceæ serratus, trista, &c.; aloe arborea, &c.; sanseviera, malvaceæ, Watsonia latifolia, narvoso humilis, papyraceæ, &c.; tulipa beyniana, &c., plants of South Africa.—Lucius Henry Spooner, paper pulp from zostera, otherwise named wrack grass, or wreck grass.—Robert Hanham Collyer, an improved method of preparing the residue of beetroot, &c. —William Edward Newton, manufacturing paper from wood, or other ligneous or fibrous substances. — Josiah Wright, Alfred Wright, and Francis Roberts, employing the stalk of the rhubarb plant.—William George Plunkett, applying the bark, leaves, and stems of the lavatera arborea (sea tree mallow), otherwise called arborem marina nostras; also the vine or straw of humulus lupulus or hop plant, and trifolium pratense, or rubens (common red clover).—David Lichtenstadt, making pulp from leather or any kind of animal fibrine, to be used with or without rags.

—Joseph Gibbs, a method of treating phormium tenax.—Romain Ignace Charles Dubus.—The residue of the bulbs or roots of the lily tribe, the lily known as the Turk's cap is preferred.

In 1858, Jean Theodore Coupier, for treating straw, cane, reed, dwarf palm, maize stem, jute, &c., for manufacture of paper.—Robert Hanham Collyer, for improvements in making paper from straw.—Jozè Luis, the application of the fibrous textile plant, called in Arabia "Diss," or in Latin "Arundo festuca patula," or by botanists "Festucoides et donax tenax."—Michael Henry, the resulting products of improvements in dyeing and tanning such as spent tan and dye stuff.—William Edward Newton, improved method of preparing wood pulp.—Philip Davies Margesson, for applying the residue of sugar cane and other canes.—Donald M'Crummen, marine plants, and heath, or heather.

In 1859, David Lichtenstadt, for converting bamboo and the like substances into pulp.—Frederick Brown, the leaves or fruit of the "citrus" plant, or tree, generally known as the citron, the orange, and the lemon. —Leon Castelain and Charles Frederick Vasserol, the liquorice root.

We are not responsible for either the botany or orthography of the patentees, but have given the descriptions as we find them in their specifications.

ON THE MANUFACTURE OF BEETROOT SUGAR IN POLAND.

BY LIEUT.-COL. SIMMONS, R.E., C.B.

The cultivation of beetroot for the manufacture of sugar has of late years received an immense development in the kingdom of Poland, and in the adjoining provinces of Russia.

As early as 1812 the Government endeavoured to introduce this manufacture into Poland by offers of loans, and by promising freedom from conscription to persons employed in it. These measures did not, however, at first meet with success, the first factory having been established only in 1831, and the first refinery in 1839.

Since that time this manufacture has received a great development, as there were in 1856 fifty-two factories in the kingdom, thirty-five of which were to be found in the Government of Warsaw alone, which, as the centre of capital, is also the principal market for the sale of sugar.

The conversion of beetroot into sugar is entirely performed between the end of September and the commencement of April in each year, beyond which time the beetroot, if kept, becomes deteriorated.

The following statement of loaf sugar, manufactured in several years, is compiled from the latest Government returns, and shows the progressive increase in the manufacture of this article. It refers, in each period, to the manufacturing season.

In the year	1849-50	there were manufactured	3,628,170lbs.	English.
Do.	1851-2	do.	8,585,587	do.
Do.	1854-5	do.	12,150,000	do.
Do.	1855-6	do.	11,031,000	do.
Do.	1856-7	do.	15,377,000	do.

In addition to which, in the years 1856-7, were manufactured of a coarser sugar, 13,636,000lbs., making a total of manufacture for the year 1856-7 of 29,013,000lbs.

The number of persons employed in the manufacture of sugar in the year 1856-7 was—

Permanently	1,748
Temporarily	5,902
Total	7,650

Besides those employed in the cultivation of the beetroot.

The crop of beetroot for the year 1858 is estimated at 350,000 tons, which, at the current value of about 24s., gives the large amount of about £420,000 as the benefit derived by agricultural interests from this manufacture.

Calculating the yield of sugar as 6lbs. for every 100lbs. of sugar, which is rather under the average, it will be seen that the quantity of sugar manufactured this year will be upwards of 33,600,000lbs.

This would show a produce of upwards of 7lb. for each inhabitant.

According to a statement I have before me, the average consumption of the following countries, in 1849, was as follows, for each inhabitant:—

England	22 lbs.
Belgium	17
Holland	$7\frac{1}{4}$
France	$6\frac{3}{4}$
Switzerland	$6\frac{1}{2}$
Russia	$1\frac{1}{2}$

It must not be assumed, however, that the consumption of sugar in Poland has increased in any degree proportionally to the increase of the manufacture, or that it approaches that of other countries.

The article of sugar is an almost unknown luxury among the lower classes, and must remain so, as long as the present high prices are maintained. The only sugar in the market is refined loaf sugar, at a price of nearly tenpence per pound, which effectually excludes it as an article of consumption of the poorer portion of the population.

It has been estimated, and may be confidently assumed, that the consumption in Poland does not exceed two pounds per inhabitant.

It appears, therefore, that the produce of the year will be 33,600,000lbs. of sugar, whilst the consumption will not exceed 9,500,000lbs., leaving a surplus of 24,000,000lbs. for exportation into Russia.

The ordinary price of refined sugar, as sold in the Warsaw market, is about tenpence per pound, and calculating a probable reduction of ten per cent. in consequence of the great increase in the production, it appears that the total value of the yield will be about £1,400,000, of which to the value of one million will be for the consumption of Russia.

The increase of this manufacture in the neighbouring provinces of Russia has probably nearly equalled that in Poland; it will be well, therefore, to ascertain what may be the effect of the development of this manufacture upon the foreign trade of Russia.

Upon reference to the Reports of the Customs Department of the Empire for the five years from 1853 to 1857 inclusive, it appears the sugar of all sorts imported into Russia by its European frontier in 1853, amounted to 47,435,000lbs., of an estimated value of 4,936,560 roubles, almost entirely in the form of raw sugar, through the Baltic ports.

In 1854 this quantity was reduced to 40,822,000lbs., valued at 5,918,226 roubles, one-seventh of which was imported by the land frontier, by which in 1853 there was no importation of sugar.

In 1855 the import of sugar into Russia was again reduced, and only amounted to 36,257,000lbs., valued at 5,208,486 roubles, more than nine-tenths of which was imported by the land frontier.

In 1856 the import trade of sugar into Russia appears to have resumed the position it held previous to the war, having amounted to 48,092,000lbs., of the value of 7,111,092 roubles, of which about two-thirds were imported by the land frontier.

The import into Russia for the year 1857 amounted to 59,150,929lbs., valued at 8,904,044 roubles, almost entirely imported by sea.

It will be seen, then, that the quantity of sugar, from the crop of 1858, available for export into Russia from Poland, will be equal to two-fifths of the whole of the stated import in the year 1857 from foreign countries. If the increased production in the adjoining provinces be taken into account, it may be assumed that the manufacture of sugar within the Empire would nearly suffice, according to the scale of consumption of previous years, for the entire supply of the country.

As the calculated amount of home-produced sugar in Russia, in 1855, amounted only to 41,876,000lbs., even after making full allowances for the defective nature of the Customs' Returns, it will be seen that sugar is an article of luxury, the consumption of which is exceedingly small in Russia as compared with other European States, not amounting to one and a-half pound per head of the population.

From the slow progress made in the material development of the masses of the people, it will probably be long ere the consumption of this article will receive any very great development, and especially so as the large interests, both agricultural and manufacturing, involved in producing this article, and which have been fostered under a high scale of protective duties, will operate to prevent the reduction in price which would immediately occur if these duties were removed.

From the facts above stated, it would appear that the extraordinary development of this manufacture in Poland is, in some measure, to be attributed to the war, which closed the ordinary channels for the importation of sugar, and caused a large trade to spring up for the supply of the Russian market across the Polish frontier, thus enhancing the value of the article.

This branch of industry was, without doubt, fostered by the high scale of duties chargeable under the old tariff, under which the duty was three roubles per pood (about threepence per pound) for raw sugar, and refined sugar was altogether prohibited.

So great was the inconvenience felt in Russia consequent on the cessation of all import by sea during the late war, that the Government on several occasions reduced the duty on sugar imported by the Polish frontier.

By the last tariff, which came into operation in July, 1857, the duty is fixed as follows:—

		Into Russia.				
			Roubles.			d.
Raw sugar	...	per pood	3·80	=	per lb.	3·8
Brown do.	...	do.	3·20	=	do.	3·2
		Into Poland.				
Raw sugar	...	per pood	2·00	=	per lb.	2
Refined do.	...	do.	4·00	=	do.	4

It would appear, therefore, that although Great Britain and other countries could compete with the home manufacturers in Russia for the supply of sugar, if those duties were removed, it is probable that the large interests which have grown up under their fostering care will for many years operate to prevent a reduction of the duty.

It appears also, that the home production in Russia, including Poland, has now become so great that it will act upon the foreign trade of this article, which, in 1857, exceeded £1,250,000 in value, and tend to the exclusion of foreign grown sugar for the Russian market.

Although the stated import of sugar from England in 1856 amounted only to 2,435,000lbs., valued at 449,400 roubles, and the result of the cessation of the Russian sugar trade will not, therefore, be felt very seriously on the direct trade with England, it must re-act upon the general sugar trade of the world, and, therefore, indirectly upon that of England.

BALSAM OF PERU.

The balsam imported into England as balsam of Peru, is produced within the department of Sonsonate, in the republic of Salvador, and along the coast of which department the trees from which it is extracted extend for leagues.

In the district of Cuisnagua there are 3,574 trees, which yield altogether only 600lbs. of the gum annually. With proper care in the extraction each tree would yield from two to three pounds, making the total quantity capable of being produced, in the before-mentioned district, about

10,000lbs. When the season has been more rainy than usual the product is much lower; but in order to meet this difficulty, the Indians heat the body of the tree by fire,—by this means causing the gum to exude more freely; this operation invariably causes the decay of the tree.

Should this mode of extracting the gum by heat not be put a stop to, the tree will soon disappear from the coast. This fact has been brought to the notice of the Government, and inquiries into the matter have been made in consequence.

The Indians employed in collecting the gum say that such trees as are well shaded yield a greater quantity, but that those which have been planted by hand yield the most. This has been proved by experience, particularly in Calcutta, where a considerable quantity is yearly collected from trees which have been so planted. During the months of December and January, the gum oozes away spontaneously. This class of gum is called "Calcauzate." It is orange-coloured, weighs less than the other, emits a strong odour, and is volatile and pungent.

The export of balsam from Salvador in 1855, was 22,804lbs., valued at 19,827 dollars. On the coast of Chiquimulilla, in Guatemala, there are many trees of the description that yield the balsam; but, hitherto, it has not attracted the attention of the people of the country to collect it, and bring it to market. That part of the coast in the State of Salvador, extending from Acajutla to Libertad, is emphatically termed the "Balsam Coast," because there only is collected the article, known in commerce as the balsam of Peru.

The particular district is intermediate to the two ports, and does not reach either of them within three or four leagues. Lying to the seaward of a low lateral ridge of mountains, the whole tract, excepting a few parts on the borders of the ocean, is so much broken up by spurs and branches thrown off from the main eminence, and so thickly covered by forest, as to be nearly impassable to a traveller on horseback. From this cause it is so rarely visited, that very few residents, either of Sonsonate or Salvador, have ever entered it. Within this space are situated some five or six villages, inhabited solely by Indians, who hold no intercourse with other towns than what is necessary for carrying on their peculiar traffic. Their chief wealth is the balsam, of which they take to market from 18,000 to 23,000lbs. weight annually. It is sold in small portions at a time, in the before-mentioned towns, to persons who purchase for exportation. The trees yielding this commodity are very numerous on this privileged spot, and apparently limited to it; for in other parts of the coast, seemingly identical in soil and climate, rarely an individual of the species is met with. The balsam is extracted by making an incision in the tree, whence it gradually exudes, and is absorbed by pieces of cotton rags inserted for the purpose. These, when thoroughly saturated, are replaced by others, which, as they are removed, are thrown into boiling water. The heat detaches it from the cotton, and the valuable balsam being less of gravity than the water, floats on the top, is skimmed off, and put in calabashes for sale. The wood of the tree is of a close grain, handsomely veined, nearly of a mahogany colour, but redder; it retains for a long time an agreeable fragrant odour, and takes a fine polish. It would be excellent for cabinet-makers, but is seldom to be obtained, as the trees are never felled, until by age or accidental decay all their precious sap is exhausted. This balsam was long erroneously supposed to be a production of Southern America; for in the early periods of the Spanish dominion, and by the commercial regulations then existing relative to the fruits of this coast, it was usually sent by the merchants here to Callao, and being thence transmitted to Spain, it there received the name of the balsam of Peru, being deemed indigenous to that region. The real place of its origin was known only to a few mercantile men.

MANUFACTURE OF PAPER IN TASMANIA.

We have not the exact particulars before us of the extent to which paper is used in the Australian colonies. But when we mention the fact, that there are issued in Victoria alone upwards of fifty newspapers, of which number some ten or a dozen are dailies, we furnish one element of the calculation that will materially assist it. In Australia paper enters as largely as in any country in the world of equal population into all the ordinary transactions of commerce and social life. The demand for it is necessarily enormous, and it is year by year increasing. Like all supplies drawn from a distance the quantity of stock greatly fluctuates, and there have been times when grave embarrassment was experienced, and the most serious apprehensions entertained of the stoppage of establishments in which large capitals were invested, from the failure of this most necessary article. The Melbourne newspapers have before now had to resort to the use of coloured papers, and the *Geelong Advertiser* was once printed on coarse brown packing paper. In addition to the requirements of the newspaper press, and the ordinary trade and domestic demand for paper, a publishing trade is being developed which will create a new demand. It is enough, however (says a Hobart Town paper), to insist upon the fact that the wants of a civilised community of upwards of a million persons in respect of this article have to be supplied, and that at present every pound and sheet of paper used is imported, to demonstrate our position that a paper mill established in Tasmania would find ready to take its produce to a market so constant and so consumptive as to render the enterprise highly remunerative.

It may be suggested, indeed, that if these conclusions are so patent, it might be anticipated that colonial capital would readily embrace the opportunity offered for profitable investment; and the suggestion has sufficient pertinence to call for remark. There is a disproportionate share of colonial capital which has been invested in mining pursuits—stimulated by the hope of larger profits than could be expected from other forms of enterprise—a condition of things which there is every reason to believe will now rapidly right itself. But this is not the whole truth. We have even in this island capital lying idle, and many men who have patriotism and public spirit enough to apply it to any practical uses—if the way is made clear to them. We want, however, the presence of practical men in a position to afford guarantees of their good faith, competence, and energy to give direction and development to the capabilities of the colony. We could point to many proofs, and some of them very recent, of the readiness of all classes here from the man of large, down to the man of scarcely more than nominal, capital to help on every really practical and apparently well directed effort to give birth to new industries. If the plant necessary for the establishment of a paper mill in Tasmania were brought to the colony, we think it is not too much to guarantee that no help on the part of the colony would be wanting to set it in operation. Or, if there were on the spot men equal to the task of directing its construction, in whose competency to conduct the enterprise to a successful issue full confidence could be placed, we do not believe the public would be found wanting in any of the necessary resources. But the condition most essential to the development of a manufacturing industry in Tasmania is, that it should be inaugurated under auspices that would command confidence. We all want the work to be undertaken by proper hands, that the success of a grand experiment may not be jeopardised by charlatanism or incompetency. The pioneers of the new movement would be welcomed from whatever quarter they came, but they would be welcomed and co-operated with cordially, in proportion as they were in a position to inspire general confidence. We must content ourselves with giving publicity to the fact, that in this colony a door stands open for any enterprising body of men to lay the foundations of a manufacturing enterprise, and that paper-making is one branch of manufacture that would most certainly command a ready success.

Lest there should be any misgiving as to the existence of a sufficient available supply here of the material of such a manufacture, we may state that the colony abounds in fibrous vegetation, which has been pronounced admirably adapted for all qualities of paper, and which would enable the produce of our mills to compete with the ordinary rag paper of commerce. The supply of this material is inexhaustible. Not only is its adaptability for being worked up into a good paper of every quality attested by the very best authorities, but the colony abounds in actual specimens of native paper manufactured by the primitive process of the rain beating down upon collected heaps of matted leaves, of a strong fibre. In the museum of the Royal Society of Tasmania are specimens collected from Mount Wellington, which overhangs Hobart Town, of perfect natural paper of great thickness thus manufactured. A sight of those specimens would satisfy the most sceptical of the availability of the vegetation of Tasmania to feed with raw material, as many mills as the demand for the Australian market would keep going. In the abundance of the raw material, and in the constancy of the demand for the finished product, the two main conditions of success exist. The presence of cheap labour, of accessible fuel, and of an abundant water supply furnishes the rest.

METROPOLITAN TECHNOLOGICAL MUSEUMS.

South Kensington Museum (Animal and Food Products, and Building Materials). Free, Mondays, Tuesdays, and Saturdays. Wednesdays and and Thursdays, 6d. each. Ten to Four, and Seven to Ten.

Museum of Practical Geology, *Jermyn-street* (Mineral Products). Free, daily, Fridays excepted, Ten to Four.

Museum of Economic Botany, *Kew Gardens* (Vegetable Products). Free, daily, One to Six.

Industrial Museum, *Crystal Palace* (Animal, Vegetable, and Mineral Products). Free to Visitors of the Palace.

Museum of the Pharmaceutical Society, *Bloomsbury-square* (Medicinal Products). Free to Members and their Friends.

East India House Museum, *Leadenhall-street* (East Indian Products)· Free on Mondays and Fridays; by Tickets, on Wednesday and Thursday, Ten to Three.

Economic Museum, *Perryn House, Twickenham*, (Domestic Economy). Open on Wednesday, between Two and Five, gratuitously. Admission, by Tickets, obtainable from the Society of Arts.

Museum of the Botanical Society, *Regent's-park* (Vegetable Productions). Admission by Member's order.

*** We shall be glad to receive short notices of the Museums of this character in the Provinces, in order to complete our list.

THE MINING RECORD OFFICE.

A testimonial, consisting of a handsome tea and coffee service and silver salver, with a purse of 200 guineas, has been presented to Mr. Robert Hunt, F.R.S., Keeper of the Mining records, by a number of gentlemen interested in the mineral industries of the empire. Mr. Josiah Berry, F.R.G.S., was deputed to present the testimonial, and in doing so stated that to Mr. Hunt was due the merit of having initiated and continued the collection and arrangement of the only official statistics in existence of the mineral produce of the British Islands, and that he had undertaken, and with vast labour and experience completed, the compilation of this admiral series of tabulated information. He had also rendered valuable services for a period of many years to the various departments of industrial science.

Professor T. C. Archer, of Liverpool, author of "Popular Economic Botany," has been appointed Superintendent of the Industrial Museum of Scotland, Edinburgh.

THE ROYAL SOCIETY OF EDINBURGH AND THE NEILL MEDAL.

At the opening meeting for session 1859-60, of the Royal Society, the Neill medal and prize was presented, through Professor Balfour, to W. Lauder Lindsay, M.D., F.L.S., for his "Memoir on the Spermogones and Pycnides of Filamentous, fruticulose and folicaceous Lichens," read to the society during the last session. In addition to awarding this prize, the society is expending a considerable sum of money,—probably equal to six or eight times the value of the prize,—in publishing the memoir in question in the forthcoming part of its "Transactions," (Vol. 22), and in relative illustrations, executed by the author, which consist of twelve plates of between 400 and 500 drawings.

The Neill prize was, by the the late Dr. Patrick Neill, of Canonmills, the eminent botanist, placed in the hands of the Royal Society, to be awarded for distinction in natural history; and this year it was offered for "a paper of distinguished merit on a subject of natural history, by a Scottish naturalist, presented to the society during three years preceding 1st February, 1859; and, failing such paper, for a work or publication by a distinguished Scottish naturalist, bearing date within five years of the time of award." As might have been expected there was no lack of natural history papers presented to the society during the years in question, and therefore no lack of competitors for this honour. In awarding all its prizes, the society is prepared to do the most ample justice to the merits of the papers sent in, by availing itself of the assistance of the most eminent authorities in every department of natural history, both at home and abroad, who are called upon to examine and decide. The medal now awarded contains on one side a profile of its founder, and on the obverse side the inscription, "Adjudged for eminence in Natural History, to Wm. Lauder Lindsay, M.D., by the Royal Society of Edinburgh." Lord Neaves, one of the vice-presidents of the society, in the course of his long and able inaugural address, remarked, in regard to the Neill prize:—"The Neill medal and prize, founded by our late member, Dr. Patrick Neill, for the encouragement of the natural history studies, in which he took a life-long interest, has been awarded by the council to Dr. Lauder Lindsay, a Scotchman, but not a Fellow of this society, for a paper on the Lichens, showing immense labour and research. This paper has been submitted to competent botanists for their opinion, and the council have pleasure in stating that it has received their high approbation. It will, therefore, not merely be rewarded by the Neill medal and prize, but it is in the course of being printed at length in the 'Transactions,' and of being illustrated by numerous plates, beautifully executed by the well-known artist, Mr. Tuffen West, of London. The delay which Fellows of the society have experienced in receiving their Fasciculus of Transactions arises from the wish of the council to include in it this important contribution, which will very soon be completed."

The Macdougall-Brisbane medal and prize, of the same society,—the only other one awarded during the past year,—was conferred on the distinguished geologist, Sir Roderick Murchison, at the meeting of the British Association, at Aberdeen, in September last, "in consideration of his original, persevering, and successful exertions to throw light upon the superposition and real age of vast geographical formations of extreme antiquity in the north-western Highlands."

RECENT WORKS ON TECHNOLOGICAL SUBJECTS.

Davison's "Geognosy of Gold Deposits in Australia," 8vo., cl.
Donaldson's "British Agriculture," imp. 8vo., cl.
Humble's "Dictionary of Geology and Mineralogy," 8vo., cl.
Bennett's "Gatherings of a Naturalist in Australasia," 8vo., cl.
Mill's "Wine Guide," 18mo., cl.

WORKS ANNOUNCED.

British Fungology, by Rev. J. M. Berkeley, 8vo., cl. Lovell Reeve.

THE TECHNOLOGIST.

THE RED DYE-STUFFS OF INDIA.

BY M. C. COOKE.

PURSUING the course adopted in the paper on "The Yellow Dyes of India and China," we now proceed to enumerate briefly the principal red dye-stuffs of India. Those of China are at present too little known, or those with which we are at all acquainted are too unimportant, to merit attention. The majority of the substances used for dyeing red in India partake of the characteristics of madder, although that substance is itself but sparingly used. The place which in Europe is occupied by madders is in India supplied by the morindas and munjeet. This latter substance has found its way into the European markets, but it has generally had a difficult matter to compete with the madder dyes already in use. The treatment it requires is similar; but although the native dyer of India prefers his munjeet and chay-root, the British dyer has still greater faith in the long-tried madders. Had a different treatment been required, it is to be questioned whether it would ever have experienced a trial here at all, since so little inclination is exhibited for new processes or new products, except they can be used as cheap substitutes for those in vogue. This is not the case solely with dyes, but with other commercial products.

NEILGHERRY MUNJEET, the produce of *Rubia tinctoria*, observes Dr. Cleghorn, "is abundant on the higher slopes of these mountains. This indigenous dye is used to a considerable extent by the Badaga tribe, whose crimson striped cloth is coloured with this root; but I cannot learn that the article is exported for merchandise, although one or two small consignments are said to have been sent to Europe. Messrs. Flynn & Co., of Madras, applied to me for a quantity of the root, and prepared a cake of a carmine colour, which produced satisfactory results. This creeper grows most luxuriantly in all the hedgerows about Ootacamund and on the slopes down to Wynaad (3,000 feet), so that the root is procurable at the simple cost of Cooly hire. I observed that the roots are larger and redder at the greater elevation, becoming knotted and duller as the altitude lessens."

This, therefore, is the true madder; but it does not appear generally to have as great a repute in India as some other red dye-stuffs which we shall hereafter name. Bombay madder finds its way to the English market, but does not realise the best prices.

Mr. H. Cope, to whom the sample of Neilgherry munjeet was submitted, observes:—"It is impossible to say, from a mere specimen of the root, whether the munjeet now before me, and that of Affghanistan, are from plants of the same species or not; but if any dependence is to be placed on the difference between the two, I should be induced to think the species distinct. I have already mentioned that the Affghan species of *Rubia* is still unnamed, unless Dr. Griffith should have affixed a name to the specimens sent home, which might be easily ascertained from Sir W. J. Hooker. The root sent by Dr. Cleghorn is much coarser, tortuous, and thicker than that of the western root. I have submitted one sample to the inspection of three brokers of experience in Umritsur, and they consider that, although containing colouring matter to a considerable amount, it is by no means so productive in this respect as the Ghuznee plant. I concur in this opinion, but think it likely that Dr. Cleghorn's sample was, like the Kangra specimen I sent you some time ago, dug out of season. It should be remembered that the cultivated species, both of Affghanistan and the south of Europe, the root of munjeet and madder, is considered unfit for dyeing purposes until the third year of its existence."

MUNJEET.—This dyeing material, the produce of *Rubia munjista*, is now tolerably well-known in Europe. Generally it is not of so great repute, or so universal a consumption as other red dye-stuffs in India, but in Assam it is commonly employed. Good samples have been grown in the Dupla Hills in Upper Assam. The colours dyed with munjeet are affirmed to be fully as durable as those obtained with madder, and appreciably brighter. It is gradually winning its way into favour with European dyers.

Dr. A. Campbell, Superintendent of Darjeeling, replying to the doubts expressed as to the use of the stem or stalk of the Nepal munjeet for dye purposes, says:—"Having had abundant means of judging of the Nepal munjeet, I would wish to certify to the fact that the *entire* plant is always dried, and is the munjeet of commerce used by dyesters in that country, as well as in Sikkim and Bootan. The root of Affghanistan may or may not be the same as the madder of Europe, but it is not, I believe, the same plant as the Himalayan munjeet. It may be well to ascertain precisely what is meant in the Bombay export returns by 'madder' and 'madder-root;' whether they are separate names for the same articles used heedlessly, or are really different articles, and if so, what? Is 'madder' the Himalayan munjeet, and 'madder-root' the Affghanistan article? Is the Affghanistan article and the madder of Europe the same? Is the root only of the European plant used in dyeing? These questions are all in need of settlement. The great *bulk* of the munjeet, as presented to the dyesters, is no doubt a serious disadvantage; but to reduce its bulk, by grinding it into powder, still leaves a great weight of material for carriage, so that the great desideratum really is to lessen the bulk and weight without any loss or damage to the colouring matter. Many years ago Dr. Irvine, of the Bengal Service, when at this place (Darjeeling), on account of his health, made some experiments for this purpose on the munjeet, but I never heard the result. His object was to procure the whole colouring matter in the form of cakes, like indigo; but how it answered I do not know. A great deal of munjeet is exported from all parts of the southern face of the Himalaya into Thibet, where it is much used in making the purple dye of Lamas' habiliments. As the transport of this bulky article is entirely effected on men's shoulders, and over difficult passes of elevations, from 14,000 to 18,000 feet, the reduction of bulk and weight is quite as much a desideratum for the Thibet trade as that to Europe."

Dr. Gibson, Superintendent of the Botanic Gardens of Western India, remarking upon this letter, states :—" My impression is—1st, That the root only is exported; 2nd, That the madder of Affghanistan is *Rubia cordifolia.* I grew a quantity of it in this garden for years, and have more than once, I think, sent specimens of the root, such as a basketful at a time, to Bombay; but as the subject was taken up by no one, I ceased to cultivate the plant. I certainly, until I saw Dr. Campbell's letter, doubted the fact of the stem containing any colouring principle, and even yet I suspect some error. I believe that the madder and madder-root, as marked in the Bombay returns, are identical."

Mr. H. Cope more recently furnished to the Agricultural and Horticultural Society of India some further information respecting munjeet. " Madder (he observes) is certainly not the same as the Himalayan munjeet, as distinctly laid down by the letter from Avignon you communicated to me some time ago, in which it was stated that not only were they not the same, but that the colours obtained were different, and applied to different purposes. Whether the munjeet of Affghanistan is identical with the madder of Europe remains to be proved. It is certain that what is exported from Sind as munjeet is exported from Bombay as madder, and that the Bombay export is called madder in England. But the matter will be shortly set at rest, when the samples my firm has sent to Messrs. King, of Avignon, reach their destination. A species of munjeet grows wild and abundantly in the Kangra Hills, but it does not appear to be used for dyeing or commercial purposes by the indigenous population. It, therefore, becomes a matter of some importance whether the Kangra plant is applicable to the purposes for which madder and the Himalaya munjeet of Nepal, Assam, &c., is used.

" The roots, when taken up, appear to me to differ in nowise from the Affghan madder—specimens of which, sent by me, were so much admired. I now do myself the pleasure of forwarding to your address one seer of this munjeet, stem and root, selected from a quantity which Mr. D. F. Macleod, Financial Commissioner of the Punjab, was so good as to obtain for me at Kangra. It labours, in my opinion, under the disadvantage of having been gathered much too early. I consider October the proper month for digging up the root, or even later. I also send two specimens of country cotton cloths dyed: No. 1, with Affghan munjeet or madder; No. 2, with the munjeet so obligingly sent by Mr. Macleod from the vicinity of Dhurmsala, in the district of Kangra. You will observe that the latter is inferior in appearance to the former. The inferiority is chiefly owing to the root having been dug much too early in the season, and probably (in the opinion of the dyer) to the root not containing, even when mature, quite so much colouring matter as the Affghan madder. It strikes me that it may turn out, that, while the Kangra root may prove the same as that of Nepal, the Affghan root will be found closely identical with the European madder. I ought to mention that the same process described below has been adopted in both cases by the dyer. If my surmise be correct, this should not have been done, as I am told, on excellent authority, that the process in Europe for dyeing with the munjeet of Bengal, and the madder obtained from Bombay, and that grown in France, &c., is very different, and the colour is not the same. If you would have the goodness to cause two pieces of similar cotton cloth to be dyed in Calcutta according to the local process, one with part of the Kangra munjeet, and one with Nepal munjeet, a fair comparison might be elicited as to their respective value and appearance as dye-stuffs.

"I give you the Umritsur mode of dyeing with munjeet, premising that all the ingredients used are carefully weighed in proportion to the weight of the cloth to be dyed; the weight of munjeet being equal to that of the cloth. The unbleached cloth weighing, in this instance, three chittacks, or fifteen tolas (about six ounces), is first washed in cold water and dried. At evening it is dipped in a saponaceous mixture of one and a-half chittack of till oil (gingellie or sesame) and three-quarters of a chittack of sujee (the impure carbonate of soda that abounds in this part of the country). Being thoroughly imbued with this ley, it is hung up to be dried. It is then washed three or four times successively in water, with a small quantity of sujee, and dried each time. Finally washed in pure water and dried.

"Two tolas of *mace* (the gallnut of the *Tamarix dioica*, largely used here) are ground to a fine powder, and with two tolas of alum form a mordant, with the assistance of water, in which the cloth is dipped six or seven times, being well wrung and dried each time. Three chittacks of munjeet are pounded fine, and a small quantity of *mace* added in cold water. This water is heated, in the first instance, to about 130 degrees, when the whole is taken out and hung up. At the second dipping, the water is heated to a higher degree, and on the third dipping is caused to boil for some three-quarters of an hour. The cloth is then wrung, dried, and ready for use, after a final washing in clear cold water. The dye is, of course, fast.

"I cannot find, on inquiry, that any munjeet from the Kangra Hills has ever found its way into our market, and I believe Mr. Macleod told me the hillmen themselves did not know the use of it; but I hear that some munjeet has occasionally been brought from Kashmere, and is considered good."

In accordance with Mr. Cope's suggestion, the Society had two pieces of cloth dyed at Calcutta, one with a portion of the Kangra munjeet received from Mr. Cope, the other with the Nepal munjeet received from Dr. Campbell. They were both inferior in colour, especially the Kangra munjeet-dyed specimen, to those received from Mr. Cope.

With the view of making our information on this point more complete, it is thought desirable to introduce in this place the local (Calcutta) native process of dyeing the few pieces of cloth above referred to, as given by the dyer (Juggoo Bundhoo, Sircar of Chitpore):—

"About fifteen tolas of each kind of munjeet were exposed to the sun; when perfectly well dried they were broken into small pieces, and the bark taken off, leaving the pure dyeing substance, which, having been dried again, was reduced to powder. During this operation two pieces of cloth, about nine feet long and two feet broad, were well washed in clear cold water; when dried they were washed in a decoction of the gall of the haare tukee (*Terminalia chebula*) and dried; they were then laid over two tables, and a thick liquid substance,* previously prepared, was put over them by means of a small flat piece of wood called 'pottaee;' the cloths being dried, were put for a brief period on the surface of the running water of the river Hooghly, and they were then thrown with full force ten times over a large flat piece of wood (such as used by washermen); they were afterwards dried; and when all this was done, the munjeet powder was put on the fire with about a seer of water in two different pots, and Dhallphul (the flowers of *Grislea tomentosa*), which is used as a mordant. When the water was in a boiling state, the two pieces of cloths were put in these two pots, and were constantly shaken by means of a stick for upwards of six hours, during which time the fire was made to burn gently—that is to say, neither very strongly nor very feebly; the cloths were then taken out, washed in cold water, and dried."

Chay-root.—This is the produce of a herbaceous plant belonging to the natural order *Rubiaceæ*, and known as *Oldenlandia (Hedyotis) umbellata*. It is common in sandy soils along the Coromandel coast. The dye is obtained from the roots, which are long, much divided, and slender. The plant is found both wild and cultivated. In commerce the roots are met with in small bundles from an inch and a half to two inches in circumference, of thin twisted roots from six to nine inches in length. The contortions are nearly regular throughout their entire length, and resemble in form the convolutions of a corkscrew, of which they are about the thickness. The native dyers assign the first place to that quality which yields the deepest red, and which is employed for dyeing thread before it is taken to the loom. This is woven into handkerchiefs formerly in great demand under the name of Pulicats A considerable quantity are still exported to Antwerp. Others, with patterns in which chocolate tints are found, and known as Madras handkerchiefs, go the West Indies and Southern States of America, through the port of London. These are much prized by the negroes.

* This substance is composed of gum arabic, alum, and sugar of lead: the two latter are given in very small quantities.

In Madura the paler tint is preferred. The cloths dyed at Madura after they are woven are exported in considerable numbers. The chay-root is in this case mixed with Morinda bark.

The other colours dyed with chay-root are—(1) Chocolate, which is obtained by the subsequent application of *pupli chuckay* to the red obtained by the chay. It is much prized in the bandana or Pulicat handkerchiefs exported to the West Indies.

(2) By the addition of salt of iron mixed with syrup a fast black colour is obtained, fit for printing chintzes, but which is never used for dyeing thread, which would be rotted by the process.

(3) A very fine red is produced by adding safflower with lime-juice and soda, but this is not a fast colour. The mordant always used is alum.

Of late years the demand for this dye-stuff has fallen off in consequence of the preference given to another material called *Cherinji.*

The native process for dyeing red with chay-root is very complicated, and is thus described for $3\frac{1}{8}$ lbs. of white twist :—

Take of sweet oil $\frac{3}{5}$ lb., ashes of milk-hedge* $\frac{3}{5}$ lb., sheep's-dung $\frac{3}{10}$ lbs. ; mix, and keep in an earthen vessel for the space of four or five years—the older it is the better. Then, when about to commence the process of dyeing to the above mixture, add fresh ashes of milk-hedge 22 pints, spring water 11 pints ; mix and strain, and add to the strained fluid ; shake the whole well together, and then add sweet oil $1\frac{1}{2}$ lbs., sheep's-dung $1\frac{1}{2}$ lbs., spring water $2\frac{3}{4}$ pints ; mix the whole in a vessel. Then steep the twist in it for an hour, pressing and squeezing it well with the hands, to cause it to absorb the fluid fully ; after which leave it to soak. On the following day remove the twist, and dry it in the sun. Then take in a vessel afresh ashes of milk-hedge $16\frac{1}{2}$ pints, spring water $8\frac{1}{4}$ pints ; mix and strain, and add to the strained fluid sweet oil $1\frac{1}{2}$ lbs. Shake the whole well together, and steep the thread in it for an hour, using the hands as before ; leave it to soak all night. Next morning take out the thread, and dry it in the sun. In the evening of the same day take in a vessel afresh ashes of milk-hedge $16\frac{1}{2}$ pints, spring water $8\frac{1}{4}$ pints ; mix and strain, and add sweet oil $\frac{3}{4}$ lb. ; steep the thread in the mixture, using the hands as before, and leave till next morning. Then remove, and dry in the sun. Next take afresh ashes of milk-hedge $8\frac{1}{4}$ pints, sweet oil 6 oz., spring water $8\frac{1}{4}$ pints ; mix, and steep the thread as before ; leave it soaking till next morning ; then remove, and dry in the sun. Take again the same mixture, in the same proportions as the last ; mix, and steep in as before until next morning. Then take afresh ashes of milk-hedge $4\frac{1}{8}$ pints, sweet oil 3 oz., spring water 7 pints ; mix, and follow the process as before, and take afresh ashes of milk-hedge $2\frac{3}{4}$ pints, sweet oil 1 oz., spring water $5\frac{1}{2}$ pints ; mix, and follow the process as before. Then take afresh ashes of milk-hedge $1\frac{3}{8}$ pints, sweet oil $\frac{2}{3}$ oz., spring water $5\frac{1}{2}$ pints ; mix, and follow the process as before. Dry the thread for three days in the sun ; on the fourth day take afresh ashes of

* Milk-hedge is a species of Euphorbia.

milk-hedge $8\frac{1}{4}$ pints, sweet oil $\frac{1}{4}$ lb., spring water $8\frac{1}{4}$ pints; mix and follow the process as before, but dry the thread in the shade the same night. Then take afresh before noon next day ashes of milk-hedge $4\frac{1}{8}$ pints, sweet oil 2 oz., spring water $5\frac{1}{2}$ pints; mix and strain, then steep the thread in the strained fluid a whole day and night, remove the thread next day, and expose it in the sun for four days. Then leave the thread untouched for a whole month, and after the expiration of that period expose it for a day or two to the sun. On the day following wash the twist in pure spring or river water, and on the evening of the next day take in a vessel afresh spring water $27\frac{1}{2}$ pints. Pounded ali* leaves 11 pints, powder of chay-root $4\frac{1}{8}$ pints; mix the whole, steep the thread in the mixture, using the hands as before, and leave to soak for the night. On the following morning wash the thread in pure water, and leave to dry.

The last process to be repeated afresh for the seven following evenings, omitting the ali leaves after the first two days. On the eighth day in the morning allow the thread in the mixture to boil—say from four to eight p.m.; then remove, and keep the thread in the vessel *covered* until next morning, when remove the thread, and wash it in pure water, leaving it to dry in the shade for a whole day. Repeat the washing and drying for the four following days; on the fifth day take afresh ashes of milk-hedge $8\frac{1}{4}$ pints, spring water $8\frac{1}{4}$ pints, sheep's dung 3-10ths of a pound, sweet oil $\frac{1}{4}$ lb.; mix, steep the thread, using the hands as before, and then take it out to dry. A similar course must be followed for the three succeeding days, then keep it quiet one day; on the following day wash the thread in good water, and leave it to dry all next day. Then take afresh powder of chay-root $\frac{1}{2}$ lb., spring water $27\frac{1}{2}$ pints; mix, steep the thread, observing the same process as before; next morning remove the thread, and wash it in good water, and leave to dry, following a similar course for three days, then keep the thread quiet for ten days, after which take afresh ashes of milk-hedge $8\frac{1}{4}$ pints, sweet oil $\frac{1}{4}$ lb., spring water $8\frac{1}{4}$ pints; mix, steep the thread, observing the same course as before, and leaving it till next day; then dry it in the shade, and follow the same process three days, then leave it for ten days, after which wash in good water, and take afresh powder of chay-root $\frac{1}{2}$lb., spring water 22 pints; mix, steep the thread in the mixture, using the hands as before, and dry in the sun next morning. Repeat the same the three following days, then on the succeeding morning wash the thread well in good water, and when dry it will have attained a beautiful fast red colour, ready for weaving purposes."

The celebrated red turbans of Madura are dyed with chay-root, which is considered superior of its kind; but this is probably owing to some chemical effect which the water of the Vigay River has upon it, and not to any peculiar excellence of the root itself.

Chay-root is said to deteriorate rapidly in the hold of a ship, or, indeed, in any dark place. Hence it has not been found to answer the expectations of dyers at home, who have received it for experiment.

* *Casan ali. Memecylon tinctorium*, vide "THE TECHNOLOGIST," No. I., p. 7.

Attention was first drawn to this dye-stuff in 1798 by a minute of the Board of Trade, recommending its importation; but Dr. Bancroft, who made some experiments with a sample of damaged chay-root, considered it inferior to madder, and its further importation was discouraged.

CHERINJI.—This root, which is grown in the Dekkan, is supposed to be the produce of *Cherongia sapida*, or *Buchanania latifolia*. This is used in conjunction with a root called *jagi*,* imported from the hill country of Ganjam, and a colour is produced nearly equal to the *chay*, whilst the process is simpler and less expensive. The colour, however, is neither so bright nor so enduring. A drop of spirit removes the colour from cloth dyed with *Cherinji*, whilst it has no effect on the chay dye. Sometimes a little chay-root is mixed with Cherinji to improve the colour.

MUNGKUDU (*Morinda umbellata*).—This dye-stuff is in extensive use in the Indian Archipelago, and sparingly on the continent of India.

MADDI CHAKA, or *Muddy chuckay* (*Morinda bracteata*).—The tree producing this dye-stuff grows freely everywhere in India, and no particular care is required in gathering it. The best dye is procured from the bark of the roots of plants three years old. It is one of the commonest red dyes of India, though the colour is dull, yet it is considered faster than the brighter tints obtained from other substances.

NOONA CHUCKAY (*Morinda citrifolia*).—The bark and root of this *Morinda* is used in the same manner as the last. Most of the Madras red turbans are dyed with this substance, which is very common in that presidency. It is called the Hal plant, and yields three different permanent shades—a bright red, a pink red, and a faint red.

SOORINJEE CHUCKAY (*Morinda tinctoria*).—Another allied substance, equally valuable, and in as common use. It is also known under the name of *ach-root*. The colouring matter of the Morindas is far more permanent than that of some other of the red dyes of India, and although not so brilliant, as at present manipulated, there is no doubt that under improved management it would become an important rival to madder.

There are other *Morindas* occasionally used in India for dye purposes. Such, for instance, as ROIOC, the roots of *Morinda roioc*, and CHACHUCA, of *Morinda chachuca*, as well as those of *M. multiflora* at Nagpore, and *M. angustifolia* in other localities.

SAPPAN.—A large quantity of *Sappan*, or *Buckum* wood, the produce of *Cæsalpinia sappan*, is grown in Malabar, and its cultivation might be still further extended. A custom prevails on the birth of a female child, which tends to keep up a good store of young trees. The Moplahs are in the habit on such occasions of planting from forty to fifty seeds of sappan, and the trees which reach maturity in ten to twelve years are her dowry when she is married. The sappan tree (puttingay, Hindoo) is cultivated in Paulghaut, Madras, for the purpose of dyeing the straw used in mat-making.

* *Jagi* is the name given by the Telugus to *Jasminum grandiflorum*; but there is no further evidence whether this is the plant of which the leaves are used as above.

This dye is much used in Pegu, where silks are dyed by means of it of a dark red colour. It is here called *Tienj-jet.*

The wood of the trunk, and also of the root, are rendered available.

YEMPALUM.—What this substance may be, which was exhibited, as a native red dye-stuff, at the Madras Exhibitions, we are unable to conjecture. Both wood and bark, under the names *Yempalum Kodi* and *Yempalum Paki*, seem to be in use in Madura. We have never seen it, nor is it to be found in the collection at the East India House. If it is of any value, we may ultimately hear of it again.

CASUARINA EXTRACT.—The extract of the bark of *Casuarina equisetifolia* was prepared by M. Jules Lepine, of Pondicherry, for one of the Madras Exhibitions, and for which he received a second class medal. The extract is fixed by a solution of bichromate of potass with alum as a mordant. It gives a reddish nankeen colour, with iron a black, and with a mixture of mordants a grey. The colour is affirmed to be unaffected by water, alkalies, solar light, or heat.

KABOUNG, or *Mangrove Bark.*—This product of *Rhizophora mangle* is one of the colours introduced by Dr. Bancroft, and of which he monopolised the use. It is used in Arracan as the source of a chocolate colour. This substance can be readily enough obtained if found valuable to the home dyer, as it is often imported for tanning. A parcel was on sale in the London markets in the early part of the present year. Another chocolate dye is in common use in Arracan, under the name of Thit-nan-weng; but of its source or value we are unable to inform our readers.

RED SANDERS WOOD.—The wood of *Pterocarpus santalinus* is stated to afford a good red with a mordant of alum, but it is not much used locally It is sold by weight, and forms a regular article of import from Madras.

RERRO—TING-NJET.—These are two purple dyes in use in Arracan, which were sent to the Great Exhibition of 1851. The bark and wood of the latter is used.

THE-DAN—THIT-TET.—Two red dyes of Arracan, the bark and wood of the first being used. They were exhibited at the same time and place as the last. The bark of *Photinia dubia* is used as a red dye-stuff in Nepal. We have enumerated these dye-stuffs, of which we are unable to give any particular information, in the hope that it may lead to some further inquiry, and that ultimately we may be enabled to add further particulars.

RUKTA CHANDAN.—Under this name a red dye is said to be obtained from the root of *Adenanthera pavonina*, the tree yielding the hard red ornamental seeds so extensively used to make bracelets. This is not at all an uncommon dye-stuff in India, nor is its use of a local character. It is one of the substances which seems to deserve a trial. Mr. Oondatje states that the testa, or hard covering of the seed, is in use in Ceylon as a red dye.

KOOSSUMBA.—Under this name *safflower*, the produce of *Carthamus tinctorius* is used in India, as elsewhere, for pinks. It is more carefully collected in China than in India, and as no substance suffers more from carelessness in collection than this, the superiority of the Chinese article may be traced to this cause.

HOANG-TCHI, or *Safflower*.—This substance is the colouring principle of the flowers of *Carthamus tinctorius*, L., known as *safflower*. The plant is cultivated, for tinctorial purposes, extensively in the provinces of Sse-tchouen, Yun-nan, Ho-nan, Kiang-si, and Chenai. The method of preparation is described as follows:—"The flowers are placed in a bag of cloth, strongly pressed, being first dipped in pure water, and then in the water of *sourrin;* the bag is wrung several times, in order to extract all the yellow juice. This done, the flowers that now contain only the red colour are damped with a watery solution of the ashes of rice straw, covered with green herbs, the day after they are formed into thin cakes."

The Chinese have been noted for producing on cotton and silk a brilliant scarlet colour.

GODARI, or *Dhauri*.—The red flowers and leaves of *Grislea tomentosa* are used for dyeing purposes. In the Northern Circars, where it is known under the name of *Godari*, the leaves are employed in dyeing leather. Sheep-skins, steeped in an infusion of the dried leaves, become a fine red, of which native slippers are made. The dried flowers are employed in Northern India, under the name of *Dhauri*, in dyeing with Morinda bark; but perhaps more for their astringent than for their tinctorial properties. Dr. Gibson states that in Kandeish the flowers form a considerable article of commerce inland as a dye. It grows abundantly in the hilly tracts of the Northern Circars.

TEAK FLOWERS.—The flowers of the Teak tree (*Tectona grandis*) are used in parts of India for dyeing red; but their use appears to be confined to a few localities.

POMEGRANATE FLOWERS.—The beautiful flowers of *Punica granatum* are affirmed to be in use in Bellary as a red dye; but how far they are available for general dyeing purposes we are unable to affirm. We should imagine their use to be entirely local, since they are unknown as a dye-stuff in most other parts of India.

MICA AND ITS USES.

MICA is a finely foliated mineral, of a pearly metallic lustre. There is great diversity in the composition of mica, coming from different localities; generally it is a silicate of alumina united with silicates of iron and potash. Very beautiful specimens of mica abound in the United States. At Acworth, New Hampshire, they lie embedded in felspar; at Monroe, New York, a large vein of a green-coloured variety exists. The crystals at Goshen, Massachusetts, are rose-red and rhomboidal; and that found in Brunswick, Maine, is in emerald-green scales.

We find the following description of the Dunwee Mica Mine in the report of the Geological survey of India:—

This is situated in Purgunnah Currucdyah, about midway between the base and summit of a mountain 600 feet high, forming the south-eastern extremity of the valley of Dunwee, near the village of the same name. The glittering effect of the mica in the sun was the chief attraction to the eye on entering the valley, and rendered the concealment of the mine by the jealous Mahajans impossible.

The mountain in which the mine is situated consists of the coarse crystalline gneiss, the strata being inclined at an angle from 60 to 80 degrees with the horizon, alternate at short intervals with beds containing flakes of mica, an inch in thickness, and varying in length and breadth from six to twelve inches.

These massive plates of mica are loosely agglutinated with large rhomboidal crystals of felspar, and occasional detached lumps of pseudo-morphic quartz, the latter often containing schorl, the whole being embedded in a soft scaly talcose matrix, from which the mica is easily removed.

The excavations are formed at all points within the space of 50 yards in breadth, and 300 in length; some being carried perpendicularly down between the strata, and others horizontally, in each case following the direction of the strata.

About 50 to 100 men and boys are employed in extracting the mica, and as many more women and children in sorting it and smoothing the rough edges of the flakes, so as to render them portable.

In the village were several Mahajans, some superintending the works, others acting as agents for the supply of mica; while the numerous bullocks with panniers, and the heaps of packages of mica in bags ready for despatch, give the place a busy appearance.

There are two other great mica mines in the same neighbourhood; one of these is at Dhoba, near the Dumchanee Pass, in Purgunnah Curruckdyah, and the other at Quadrumma, in the purgunnah of that name. They are said to be larger and better mines than the one here described, which has only been recently opened.

The Dhoba and Quadrumma mines have existed for many years, each, it is said, affording annually upwards of 100,000 maunds of mica. The mica is sold at the mines at 4 rs. (8s.) per maund. One lakh of maunds are said to be transmitted annually from the Dunwee mine alone to Calcutta, *viâ* Bancorah, where it is sold at Company's rupees 7-8 per maund, or 30 rs. for four maunds.

Mica is in general request throughout India, and is largely employed in decorative purposes at native festivals. From what I could learn, three-fourths of the supply for all Hindustan would appear to be derived from the three mines here alluded to. It therefore becomes a question whether the produce of these mines might not be made available to the public revenue.

The additional cost of a rupee or two per maund imposed in the form of tax, would be little felt in an article the consumption of which falls upon no particular class, while the revenue derived from this source might be devoted to the construction of roads; and thus, by facilitating transit, ultimately cause a reduction in the price of the article, more than equivalent to the duty levied upon it.

One of the principal uses to which mica is turned on the other side of India is as a substance for miniature drawing and paintings, for which Delhi and other towns in the north-west have long been remarkable. The manufacture of ornaments from it for female attire is carried on on a very extensive scale in the Bombay bazaar: we are not aware that any account of it has appeared in print. The mica which is most firm, elastic, and transparent, chiefly found in soft, flexible, and silvery varieties, fetches a comparatively trifling price. It is split into thin plates, which are set aside for use. When meant to be coloured, a piece of white or yellow foil, either plain or coloured, in general either crimson or green, is placed between a couple of plates of mica, which are firmly gummed together. A thin sheet of tin, brass, Dutch gold, or plaited copper, is now taken and punched out in little capsules about the size of half a sweet pea, or half a pellet of No. 1 shot. These are carefully lifted and gummed in regular patterns on the mica, which is then cut into small discs, generally circular, or of the form of a star. These are fastened on paper and sold for so much a dozen. They are afterwards neatly stitched all over the thin muslin parts of the dress, in such a manner that the effect produced by them is extremely pleasing.

In Siberia thin sheets of mica have long been used for glazing windows, whence it has been called Muscovy glass. It is found in Siberia and on the borders of the Caspian Sea, in very large sheets of three or four feet square. It is regularly quarried, and forms an article of commerce, the price varying according to the purity and size of the plates. Very large plates are dear; those of ordinary size sold some few years ago at 5s. or 6s. each on the spot. Brown and grey mica are used in lanterns, in stove doors, and in the windows of some ships of war; bearing change of temperature better than glass, and not being subject to break with the percussion occasioned by the discharges of cannon.

Mica is sometimes employed in the making of false avanturine, and for other similar purposes, when it is required to produce the appearance of a gold and silver powder. Walls are sometimes powdered over with mica, which gives them a pretty brilliant appearance. It is also employed as a sand to dry writing, for which purpose it is sometimes coloured. In the state of a very fine powder it is known as cat's gold and cat's silver.

Mica is easily separable into very thin plates, about the 250,000th part of an inch in thickness, and is in that state almost transparent; hence it is useful in optical experiments.

Lepidolite is a variety of mica, containing lithia and fluoric acid. It is massive, but composed of brilliant and pearly spangles, or little lamillar masses of a pretty lilac colour, and sometimes pearl blossom, of a very charming effect. It takes a pretty good polish, but unfortunately it is very soft, and the pieces are not large. It is worked into slabs, boxes, &c. It occurs principally in granite, and is found in Moravia, Saxony, Bohemia, the Ural, at Paris, in the State of Maine, and in Connecticut.

THE PRODUCTION OF, AND TRADE IN, BEES'-WAX.

BY THE EDITOR.

The collection and commerce in bees'-wax is more extensive than is generally supposed, although it has been much interfered with of late years by the stearines and solid vegetable oils obtained, which come into use for many purposes for which wax was formerly employed. Setting aside, for the present, the other commercial product of the honey bee, we shall touch only upon that obtained from the comb, or hive, in which it lays up its store of provision for future use. A young hive will yield at the end of the season about a pound of wax, and an old hive about twice as much. The finest wax is found to be made in dry, heathy, or hilly countries.

Every comb newly made is white, but they become yellowish, and, indeed, black, by age and exposure. All combs do not, however, furnish wax equally white, as is well known to those whose business it is to bleach it. Yellow wax should be of a good consistence, fine colour, and of a pleasant smell. It contains a good deal of essential or acid salt, with a small quantity of oil and earth. The saline constituents are less perceptible in the white wax.

The bees'-wax of Ceylon, unlike that of Europe, contains no elements of acidity. The per-centage constituents of bees'-wax, according to the best authorities, are as follows:—

	Gay Lussac and Thenard.	Saussure.	Ure.
Carbon	81·79	81·59	80·69
Oxygen	5·54	4·55	7·94
Hydrogen	12·67	13·86	11·37
Total	100·	100·	100·

The quantity of wax produced in this country it is impossible to estimate; but Sir Richard Phillips, in his "Dictionary of Arts," assumes the number of bees in Great Britain and Ireland sufficient to produce upwards of 1,300 tons of wax annually, besides 5,000 tons of honey.

The following are the present prices of bees'-wax (September 20, 1860), as compared with the corresponding period last year:—

	1860.	1859.
	£ s. £ s.	£ s. £ s.
English	8 5 to 8 10	8 5 to 8 10
German	8 0 to 8 5	8 0 to 8 10

	1860.	1859.
	£ s. £ s.	£ s. £ s.
American	8 15 to 10 0	8 15 to 9 0
" white fine	10 0 to 10 19	10 0 to 10 10
Jamaica	8 12 to 9 7	9 0 to 9 10
Gambia	9 0	8 15
Mogadore	6 6 to 7 10	6 0 to 7 10
East India	7 10 to 9 0	7 0 to 8 10
" bleached	9 0 to 10 10	9 0 to 10 0

The yellow wax, used in this country, comes principally from West Africa, the United States, and Russia. Upper Egypt also produces large quantities, and we import large quantities from India and Northern Africa. That which is very white, clear, transparent, hard, brittle, tasteless, and not sticking to the teeth, when chewed, is reckoned the best. In Russia and America there is sometimes found, in the trunks of old trees, a sort of black wax, in round bits, of the size of nutmeg. This is produced by a small kind of bee, and when heated has a smell like balm. The Americans make candles of it. Fresh wax has a peculiar honey-like odour; its specific gravity is ·96. At 150 degrees it fuses, and at a high temperature volatilizes, and burns with a bright white flame.

There are two kinds of wax found in commerce—yellow, or unbleached, and white, or purified and bleached. The bleaching of wax is effected by exposing it in thin laminæ to the action of the light and air, by which it becomes perfectly white, scentless, harder, and less greasy to the touch. To accomplish this, it is first broken into small pieces and melted in a copper cauldron, with water just sufficient to prevent the wax from burning. The cauldron has a pipe at the bottom through which the wax, when melted, is run off into a large tub filled with water, and covered with a thick cloth to preserve the heat till the impurities are settled. From this tub the clear melted wax flows into a vessel having the bottom full of small holes, through which it runs in streams upon a cylinder, kept constantly revolving over water, into which it occasionally dips. By this the wax is cooled, and at the same time drawn out into thin sheets, shreds, or ribands by the continual rotation of the cylinder, which distributes them through the tub. The wax thus granulated or flatted is exposed to the air on linen cloths, stretched on large frames, about a foot or two above the ground; in which situation it remains for several days and nights, exposed to the air and sun, being occasionally watered and turned; by this process the yellow colour nearly disappears. In this half-bleached state it is heaped up in a solid mass, and remains for a month or six weeks, after which it is re-melted, ribanded, and bleached as before—in some cases, several times—till it wholly loses its colour and smell. It is then again melted for the last time, and cast with a ladle upon a table covered over with little round cavities, into the form of discs or cakes of about five inches in diameter. The moulds are first wetted with cold water, that the wax may be the more easily got at, and the cakes are laid out in the air for two days and two nights, to render them more transparent and dry.

The rearing and management of bees is more attended to in Russia than in any other European country, and is, in fact, the principal occupation of several tribes. The wild bees, however, greatly exceed those that are domesticated. Their culture is principally attended to in the provinces of Kasar and Ourfa. Individuals among the Baschkirs possess 100 hives in their gardens, and upwards of 1,000 in the forests! Honey is very extensively used in many parts instead of sugar. The export of wax is very considerable. In 1834 it amounted to 22,248 poods, or 800,928 lbs.

The wax of the Ukraine is reported to be the best after that of Smyrna and of the Archipelago, but it is not well bleached, and sometimes contains particles of honey. The wax of Poland follows next; that of Mingrelia is only of a very inferior quality. The wax of Wallachia and Bessarabia is very good, and is sent to Trieste. The merchants of Galatz and Brailoff purchase this article in Bulgaria likewise. The ports of the Black Sea export about 10,000 poods of wax yearly; of which Taganrog ships 1,000 to 2,000 poods, and Odessa the remainder.

The rearing of bees is carried on most extensively in the Vayvode and the Temeser, Banate, Croatia, Slavonia and Transylvania, on the military portions of Galicia, in Lombardy and Venice, and in Styria, likewise in Carinthia and Carniola. In the other provinces this trade is of little consequence or extent. The Germanic, Slavonic, and Italian provinces produce on an average 30,000 cwt. of wax, and the production of the other half of the Austrian empire may be of equal amount. The introduction of stearine candles has interfered largely with the trade in wax candles.

Bees'-wax constitutes a very valuable and considerable article of commerce in the East. Bees have nowhere been domesticated, that I am aware of, in Asia or the Indian Islands. From the perpetual succession of flowers, and it being consequently unnecessary to lay up a store of provision, their honey is small in quantity, while, from the quality of the vegetation, it is naturally of much inferior flavour to that of higher latitudes. The bees of the Indian Islands, however, afford an abundant supply of wax, which is largely exported to Bengal and China. The greatest supply is obtained in the islands furthest to the East, and, above all, in Timor and Flores. According to Mr. Crawford, as much as 20,000 to 30,000 piculs is annually exported from thence. The Chinese collect it largely themselves, but the consumption is small in the eastern parts, wax being only employed to encase the tallow, which, from the heat of the climate, never becomes hard in the southern provinces. Wax from the Eastern Archipelago, Patna, and from insects indigenous to the Tenasserim Provinces was shown at the Great Exhibition. The bees of the Indian Archipelago, unlike those of Europe, suspend their hives from the boughs of trees; and, frequenting particular trees for a series of years, they come to be looked upon as private property, and are handed down from father to son.

In the six years ending with 1850, the average annual quantity of bees'-

wax imported into Java from the islands of the Eastern Archipelago was 5,215 piculs of 133⅓ lbs. each.

In no country in the world do bees thrive better than in Van Diemen's Land, or prove so productive with a trifling amount of attention—circumstances due, no doubt, to the mildness of the winter season, and the fact of many Tasmanian plants blooming throughout the winter months. The bee has now become naturalised in the forests, and many of the hollow trees are filled with the produce of their labour.

A correspondent in Nelson, New Zealand, thus reports upon one season:—"I commenced with six old stocks or hives. They began swarming on the 5th of October, 1858, and finished on February 1st, 1859. From the commencement of swarming till ending, they threw out thirty swarms. The produce of honey is 300 lbs. of pure clear honey, 12 lbs. of wax, and 12 gallons of comb washing, making excellent wine. I have seven stocks in reserve for another season. Much I could say upon the culture of bees; but I am unwilling to trespass upon your time and space."

The culture of the honey bee has annually increased in the southern part of the Dominican Republic. What was formerly merely the pastime of a few individuals, is now done on a much larger scale. This occupation suits the character of the people: it requires no exertion or constant attention. In 1848, the quantity of wax exported amounted to but 21,871 lbs.; in 1855, 83,572 lbs. were exported, notwithstanding a hurricane in August of that year committed fearful ravages amongst the apiaries. Besides the 83,572 lbs. shipped from the port of San Domingo, 68,571 lbs. was exported from Puerto Plata, the whole being valued at £8,741. The wax is principally sent to St. Thomas, Curacoa, France, &c. The honey, amounting to 94,990 gallons, valued at £6,171, was exclusively shipped to the United States. Adding to this the consumption of wax in the country itself, where it is almost exclusively used in the interior for lighting the houses, as well as for all religious ceremonies in the churches, it will not be overrated to state that the industry of the honey bee has yielded to the Dominicary in 1855, £21,000.

The average export of bleached wax from Havana in the four years ending 1857 was 10,500 cwt., and of honey 2,000 tierces. The wax goes chiefly to Mexico and Spain, and the honey to the United States and the North of Europe. Bees'-wax is collected in considerable quantities in the eastern districts of Yucatan, especially those parts which enclose the Bay of Campeche. It is said to be much more difficult to bleach this wax than that which is produced in Europe. In 1855, the whole product of honey in the United States was estimated at sixteen million pounds, worth, at 7½d. a pound, upwards of half a million sterling. Portugal produces 650,000 lbs. to 700,000 lbs. A bee-keeper, in the province of New Brunswick, makes the following remarks:—

"The industry of the bee is proverbial, and it may be well for the dronish portions of our race to witness their operations. They occupy a field of labour which, were it not for them, would yield us no sweets. No living creature which is subject to the control of man, pays so large a share of profit as the honey bee. As we look abroad upon our cultivated fields, upon our hills and valleys, what an entire loss are we compelled to witness, of vast quantities of honey, on every side, which, without injury to any one, might be gathered, if bees in sufficient numbers were introduced throughout the province. Some years ago it was calculated that in one year the island of Cuba exported honey and wax to the value of upwards of £100,000 sterling; and it has also been ascertained that if bees were more generally kept, the pastures of Scotland would produce four million pints of honey, and one million pounds of wax, with scarcely any outlay of capital or time. There is still living on the Pentland hills, near Edinburgh, a shepherd who takes charge of hundreds of hives annually, for farmers living at a distance. This province, New Brunswick, contains upwards of seventeen millions of acres, and we may safely estimate the production of one acre to be one pound of honey, which is but a small part of the real product in most places. Bee keeping, when conducted on proper principles, will form no mean item in the domestic economy of the agriculturist, and ought to yield a profit at least sufficient to pay the rent of a small farm. I was remunerated last year with four to five cwts. of honey and wax, from not over a dozen of hives, situate in my small flower garden, and several who keep these busy bodies are in a fair way to equal, if not exceed that quantity the present season. At the same time let it be remembered that the bee is too fond of roaming for its pastures to be confined to a flower garden."

Bees'-wax is a considerable article of trade among the Mandingoes, on the banks of the Gambia. They make hives of straw, resembling ours in shape, and fit a bottom board into them, through which they form an aperture for the bees to pass through; they then sling them to branches of trees. When they take the combs, they smother the bees; and, pressing off the honey, of which they make wine, they boil up the wax with water, strain it and press it through coarse cloths into holes made in the ground for the purpose. They make and sell large quantities of it on the river, but its manufacture might be much increased. That which is clearest from dirt and dross is, of course, the best. The factors prove it by boring the cakes, which are from 20 lbs. to 120 lbs. weight. We import annually about 2,000 cwts. of unbleached wax from the Gambia.

The following are some of the principal varieties of wax received here:—

American yellow wax.
French yellow wax.
French bleached wax.
West African wax.
Cape wax.
Sierra Leone wax.
Gambia yellow wax.
Morocco yellow wax.
Mogadore wax.
Irish yellow wax.
Ditto prepared for bleaching.
Irish yellow wax bleached by the action of sun light.
East Indian yellow wax.
Madras virgin wax.
Jamaica wax.
Cuba wax.
Java bleached.
Mauritius dark wax.
Continental wax received through Holland.

The imports of bees'-wax in 1858 were 1,964 cwts. bleached, and 9,679 cwts. unbleached. The unbleached came chiefly from Java, British India, and France, and was valued at about £10 the cwt. The unbleached came principally from Morocco (2,654 cwts.), British East Indies (2,353 cwts.), Gambia and West Coast of Africa (1,697 cwts.), United States and British West Indies. The average value was about £8 5s. per cwt.

The imports and exports of bees'-wax into the United Kingdom in quinquennial periods have been :—

	Imported. Cwt.	Re-exported. Cwt.
1826	4,130	1,493
1831	7,203	2,382
1836	7,999	2,778
1841	7,484	3,776
1846	10,210	2,913
1851	10,448	3,403
1856	13,766	1,794
1858	11,643	3,284

ON NUTMEG CULTURE IN THE BANDA ISLANDS.

BY DR. BLEEKER.

Dr. Bleeker, so well known for his fish-lore, visited the Banda Islands in 1855, in the suite of Governor-General Duymaer von Twist, and our readers may find his remarks on the nutmeg plantations an interesting supplement to Dr. Oxley's account of them, which still remains the best that has been published. Dr. Bleeker, indeed, purposely omits the details of the cultivation, collection of the fruit, smoking, liming, and packing of the nut, and drying of the mace, on the ground that these have been so often described by travellers that any mere explanation of them would be superfluous. But the fact is, that all Dutch writers on the Bandas have passed over the cultivation, even the garrulous and voluminous Valentyn being silent on it, although otherwise so minute, that each park or plantation is separately described by him. Dr. Bleeker is not the only writer who refers to the mythical labours of his predecessors, and there seemed to be every warrant for the suspicion that an intentional reserve was maintained, until Dr. Oxley discovered the real fact to be, that such a thing as cultivation of the nutmeg is entirely unknown in the Bandas.

Dr. Bleeker states that the nutmeg begins to yield fruit in its seventh or eighth year, and continues to do so till its fortieth year, and even later; that although it attains a height of forty or fifty feet, it needs and receives the shade of lofty trees; that although the fruit ripens all the year round, it is more plentiful in August, and in November and December, the principal crop being in August; that the nut continues to be limed for exportation; and that the broken nuts are made into the solid fat termed nutmeg soap.

Dr. Oxley states the number of bearing trees in the thirty-four gardens at 319,804. According to Dr. Bleeker, there were in 1854 only 297,272 bearing trees, out of a total of 424,573. The produce was 537,861 lbs. of nutmegs, and 133,986 lbs. of mace, being 1·8 lb. of nutmeg and 0·45 lb. of mace, or a total of 2·25 lbs. of spice from bearing trees—a yield small compared with that which has been obtained from the best plantations in the Straits settlements.

The produce of the Banda trees has varied very much, owing partly to natural and partly to artificial causes. In the earlier part of last century it was greater than it has since been; the nearest approach to the old figure having been attained in 1847, when the crop amounted to 755,252 lbs. of nuts, and 105,051 lbs. of mace. The quinquennial yield from 1830 to 1854 was as follows, in pounds :—

	Nutmegs.	Mace.
1830 to 1834	1,651,764	475,140
1835 to 1839	2,787,555	699,672
1840 to 1844	3,077,930	712,247
1845 to 1849	2,978,640	691,814
1850 to 1854	2,633,244	656,824
Total...	13,129,133	3,235,697

The annual average has been on the twenty-five years, 525,165 lbs. nutmegs, and 129,428 lbs. mace; and during the last fifteen of them, 579,321 lbs. nutmegs and 137,392 lbs. of mace. In 1798 the maximum annual quantity to be delivered to the East India Company was fixed at 520,000 lbs. of nutmegs, and 130,000 lbs. of mace, the park-holders being obliged to destroy the produce above the limit. It was not reached, however, till 1835, and by that time the Straits plantations had rendered obsolete regulations based on the maintenance of the old monopoly.

On the island of Neira there are three plantations, Zevenbergen and Hersteller, Bankubatu, and Lautakka, containing 32,642 trees. Ay possesses six plantations—Welvaren, West Klip, Wiltevreden, Mata-lengko, Kleinzand and Vertvachting, containing 172,931 trees. Lonthoir, or Great Banda, has twenty-five plantations; eight in the district of Lonthoir, containing 135,145 trees; eight in the district of Voorwell, containing 67,806 trees; and nine in the district of Achterwal, containing 113,609 trees. There are 2,456 labourers employed on the plantations, of whom 1,836 are on Great Banda. The plantations not only differ greatly in size, but are very disproportionate in the quantity and quality of their produce, and in the labour bestowed on them. The number of trees varies from 4,000 to 28,000, and the produce from 5,000 to 32,000 lbs. of nutmegs. The produce is classed into medium, inferior, and broken nuts, and into good mace and chips. The inequality in the produce, acre for acre, depends on many causes, such as the situation of the plantations with reference to the prevailing winds, the soil, facility of collecting the fruit, and the care bestowed on it by the perkeniers. The Government pays to those of Neira 16 doits*

* A doit is a little more than a farthing.

a pound for the best nuts, 6 doits for the inferior, and 4 doits for the broken; for the first quality of mace, 40 doits; and for the second, 20 doits. Those of Lonthoir are allowed a little more, on account of the greater cost of carriage. The gross receipts of each vary from 1,000 florins to 8,000 florins.

The whole sum paid to them for the crop of 1854 was 113,223 florins. Their average receipts are 130,497 florins, and expenses 79,488 florins, leaving only 51,009 florins as their gross incomes. The income from one park is about 5,300 florins, of another about 4,000, of two about 3,000, of one about 2,000, of seventeen about 1,000, of eight about 500, one being as low as 145 florins, while another shows a deficit of about 500. In many cases these petty incomes belong to several persons jointly, eighteen of the thirty-four plantations having from two to nine shareholders each. When it is added that twenty-one of the plantations are in debt to the amount of 143,867 florins, bearing an interest of 13,213 florins, it will be seen that the lot of a Banda spice planter is not a very enviable one, and that so long as the Government maintains the monopoly it provides most effectually against any improvement in the plantations, or in the condition of the population dependent on them. It should be stated, however, that the park-keepers have some other sources of income.

The fruit of the Kanari trees, which overshadow the nutmegs, yields by expression a valuable oil. By this and other means, especially fishing, they gain from 2,000 to 3,000 florins a-year.

The profit made by the Government on the spices of the Bandas is considerable, as the following accurate account will show:—

Debit.	Florins.
537,861 lbs. of nuts and 133,986 lbs. of mace—viz.:—	
No. 1 nutmegs, 410,228 lbs. at 16 to 20 doits	61,218·40
No. 2 nutmegs, 86,215 lbs. at 6 doits	4,310·90
41,418 lbs. broken, at 4 doits...	1,380·72
No. 1 mace, 131,389 lbs. at 40 to 44 doits	45,861·16
No. 2 mace, 2,597 lbs. at 20 to 22 doits	452·12
	113,223·80
Expenses preceding shipment to Java...	109,717·23
Freight to Java	7,000·
Freight to Holland, insurance, &c., 12¾ per cent. on the market price in Holland	122,094·17
Total	352,035·
Credit.	
No. 1 nuts, 410,228 lbs. at fl. 1·57...	644,057·96
No. 2 nuts, 86,215 lbs. at fl. 1·40	120,701·
No. 1 mace, 131,389 lbs. at fl. 1·45	190,514·05
No. 2 mace, 2,597 lbs. at fl. 0·90	2,337·30
	959,610·31
Profit	607,575·31
Equal to	£50,631

THE RIVER AND LAKE FISHERIES OF NORTH AMERICA.

In taking up this comprehensive subject, we do not allude to the fisheries pursued upon the British coast or elsewhere at sea, but simply to the vast and neglected field afforded for successful operations in this line among the rivers of Canada. There are, perhaps, thirty rivers, of more or less importance, which fall into the St. Lawrence, between Quebec and the Gulf, in which we understand that salmon and trout may be taken in great abundance. Indeed, those who have had some personal opportunity of investigating the subject, assure us that there is nothing superior to them, either in point of the opportunity for sport, or in the advantage which might be taken of the fisheries in these streams for purposes of profit, in any of the rivers of the British Isles or the North of Europe. Of late years the Canadian Government has paid some attention to the subject, and has rescued these rivers from the mode of fishing practised by the Indians, and that scarcely less savage of the Hudson's Bay Company.

Under the more intelligent provisions of law, several of the streams have been rented, both for net fishing and rod fishing; but though the product, both to the Government and leaseholders, might be very great, yet the profit to neither amounts to much, because no due means are provided for getting the fish to market. The distance and chances to which sailing vessels are particularly liable prevent a full supply of the most delicious fish in the world to the chief cities of Canada, because the people and the Government do not seem yet to have waked up to the ready means of conquering the obstacles interposed, by the employment of a suitable steamer or two, to make the proper trips at regular periods, during the appropriate season, to stop at the regular stations to convey the necessary supplies, and to transport the sportsman and his ample prey to points where they could be disposed of to advantage.

Were this course adopted, these Canadian streams would so n find plenty of people from the States and probably from Europe, to take leases of their fishing privileges for the season, and a great deal of mutual benefit to all parties, in the way both of profit and recreation, might ensue. But while the Canadians are thinking over this suggestion, it would be not surprising if some of our enterprising Yankee friends should appear upon the premises prepared for duty and pleasure, at all points, after having obtained due permission of the Government.

On the first discovery of the northern coasts of North America, whether of Greenland, Labrador, the present British provinces, or the United States, nothing, in the first instance, so much attracted the admiration of the discoverers as the immense profusion of animal life which teemed in all the littoral waters, the shoal places of the ocean itself, the estuaries, the river courses, and, as they were subsequently and successively discovered, the interior streams and inland lakes of the virgin continent.

The Norsemen, who, beyond a doubt, were the first visitors of America, at least since the Christian era, spoke with scarce less enthusiasm of the shoals of salmon—a fish with which they were well acquainted, as swarming in their own wild Norwegian *fiords* and rivers—than of the grapes and maize of Vinland—fruits of the earth which, denied to the rigours of their native climate, they had yet learned to know and value, by their inroads on the sunny shores of southern France, and the vintage-laden soil of Italy and the Sicilian islands.

Within two years after Sebastian Cabot's discovery of Newfoundland, in the year 1497, sea fisheries were established on the coast and banks of that island; and these fisheries "formed the first link between Europe and North America, and for a century almost the only one." *

The gallant St. Malousin mariner, Jacques Cartier, the discoverer and namer of the bays of Gaspe and Chaleurs, of the St. Lawrence and the isle of Mont Real, was forcibly struck, as he could not fail to be, by the innumerable multitudes of salmon and sea-trout with which those waters are literally alive during the season—since, after above two centuries, during which the reckless extravagance and wanton cruelty of the white settler, more than his greed (for he has slaughtered at all seasons, even when the fish is worthless), have waged a war of extermination on the tribe, their numbers still defy calculation, and afford a principal source of rich, cheap, and abundant nutriment to the colonists, as well as the material for a profitable export trade.

Further to the west, the waters of all the New England rivers—the mighty flow of the Penobscot, the silvery Kennebeck, the tumultuous Androscoggin, the meadowy Connecticut, so far as to the lordly Hudson and the rivers of New Jersey, which enter into its beautiful bay—were found by the first settlers to abound with the sea-salmon; and to their plenteous supply the early Puritan settlers, in no small degree, owed their preservation during the hard and trying times which followed their first attempts at colonisation. That the Delaware likewise abounded in this noble fish can in no manner be doubted, for, of all the rivers on this side of the continent, there is no water so well adapted to their habitation, both from the absence of any material fall or chute, which should hinder their ascent, and from the purity and gravel bottom of its upper waters, as well as of its numerous tributaries, all of which are admirably qualified for the propagation of this species.

South of the Capes of the Delaware, it would seem probable that the true sea-salmon never existed. In the first place, because it appears that, on this continent,† the thirty-eighth degree of north latitude is, on both coasts, the extreme southern limit of the true sea-salmon; and secondly, because, in the Susquehanna and rivers still further south, even so far as the Vir-

* "Hildreth's History U.S.," vol. i., p. 37.

† On the continent of Europe it does not extend southwardly below 44° north latitude, if—of which we have some doubts—it is taken south of the Isle d'Ouessant, in the Bay of Biscay.

ginian waters, the first discoverers, who had learned, from the accounts of the northern adventurers, to look for salmon in all American streams, gave the name of white salmon to a fish which, in the absence of the *Salmo salar*, they did find in the estuaries they entered; and which still, though belonging to a totally distinct family, being a percoid fish, in the vernacular, the growler, retains the honours of its unduly-applied title.

In respect of fish, no natural cause prevents their co-existence, in the greatest abundance, with man in his highest state of civilisation and refinement, in the midst of the greatest agricultural or manufacturing opulence.

Easily scared, in the first instance, by unusual *sights*—for it has been, we think, thoroughly proved by a series of curious and interesting experiments on the trout, that most kinds of fish are insensible to *sounds* *—the natives of the water speedily become reconciled to appearances, which become habitual, when found to be connected with no danger.

Consequently large cities on their river margins, great dams and piles of buildings projected into the waters, the dash of mill-wheels, and the paddles of steamers, have no perceptible effect in deterring fish from frequenting otherwise favourable localities. Every angler knows that the pool beneath the mill-wheel is, nine times out of ten, the resort of the largest and fattest brook trout in the stream. Every shad-fisher knows that the growth of Philadelphia and New York has in nowise affected the run of shad up the Delaware or Hudson, how much soever his own indiscriminate destruction of them by stake-nets, by the seine, and, worst of all, by capturing the spent-fish, when returning weak and worthless to the sea, after spawning, and known as "fall shad," may have decimated their numbers, and may threaten their speedy annihilation. It is well known that the vast saw-mills at Indian Old-town, on the Penobscot, with their continual clash and clang and their glaring lights, blazing the night through, have no effect in preventing the ascent of salmon into the upper waters of that noble river, wherein they still breed abundantly. It has been proved, beyond the possibility of question, by the vast increase of salmon in the Tay, the Forth, the Clyde, and other Scottish rivers, since the enforcement of protective laws by the British Fishery Boards, that the continual transit of steamers to and fro has no injurious effect on their migrations.

In a word, it is fully established that, if care be taken to prevent and restrain the erection of obstacles to the ascent of these fish from the salt into the fresh waters, for the deposition of their spawn, and if protective laws be rigidly enforced, to render impossible the wanton destruction of the breeding fish on their spawning beds, and during the season when their flesh is not only valueless, but actually unwholesome, while they are engaged in the process of breeding, or are returning, spent, lean, large-headed, flaccid, and ill-conditioned to the sea, for the purpose of recuperating their health and reinvigorating their system, by the marine food,

* Those who are curious on this subject are referred to a very clever little work, "The Flyfisher's Entomology," London, 1839, pp. 1, 20.

whence they derive their excellence—there is no limit to their reproduction or increase, allowing every fair and reasonable use of them, whether for local consumption or foreign export.

In a paper read before the Canadian Institute, by the Rev. W. A. Adamson, D.C.L., on the "Decrease, Restoration, and Preservation of Salmon in Canada," after referring to the importance of the salmon as an economical production and as an article of commerce, and stating, as an article of food it is the most valuable of fresh-water fish, both because of its delicacy of flavour, and the numbers in which it can be supplied, it was observed that, by prudent exertions and at a small expense, it could be rendered cheap and accessible to almost every family in Canada, and at the same time an article of commercial importance for export to the United States, in which such fish are well nigh exterminated. About twenty-five or thirty years ago, every tributary of the St. Lawrence, from Niagara to Labrador, and Gaspe abounded with salmon; now, with the exception of a few in the Jacques Cartier, none are to be found between the Falls and Quebec. Two causes for this were alleged; first, the natural disposition of uncivilised man to destroy whatever has life and is fit for food; second, the neglect of those who have constructed mill-dams, in not attaching to them slides or chutes, by ascending which the fish could pass onwards to their spawning beds in the interior. The real cause of their disappearance is not, as some allege, the sawdust of the mills, but the insuperable obstacles put in their way, by which they are prevented from gaining those ærated waters high up the streams, which are essential for the fecundation of their ova and propagation of the species. The modes adopted in France, England, Scotland, and Ireland for preserving this fish, are the construction, below each mill-dam, of a series of wooden boxes, proportioned to the height of the dam. This, in the case of Canada, could be done for about 20 dolls. Suppose, for example, the height to be gained was fifteen feet, and that the salmon made five feet at a bound, only two such boxes, each five feet high, would be required. In the waters of Lake Ontario, a few of the genuine salmon are occasionally taken, especially at the mouths of the Humber and the Credit, in May or June. There are other facts which prove that this fish can live and breed in fresh water without visiting the sea. Mr. Lloyd, in his "Field Sports in the North of Europe," tells of a fishery near Lake Katrineberg, where some ten or twelve thousand are caught annually, and that they have no means of access to the sea. They are, of course, small in size and deficient in flavour. Mr. Scrope tells us of a salmon put into a well and living for twelve years. It became so tame as to come and feed from the hand. The fact that they are to be found in the Credit and Humber, and the tributaries of the St. Lawrence, proves that these rivers might be again stocked. Those tributaries of the St. Lawrence between Quebec and Labrador, for a distance of 500 miles, are held under lease from the Government by the Hudson's Bay Company, who fish in an unsystematic manner with standing nets. By means of proper weirs the fishermen in

Europe have the fish completely under their control; but there is no such thing in Canada. Old and young, valuable and worthless, are all treated alike. Dr. Adamson thinks that the Hudson's Bay Company set but little value upon these fisheries, and that the approaching termination of their lease renders them careless as to incurring expense by erecting weirs. The protection afforded by the Company was the only safeguard the salmon had. Were this protection withdrawn for one year without the substitution of another as effective, this noble fish would be utterly exterminated from the country. Fishermen from Gaspe and Labrador would swarm in the estuaries and bays, and would kill every remaining fish. Attempts of this sort have been already made. Schooners from the United States have arrived in the Bay of Seven Islands with well-armed crews and set nets in the Moisie, in despite of the Hudson's Bay Company. The River Bersinius was this year in the hands of an American company, who, with the Indian spear, mutilated large numbers of this fine fish; and after glutting the Portland and New York markets, they brought up some boxes to Toronto in September, when they were out of season and unfit for food. By care the rivers of Lower Canada might be made as productive as those of Europe, for which large annual rents are paid. The obstacles to their proper management are, their distance from civilisation, the want of means of intercourse with inhabited portions of the country, their liabilities to trespass by armed ruffians, and the rigours of the climate in winter. One or two armed steamers would be required to cruise during the summer, about the mouths of the rivers, as on the east coast of Denmark, to supply stores to the different lighthouses, to convey managers to and from the several stations, and to protect the lessees of the province. They could also convey the fresh caught fish to the railroad stations at St. Thomas and Quebec; thence to be distributed to the markets of Canada and the United States. Prompt action is required. If plans be not matured before the King's Posts are abandoned by the Hudson's Bay Company, the salmon rivers will be taken possession of by hordes of lawless men, who will in no way contribute to the revenue of the country, but will exterminate the fish and desert our shores. A whole tribe of Indians—the Montagnards—will be reduced to a state of positive starvation, for upon the Hudson's Bay Company they have hitherto been, and are now, dependent for their ammunition, guns, and other means by which they obtain their food and clothing.

The Legislature of Canada passed a Fishery Act, about two years since, for the regulation, protection, and encouragement of the inland as well as the Gulf fisheries; and two Superintendents of Fisheries were appointed—one for Upper and one for Lower Canada—each with a staff of suitable overseers, &c. The Upper Canadian official has made but little progress in his duties; the Lower Canadian a great deal. We have not yet earned that any of the obstructions which have caused the destruction of the salmon in the Credit, the Humber, the Don, and many other rivers in Western Canada, where they once abounded, have been removed.

Mr. Richard Nettle, of Quebec, the Inspector of Fisheries for Eastern Canada, has been lately occupied in visiting the fisheries on the lower St. Lawrence, and in enforcing the law, which enacts that all mill-owners who have mill-dams on rivers, shall erect fish-slides, or passages, by means of which trout and salmon may ascend and descend to and from their spawning-beds, and without which they must soon become extinct. He now appears to be engaged in carrying out the views of the Legislature, by providing a supply of young salmon for the rivers in the lower province, in the same manner that has been attended with such signal success in various parts of France, England, Scotland, and Ireland. It may be interesting to describe the method he adopts for artificially breeding salmon.

In a large room, well ventilated in summer and sufficiently warmed in winter, is a tank, about eight feet by twelve, divided into two main compartments—one deep, the other shallow. The latter is again subdivided into three divisions of different depths, from six inches to about one. Water from the city pipes—which is supplied from Lake St. Charles, up in the mountains, eighteen miles away—is kept constantly flowing into this tank, with the proper contrivances for preventing any sudden stoppage of the supply. The shallow parts of this, the ovarium, are floored with sand and stones, in imitation of a river's bed. The deep part has only a few pieces of rock at the bottom.

Salmon spawn in September, and at that time the female fish are taken with nets from the neighbourhood of their spawning-beds. A very gentle pressure makes them shed their *ova* into a pail to the number of perhaps 20,000 each, and a single male fish then suffices for the impregnation of a pailful of spawn, which is then very carefully brought to the ovarium and placed in the shallow compartments above described.

When first taken, the spawn is of a yellow colour, each little egg being of the size of a small pea, and semi-transparent. Close observation detects a little reddish spot on one part of the ovum. In a short time this spot, which is where the impregnation occurred, grows larger and deeper in colour, while the ovum gets more and more opaque. In December, the rudimentary fish can be seen, curled up within the skin of the egg. In January, the black spots become visible—the eyes of the embryo. Towards the end of February, the little fish bursts from its confinement. Last year, the first of the spawn completed these transformations in 113 days.

When the salmon thus make their appearance, they are almost like small tadpoles, or bullheads, in form, and lie quiet among the stones for a few days until they become more shapely. Then they become lively, and rush about the tank briskly. A fly, thrown upon the water, brings a host of them up to the surface, eager for their prey. They grow but little for several months, none becoming longer than one's finger. But if these little creatures are then put into a river, they will make their way downwards to the sea, grow with surprising rapidity in salt water, and return to the same river next year, weighing from four to seven pounds.

The advantages of breeding salmon artificially are several, but it is sufficient to mention one or two. When the spawn is deposited in the rivers, it may remain barren. If it escapes this danger, the trout and other fish eagerly seek for it, and they even say that large trout will follow the female salmon at spawning time, in expectation of a meal. If the eggs do, in time, give forth small fry, these have to run the gauntlet of innumerable perils before they reach the sea, and grow to a sufficient size to be careless of other enemies than man or the salmon-eating otter. Thus, perhaps, 99 per cent. of the spawn—certainly 90—is destroyed. By artificially breeding, that quantity lives. Mr. Nettle's experimental tank now contains about 5,000 spawn, and all are in a forward state.

Nor is fish-breeding likely to remain a mere experiment in Canada. Three large lakes—Megantic, St. Francis, and Louisa—have just been leased for nine years to a M. De Courtenay, a French gentleman, who lived a long time in Italy, and was President of the Fishery Company of the Lago Maggiore. M. De Courtenay intends taking there some of his old Italian *employés*, spending several thousand dollars in erecting and managing apparatus for artificially propagating salmon in one lake, sturgeon in another, and some other fish in the third. The object of renting three lakes at once is that one kind of fish may be bred in each, and the staff of men may be shifted from one to the other according to the season: one kind being best preserved in summer, another in winter. And as the lakes, Megantic, &c., are of large size, as may be seen by referring to the map, the enterprise is one which will make a noise in the Province. The right of the people living around these lakes to catch fish for their own consumption is reserved by the authorities. For this reason, as well as because of the size of the waters, propagation must be carried on most extensively to yield any return. It is intended to supply the markets of New York, Boston, and Montreal with fish of the choicest varieties, to send the supplies, barrelled, to the West Indies and to South America, and to erect factories for the making of coarse and fine isinglass and fish manure. Of course, this being a new thing in the Canadian climate, the experience of Mr. Nettle and the ascertained results of his experiments must be very valuable.

A correspondent of the *Quebec Chronicle* says that the value of the salmon fisheries of the St. Lawrence and its tributaries ought, with proper care, to yield a revenue of at least £75,000 per annum; and with a few years' culture, the value would be increased *ad infinitum.* The River St. Lawrence and its tributaries are abundantly stocked with salmon. It is the attribute of a good Providence to create—the practice of men to destroy; and they have in a great measure destroyed the salmon and other valuable fisheries of the St. Lawrence. The fish are hunted in season and out of season, by net, by spear, by fork, by negog—before spawning, when spawning, and after spawning; and thus fisheries which might supply the mart for this continent, ay, for Europe also, are destroyed by the cupidity and avarice of that land shark—man.

It cannot be said, observes an American writer, that as a nation we are either ignorant or regardless of the national value of fisheries; when, but a few years since, we were in a state of extreme agitation and excitement, and on the point of rushing into hostilities with the most powerful maritime nation on earth, for the assertion of certain questionable rights of fishery—rights, in fact, according to the opinions of some our most able and responsible statesmen, which were, as *per se*, entirely untenable—on the coasts and within the bays of a neighbouring foreign Province.

And yet, were we as ignorant thereof as the most benighted of savages, we could not be more utterly regardless of the mine of wealth, richer, surer, and far more cheaply obtained than the boasted gold of California, neglected at our very doors, in every river mouth from the Delaware to St. Croix, along our whole eastern Atlantic seaboard, which might, with a minimum of legislative aid and protection, and the exertion of the smallest portion of common sense, self-restraint, and foresight, on the part of our maritime and rural population, afford cheap and delicious food to hungry thousands, and a large source of national wealth, as a material for export, and stimulant to commercial enterprise. Within the memory of man the Connecticut river swarmed with salmon; and it is stated, in the *Hartford Courant*, that "it is well known that individuals, coming in from the country for a load of shad, could not purchase any unless they would consent to take so many salmon off the hands of the fishermen. They were often sold as low as two coppers the pound."

"The cause of the destruction of the salmon was not," continues this writer, "so much the numbers caught by the fishermen, as the obstructions which the dam at Enfield placed in the way of the descent of the young fish to the salt water. A resident at Enfield, when a boy, distinctly remembers seeing, in a very dry summer, when the water hardly flowed over that dam, thousands of very young salmon, on the upper side, prevented from going down, all of which died there in a short time."

It is, however, the stoppage of the ascent of the breeding fish, not that of the descent of the young fry, which is fatal to the race. The salmon can be, and has been, successfully introduced into inland lakes of fresh water, having no communication with the sea; nor is the exclusion of the young fish from salt water fatal to its life, although it prevents its growth, deteriorates the quality of its flesh, and, probably, deprives it of the powers of reproduction.

Inasmuch, however, as the salmon cannot propagate its species except in rapid, highly aerated, fresh, spring waters, if the parent fish are debarred of access to the upper tributaries of the rivers, in which alone their eggs can be brought to maturity, the breed must, of course, become extinct; and, again, inasmuch as the salmon invariably returns to breed in the river wherein itself was bred, even if the obstacles to the ascent of the fish were removed, unless the waters should be re-stocked, no salmon would ascend them, the way being lost, or a traditionary instinct of the existence of obstacles descending among them from generation to generation.

This fact is evident, from the circumstance that, although sea-salmon abound in Lake Ontario, and run freely up the Credit, and other Canadian streams on the north, as well as up the Salmon River on the south side of the lake, none are ever known to enter the Niagara, doubtless in consequence of the bar interposed to their progress by the Falls of Niagara, which must be known to the successive shoals which arrive at its mouth. Gradually, the salmon has receded eastward and eastward still, until it is already becoming rare in the Kennebeck, decreasing in the Penobscot, and in gradual but rapid progress of extinction in all the waters of the United States.

Even in the British provinces of Nova Scotia and New Brunswick, wherein the salmon fisheries are of vast importance—the exports alone, apart from the home consumption, which is enormous, amounting to the annual value of several hundred thousands of pounds sterling—such is the reckless destruction of the fish on their spawning beds at seasons of the year when the flesh is valueless as food, and such are the increasing obstacles to their propagation and increase, that protective enactments are loudly called for, in order to prevent the annihilation of the fish—especially by Mr. Moses H. Perley, her Majesty's Emigration Officer, who has been largely employed by the Provincial Government in the investigation of this subject, and who has not only devoted much time and attention to the subject, but has thrown much light on it by his researches.

We understand that the Natural History Society of New Jersey are prepared to make, to the three States of New York, New Jersey, and Pensylvania, an offer to re-stock the Hudson, Passaic, Raritan, and Delaware rivers, with salmon fry ; provided the legislatures will jointly or severally pass such laws for the preservation of the fish, until they shall become fully established in those waters, and for ever during spawning season, including the removal of all obstacles to their free ingression and retrogression to and from the salt water as shall be deemed sufficient, the society asking no privilege or remuneration beyond the actual expenses of providing and transporting the fry.

Mr. W. H. Herbert argues that, by the extension of similar provisions to any waters wherein salmon have formerly existed, but are now extinct, coupled with measures considerately undertaken for repeopling the breeding streams, about their head waters, with young fry, all and every one of the eastern Atlantic rivers might be rendered equally prolific with those noble salmon rivers, the St. John, the Miramichi, the Restigouche, the Nepisiquit, and others flowing into the bays of Chaleurs and Gaspe, and more so than the Foyle, the Tay, the Clyde, the Forth, and other Scottish and Irish rivers, even in their improved condition.

Mr. Herbert's theory, as to the destruction of the salmon, in the first instance, which he supposes, in some measure, to have preceded the exclusion of the breeding fish from the proper waters, appears to point to the poisonous matter infused into the rivers by the bark from the saw-mills, which, in all the rivers of the cleared districts, has long passed away, and ceased to have any influence; and he assumes, as a certainty, that there are no causes now existing in the waters, at least, which he has specified, to prevent the propagation and increase of the salmon to any given extent, if properly introduced, adequately protected, and suffered to visit its spawning places without interruption.

That the object aimed at is worthy of a trial, is not to be denied or doubted, and that, if attainable, it would be productive of great national benefit, is as certain—it being no less than the creation, or, at least, the regeneration, of a new, or *quasi* new, branch of national industry, which would necessarily employ and produce a large capital; which would give work and wages to several thousands, probably, of hands; and, what is of yet more consequence, would furnish—in these times of high prices, scarcity of provisions, and increasing demand for food—a cheap and abundant article of nutriment for the masses.

Again, the necessary outlay for restoring these waters is rated at so mere a trifle, that it is unworthy of a thought—the estimated expense of stocking the rivers named, in the first instance, not exceeding a thousand or two of dollars, added to the individual outlay of a few mill-owners, in remodelling their dams in a manner which would permit of the ingress and egress of the fish, without in anywise affecting the height of the head of water, or the supply maintained by the present system.

P. L. S.

ILLUSTRATIONS OF INDUSTRIAL ART AND OBJECT-LESSONS.

One of the prominent features of the day is certainly the increased attention which is given by Government and individuals to the popular illustration and exemplification of Economic Industry, and the application of Science and Art to Manufactures. Lecturers, schoolmasters, and popular writers all address themselves to this task, and with a very beneficial result; for the noble museums open for examination, and the subsidiary aid available, now serve to open up a vast field of interesting information to the many, which was formerly confined to a few, and was scarcely considered of sufficient interest to occupy the attention of the public. It is quite useless to attempt to teach Natural History or the useful arts by books alone. The lecture which is illustrated by diagrams, experiments, and specimens, is usually far more popular than the mere *viva voce* explanation can be; and whether the study be mineralogy, conchology, or botany, a collection of specimens is invaluable, both to the teacher and student. The illustration of commercial products, and their uses in the arts and manufactures, by a well arranged compact cabinet of specimens, has not hitherto been much attended to. Indeed, the task of collecting, systematically arranging, labelling, and describing a varied assortment of specimens from the three kingdoms, is no easy matter. This has, however, been well done within the last few years by an experienced hand, who has addressed himself to the task with an energy and a zeal which deserve public encouragement and support. Mr. T. E. Dexter, of the Royal Military Asylum, Chelsea, now prepares cabinets of Natural History, specially intended for educational purposes and object-lessons. These cabinets, which, from close examination we can heartily recommend, are now in use in the normal, model, regimental, and garrison schools of the British army in this country and in India; in various training institutions of Great Britain and Ireland; in many commercial and elementary schools, and private families.

Accompanying these are special volumes intended as text books, of which new editions have just been issued.*

Object-lessons, it is well observed, powerfully develope the mental faculties of the young, afford correct ideas of the properties of articles, both rare and common, and show whence such articles are obtained.

Object-lessons are applicable to children of all ages. The world of nature, so full of the highest and most ennobling lessons, is too often a sealed book to those who attend our elementary schools. Such should not be the case. There is no class of persons, high or low, rich or poor, learned or ignorant, but may derive some advantage from the study of these natural substances.

The Great Exhibition of 1851 was an object-lesson upon a world-wide scale. The Museum of Economic Geology, in Jermyn-street; that of Economic Botany, at Kew, and the Museum of Animal and Food Products at South Kensington, are intended to convey instruction to all classes of the community by means of objects. And while the visitor to these splendid collections gazes upon and admires the curiosities, the wonders, and treasures of the three great kingdoms of nature, and feels himself deficient in knowledge with regard to the greater part of what he observes, yet what pleasure is felt on recognising a substance with which he is more intimately acquainted, and connected with which may be some pleasing associations. The study of these objects is not only important and instructive to the mind of the adult, but is peculiarly so to the minds of the rising generation, and ought, therefore, to form an important part of the daily routine in all schools.

The little works referred to, which contain a large amount of useful, descriptive commercial, and statistical information, have been compiled with a view of affording a certain amount of information respecting some of the most important substances known in commerce. They are intended as useful class reading books for young persons, and afford materials for a series of entertaining and instructive lectures upon the branches of Natural History, illustrated by the specimens found in the cabinets.

* "Animal and Vegetable Substances used in the Arts and Sciences." Second edition, revised and improved.

"Mineral Substances: being an Explanatory Text-book of the Minerals and Metals used in the Arts and Manufactures," &c. By T. E. Dexter, of the Royal Military Asylum, Chelsea. Groombridge and Sons.

The vegetable substances are arranged under six divisions or classes, in order to show some of the ways in which trees and plants are useful to man—viz.: Roots, Juices, Bark, Stalks and Stems, Leaves and Flowers, Fruits and Seeds of Plants, &c.

There is, perhaps, no one of the Natural History sciences that can be so successfully introduced into a course of education as botany. Plants are always to be g t. The study of their structure is well adapted to call out the observing powers of children, whilst their classification is founded on principles which apply to the arrangement and classification of all facts. The use of the knowledge of plants is, also, not slight. They supply the material of many of our most important manufactures, whilst the great question connected with the supply of food to man and the domestic animals are dependent on a knowledge of plants and their functions. At the same time, little has yet been done beyond the requirements of our medical schools, for the systematic teaching of botany in our schools and universities.

The animal substances are arranged so as to show the various commercial products obtained from the primary groups and classes into which the animal kingdom is divided, and are intended to illustrate the various useful applications of animal substances to industrial purposes—viz., for clothing, domestic and ornamental purposes, pigments and dyes, perfumery and pharmacy, and the application of waste substances, quills, pens, guano, tortoiseshell (raw and prepared).

This collection will serve to furnish an approximate idea of the extent of the commerce in animal products. The aggregate value of the articles dealt in exceeds £136,000,000 sterling, employs an amazing amount of capital, and gives busy industrial occupation to a very large number of persons, in the collection, distribution, and after preparation of the material, to fit them for use; while the large amount of tonnage of shipping employed, and the inland transport from place to place, of the raw material and the finished manufactured product resulting therefrom, are other elements of active industry in which our population are specially interested.

FRESH WATER WEED OF CHINA.

This weed is similar in nature and uses to our Irish moss. It is from the province of Huper. It differs from our sea weed, in being found on the banks of the fresh water lake, the celebrated Yungting Hu. A specimen was lately presented to the Agri Horticultural Society of India by C. Alabaster, Esq.

DIAMONDS.

An interesting paper on diamonds was read at a recent meeting of the Royal Institution by N. S. Maskelyne, of the Mineralogical Department of the British Museum. A detailed account appeared in the *Critic* of June 30, 1860.

THE TECHNOLOGIST.

THE TIMBER OF TASMANIA.—BLUE GUM.

BY DR. MILLIGAN.

The Royal Society of Tasmania lately submitted to its members a paper "On the Commercial Value of Tasmanian Timber as respects the English Market." Effectual means have recently been taken by the Colonists to bring under the notice of European engineers the hard woods of Tasmania. Dr. Milligan, the late Secretary of the Royal Society, has done much to bring the colonial woods into notice; and we think we shall be doing good service in making public some of his details respecting the Blue Gum especially, on which we believe a paper is to be read during the present session before the Society of Arts.

Tasmania abounds with forests of timber almost unlimited in extent, and of a quality equal, if not superior, to any other hard wood in the world. Its strength and durability have been frequently tested. It has been pronounced by scientific men to be unsurpassed in these qualities by any other timber of which we have any knowledge. Amongst our trees there are the blue gum *(Eucalyptus globulus)*, the stringy bark *(Eucalyptus gigantea)*, and the peppermint *(Eucalyptus amygdalina)*. These timbers, from their superior quality, have attracted considerable attention; but, unfortunately for us, that attention has not been secured in the right quarters. Very many years ago Sir John Franklin brought the subject under the notice of the British Government, and strongly recommended that our timber should be employed for naval purposes. Since then, Sir William Denison has, by scientific tests and by experiments, confirmed the favourable opinions expressed by Sir John Franklin regarding its valuable properties; and we believe Sir Henry Young has also represented its usefulness to the Admiralty. That the peculiarities of our timber remain at the present moment comparatively unknown and unappreciated, is the best evidence we could have that other steps than these must be taken if we wish to secure those advantages which our forests are capable of conferring upon us. The reputation of our hard wood has been hitherto strictly confined to the Australian colonies.

It has been used to a considerable extent in the construction of Victorian railways, and other public works; indeed, it will be found in the structure of thousands of public and private buildings in the chief cities and towns of Australia and New Zealand. But we are in a position to supply the whole world, if the whole world would only deal with us. The enormous consumption of timber now going on in railways alone must soon make the question of supply worthy of the most serious consideration; and surely, then, the inexhaustible forests of this hard wood, now lying despised and useless in Tasmania, cannot be, and ought not to be, a matter of indifference to railway contractors and others immediately interested in railways.

Then, again, in addition to supplying an article superior in quality, that is in durability, to any timber hitherto employed, we can do this on terms as reasonable, if not more reasonable, than any other country. This is an argument which generally carries some weight with it. All the banks of our noble rivers are fringed with some of the most stupendous and magnificent trees in the world. Ships of any conceivable tonnage could lay alongside and load with timber without the slightest risk or inconvenience. The saw-mills at Oyster Cove, and the Strathblane establishment at Port Esperance, have been erected in positions to facilitate the conveyance of cut timber to the water's edge. Tramways have been laid down, and jetties have been built; indeed, every difficulty which presented itself has been overcome, and all that we now want is a market. In England, in France, in Germany, and in India such a market exists we know. Tenders were invited a short time since, in a public journal in Launceston, by a gentleman residing on the northern side of this island, and who is acting as agent for others, for the supply of an immense quantity of railway sleepers for India. This was the first tender ever invited in this colony, and many, on that account, but more especially on account of the magnitude of the contract—involving about £4,000,000 sterling—were credulous as to its being a *bona fide* transaction. At all events, it is consolatory to know that an offer has been made by the principal merchants engaged in the timber trade to supply India with the whole quantity required; and that, too, at a price for which no other country could afford to supply timber of the same quality, even if it had timber of the same quality to supply. Should this contract be accepted by the Indian Government, we shall need no other advertisement.

Several of our homeward-bound wool ships have taken specimens of railway sleepers with them to England. If this were known, contractors, and those interested in railways, might think it worth their while to inspect the article we now offer, and form their own judgment regarding its value. Ships, for a mere nominal freight, would gladly ballast with these sleepers, instead of with stone, as at present. Indeed, it would pay them better to do so. If we can only secure a hearing, therefore, amongst men who are mixed up with railway matters, and induce them to examine these sleepers and to practically test their quality for themselves, we shall have succeeded in accomplishing the only object at which we now aim. England ought to feel as interested in the question of railway supply as we are in that of supplying the timber. If we get the Indian contract—and it is not clear that we shall not—other nations will be as anxious to secure their turn as they are now apparently indifferent. It is only a question of time. That they will have to come to us eventually we are persuaded. At the rate timber is now being consumed, our vast forests of splendid hard wood must attract attention before long. Great Britain has undoubtedly the best right to it; but if she won't deal with one of her own babes, when we can serve her with a better and a cheaper article than any one else in the same trade, she cannot blame us for casting about for some other customer.

With reference to the claims of the timber of this colony to the attention of the contractors for works in which hard wood is largely used, we have the opportunity of referring to an extensive shipment of blue gum, in the shape of piles and sawn timber, for the construction of the Government Railway Pier at Williamstown—the port terminus of the Victorian Railway system. It is the design of the Victorian Government to carry the railway jetty far into Hobson's Bay, to enable ships of heavy tonnage to unload direct into the railway trucks. This work has necessitated the use of timber of great size and length, and capable of resisting the destructive agency of both air and water. The Melbourne contractors had their attention directed to the timbers of Tasmania, and from our forests obtained their supply. To complete this one contract alone, piles to the value of nearly £7,000, and sawn timber to the value of nearly £11,000, have been exported to Williamstown. The order comprised upwards of 650,000 feet of blue gum, in the shape of beams, planks, and joists, and 1,450 piles, ranging in length from 45 feet to 86 feet, and 16 inches and upwards in diameter in the centre. The timber was for the most part cut from trees of large dimensions, many of them being upwards of eight feet in diameter. The completion of this order has given the highest satisfaction to the Melbourne contractors and engineers, who have not hesitated to describe the timber that has been delivered as of the very finest quality, and the best fitted for the use it is designed for which they had ever seen. They speak of it as certain to resist the action of the dry rot. In fact the size of our trees enables the splitter to select the heart of the timber, whatever the dimensions of the pieces required. The blue gum of Tasmania has been ascertained by abundant experiments to be one of the most enduring of all timbers, and to have claims, therefore, above all others for employment in those particular works which are specially exposed to destructive influences. Like all timbers, it is found to be best in quality when it is cut at the proper season. But the most conclusive testimony to its value is the strong commendation bestowed upon it by the contractors for the great work we have adverted to. The length to which the Williamstown pier had to be carried out into deep water, required the use of piles of great size and strength; and when we repeat that an abundance of blue gum trees were felled from which piles have been cut, from 86 feet in length downwards, the availability of this Tasmanian timber for works of this kind will be apparent.

The timber for this order was felled in Lady's Bay, in the river Derwent. On the same spot a dozen orders might be executed of similar magnitude. Nor is this a solitary instance. Large tracts of the island, and those bordering on, or in the immediate vicinity of, navigable water courses, are thickly timbered with this hard and almost imperishable wood. Small portions of it have from time to time been sent to England, but not in sufficient quantities to attract the attention of European contractors; and its value in railway construction, and other uses in which great durability is required, has thus never been otherwise than locally tested. We are glad to know that 100 tons of railway sleepers, made of the blue gum of Tasmania, have been shipped on board the "Cissy" for London. We trust this fact will be made widely known in England, and on behalf of the colony we invite an inspection of this sample of Tasmanian produce. We believe that this island possesses all the requisites for a far greater timber trade than has yet been developed. We have, indeed, for years supplied Australia with most of the wood employed in building and cabinet work. But we claim, at all events, a share of that great traffic which the extension of railways and other works of magnitude, both in Europe and in India, is creating. And to obtain this we only need that the true character of the article we are capable of supplying should be generally known.

We trust to be able shortly to report the adoption of some active official steps with a view to the introduction of the hard woods of Tasmania into the English market. Some difficulties stand in the way of our immediately realising all the advantages that ought to accrue to us from our possession of this invaluable article of export. The first of these is that the real properties of our timber are very imperfectly known to the engineers and contractors of the mother country. That our blue gum attains an average elevation and size greater than any other tree in the world; that planks of this wood have been cut, measuring the enormous length of 160 feet, by a breadth of 20 inches, and 6 inches in thickness—of such magnitude, in fact, that it was found impracticable to find ships capacious enough to carry them to the Exhibitions of 1851 (London) and 1855 (Paris); that this tree attains, at its full growth, a height of from 250 to 350 feet, and a circumference varying from 30 to 100 feet at four feet from the ground, and that, in regular forest ground, it rarely gives off its principal limb under 100 feet: whilst there is not unfrequently a stem clear of any branch for 200 feet and upwards; that its specific gravity is far in excess of that of teak, British oak, or even saul; that it has been proved by experiments, instituted to test its breaking weight, to be superior in point of strength and elasticity to all other known timbers—are facts well known in practical and scientific circles in this island, but which have never yet been brought with sufficient prominence before the engineering world. Its length and dimensions, its power of resisting pressure, and its durability, are all greater than can be obtained from any other timber in the world. Locally it is employed in an infinite variety of uses—by the shipwright, the millwright, the carpenter, and the engineer. We have great colonial works constructed of it—as, for instance, the bridge across the Derwent at Bridgewater, which measures 96 feet in length, with a roadway of 24 feet, and which is built entirely of this timber upon piles of from 65 feet to 90 feet each in length. The engineers of the great railway jetty in Hobson's Bay, which is to form the sea terminus of the railway system of the colony of Victoria, have, as already mentioned, obtained piles of enormous length of the Tasmanian blue gum for this work. We need not multiply these instances, but we will refer to one case of the use of this timber in the island, as affording a striking proof of its value as an inestimable material. At a mill in Hobart Town, a water-wheel constructed of blue gum has been in constant use for upwards of twenty years, and, on removing with a penknife the external coating that has accumulated during that period, it is found that the wood is as sound as on the day it was first used.

As the best means of bringing the valuable properties of this timber and other of our hard woods practically under the notice of English engineers, we believe it is not unlikely that the Colonial Parliament will, during its present session, vote a sum of money for the gratuitous distribution in England of properly selected specimens to be practically tested in actual works. We say, properly selected specimens, because it is not fair to the colony that timber cut full of sap, or otherwise under conditions favourable to premature decay, should be taken as samples of what the woods of Tasmania really are. And to prevent an inferior article being sent into the market, and generally to promote the development of an export trade in timber, it has been suggested that a Government Inspector should be appointed whose duty it should be to certify to the proper quality of the wood, and to impress each end of it with an official stamp, which shall be a guarantee as to its genuineness and value, and to imitate which shall be felony. The impression prevails here that the timber supply of Europe is rapidly contracting; that the engineering world will soon be anxiously casting about them for new sources of supply; and that nothing is wanting to give Tasmanian hard woods a preference over all others but to secure for them a fair and sufficient test. This it is hoped that the steps now proposed to take in order to get them actually laid down on some railway line and otherwise used in bridges, &c., at the expense of the colony, will effect. And it is further hoped that by taking the guarantee we have named for the quality of the material, we shall succeed in keeping up the character of our timber in the English market.

The blue gum (*Eucalyptus globulus*), as we have seen, is one of the largest of forest trees in the known world. From observations made on the annual lines of growth, it would appear to attain its full magnitude in about 300 years. There can, however, be little doubt that trees of the blue gum now exist in Tasmanian forests which have witnessed the revolutions of more than a thousand years. Naturally the tree prevails at the southern end of the island, and along the eastern coast, and on some of the islands in Bass's Straits, and it has been found upon the Australian mainland by Dr. Mueller. It is a fast-growing tree while young, and, when standing well apart, it assumes a very elegant shape, and presents a great profusion of rich, massive foliage. It is now being introduced into New Zealand and the Cape of Good Hope, for the sake of its rapid growth, and the value of its timber. Blue gum has been extensively used in the ship-yards of the colony for keels, and for the timbers and planking of vessels—for which the great lengths in which it can be procured particularly adapt it. It is used for ships' tree-nails and for boat-building; also for house-building, for shingles, and for the internal fitting of houses; for piles and the construction of bridges and wharves; for machinery, farming implements, and for the erection of fences, &c. By distillation, the leaves of the blue gum yield an abundant supply of a strong essential oil, which has been found to possess the active and valuable medicinal properties of the "cajeput oil" of commerce. From lesions in the bark of this tree, of the *Eucalyptus gigantea*, and of some other species of the same genus in the island, a bright red and highly astringent gum exudes, and hardens on exposure, which is successfully used in medicine as a "kino." One species of this genus produces, by exudation, after puncturation by an insect, and exsiccation of the juice, a delicate white saccharine substance, known as "manna" in the colony. Another species, "*Cider tree*," inhabiting the high tableland, known as "the Lake Country," yields, by incision of the bark, large quantities of saccharine juice, which is said to be slightly intoxicating when drunk in considerable quantity.

The blue gum derives its name from the bluish grey bloom with which, when young, it is covered. The outer layer of bark dries and peels off periodically, leaving a smooth bark of a bright buff colour, which soon changes to the aforesaid grey. The trees grown on the hills afford better timber than those of the valleys, and the timber of the north side of the island is deemed inferior to that of the south. It is stronger when dry than when green, but is used extensively in the latter state for shipbuilding in the colony, as it is then much easier worked. The "Harpley," built of blue gum, fresh cut from the bush near Launceston, was found to be unsound in her timbers when bored in London. When, however, this wood has been properly seasoned, which requires, by the present sytem, two years, no such indication is apparent; and Mr. Watson, the well-known builder of Hobart Town, has declared, in all his experience in repairs of colonial built vessels, he has never observed any appearance of dry rot. The timbers of the "William," a brig of 121 tons, built at Launceston, were found, after a lapse of fifteen years, to be perfectly sound. Mr. Watson proposes that the trees should be "killed" in the month of May, and left standing for six months, then felled and cut into planks or logs, and put into the water for three months. Spars can be obtained from the blue gum of sufficient length and girth for the largest class of ships, but the wood is not very suitable for this purpose, on account of its great specific gravity, which is above that of water. For kelsons, beams, wale planks, and stringers, Mr. Watson considers it unrivalled. It takes the steam well, and there is no fear of its spauling in working round a full bow.

The average breaking weight of blue gum seasoned twenty years was 1,225 lbs., and the direct cohesion upon the square inch 21,667 lbs. seasoned one to five years, 975 lbs. breaking point, and 27,339 lbs. cohesion.

	lbs.		lbs.
Stringy bark (seasoned)..................	974	....	21,140
Ditto, green	734	....	21,057
Swamp gum, seasoned (inferior)......	914	....	16,888
Ditto, green	719	....	18,488

The elasticity of thoroughly seasoned blue gum is a half greater than that of teak and moorung saul; double that of peon, ash, English oak, and red pine; three times greater than that of pitch pine, Dantzic and Adriatic oak; and five times greater than that of elm.

Swamp gum is the largest of the Eucalypti. A tree measured by Mr. Mitchell was 87 feet in height to the first branches, and 21 feet in circumference at eight feet from the ground. A second was 213 feet in extreme height, and 18½ feet in circumference at ten feet from the ground; and a third was 251 feet. But these are dwarfs compared with others, and some of the blue gums on the southern coast and on Maria Island. This wood is lighter and of opener grain than the blue, from which, by a casual observer, it is scarcely distinguishable, and is preferable for spars, although subject to cracks. By some it is considered equal to ash, and hence is sometimes called ash-gum.

Stringy bark shrinks, and is liable to rents, but yield spars of the largest size. A sound tree of this variety, in the vicinity of Cam River, a mile or two from the coast, on the north side of the island, measured by Mr. Mitchell, was 200 feet in height, to where its trunk had been broken off, and was 64 feet in girth at four feet from the ground. Its specific gravity is under 1,000.

THE TRADE IN COPROLITES.

BY THE EDITOR.

Coprolites are the exuviæ of extinct animals, but in the commercial meaning the name includes also bones, teeth, and other fossil relics of animals. Containing much phosphate of lime, they are used for making superphosphates. When ground to powder in a mill, and acted on by sulphuric acid, a part of the phosphoric acid is liberated, and a more soluble compound obtained. But little is known on this subject, and no lengthened details have yet been published that we are aware of. It is chiefly in the counties of

Cambridge and Suffolk that coprolite is obtained. The following particulars relate chiefly to Suffolk coprolites.

It is supposed that part of south-east Suffolk was once a large arm or estuary of the sea, wherein dwelt the monsters of the deep, and that their organic remains have been buried up by some great convulsion of nature, most probably at the time of the deluge. At the distance of ten miles from the present boundary of the sea, we find parts of land animals and vegetable remains; but what more likely than that the beasts of the forest should have preferred the margin of the water?—their bones, with trees, fruit, and seeds, all having been washed into the sea. That it was once the sea is sufficiently proved by the shells, and the great quantity of cement-stone we find, of exactly the same description dredged for on the coast. A still more convincing proof is the immense quantity of barnacles; in some knots each barnacle is as large as a walnut. Coprolite is a species of fossilized guano, most probably of the saurian, whale, shark, and other large animals. It looks like very dark oblong pebbles, rounded and polished by the water; they are very brittle, and the interior is dullish brown, slightly tinged with yellow, but they emit no smell. Some of them contain small teeth and bones, which show that they belong to some carnivorous animal—bones and vegetable remains being comparatively rare. Coprolites were first discovered in this part of the country about the year 1846. A celebrated artificial manure manufacturer was walking with a gentleman on Bawdsey beach, and picked some coprolites up that had been washed out of the crag cliffs. Finding it contained manuring properties, he requested this gentleman to employ children to pick it up. This continued about two years, when one day the children had picked some out of the cliffs so far under that the crag slipped in and killed a little girl. At the inquest the jury wanted to know what coprolite was; the consequence was, farmers discovered that their crag pits were full of it, and some began to dig for it, selling it to the same gentleman at about £1 per ton.

The manufacturer had obtained a patent, but, it being infringed, he brought an action and lost it; and then every one was allowed to manufacture it into manure. The result was, it gradually rose in price to £3 10s. It is very heavy, three pecks weighing about one cwt. This was an inducement for all to raise it. Fine crops of wheat were dug up, buildings were undermined, cottagers turned over their gardens, clergymen the churchyards, and surveyors the roads; some farmers employed over fifty men at it, and, though numbers were imported, labourers' wages were raised fifty per cent. by it; and those who had no coprolite felt it severely, and some parts of the country had the appearance of the Australian gold fields. Many made their fortunes, and others for years made the rents of their farms by it. The landlords claim a share, generally half the net profits, but the lord of the manor has no claim. It is generally found within two miles of the banks of either the Orwell or Deben rivers, and lies in beds from ten to five hundred yards in width, and from two to forty feet in depth. After digging through the top soil, we come to a light sand, and then to some white crag, which gradually becomes red; next a strata of dark crag, interspersed with every variety of sea shell, under which, and above the loam, we find the vein of coprolites, from six inches to thirty-six inches in thickness. It is found mixed with crag, cement-stone, shells, and water. In some cases there are two veins, with a strata of crag between them; and at one place it is found in the sand just beneath the top soil. It is worked by digging a long trench about two yards wide, and when they have dug out the coprolites they dig another parallel, the earth from which fills up the old one, and so on in succession; as it lies next the loam, the water is very troublesome, and in most places has to be pumped out. After the coprolites are thrown out they sift away the crag, and when the soil sticks it has to be washed; it is then spread out on a table, and the shells and stones are picked out by children, after which it is weighed and generally conveyed by water to the manufactory; there it is ground up and pulverised with sulphuric acid. Coprolite is principally used for manure, and for adulterating guano, and the refuse is used in the manufacture of fine ware, and some particular kind of paint. The cement-stone is used for building out-houses, and the loam for making bricks.

These extraordinary diggings have opened such a field, for geologists and scientific men as does not exist in any other part of the kingdom. The fossil remains are so numerous and rare that we will not attempt to describe them, but merely state the principal things that are found. The remains of the whale and saurian are very numerous, also those of the shark and all kinds of fish; but the bones found of land animals, such as the mastodon, elephant, rhinocerous, deer, wild boar, and birds, are not so plentiful. Some of the fossil shells are very rare, and there is a great variety of beautiful coral. We find several specimens of wood, all of which receive a high polish, and enable you to distinguish the description. A large assortment of fruits and seeds, most of them very perfect, are also found.

The consumption of mineral phosphates, according to a recent estimate of Professor Anderson, of the University of Glasgow, is about as follows:—

	Tons.
Cambridge Coprolites	40,000
Suffolk Coprolites	3,000
And all other mineral phosphates	5,000
	48,000

Which, being entirely converted into superphosphates, will yield 72,000 tons; at £5 per ton value, £360,000. Coprolites ground to a fine powder, and containing 58 per cent. of phosphates, sell at £2 12s. per ton, and a ton of pure phosphates is consequently sold for £4 8s. In this state, however, the price is extremely low, because it is alleged that the phosphates are in so compact a condition that the plant cannot avail itself of them, and they are only used as a raw material for the manufacture of superphosphates.

GROWTH OF OPIUM IN CHINA.

There seems no ground for doubting any longer that the cultivation of the poppy is rapidly extending in China. A correspondent of the *North China Herald* states that opium is becoming the winter crop of several provinces, especially of Yunan, Honan, and Che-keang, and that the growers are yearly bringing it to greater perfection. This year it can be used without a mixture of Bengal or Malwa, and the inferior classes of Malwa. It is grown in a fine light soil on a slope, where the moisture can easily drain off. In cultivating, the Chinese look more to quantity than quality, and therefore force the poppy till the heads are truly enormous. In April the juice is ready for gathering. On the capsule four broad delicate cuts upwards are made, leaving the wound covered by the overhanging skin, as a protection against the dews and heat. Early in the morning each wound is scraped by a piece of blunt bamboo, the juice being deposited in a hollow bamboo at the gatherer's side; a process repeated every morning till the flow ceases. The juice has a very acrid taste, and is chiefly used for mixing with the dearer Patna and Malwa. A field of poppies standing on the hill side, seven feet high, and flaunting its gaudy blossoms in contrast with the rich green of the leaves and stalks, is, we may well believe, a beautiful sight. Pity is it that death lurks in every flower, and that the misdirected art of man contrives to develope its presence for other than medicinal purposes.

Sir Henry Pottinger, in a despatch dated April 16, 1844, stated :—" I may take this opportunity to tell you, that the trade in opium is now publicly carried on at Canton, and that both there and at the other ports opened by treaty the mandarins openly give out that they cannot and dare not stop it, else it would lead to the cultivation of the poppy in China to so great an extent, as to cause a scarcity of food, if not actual famine, and that that scarcity would be the forerunner of popular disturbance and rebellion."

The opium produced in the west and south-west of China is grown during the winter season, the rice during the summer. The cultivation of the one does not interfere with the cultivation of the other. The poppy is, however, said not to thrive so well in China as in India, and the extract is generally of a harsher taste; so that, though cheaper than the imported drug, it will not sell unless mixed with the Indian opium.

Mr. Fortune saw the poppy growing for the purpose of obtaining the inspissated juice in the north of China, but it is impossible to state how much is absolutely grown.

THE COMMERCIAL VALUE OF THE WHITE PORPOISE OF THE ST. LAWRENCE.

The animal generally termed the porpoise is a species of whale—the northern beluga (*Beluga catodon*) of Gray. Although occasionally seen in the Bay of Chaleur and parts of New Brunswick, it is chiefly in the river St. Lawrence that it is common. This cetaceous animal, formerly so abundant in the St. Lawrence, became, after the discovery of Canada, an article of commerce which entitled the first colonists, who engaged in catching it, to a special protection on the part of the French Government.

In 1707 there were no less than eight companies, established at different points of the river, for carrying on this business, whom the Intendants protected by their edicts and ordinances; and their number, at this period, would alone be sufficient to prove the importance which this fishery might acquire. The oil of the porpoise was then worth only a franc a gallon, its skin was somehow considered of little value, but the facility with which it was taken was so great, that the quantity alone sufficed to make it sought after, and to render the pursuit profitable to those engaged in it, amongst whom a company of six *habitans*, at Riviere Ouelle Point, was particularly distinguished.

During the year 1710 this company took 800 porpoises. Some years later it killed thousands, but the numbers gradually diminished every year; and, whether from the more frequent navigation of the river proving a cause of alarm to this valuable fish, or from some of those hidden causes which the depths of ocean veil from us, they ceased to live together in large shoals, and dispersed into all parts of the river. It cannot, however, be said that they are now less numerous in the St. Lawrence than heretofore; on the contrary, their number is much greater, and their species belongs exclusively to this river. It is in a manner the king, as it is also the largest and most profitable of those which live permanently in the North American waters.

This animal was formerly taken in enclosures, made of light and flexible poles fixed in the beach, within which the porpoise pursued the small members of the finny tribe during high tide, and where, when once his appetite was sated, he became heavy and almost asleep from gluttony, and seemed to forget, during several hours, the dangers which surrounded him as the tide went out. The fisherman, silent and on the look out upon the cliff, having seen that the waves had retreated, and were now breaking upon the rocks outside the enclosure, gave the signal; two or three light skiffs (either bark or wooden canoes), manned by three or four expert rowers, appeared upon the waves, which they scarcely touched with their oars. Standing in the bow of each of these canoes a man, with bare and muscular arm, a steel spear in hand, intently followed with his eye the track of the fish, indicating the course to be taken, whether to the right or left, and struck the mortal blows. Often, after one of these vigorous strokes, which were enough to kill the largest porpoise, the spearsman might be seen, when he did not strike aright, urging on the pursuit for a new contest of speed between his skiff and the wounded animal; sometimes the blood which reddened the surface of the water indicated the course to be followed, and sometimes the sound of the subdued breathing of this cetacean, which comes to respire and throw off the air, at the top of the water, spouting up a stream which descends in the form of a curve. The porpoise might break through the fence of flexible poles, eighteen or twenty inches apart, but he is afraid. As soon as he sees them, he returns by the way he came; a new stroke is given, but it is by a harpoon, which has a light rope attached. The struggle is becoming more intense and animating, and the fisherman smiles with satisfaction; the paddle at the stern of the frail skiff is alone put into requisition. It is now the turn for the boatman to display his skill. The animal leaps out of the water, stops, dives and turns about in every way and in all directions; a white foam like that of a rapid rises on each side of the bows, and the progress of the canoe, hitherto so swift, suddenly stops; the animal is fatigued by his wound; he wants to breathe, but fear keeps him at the bottom of the water; and immediately the man in the bow rolls up at his knees the line which he had allowed to run out, he uses it to guide the direction of his barque, which light and soft strokes of the oar bring silently forward to the victim. Again he stands up, and with one hand brandishes his spear, while with the other he suddenly chucks the rope, thereby inflicting renewed pains; the fish once more leaps, but this time is the last, for a vigorous blow aimed at the spine, between the head and neck, has effectually done for it.

These chases sometimes last for whole hours, and there were instances of this kind in 1857 and 1858. One hundred and fifty-nine porpoises were taken during those two years, at Riviere Ouelle. Stakes are now used to make the enclosures only at Riviere Ouelle, St. Anne's, and Isle aux Coudres. But, for some years past, another method has been adopted; and, no doubt, if it had been on a more extented scale it would have yielded immense profits.

Mr. Tetu, of Riviere Ouelle, so well known for his enterprising spirit, and by the distinguished consideration which he has gained by his experiments in the capture of the animal, the clarifying of the oil, and the employment of its skin in the manufacture of a leather which has no equal, has, for several years past, in conjunction with other persons engaged in the same commendable pursuit, adopted the system of taking the porpoise in nets, near the river Saguenay. Thanks to his experiments, the oil is worth 6s. a gallon, and the leather from 6s. to 10s. a pound. This oil is extremely ductile, inodorous, and gives a brilliant light, only surpassed by gas. It is superior to any other for the use of lighthouses, because it does not coagulate, even in the most intense cold, and its ductility renders it invaluable for greasing leather, and also machinery, which it preserves from injury by friction. Appreciated as such by the Great Exhibitions of Paris and London, of Canada and New York, it has gained Mr. Tetu testimonials which do honour to him as a useful citizen.

The skin of this animal is of a tissue the exact character of which it would be difficult to establish, when we have before us ten or twelve samples of different kinds of leather made from the same skin; in the normal state, kid, sole leather, harness leather, velvet leather, plush leather, black leather for foot gear, and varnished leather. The skins are dressed for traces, and the Canadian mail bags are usually made of them. These bags are very white, thick, and soft; they stand much chafing and effectually resist the wet. Porpoise skins, when tanned, will compare favourably with the best French kid in beauty, cheapness, and durability. For a light shoe the leather is equal to Morocco or any other made. To those troubled with corns or gouty feet, it is found a great comfort, in comparison with the stout cowhide mostly used. The tanned and prepared skins, and boots, &c., made from them may be seen in the collection of animal products in the South Kensington Museum.

The average price of a porpoise, considering the increasing value of its skin and its oil, is 100 dols. Its weight is about 2,500 lbs.; the largest attain 4,000 lbs., and are worth 180 dols.; these are about 22 feet long and 15 in circumference. The ear is so small that only connoisseurs can find it, and the sense of hearing more acute than in any fish of the whale kind.

PAPER FROM INDIAN CORN LEAVES.

The following communication on a new kind of paper material is based upon an article in the columns of the *Breslauer Gewerbeblatt*. On one or two occasions we have drawn attention to this waste substance, as a useful paper material, before the Society of Arts and elsewhere. The supply is very large, and the chief use of the leaves, &c., hitherto has been for packing purposes, for wrapping oranges, &c. When we consider the enormous crops of maize in North America alone, the material, if husbanded, might become profitable.

Among the many endeavours that have been made, both in ancient and modern times, to procure a fit substitute for paper, one at length has been crowned with success. Recent experiments have proved Indian corn to possess not only all the ordinary qualities necessary to make a good article, but to be in many respects actually superior to rags, hitherto the only material found to be really available for that purpose. The discovery to which we allude is a complete success, and, indeed, may be expected to exercise the greatest influence upon the price of paper within a very short time. Indian corn, it is true, cannot be grown except in countries of a certain degree of temperature—at least, not with the prolific result of warmer climates; yet the plant is of frequent occurrence all over the continent of Europe, and can be easily cultivated to a degree more than sufficient to satisfy the utmost demands of the paper market. Besides, as rags are likely to fall in price before long, owing to the extensive supply of material resulting from this new element, the world of writers and readers would seem to have a brighter future before it than the boldest fancy would have imagined a very short time ago. This is not the first time that paper has been manufactured from the blade of Indian corn; but, strange to say, the art was lost, and required to be discovered anew. As early as the seventeenth century, an Indian-corn paper manufactory was in full operation at the town of Rievi, in Italy, and enjoyed a world-wide reputation at the time; but with the death of its proprietor the secret seems to have lapsed into oblivion. The manifold attempts subsequently made to continue the manufacture were always baffled by the difficulty of removing the silicious, resinous, and glutinous matters contained in the blade. The recovery of this process has at last been effected, and is due to the research of one Herr Moritz Diamant, a Jewish writing master in Austria. Having busied himself for some time in experiments on Indian corn, the ingenious discoverer has at length been rewarded with the desired results of his labour; and a trial of his method on a grand scale, which was made at the Imperial manufactory of Schlögelmühle, near Glegnitz (Lower Austria), has completely demonstrated the certainty of the invention. Although the machinery, arranged as it was for the manufacture of rag paper, could not, of course, fully answer the requirements of Herr Diamant, the results of the essay were wonderfully favourable. The article produced was of a purity of texture and whiteness of colour, that left nothing to be desired; and this is all the more valuable from the difficulty usually experienced in the removal of impurities from the rags. Knots, and other inequalities of surface, so frequent in the ordinary paper, and which give so much trouble in printing, the new product is entirely free from, and this without the material undergoing any special process to attain the desired end.

Another immense advantage, and this in an economical point of view, is the reduction of the steam power required in the manufacture by *one-third* of its present amount, in consequence of the material being reduced to pulp by chemical, and not, as at present, mechanical agency. The present proprietor of the invention is Count Carl Octavio Zu Lippe, Weissenfeld, who has bought it from the originator, and from several experiments deduced the following results:—

1. It is not only possible to produce every variety of paper from the blades of Indian corn, but the product is equal, and in some cases even superior, to the article manufactured from rags.

2. The paper requires but very little size to render it fit for writing purposes, as the pulp naturally contains a large proportion of that necessary ingredient, which can at the same time be easily eliminated if desirable.

3. The bleaching is effected by an extraordinary rapid and facile process, and, indeed, for the common light coloured packing paper the process becomes entirely unnecessary.

4. The Indian corn paper possesses greater strength and tenacity than rag paper, without the drawback of brittleness, so conspicuous in the common straw products.

5. No machinery being required in the manufacture of this paper for the purpose of tearing up the raw material and reducing it to pulp, the expense, both in point of power and time, is far less than is necessary for the production of rag paper.

Count Lippe having put himself in communication with the Austrian Government, an imperial manufactory for Indian corn paper (*maishalm papier*, as the inventor calls it), is now in course of construction at Pesth, the capital of the greatest Indian corn growing country in Europe. Another manufactory is already in full operation in Switzerland; and preparations are being made on the coast of the Mediterranean for the production and exportation, on a large scale, of the pulp of this new material.

It is not merely the blades of Indian corn, but the leaves, the tassel, the sheathing of the grain, the cob, and the stalk might all, we believe, be utilized by the paper manufacturer. A reference to the list of paper materials patented, given at page 50, shows that this substance has often been taken into consideration, but never as yet obtained in quantity, or manipulated upon satisfactorily. Let us express a fervent hope that a great traffic will arise in this cheap and useful material, and that English vessels will, before long, be freighted with shiploads of books and papers *in futuro*. In Brandenburg, with its indifferent soil, and where the temperature is certainly not higher on the average than that of Great Britain, Indian corn, though a novel introduction, may now be seen on many a sandy acre rearing up its broad leaf blades to a height of half a dozen feet or upwards.

PROFESSOR SHELLEY ON MANUFACTURING ART.

On the afternoon of the 11th ult. Professor Shelley delivered at King's College the introductory lecture to a course on Manufacturing Art, before a numerous audience.

Professor Shelley (having been introduced to the audience by the Principal of the College, Dr. Jelf) said:—In reference to the course of lectures upon Manufacturing Art and Machinery, which he had the honour to be elected by the Council of the College to deliver, the students might, he thought, be benefited by an introductory lecture, which would give him an opportunity of laying before the authorities of the college, the students, and the strangers who might be present, a general outline of the topics which he proposed to discuss, and some idea of the method of discussing them, which he proposed to pursue. And he thought it would benefit the students if he imparted to them a few hints derived from his own experience in travelling through life, and endeavoured to encourage them in the prosecution of the task they had undertaken to perform, by mentioning some eminent men who had pursued a similar line of study, and who would serve as examples and incentives to future enterprise and invention, and his great desire and hope was to be able to induce the students to emulate those eminent examples. Many of those gentlemen who had now come to the college with the object of studying the applied sciences had, he dared say, already made up their minds as to the particular calling or profession which they intended to educate themselves for, and which they afterwards proposed following up. Many others, he dared say, were at the college studying, and endeavouring to find that particular branch that suited their tastes before they finally determined the exact course which they intended to pursue in the future. He thought he might be allowed to tell each of these classes of students that they were wise. For those who had made up their minds as to their calling might rest assured that if they were determined to adhere to their choice and persevere in their task they would overcome all obstacles, and speedily attain excellence in the line they had chosen; while those who had not made up their minds might be confident that if they studied well there would be abundant opportunities of turning their knowledge to good account, either in England or abroad. For a knowledge of mathematics, chemistry, geology, and the development of machinery was a means of daily adding to our material wealth; and there would be a constant demand for those men who had made it their study to understand scientific principles. The section of applied science which it was his province to draw their attention to was that of manufacturing art. Improvements in manufacturing art and machinery had wrought mighty changes in the condition of the world, which the Professor illustrated by referring to the great social changes which had taken place owing to the development of mineral wealth, caused by James Watt and the pumping-engine, by railways, of which the steam-engine had been called the father, by the changes in literature wrought by the printing-machine, and by the changes effected by the improvement of the electric telegraph—in his opinion the greatest of them all. He was sure that every one connected with this university would be gratified to know that of the eminent men who had advanced applied science, four had been professors there; two out of the four were not with them now, but they could not recall their memories to their minds without feeling that by their talents, brilliant discoveries, and inventions, they had advanced us as a nation, and promoted our national greatness. The principle of a given manufacture might be explained to, and as easily understood by, any person of ordinary education; but it did not follow the process could be gone through without a number of years' additional training and attention. The Professor proceeded to say that labour performed by the hands of a man, without any other assistance, would be extremely limited in the usefulness of its application; and in order to carry out any great work, some means should be found for uniting the exertions of several men, or of increasing the power of one man. The means of doing so was called machinery. The labour of cultivating the ground or tilling the earth required in its primitive form but little skill and no machinery, the rudest and simplest forms of tools might be used, and the seed scattered by the hand; but great improvements had been effected by machinery. The Professor then directed the attention of his audience to some of the students who had been at this college, and who had distinguished themselves by their works in their occupations in every-day life. They were spread over all parts of the earth—some were in India, and some in China. One of them was Mr. Thomas Winter, an engineer and naval architect, who came up to the college from Scotland, and afterwards highly distinguished himself by scientific investigations in India, especially on the rivers, for which he invented several kinds of boats (models, drawings, and sections of the boats were explained by the Professor). Another gentleman who distinguished himself at the college, and who was now carrying on a large business in Yorkshire, was Mr. Charles Cochran, who was a senior scholar, and who had become eminent by inventions connected with heating apparatus used in the manufacture of glass. There were many other gentlemen brought up at the college whom he might mention as having distinguished themselves in their various avocations; amongst others, Mr. Mawdsley, Mr. Vaukes, Mr. White, Mr. W. Cochran, Mr. Hatcher, Mr. Edward Chance, Mr. W. Burges (the architect of the Memorial Church at Constantinople), Mr. Miller (who had gone to Sydney), Mr. Fox, Mr. Henry Worms, Mr. W. M'Kean, &c. Theoretical knowledge was not sufficient in the study of the applied sciences; there should be practical knowledge, which could only be obtained in the laboratory and the workshop. The Professor then spoke in favour of cleanliness in the making of experiments, and in the general practice of the laboratory and workshop. After recommending as a class-book to the students who attended his lectures, his predecessor, Mr. Goodeve's, book on "The Elements of Mechanism," he stated that Mr. Goodeve had received a Government appointment at Woolwich, where he wished him the enjoyment of every prosperity and success. The Professor then passed a warm eulogium on the late Professor Cowper (one of whose pupils he was, and whose mode of teaching he should endeavour to follow), who would be long remembered for his talent and amiable qualities; and spoke in terms of panegyric of the late Principal of the College, Dr. Lonsdale, now Bishop of Lichfield; of his successor, the present Principal, Dr. Jelf, and other professors connected with the college. At the close of his lecture, which was illustrated by many drawings and models, the Professor was warmly applauded.

TEA SUBSTITUTES OF MAURITIUS.

BY M. LOUIS BOUTON, OF PORT LOUIS, MAURITIUS.

CULEN, or *Koulin*, the striped-flowered psoralea (*Psoralea glandulosa*), was originally introduced into the Mauritius from Chili, where it is indigenous. The Rev. Father Feuillée was the first who made known this plant, discovered by him in Chili, where he has found it, he says, at 33° of the South Pole. This shrub is a vulnerary and depurative. The natives pound the leaves and apply them as a poultice on their wounds. The decoction arrests dysentery, and the infusion of the roots excites vomiting. Some use an infusion of its ashes as a purgative.

The leaves, according to the Abbé Molina, are considered as a powerful vermifuge, and one of the best stomachics. They are used as an infusion, and their aromatic flavour causes them to be preferred by some persons to tea, for which they may be substituted. In Chili they are so used, instead of the Chinese beverage, under the name of Jesuit's tea.

The Culen has lately acquired a great reputation in the Mauritius as a medicinal substance. It is to the kind attention of the Hon. M. Lemière that we are indebted for the knowledge of this plant—the existence of which in the colony was no longer suspected by us—as well as for the manner of employing its leaves and stems in diseases of the respiratory organs.

The Culen is taken as an infusion in the shape of tea; it is, according to those who have been under the necessity of taking it, a sovereign remedy in asthma, oppressions of the chest, and other irritations of the bronchiæ and lungs, which it relieves and dispels almost instantaneously.

The leaves are also used dried, and afterwards smoked like tobacco.

FAHAM or *Faam*, an orchidaceous plant (*Angræcum fragrans*), is found in the interior of the island. According to notes communicated by M. Fleurot, the crystals obtained from it are in small groups, having a sweet aromatic odour. Examined with the microscope they represent rectangular prisms, in round groups of about two millimetres in diameter; they are soluble in boiling water, extremely so in boiling alcohol and ether, but considerably less so in the same liquids cold.

Virey wrote about the Faham in 1820 and 1826 in the *Journal de Pharmacie;* and Dr. Giraudy, who studied it seriously, discovered, in the aromatic principle of this plant, a diffusible stimulant capable of deadening nervous sensibility; in the bitter principle, an excellent stimulant to revive the strength of the nutritive organs; and in the mucilage, a demulcent to relax the tissues. He therefore considered it as a powerful medicinal agent, and likely to be employed with success either to assist digestion, to soothe coughs and pains of the chest, to remove spasms and oppressions, or to promote expectoration in colds, hooping coughs, fits of asthma, and pulmonary phthisis, whenever the nervous irritation and inflammation predominates. The odour of the dried plant is peculiar, and resembles that of the Tonquin bean; the infusion or syrup is very pleasant. Not only here but elsewhere it has been used in infusion, as a beverage, in substitution for Chinese tea.

JAMAICA VERVAIN, or *Verveine bleue.*—The leaves of *Stachytarpheta Jamaicensis*, when fresh, are applied to ulcers, but when dried, they form a bad kind of tea, known, and sometimes sold, as Brazilian tea.

THE DU MEXIQUE, *Botrys*, *Herbe pipi.*—This plant (*Chenopodium ambrosioides*) is common in the island. All the parts of the plant have a strong aromatic smell, and are used as a vermifuge. As one of its names implies, this plant has also been used, and to a certain extent doubtless is so still, as a tea substitute.

CITRONELLE, *Lemon grass.*—This plant (*Cymbopogon Schœnanthus*) is a native of India, but is cultivated here. It is, says Dr. Wallich, a favourite herb with the Asiatics, both for medicinal and culinary purposes, and is found to afford a drink generally very grateful to the palate in sickness. Dr. Maton, Physician Extraordinary to the late Queen Charlotte, informed me that he had been repeatedly treated with a dish of lemon grass tea by her Majesty, who used to be very fond of it, and was supplied with the plant from the Royal Gardens at Kew.

CAPILLAIRE.—This little fern (*Adiantum caudatum*, L.) is found over a great part of the world; in China, Ceylon, Java, and the Mauritius, where it grows even in dry places and on rocks. It is much employed in infusion as a diaphoretic, and also as a substitute for tea.

THE NITRATE OF SODA AND BORATE DISTRICTS OF PERU.

BY WM. BOLLAERT, F.R.G.S., ETC.

Much Nitrate of Soda is shipped from Pisagna Bay. Iquique is, however, the principal port for its shipment. It is dug up and refined some leagues distant in the interior. In 1830 only 900 tons were exported, but in 1859 78,700 tons. The present population of the province of Tarapaca is about 18,000, the greater portion of whom are occupied in the manufacture of nitrate of soda; then follows the agricultural, which is but limited, in consequence of the general arid character of the country. In 1827, at the request of General Castilla, then Intendante of the province, Mr. George Smith and myself examined the district, presenting the survey and report to the Peruvian Government. This I extended in my "Observations on the Geography of Southern Peru, with Map." Mr. Smith has lately forwarded to me the most recent account about nitrate, printed on an elaborate plan, published in Lima, of the localities in the province of Tarapaca, where the nitrate of soda and borate of lime are found, with the position of the principal oficinas, or works, and the ports the nitrate is shipped from. I translated the following from his observations on the plan:—The Pampa de Tamarugal is a plain having a rise of about one per cent. from east to west. There is greater abundance of salitre or caliche (native nitrate of soda) on the north about Tana; also in the south to the river Loa. In the far north it is not worked, there being no water; neither in the south, on account of the distance from the coast. It is generally considered that the nitrate of soda producing ground does not extend beyond the ravine of

Camarones on the north, nor south of the river Loa; however, some say it is found in Bolivia, south of the river Loa, far in the interior, and distant from water. Mr. Smith gives all the positions whence the nitrate is extracted, and also where very large quantities are pretty well known to exist. He likewise notes the spots where the borate of lime is met with. He calculates that the nitrate ground covers fifty square leagues. There have been single square yards of ground that have produced nearly a ton weight of nitrate, the layer being three yards thick.

If we allow only 100 lbs. weight of nitrate for each square yard, we shall have the enormous quantity of 63,000,000 tons; so that at the present rate of consumption there is sufficient for 1,393 years. The opinion in the country is that the nitrate is formed from the waters that come from the Cordilleras. There are about forty nitrate works and nine shipping ports, including Iquique. At the Soronal (its lowest position), the nitrate is found at 2,593 feet above the sea, and thirteen miles inland; its most elevated is 3,724 feet, and at twenty-three miles. The borate is found as high as about 3,600 feet, and as low as 3,211 at the Noria—a town built of salt, and where is found the largest nitrate of soda quarry and refining works.

Some years since a chalky-looking substance was met with, which was called "Tisa." On examination it was found to be a mineral of borax. Subsequently a box of minerals was sent me by Mr. Smith, in which was enclosed some small specimens of the tisa. This was examined and proved to be a new boracic acid mineral. Mr. Smith came to England, and on his return I begged of him to examine the locality for borate. This he did, and found the district to be very rich in the mineral, as well as various other parts of the Pampa de Tamarugal. It has also been found in the northern part of the desert of Atacama. Preparations were made to work the borate grounds, but the Peruvian Government having been led to believe that it was too valuable an article to be exported, except under similar conditions as the guano—viz., a government monopoly—the working has been interdicted. Some portion has been extracted, and the greater part smuggled out of the country. Permission has occasionally been given to a favoured few to export small parcels, which bring about £30 per ton in the English market. If allowed to be exported under favourable circumstances, there would be a good demand, and it would be applied to numberless uses in the arts. I have deposited in the Museum of Practical Geology in London a large nodule of this new boracic acid mineral; also specimens in the British Museum. Pickeringite and Glauberite occur with the borate. Iodic and chromic salts are found with the native nitrate of soda.

Formation of Caliche or Nitrate of Soda, and its Manufacture into Refined.—Section of nitrate ground at La Norina, descending—

I. *Costra*, or crust, composed of earthy matters, angular pieces of rock-salt, and other saline matters, about two feet thick.

II. *Caliche*, granular layers of nitrate of soda, containing salt, other saline and earthy substances, and angular pieces of stone, to five feet thick, often accompanied with much Glauberite (sulphate of soda), some Pickeringite (magnesian alum), mixed with earthy matters, as silica, alumina, carbonate and sulphate of lime; also iodine, bromine, chrome, and boracic acid mineral.

III. *Coba* is the general loose earthy covering to the silico-calcareous and porphyritic rocks, and here at the Noria the borate is found in nodules, from the size of a pea to two feet in diameter. In some parts of the Coba the borate is seen in thin striæ with sulphate of lime.

In this region it appears to me, that salt and other saline matters, including boracic salts, have been formed in the Andes, and brought down by streams and percolation. (The almost pure chloride of sodium on the mountains of the coast I have supposed to be mainly indebted to the salt vapours of the ocean). There is scarcely a trace of organic matter in the soil, to afford nitrogen to change the salt into nitrate. Ought we not rather look to the atmosphere for nitrogen, and the various chemical changes resulting from solar heat, dews, and occasional slight rains.

The salt of the Salares is a mixture of various saline substances; and, as there is abundance of calcareous minerals, the nitrogen of the air may give rise to nitrate of lime, then the change will be as follows:—

	Nitrate of Soda.		
Nitrate of Lime.	Nit. Acid. ——	Sodium Oxygen.	Chloride of Sodium. Water.
	Lime. ——	Chlorine. Hydrogen.	
	Chloride of Calcium, or Muriate of Lime.		

The saliteros say that one may almost see the salt of the Salares transformed into nitrate. A salitero observed to me that he could not tel where the salt came from, but he believed the nitrate was formed by light rains trickling through saline and earthy matters, turning the salt into nitrate. Some caliches when quarried are called green, and on exposure to the air ripen, yielding the nitrate more easily. Sometimes the salt and caliche has a yellow, pink, or green colour, caused, I think, from chrome.

Manufacture of Nitrate from Caliche.—The nitrate grounds are known to be on the edges of the salares and rising ground: at the Noria water is within a foot of the salar. There are some nitrate grounds without any apparent salar, and where water is now thirty to forty yards deep, and even deeper; but salt has been there to form the nitrate.

Having Cateado, hunted for, and found the nitrate ground, habitations are built of salt from the salar, wells are dug, the water being extracted by Norias; paradas or iron boilers in pairs are fixed; depositos or settling tubs; bateas of iron or wood as crystallisers; tubs for mother liquor; provisions for the people and food for animals. The salitero or refiner can now commence operations, having, however, previously obtained legally his estacas of 200 square yards. Some manage to become possessors of very large tracts of nitrate grounds.

The salitero now directs his barretero or quarryman to make openings with a heavy iron bar, increasing in width at bottom, through the costra and caliche to the coba; this is the tasa or cup into which is put from one to fifteen hundred weight of very rough powder (made from nitrate of soda, and sulphur from the volcano of Isluga), the upper part being well rammed with loose earth; these are called bombones, and are exploded, which loosens the earth and turns it up. The irregular masses of caliche are broken into large lumps, collected out of the loose mass, and conveyed in panniers by asses to the oficina or refinery; here the large pieces are broken into smaller by the asendrador and thrown into the boiler, to which, when nearly full, water is added, and the boiling commences, more caliche being added at intervals. In about seven or eight hours the saturated boiling point of the liquid has attained a temperature of 240° F., when the mother waters are added. The boiler-man now removes with a shovel the borra or salt that has been precipitated, and earthy matters separated and subsided to the bottom of the boiler. The solution is bucketed out into the deposito, where a further quantity of earthy matter, the ripia, goes down, leaving a clear solution, which is then run into coolers, where crystallisation takes place, producing salitre or refined nitrate of soda, which is shovelled out of the bateas, and the sun's heat soon dries it. It is now bagged and sent to the coast for shipment. The best refined nitrate was found to be composed of water, 0.11; salt, 1.84; sulphate of soda, 0.35; nitrate of soda, 97.70 = 100,00. This nitrate trade employs nearly all the people in the province, about 12,000, exclusive of foreigners and Chinese labourers. The exports could be increased to any extent, as the nitrate grounds are inexhaustible.

Messrs. George Smith & Co. have been using large boilers, and of more scientific construction, with advantage; they also have commenced boiling by steam. The fuel used is the tamarugo and algarobo trees; these are getting very scarce; thus much English and Chile coal is also resorted to.

This nitrate of soda has been known about a century. It was discovered by a woodcutter, named Negreros, in the Pampa de Tamarugal, by his having made a fire at the spot that still preserves his name; the ground began to melt and run like a stream—the melted substance was examined and found to be nitrate of soda.

About 1794 the German mineralogist, Haenke, was sent to the province to teach the method of its extraction, and turn it into nitrate of potash, for gunpowder, which it is said he did, by adding to it a solution or ley prepared from burnt cactus, which contains 8 per cent. of potash. Caliche was subsequently sent to Concepcion, in Chile, to be turned into nitre, but with little success. In my first series I have given some particulars as to the history of nitrate and its varieties, also that it contained chrome and iodine. Of chrome it is in very small quantities ; but as to the iodine, Ulex, of Hamburg, got six-tenths per cent. out of a mixture of caliches. Hayes, of New York, the same. Ulex obtained one-half to one per cent. from the mother waters. I suspect that in some varieties the per centage of iodine is greater than given by Ulex. Sea water only contains one-millionth part of iodine ; that found in the nitrate has its origin, I conceive, from mineral iodides and iodates. When the caliche has a yellow or orange colour, it is called azufrado and canario. The mother waters at Negreros are sometimes blood red. I once supposed that this colour was owing to iodine ; I now think it is from chrome. Bromine has been found in the caliches.

About 1853, several vessels were sent to the West Coast of Africa, in the hope of being able to ship nitrate of soda, but the saline matter met with there proved to be salt. The vicinity of the Dead Sea has been examined for nitrates, but none as yet found. Nitrate of soda is well known as a fertiliser, and is used extensively in the arts. It has been converted into nitrate of potash for the gunpowder makers, but its employment has not been patronised in consequence, it is said, of its deliquescence. I am informed that pure nitrate of soda is not deliquescent—is it that such property is owing to chloride of calcium the imported nitrate always contains ?

Test for Nitrate of Soda.—The cateador or caliche-hunter easily distinguishes nitrate by the taste, which is bitter and cooling ; salt is merely saline. A delicate test is the following, which will show if there be only 2 per cent. :—Add sulphuric acid to a portion in a tube, when, if nitrate be present, red fumes will appear. Salts of soda are distinguished from salts of potash, the soda giving no precipitate with muriate of platina. Hofstetter is said to have found 0.43 nitrate of potash in a sample of refined nitrate from Tarapacá.

I will now give some details of my own examination of the Pampa de Tamarugal, where it principally exists, and in large quantities. Leaving the Noria and ascending the steep side of its hollow, our course lay east by south, over undulating country, between high mountains, some giving off very large quantities of detritus ; descending a ravine, and approaching the Pampa de Tamarugal, we came upon nitrate caliches at the Rinconada, and descending a little lower, an extensive salar is entered, having on its west margin considerable tracts of nitrate caliches. A few tamarugo* and algarobo † trees are seen ; but, excepting these, a salt desert and arid plain occupies the foreground, and far away to the east are the mighty Andes.

On the eastern margin of the Salar, in particular, as well as in it, and

* Raimundi says it is a *Prosopis*, or it may be a new genus.

† *Prosopis dulcis.* Seemann calls the algarobo, of Panama, *Hymenaea splendida ;* that of Peru, *Prosopis horrida ;* that of Chile, *P. siliquastrum*, In Tarapaca the Tamarugo is sometimes called Algarobilla ; its pods are round, one to two inches long. The pods of the Algarobo are eight to nine inches long, and contain saccharine matter. The Tara is of the family of Mimosa, it yields much tannin, the pods are flat.

where the ground is free from salt, there the borate is first met with, in some places, from the surface to three feet below it. We progressed along an old dry watercourse (free from salt) into the tisas, or borate towns, at 3,200 feet; the sky was very clear and blue, and the sun intensely hot. We visited the two small villages, built of salt; around them excavating and collecting the borate was going on to some extent, although against the orders of government, and conveyed by unfrequented tracks to the coast, and smuggled off. Some few persons have been allowed occasionally to ship small parcels, but up to the present time (1860) the extraction of the borate has not been permitted, although its exportation would be beneficial to the province, and the substance of great use in the arts in Europe.

The borate ground is generally flat, and the surface free from salt, the making its appearance in uneven nodules of all sizes, but generally that of a large potato (one was found at the Noria weighing fifty pounds). The nodules are sparely or plentifully imbedded in a now dry, saline mud; however, in some places, this saline mud is damp and even wet, from its proximity to the water of percolation of the Pampa. This water doubtless plays an important part in the formation of the borate. Much glauberite, in large and small crystals, is found at times combined with the borate, as well as separate. Sometimes the ground or strata is made up entirely of borate. This is the general position of the mineral, having water not far off below; and I cannot help thinking that surface waters in particular have brought saline matters from the Andes into the Pampa, and with boracic salts. In the Pampa they have found lime and soda, which has given rise to the present borate of lime and soda formation.

In working the borate grounds, the boratero has merely to open a hole in the soft surface of the ground, and commence immediately picking out the nodules of borate and bag them, the substance being ready for transit to the coast and exportation. This requires little or no capital, whereas quarrying and refining nitrate of soda is a serious matter on the score of outlay. Up to March, 1854, some 10,000 quintals had been extracted, selling in England for about £30 per ton.

Dr. Philippi, during his investigations in the desert of Atacama, in 1853, did not observe any borate, but much salt and a little carbonate of soda. A friend of mine gave me a specimen, said to have come from near Calama, in the northern part of the desert. I have examined several saline materials from that region, but salt and sulphate of lime have predominated. No nitrate of soda has yet been brought from there, although it is said by some to exist.

The pure borate of lime is found in only few places, as in the Rinconada, Cabreria, Tronco, and between the oficinas of Independencia and Colombia. The borate found under the salitres is accompanied by glauberite. The white pasty substance found in many places, particularly at the Pascana del Tronco, as also in nearly all the spots covered with grama grass, is not borate, but a mixture of sulphates of lime and soda and salt. The substance collected near the Aguada del Sur has no value.

Borate from Cabreria and Rinconada gave 42·20 per cent. boracic acid. From the Pascana of Pedro Castro, 21·25; is of a yellowish colour (probably from chrome); a white matter from Tronco, Challapozo, and Challapozito, borate of lime, 5 per cent. White matter from Aguada del Sur, no borate, principally sulphate of lime; but, one league distant, good borate is met with. At the Puquios of Quilliagua is a polyhalite, composed of sulphates of lime, magnesia, and potash, with salt. The salt found near Matilla, called San Sebastian, is threnardite. Under the calichales of Challa, there is much glauberite. In Zapiga, under the nitrate, borate is met with, containing borate of lime, 35·17; borate of soda, 20·21. Borate, between Independencia and Colombia, contains 43·139 boracic acid. Mr. George Smith made borax from it in Iquique. He sent borate to the United States, where it was examined by Hayes, and obtained the name of Hayescine.

Test for Borate.—When in small quantities, macerate in alcohol, adding a little sulphuric acid; evaporate the solution, in firing it, and, if there be the merest trace of boracic acid, it will colour the flame green.

THE BLUE DYES OF CHINA AND INDIA.

BY M. C. COOKE.

CHINESE BLUES.

The practice of dyeing blue cloths is very ancient in China. It is recorded as early as the reign of the Emperor Hoang-ti, who died B.C. 2598. The Chinese books call the plants that yield indigo by the name of *lan*. Of these there are numerous species, and their identification is still by no means satisfactory. The fresh leaves of the different species of *lan* are extensively used in dyeing light blue. I have been informed by a silk dyer that he received some time since a light blue silk scarf from China, in the colour of which he took considerable interest. He made every effort to discharge a portion of the colour, but without success. The dye was one with which he was entirely unacquainted, and, after making several experiments upon the scarf, he is positive that it was not an indigo dye. Hence we may conclude that our silk dyers have yet something to learn from those of China in the art of dyeing blue.

Lan, of Canton.—It is difficult to fix the botanical name of this *lan*, which is described as an acanthaceous plant. It is very common in the provinces of Kouang-toung, of Fo-kien, and Tche-kiang. The fresh leaves are used for light blue. When about to dye, the cloth is dipped in cold water, dried in the sun, and dipped in a warm bath of leaves of *lan*, into which a small quantity of lime juice has been poured. When used in the form of paste, the Chinese generally take precautions to keep it in a moist state. Dry indigo is seldom used for blue dyes in any portion of the Chinese empire.

THOU-TIEN, or *Tcha-lan*.—There are in China several species of *Indigofera*, and one of them yields a blue dye. Dr. Williams states that it is *I. coccinea;* and Loureiro, *I. tinctoria.* There are extensive plantations of indigo in the southern provinces of China, especially in those of Kouang-si, Kouang-ton, and Fokien. The cultivation does not extend beyond Tche-kiang. A Chinese dyer affirms that the blue of the Indigofera paste is not only superior to the other Chinese and Siamese indigos, but also to the solid indigos of Java and Manila.

SIAOU-LAN, *Northern lan*.—In the vicinity of Pekin are plantations of a species of *Polygonum*, which, on fermentation, yields a fine indigo. Thunberg and others enumerate the following species in use for blue dyes. *Polygonum Chinense*, *P. barbatum*, *P. perfoliatum*, *P. aviculare*, and *P. tinctorium.* Whole fields of a species of Polygonum are cultivated at Tchou-san for dye purposes. The *malan* is supposed to be *P. barbatum*, and the *Choiu-liao*, *P. perfoliatum.* In 1784 the missionaries of Pekin stated—"It seems beyond a doubt that the plant *lan*, from which indigo is obtained, has been known and cultivated for dye purposes centuries before the Christian era. It seems certain that it is a true Persicaria."

TIEN-HOA, or *Tien-tsing*.—The *Isatis Indigotica*, Fort., yields this dye. The plant grows in almost every province of China, but principally in Fokien, Kiang-sou, Kiang-se, Tche-kiang, Koang-toung, and Kouang-si. A considerable proportion of the *tien* indigo used at Canton comes from the latter province. At Amoy much is obtained from the Isle of Formosa, and the district of Thsiouen-tcheou-fou. It is sold to the dyers in the form of a gummy, almost liquid, paste, and they take precautions to prevent its drying up, as, when dry, it only yields a blackish colour. This stuff yields solid dark blues. The boiler is charged with 300 litres of cold water, 38 kilogrammes of indigo, and 1½ kilogramme of shell lime. For every kilogramme of indigo subsequently put into the boiler 37½ oz. of lime are added, with sufficient water to keep the vessel full. The boiler is charged six or seven days before the period of dyeing. In some factories the cloth to be dyed is first dipped in water, tinged with vinegar. A blue black in much esteem is obtained from a mixture of this indigo, with the fruit of Kao-hoa (*Fortunæa Chinensis*).

TIEN-CHING.—Mr. Fortune first drew attention to this dye, noticed by him in the province of Tche-kiang. He says:—"It is obtained from a species of *Ruellia* (*R. indigotica*). It is singular that a plant of this genus, perhaps the very same, has been recently discovered in Assam, where it is similarly cultivated for the blue dye it yields. Who knows but we are on the eve of discovering that this species, producing a dye unknown to trade, is cultivated everywhere, from the eastern shores of China to the frontiers of Bengal." At Tche-kiang, the indigo is extracted from the stems and leaves of this plant by the process of steeping and pounding, and it is sold in the form of a paste, called *tien-ching*, at the rate of from 40 to 80 centimes per kilogramme.

INDIAN BLUES.

Indigo.—The greater proportion of the indigos of India are prepared from *Indigofera tinctoria*, which is extensively cultivated for that purpose. There are two processes for manufacturing indigo; the one the *dry leaf*, and the other the *green leaf* process. The latter is considered the best, and is in most common use. In India the following is the process adopted for the manufacture of green leaf indigo. When the plant begins to flower, it is cut down at about six inches from the ground, and carried to the steeping vats with as little delay as possible, strewn horizontally in the vats and pressed down by means of beams fixed into side posts, bamboos being placed under the beams. Water is immediately run in, just sufficient to cover the plant. If water is not at once let in, the plant will heat, and become spoilt. The time for steeping depends much on the temperature of the atmosphere, and can only be learnt by experience and careful watching of the vats, but in close sultry weather, with the themometer 96° in the shade, eleven or twelve hours are sufficient. In cooler weather, fifteen or sixten hours are requisite. If the plant is very ripe, the vat will be ready earlier than if the plants were young and unripe. The following are indications that the vat is ready to let off:—

1. As soon as the water begins to fall in the vat.
2. When the bubbles that rise to the surface burst at once.
3. On splashing up the surface water it has an orange tinge mingling with the green.
4. The smell of the water. When ripe, it should have a sweetish, pungent odour, quite different from the raw smell of the unripe green-coloured water.

About seven men enter the vat and agitate it, either by the hands or with a wooden paddle, at first gently, but gradually increasing as the fecula begins to separate, which is known by the subsidence of the froth, and the change of the colour of the water from green to dark blue. The time necessary for this beating process is generally from 1¾ to 3 hours.

The following tests may be employed to ascertain if the heating has been sufficient.

1. Take a little of the water in a saucer and let it stand. If the fecula subsides readily, and the water remains of a Madeira colour, the beating may be stopped.
2. Dip a coarse cloth in the vat and wring out the water, observing the colour. If green, the beating must be continued, but if a brownish colour, it is ready.
3. When sufficiently beaten, the surface of the water will, as soon as the beating is suspended, become of a peculiar glassy appearance, and the froth will subside with a sparkle and effervescence like champagne.

Three or four chatties of cold water or weak lime water are then sprinkled over the surface, to hasten the precipitation of the fecula, which does not completely take place in less than three or four hours. The water is then drawn off from the surface through plug holes in the wall of the vat. The fecula at the bottom is then removed to the boiler. It is brought to the boiling point as quickly as possible, and kept there for five or six hours. While boiling, it is stirred to keep the indigo from burning, and skimmed with a perforated ladle. When sufficiently boiled, it is run off to the straining table, where it remains twelve or fifteen hours draining. It is then taken to the presses and gradually pressed. This process takes twelve hours. It is then ready to be taken out, cut, stamped, and laid in the drying house to dry.

A good sized steeping vat is 16 feet by 14 feet, by 4½ feet in depth. The beating vat is somewhat shallower. Two hundred maunds of the plant (16,400 lbs.) do very well to yield one maund of indigo (82 lbs.). A vat of the above size holds about 100 maunds of plants. The plant sown in June is cut three months afterwards and manufactured. A second crop will be taken from it in the following August. This cutting produces the largest quantity and best quality.

In former years the usual mode of extracting indigo as practised in Southern India was from the dry leaf, but this is now almost entirely superseded by the better system of *green leaf* manufacture detailed above, which is followed in all the indigo growing districts of the Madras Presidency, save the province of South Arcot. In the latter the *dry leaf* process is still persevered in, but it is likely that it is only so from the distance to which the leaf has generally to be carried before it reaches the factory, and the consequent partial drying that takes place on the journey.

The imports of East India indigo into London, and the deliveries for home use and consumption, in the last eight years, have been as follows, in chests :—

	Imports.	Deliveries.
1852	33,052	34,102
1853	24,919	30,883
1854	27,277	27,060
1855	22,495	30,222
1856	30,388	25,782
1857	24,169	24,746
1858	22,826	23,505
1859	19,444	24,748

The quantity sold at the quarterly sales, and the stocks held, were :—

	Chests sold.	Stock, Dec. 31.
1854	24,500	23,488
1855	27,709	15,750
1856	20,900	20,356
1857	21,200	19,779
1858	18,200	19,044
1859	18,200	13,738

A fine indigo has been manufactured experimentally in India from *Indigofera cœrulea.* We are not aware of any of the commercial indigos of

India being derived from this species. Roxburgh particularly extolled the quality of this indigo, which was prepared for him by the natives.

CUDDAPAH INDIGO.—This, which is an excellent kind of indigo, is obtained from *Indigofera anil.* The same species is probably employed in other parts of India.

SIAMESE INDIGO.—All the indigo manufactured in Siam is obtained from wild plants, which are abundant. The quality of this indigo is good, though inferior to that of Java and Manila.

PALAS INDIGO.—This indigo, the produce of the leaves of *Wrightia tinctoria (Nerium tinctorium)*, is manufactured in Southern India. In the Carnatic it is made in small quantities for home use. It so much resembles, in appearance, the true indigo, that it has been sent over and sold in the English market as genuine indigo, and realised the price of an East Indian indigo of medium quality. From samples which we have seen we doubt whether even the experienced eye could detect the difference. Had such been the case the substitution already alluded to would not have been so successful. This indigo is also called *Lilaroum.*

A blue dye, analogous to indigo, is obtained from a twining plant *Gymnemia tingens* (*Asclepias tingens*, Roxb). The Burmese are also said to obtain a green colour from the leaves. We are not aware of the introduction of this indigo into commerce, nor of any extensive manufacture for trade purposes.

TAROUM AKKAR.—The blue obtained from *Marsdenia tinctoria* (*Asclepias tinctoria*, Roxb.) is used as a dye in several parts of India, and of the Indian Archipelago, especially in Pegu and Sumatra. Roxburgh obtained from the leaves, by means of hot water, a quantity of indigo considerably stronger in his opinion than that obtained from *Indigofera tinctoria.*

TARŒM AROI.—In the island of Java *Marsdenia parviflora* is cultivated, and yields a blue dye resembling the *Tarœm akkar* of Sumatra. It is a kind of indigo, for *Tarœm* signifies *Indigo.*

KEEN-BOON-THEE.—A cake of a pale green indigo-looking substance was exhibited at one of the Madras Exhibitions from Pegu. It was stated to be prepared from the leaves of *Acacia rugata.* But no account of the uses of the dye was given. It would probably answer the purposes of an inferior indigo.

TANTEPU.—Under this name and that of *Tagarapu* the seeds of *Cassia tora* are exported from the Northern Circars for dyeing blue with indigo. They are used in Vizagapatam and also in Bellary. The process has not transpired.

ROUM OF ASSAM.—The dye named *Roum* by the natives of Assam is prepared in the valley of the Berhampooter. It is extracted from a species of *Ruellia*, an acanthaceous plant. This plant (the specific name of which is unknown), or a species nearly allied to it, is cultivated with the same object in Pegu, and other parts of the Burmese empire. The *Roum* must not be confounded with another substance called *Lilaroum.* Dr. Falconer thinks that the Roum contains indigo of the same kind as that yielded by species of *Isatis* and *Wrightia*. Some think that the species of *Ruellia* yielding the *Roum* of Assam is *R. comosa*, Wall.: or the *R. eucoma*, Steudel. It is doubtless the product of more than one species.

SINGAPORE BLUE.—From an acanthaceous plant at Singapore the Chinese extract, for their own use, a blue dye which Mr. Seemann thinks may be identical with *Roum*.

ISPRUCK.—A blue dye yielded by a species of *Delphinium* is in use in Scinde under this name. Whether used as an extract, or dyed from the plant itself, we are not informed.

MOURINGHY.—The wood of *Moringa pterygosperma* is used as a blue dye-stuff in India. Its use is very local and unimportant, since it offers no advantages superior to indigo.

MAHARANGA.—A blue dye obtained from *Maharanga emodi* is employed in Nepal. Under the name of *Maharanga* the roots are imported into other parts of India, from Gosainsthan and probably from Thibet.

From this enumeration it will be seen that the majority of the blue dyes of China and India are either true indigos, or partake very much of their nature. There are but few novelties to interest the home dyer, unless he could obtain and experimentalise upon the *Roum* of Assam, the *Siaou lan* or *Tien-ching* of China, or the *Taroum-akkar* of Sumatra.

We purpose at a future opportunity enumerating the other dye-stuffs of China and India which are not included in the present and two previous papers.

Correspondence.

To the Editor of the "TECHNOLOGIST."

SIR,—I congratulate you on your undertaking the establishment of the TECHNOLOGIST, although you are, according to my opinion, fifty years behind. I am a German, and we have done such things already fifty years ago. You have done the same thing isolated, as did Dr. Ure, G. Dodd, and M'Culloch, but you have had neither a real polytechnical college, nor general works for technological purposes. There can be no doubt that the single branches of science are very well taught by extremely well-versed gentlemen in the different colleges of the universities of Great Britain; but there seems to be till now no private teaching of the whole science. You know as well as I do myself, that the Polytechnical School at Paris, founded by Napoleon I., is destined exclusively for the training of young officers; that the English institution of that name has come down to a mere place of amusement; and that the Panopticon for Science and Arts has been closed, because its numerous visitors were not inclined either for science or for arts. The only institution deserving its name is the Polytechnical School at Vienna, erected in the year 1820, where they have a private college of technology, under the auspices of Professor Altmüller. The author of these lines has visited the said institution, getting there the greatest advantage for his lifetime. A scholar of Professor Altmüller is also Mr. Karmarsch, who is at present a renowned man in Technology, and director of the Polytechnical School at Gottingen. The undersigned, who does not assume the title of a scientific man, had got then already so much knowledge of woods that he could assist Professor Altmüller in arranging a collection of woods, which has since been imitated rather poorly in different museums. In the said polytechnical institution the writer very soon experienced that those professors are the most profitable ones to their scholars who have been before practical men of business, as Professor Meisner, who had been a practical chemist, whereas the real learned men don't produce so much good. At that time Professor Hermstaedt was very much celebrated by his work on Technology, and by his advice he was extremely useful to the manufacturers. At the same time Professor Wolf was very much esteemed as a teacher of the Chemical sciences. I must relate a characteristic case of that time. In the year 1816 the first lac-dye had been introduced by the East India Company, who wished to extend the use of that article. The writer received some specimens of it, and, making use of Dr. Bancroft's receipt, he had the good fortune to produce a very fine scarlet dye, and to spread the said article in Prussia. Wolf, professor of chemical and natural science, also received a specimen for investigation, probably without Dr. Bancroft's description ; and he declared, not as the Academy of Sciences at Paris did in the "Candide," that the wool was red, because it had been taken from red sheep, but that the product called lac-dye had been prepared from rags of old English uniforms.

After the commencement of the Technologist, appeared a popular Technology by Mosènius, which was not exactly scientific, but nevertheless extremely useful; since that time there have been erected polytechnic schools in all the large and middle cities of Germany, where technology is taught. Of all the like journals the Polytechnical journal of Dingler, begun at Augsburg, 1816—1820 prospered the most. Mr. Dingler was a calico-printer, and I don't see why a calico-printer should not be as well an editor of a polytechnical journal as a Manchester man could make a treaty of commerce.

This polytechnical journal, which, under the auspices of the renowned publisher Baron von Cotta, has obtained great fame and circulation, appeared formerly only monthly, but is now issued every fortnight, in octavo volumes of . . . pages. What I have to blame in your journal is not the contents, which I think exceedingly good, but the limited scale on which you have published the Technologist. You will not have sufficient space for the contributions you will obtain in a short time ; and, as an example, I beg to tell you that my friend, Mr. S. C. Hall, published at first the *Art Journal* at 1s. a copy, and had not two thousand subscribers. I took the liberty to tell him that he had better make a journey through the country in order to visit booksellers and others, and now that journal has got more than 14,000 subscribers, who pay half-a-crown a copy !

London, October 16th, 1860. FRANCIS STEINITZ.

Reviews.

Antiquarian, Historical, and other Researches in New Granada, Equador, Peru, and Chili; with Observations on the Pre-incarial, Incarial, and other Monuments of Peruvian Nations. By WILLIAM BOLLAERT, F.R.G.S., Corresponding Member of the Mines of Chili, &c. Trubner & Co.

MR. BOLLAERT is so well known for his geographical and antiquarian researches in South America, that any work from his pen forms an acceptable contribution to our stock of information. His various papers before the different learned societies of the metropolis and the British Association, and his valuable contributions to all our principal museums of commercial products, antiquities, &c., renders it scarcely necessary for us to say much respecting this, his latest, work, which is fitly dedicated to Sir R. Murchison. It is chiefly devoted to antiquarian and ethnological subjects; but there is scattered through its pages a great amount of recent geographical and statistical detail, and even some quantity of technological detail, of which we have availed ourselves in the present number. The book is illustrated by a large number of plates, and will be read with interest by many.

The Experience of Forty Years in Tasmania. By HUGH M. HULL, Esq. London: Orger & Meryon.

THIS is one of the best and neatest compendiums of colonial information that we have seen yet brought out, and it describes honestly and truthfully one of our antipodian possessions of which much too little is known. It is such hard books as these—issuing from the colonies themselves, and not merely compilations got up by interested and unscrupulous parties here—that will do most good in impressing intending emigrants with the true nature of the localities in which they may wish to make their home. Many years ago, in the *Colonial Magazine*, we advocated strongly the interests of this island, and pointed out its various capabilities and advantages as a field for settlement; and its progress since has served to strengthen rather than weaken the favourable opinions we then expressed. The statistics and details of colonial products would alone entitle this little work to a favourable notice at our hands. Mr. Hull has done his work well, and it forms an admirable guide for the purpose for which it is intended—an illustration of the Tasmanian products exhibited in the Crystal Palace, and which are so well arranged and described by Dr. Price. A map of the island, and about a dozen well-executed wood-cuts, add greatly to the interest and usefulness of this manual of Tasmania.

A NEW MATERIAL FOR THE MANUFACTURE OF PAPER.—At a period when the papermakers both in England and upon the Continent are complaining of the inadequate supply of rags for the manufacture of paper, it may perhaps interest some of our numerous readers to learn that M. de Paravey, in a recent communication to the Academy of Sciences at Paris, called the attention of the members to a plant from which an excellent kind of paper is procured in Upper Scinde, and to the north of the Himalaya mountains. This material is much used in Thibet, and amongst the native bankers of India; and its employment is referred to by Moorcroft and other travellers. When it has become soiled, or written upon, it can be made up again and re-bleached. The plant in question is the *Ruscus aculeatus*, commonly known in this country as Butcher's Broom, and may be met with in considerable quantity in most woody districts.—*London Medical Review.*

THE TECHNOLOGIST.

PREPARING AND COOKING BREAD FRUIT.

Of the bread fruit tree there are various kinds, distinguished by fruits of different sizes, the largest of which is the sweetest and most agreeable to the taste. Nature seems to have been very bountiful in her supply of this fruit, for the different varieties follow each other throughout the year. They have a peculiar method of preserving it, of which the following description may give some idea:—

"When the bread fruit is ripe, it is prepared by paring off the outer rind, and cutting it up into small pieces; holes are then dug in the ground to the depth of three feet; these are thickly lined with banana leaves, in order to prevent the water from penetrating. They are then filled, to within a few inches of the top, with the sliced bread fruit, thatched over with the same description of leaves, and covered with stones to press it down. This renders the holes both air and water tight; after a while fermentation takes place, and it subsides into a mass similar to the consistency of new cheese. Their chief reason for preserving the bread fruit in this manner is to provide against famine, as they have a tradition that a violent hurricane took place at the island about a century ago, which blew the trees down, and caused a great scarcity of food. It is said that it will keep in these holes for several years; and, although it emits a sour and most offensive odour when taken out, the natives consider it an agreeable and nutritious article of diet, equally palatable as when in its fresh state. It is eaten principally at their feasts, and is consumed in large quantities. When taken out of the pits, it is well kneaded, wrapped up in banana leaves, and baked in ovens of hot stones. These ovens are prepared by heating a quantity of small stones, and placing a layer of them on the ground; on which the food is laid, having previously been well wrapped up, in clean banana and wild taro leaves, to keep it clean and prevent it from burning. The remainder of the hot stones are laid over it, and the whole closely covered up with leaves, mats, &c., to prevent the steam from escaping. In a couple of hours the things will be sufficiently cooked; and a person unacquainted with this South Sea mode of cooking would be surprised to find the food so well done. I consider this to be the best mode of cooking yams and bread fruit, and much superior to our plan of baking and boiling them."—*Cheyne's Western Pacific.*

ON THE FORMATION OF LOCAL MUSEUMS.

BY WILLIAM CURTIS.

No institution is complete without its museum; and a collection of specimens, for educational purposes, is easily formed, extensive enough to teach powerfully by means of objects. A museum in a village need not be a very expensive addition to a school or institution. It may be at first only a museum of elementary knowledge, established by the outlay of a few pounds. This, with gradual additions, will soon become valuable, particularly if there be an individual or two in the neighbourhood with sufficient knowledge of natural history to make local collections of plants, birds, insects, geological specimens, &c. Much assistance may be obtained, and a useful interest may be excited, by such persons setting the younger members to work to make collections of natural history—*e. g.*, of zoology, including comparative anatomy, especially osteology; birds and their eggs; reptiles and fishes; land and fresh water shells; marine shells and other products of the coasts; insects, and specimens of their architecture; plants; minerals; geological specimens, as fossil organic remains and rocks, plastic materials and stones used for building and other economic purposes. Much may be thus done in almost every district, at a trifling cost for cheap glass cases, but of course more may generally be done in towns than in villages.

Other suitable objects are local productions of various kinds, local antiquities and raw materials of manufacture. These last, if exhibited in progressive stages, from the natural product to the finished article, would possess great interest in towns remote from the centres of manufacturing industry.

In most cases, apart from a small collection of primary objects and models, and diagrams for general instruction in the arts and sciences, the museum should be a strictly local one. The members of an institution will take more interest in collections of their own making; and, with a little guidance to a rational study of the natural sciences, will learn more from a large museum containing a bewildering number of objects. In educational museums, rare and curious specimens are not the most valuable, but those which are most common, and therefore most important. A plant from the coal formation, and a flint from the chalk, may teach valuable lessons in geology.

It is to be regretted that young men destined to instruct youth, particularly in villages and small towns, are not instructed in natural history, whilst much of their energy is wasted in learning things which will never avail them in schools for children under twelve or thirteen. Much good might be done by clergymen, if their inclination and taste prompted them to take an interest in these things. The selection and arrangement of specimens require a competent curator, and this office might be conveniently filled by the clergyman, or schoolmaster, if he had a knowledge of natural sciences. We ought not to see institutions, capable of carrying out effectively other educational plans, failing in one so important and simple as the formation of a museum. A visit to the South Kensington Museum will afford much useful information to those desirous of forming elementary and industrial collections.

At the last conference at the Society of Arts, the last subject discussed was, "Whether the institutions should promote the formation of local museums—and, if so, whether these museums might not easily, and with advantage, be made to represent the productions of the locality, instead of being of the heterogeneous character often given to them." Institutions should promote the formation of museums—they may easily be made to represent the productions of the locality—and they ought not to be made too miscellaneous. In connection with the short discussion which then ensued, I will make a few observations. In Alton, where we possess a good educational museum of natural history, we have never adopted the Local Museums Act, because the sum so raised would not be sufficient of itself—because we feared that a public rate would be an excuse for withholding private aid—and because, worked in connection with the other objects of the Mechanics' Institution, we did not require additional means of support.

In the discussion, one of the speakers questioned the utility of museums, and said that, to be of any educational value, they can be formed only in larger towns. I entirely dissent from this. If museums are, as he added, most miserable specimens of decay, it is because the public, and promoters of mechanics' institutions generally, are not sufficiently alive to the vast importance of teaching by the eye.

The same speaker also advocated impromptu museums. These I regard as valuable only as getting up a temporary excitement for a special purpose—as giving life to conversazioni, &c. But I attach the greatest importance to the remark made by Mr. Harry Chester on that occasion—that local museums would be of no value unless they were permanent, and the specimens properly classified and labelled.

There would be no objection to the exhibition of miscellaneous articles, if kept apart (in a separate room if possible) from the scientific collections, for many would be enticed into a museum more by them than by natural productions arranged in strict educational order.

Suggestions respecting Provincial Museums.—The objects of provincial museums should be:—1st. To make complete collections of local natural history in every department—mineral, vegetable, and animal—of local arts and manufactures, produce, imports, and exports—and of local antiquities—also to record local natural phenomena. 2nd. To have as complete a collection as possible of objects typical of family groups in every department of natural history, including geology, and also illustrations of the more important arts, manufactures and imports, for educational purposes. Arrangements should be made for the delivery of familiar lectures on the contents of the museum. To assist curators there should be prepared classified lists of types of classes, orders, families, and sub-families—with or without descriptions—with wood cuts of the types (coloured). These cuts might, in many cases, be placed in the museum till the objects themselves, or some nearly allied species, could be obtained. There should be printed labels for naming the typical collection. Curators would obtain valuable aid if there were set up (say at the British Museum) a collection of these typical specimens, as a model museum, in the best and most economical manner. This would be very useful to students and amateurs commencing the study of natural history. The Society of Arts might appoint (and, if necessary, the Government pay) an inspector of museums, to visit them from time to time, to report on their condition, and to publish abstracts of such reports in the Society's *Journal.* His accumulated knowledge and experience would enable him to offer valuable suggestions to the curators as to their arrangements, and the means of making the most practical use of their collections. The inspector should be kept informed as to the specimens, or objects, of every kind that there may be to spare from any of the national or other collections. In his tours he would ascertain wants and redundances, and be able to distribute duplicates to advantage. Other useful measures might be to print and circulate instructions on the collection and preservation of specimens of all kinds—to encourage officers of ships (especially the surgeons) to bring home the productions, natural and artificial, of foreign countries—and, lastly, as illustrations of processes in arts and manufactures, and imported raw materials, are often difficult to obtain in country places, and would be valuable additions to many provincial museums, the Society of Arts might assist in obtaining them at a moderate cost. The first act of the inspector should be to make a comprehensive report of all the existing museums attached to the institutions in union, stating particularly their condition, means, and expenses.

Alton.

DYE-STUFFS OF INDIA AND CHINA.

BY M. C. COOKE.

That the papers already communicated on this subject might be rendered more complete, we have now added thereto a brief account of such other dyeing substances as are in general use. This will constitute the four papers on this subject—a complete history of the dye-stuffs of India and China, so far as the limits of this Journal would permit such a history to extend. Dyes of animal origin, catechus, gamboges, and other similar products are excluded. Animal dyes are confined chiefly to lac products and cochineal; catechus will be more in place amongst tanning extracts, and gamboge and dragon's blood can scarce merit the title of dye-stuffs.

The wood of *Cæsalpinia pulicata* is employed in the East Indies as a dye-stuff. It greatly resembles *Cuba fustic;* and two or three parcels lately sold in the London market of a "new dye wood from the Indian Archipelago," were doubtless the produce of this tree. There is every probability of its becoming an established article of British commerce.

KAYU KUDRANG.—This is a yellow dye-wood, produced at Malacca. A specimen was sent to the Exhibition of 1851, but its source is undetermined. It is a harder and closer grained wood than Sappan, and of a lighter colour; it more resembles the wood of *Cæsalpinia pulicata*, except that it is heavier and more compact.

BUNCHONG BALU.—A dye wood of the Celebes, source undetermined. It was exhibited at the Great Exhibition of 1851. The wood resembles Sappan wood in appearance, and is doubtless the produce of a species of *Cæsalpinia.*

KAYU SAMUCK.—A dye wood from Labuan. The tree which produces it grows to thirty feet in height, and two feet in diameter. Of the character of the wood we are unable to speak from personal knowledge.

KAYU LAKAH.—This is a Malayan red wood, which was shown at the Great Exhibition of 1851. It is heavy and compact, somewhat resembling red sanders wood, but, when powdered, the colour is browner and not so brilliant. It has not hitherto been imported into Europe for commercial purposes, but appears worthy of a trial.

KAYU LAXKA.—This is a red dye wood, so closely resembling the *Kayu lakah* that it may be the produce of the same tree, although, from certain small peculiarities, we are inclined to consider them distinct. Either of these woods seem to be applicable to the same purposes as red sanders wood.

PALLUNGA MURRA.—A large tree, known under this Canarese name, grows in the Nuggur District. The wood is used as a red dye, in fixing which the myrabolaus of *Terminalia chebula* and alum are said to be used. The colour and general appearance of the wood resembles Sappan: it is very bright, but not quite so deep.

RAT-KERIA, of Saffragam.—A kind of red wood, evidently a species of *Acacia*, employed in Ceylon for dye purposes. The higher classes of the Kandians consider this wood as a powerful agent for purifying the blood. They prepare and use an infusion thereof by pouring hot water into beautifully carved cups made of this wood, which readily dissolves the colouring matter. It is employed alike by the Budhist priests and the Kandian ladies.

YELLOW STEMS.—The stems of a Menispermaceous plant about an inch in diameter, used for dyeing yellow, have been received from Upper Assam. They greatly resemble the thinner pieces of *Mara manjil* or *Tree turmeric*, the *Bangwellgetta* of the Cinghalese, and may be the produce of *Fibraurea tinctoria*.

OOBAR, OR KAYU OOBAH.—This red wood, according to Dr. Marsden, is used in Sumatra for tanning fishing nets. He states that it resembles the logwood of Honduras, and might be used for the same purposes. The bark and wood were exhibited in 1851 as dye-stuffs.

HOANG-LOU.—The wood of *Diervilla versicolor*, Sieb. and Zucc., is used as a yellow base for scarlet dyes amongst the Chinese.

KUEPHUL.—The bark of *Myrica sapida* is used for dyeing yellow at Rohilkund.

SOGAH, OR SAGAH BARK.—This bark, which resembles mangrove bark in appearance, was one of the substances exhibited by the East India Company from Singapore, in 1851, as a dyeing material.

SAMAK BARK.—This bark was also exhibited in 1851, from Singapore, both as a tanning material and as a dye-stuff.

LOPISIP.—A dye bark from the Celebes, by way of Singapore. This bark is very thin—not thicker than good brown paper, and very brittle. An unnamed bark from Singapore, very much resembling this, made its appearance in the London market during the past year; but, being unknown, and without good introduction, was not at all successful in meeting with a purchaser.

PUTTUNGHU BARK.—This substance is used for dyeing in the Nizam's country. It was exhibited as received from Capt. Ogilvie in 1851, but no information was attached.

AM-KA-CHAL.—This substance is a bark in small pieces, and is employed in dyeing at Patna.

BAIL-KE-CHAL.—This also is a bark, resembling the root bark of *Ægle marmelos*. It is employed for dyeing at Patna.

BOORADA-I-MIS.—This bark is in small fragments. We have only met with it in a series of dye-stuffs from Patna.

GARAN-CHAL BARK.—The bark of *Ceriops Roxburghianus* is used in India for dyeing, chiefly in the Presidency of Bengal. The tree which produces it is allied to the mangrove, and the bark seems to possess similar properties.

RINU BARK.—This bark we are unable to refer to its botanical source. It is employed, to a small extent, as a dyeing material in Mirzapore. In the form prepared for use it consists of pieces about an inch square, and generally half an inch in thickness. It approximates most in appearance to the chopped root and bark of *Morinda tinctoria*, but evidently not identical.

LODH BARK.—The bark of *Symplocos racemosa* is used in dyeing in India, but chiefly, we suspect, as a mordant.

TOOLA LOODH.—The bark of *Wendlandia tinctoria* is also employed as a mordant, for some of the Indian red dyes.

SARACUNDRAPUTTAH.—The bark of *Cathartocarpus fistula* is used at Palamcottah, and other parts of India, as a dye-stuff.

CHINESE LO-KAO, or *Green dye.*—This substance, to which attention has been drawn during the past ten years, and great exertions made to discover its source, is now ascertained to be obtained from two species of *Rhamnus* (*R. chlorophorus* and *R. utilis*). The *Lo-kao* is the sediment remaining after dyeing cotton cloths with the barks of both plants. This sediment is spread on blotting paper and dried; it then assumes the appearance of thin scales, like dried orange bark. During and after the Paris Exhibition of 1855, the value of the Chinese colour applied to silk became more and more appreciated. Its value consists in its being a pure and simple green, distinguished, it is said, from all the other shades of that colour by its remaining pure in artificial light. The quantity imported into France during the first six months of 1857 was 1,100 lbs., and the commercial value about £8,000. The *Lo-kao* does not contain any principle that resembles the constituent of indigo. It has been two or three times in the London market during the past twelve months, and realised about 7s. 6d. per ounce.

CUPLA ROOT.—The root of *Rottlera tinctoria*, as well as the red resinous powder of the capsules, yields a scarlet colour, and is employed for dye purposes.

MOTHA.—The roots, apparently of a species of sedge (*Cyperus*), are employed in dyeing at Patna. Whether they have, from similarity of name, any connection with the dye-stuffs of Rajpootana to be next mentioned, we are unable to state, for, although we have examined this, we have never seen them.

MOOSHE, MUCHA, AND MUCHKEE.—Three specimens of dye-stuffs under these names from the Rajpootana States were shown at the Exhibition of 1851. They may be the same substance, or a variety of it under a variation in name, or entirely different substances. In the absence both of specimens and information, we are at present unable to decide.

HUNSRAJ.—The fronds of a maiden-hair fern (*Adiantum lanatum*) are affirmed to be used in dyeing in Bengal.

GOOLJALEEL, or *Usburg.*—An East Indian substance, consisting of flower buds, flowers, broken leaves, and small portions of thin twigs or stems, used for dyeing yellow. It has been received from Cabool under the name of *Gooljaleel.* In Northern India *Usburg* is synonymous with *Ukkulbere*, as a popular designation of *Datisca cannabina.*

DICALYX.—The powdered leaves of *Dicalyx tinctoria* are employed at Mirzapore for dyeing red.

SUMATRA GARDENIA.—In Sumatra, a species of *Gardenia* (*G. glutinosa*) yields fruits which furnish a beautiful yellow colour equal to that produced by the *Hoang-tchi* of China.

SAFFRON.—This well-known substance, scarcely important as a dye-stuff, is produced in the vale of Cashmere, from indigenous species of *Crocus.* The colouring matter seems to be present in as great a proportion as in European saffron.

GOOLANNA.—The dried, fleshy, calyx of a flower from Scinde, undoubtedly *Punica granatum*, stated to be used in the preparation of a colour. A small specimen of this substance may be found in the East India House Museum.

Burmese and Siamese Dye.—A curious deep purple substance is preserved in the East India House Museum, obtained both from Siam and Burmah, and which appears to be the anthers of a flower. In both those countries it is stated to be used as a dye. But beyond this we have no information, not even the name by which it is distinguished.

The flowers of *Abutilon striatum* seem to be in use in India for dye purposes.

Mangosteen Peel.—The coat or rind of the fruit of the mangosteen (*Garcinia mangostana*), and the bark of the Katapping, or wild almond (*Terminalia catappa*), are used for dyeing black in the Island of Sumatra. With this the blue cloth from the West of India is rendered black, as usually worn by the Malays of Menangcabow.

Kadookai Flowers.—The flowers of *Terminalia chebula* are employed in some parts of India in dyeing yellow. The substance which we have seen under the name of *Cadooca-poo*, or "flowers of Terminalia," is a species of gall, produced on *Terminalia Chebula*, or *T. belerica*.

Basella.—Mr. Ondaatje states that the berries of *Basella rubra* afford a red dye in Ceylon, which is very difficult to fix.

Munjulde.—This substance appears to be the fruits of *Terminalia chebula* collected and dried before they are ripe. Under the above name they are known in Assam, where they are employed in dyeing.

Ah-lok-no-ta.—The long thread-like filaments of an orchidaceous plant (*Cymbidium tessaloides*), which are of a poisonous nature, are included amongst the dye-stuffs of the East India House Museum, received from Chota Nagpore.

Makleua.—This berry grows on a large forest tree at Bankok, and is used most extensively by the Siamese as a black dye. It is merely bruised in water, when a fermentation ensues, and the article to be dyed is steeped in the liquid and then spread out in the sun to dry. The berry, when fresh, is of a fine green colour, but after being gathered for two or three days it becomes quite black and shrivelled like pepper.

Benkita Barrung.—This substance, producing a dark purple dye, was sent from Borneo in 1851.

Burmese Orchil.—From Burmah we have received a specimen of orchella weed (*Roccella phycopsis*), which is apparently rich in colouring matter, and equally valuable with the ordinary *Roccella tinctoria* of commerce, of which species Dr. Lauder Lindsay considers it merely a variety.

East Indian Orchella.—Varieties of *Roccella fuciformis* are collected and used in dyeing in India and Ceylon. We have not seen *R. tinctoria* from these localities, but it is probably collected and used as in Burmah.

Jaffna Moss.—This dye lichen, *Alectoria sarmentosa*, is collected in Ceylon for tinctorial purposes. We have not succeeded in discovering it in the Museum of the East India House, with the exception of a very small fragmentary specimen.

CARANJA MOSS.— *Usnea barbata*, and its variety *florida*, or chiefly the latter, are collected for dyeing in Ceylon and on the Peninsula of India, under the name of *Caranja*. Other species are sometimes included under this name.

ASHNEH.—Dr. Lindsay informs me that some years ago he saw in the herbarium of the Royal Botanic Garden, Edinburgh, a dye lichen from Saharunpoor, sent by Dr. Jameson, and labelled *Borrera Ashneh*, a specific name which is not to be found in any work on lichens with which he is acquainted, and which specimen he considers to be *Parmelia Kamtschadalis*. In Dr. Lindsay's History of British Lichens the generic name *Usnea* is stated to be derived from the Arab, *Achnêh*, or *Achnen*, a generic term for all lichens. In India species or varieties of *Usnea* are amongst the most common of all lichens. Appended to a specimen of *P. Kamtschadalis*, in the East India House Museum, are the following remarks:—" *Ashneh* of the Arabs, *Chulcheleera* of India, the old *Usnea* of materia medica. *Alectoria Arabum*, Ach.; *Borrera Arabica*, Royle." To which is added, in the writing of the late Dr. Royle, " Certainly distinct from *Alectoria Arabum*, Ach., as figured by Dillenius." This specimen appears to differ in no respect from the *Parmelia Kamtschadalis*, Eschw.

CHULCHELEERA.—A mixture of dye lichens employed at Saharunpoor for dyeing, contains *Parmelia Kamtschadalis*, *Parmelia perlata*, and its variety *sorediata*, *Usnea florida*, *Ramalina calicaris*, and fragments of *Physcia leucomela*. In this mixture the first-named species constitutes the greatest proportion.

JETAMASHEE.—Under this name a mixture of lichens, including *Parmelia Kamtschadalis*, *P. perlata*, *U. florida*, and *Ramalina calicaris*, is employed at Patna for dyeing purposes. It resembles another mixture, which is known under the name of *Chulcheleèra*, also employed for a like purpose in other parts of India. The first species (*Parmelia Kamtschadalis*) predominates in the *Jetamashee*.

RATTI-NARA.—A dye lichen under this name was shown at the Madras Exhibition of 1855. Not having seen it, we are ignorant of the species included under the above name. Probably it is only the same as that already described under *Jetamashee;* and, coming also from Nellore, it is, without doubt, identical with the *Ratti-pu*, so that the three are but local names for the same substance.

RATTI-PU.—In 1857, specimens of lichens, under the name of *Ratti-pu* (stone-flower), were received from Nellore by the Commissioners of the Madras Exhibition. The jury requested Dr. A. J. Scott to report on their value. His report stated, " The lichens examined by me do not appear to possess any very well marked dyeing properties. By the mode of testing, however, employed by Westring of Stockholm, a yellowish fluid has been obtained through the agency of ammonia and chloride of ammonium, which imparts its colour to cloth immersed in it."

The lichens, known or described under the names *Ashneh*, *Ratti-nura*, *Ratti-pu*, *Chulcheleera*, and *Jetamashee*, appear to be identical, and the chief species constituting the mixture is apparently *Parmelia Kamtschadalis*.

A PROPOSAL FOR VOLUNTARY CLASSIFICATION OF MANUFACTURED AND UNMANUFACTURED PRODUCTIONS.

The superabundance of all kinds of manufactured and unmanufactured products, which has of late years prevailed in almost every European market, renders it of the utmost importance that some remedy should be applied to check a system, which becomes alike prejudicial to the producer and to the consumer, and the most effectual remedy that presents itself to our mind is that of improvement in every class of manufacture.

The Great Exhibition of 1851 was in itself a great step in that direction; but, unfortunately, only a temporary one, and one may reasonably doubt whether a second Exhibition of all Nations will be ever so successful in that respect. It has, therefore, occurred to us that the object in view—viz., that of an universal improvement in all classes of goods—might be obtained by interesting importers, manufacturers, and salesmen to unite in a general system of classifying all goods that may be brought into the market.

This system of classification has been followed during many centuries in almost every civilised country of the world, its purpose being to divide the goods into several distinct classes, to obtain more remunerative rates for those coming under the category of "first class," thereby enabling manufacturers and dealers to sell inferior qualities of the same article, classed as "second," "third," &c., at lower rates.

This classification of goods has already been adopted in many manufactories and markets, and in some places they are regulated by the authorities of the towns or countries in which such markets or manufacturies may be established; and if such classification were regulated by competent juries, selected by the manufacturers themselves, and confirmed by higher authority, it would undoubtedly have the effect of causing a general striving after amelioration in all productions; in fact, a similar result to that obtained by cattle, horticultural, and other exhibitions, where the manufacturer and salesman gain an opportunity of notoriously proving (upon official evidence) such or such an article to be of really "first rate" quality, whereby he is enabled to obtain a much higher price than he could without such evidence.

The mode of classifying goods hitherto adopted by manufacturers has been to mark and stamp their productions with their own trade mark; which experience has, however, shown does not protect them from imitation and counterfeiture; whereas, if those marks were placed under legal control, in the same manner as those used to classify jewellery, gold, silver, &c., they would be both a proof of the superiority of the articles, and a protection to the manufacturer, as it would then become a punishable offence to imitate or falsify the stamped, punched, sealed, or plumbed mark, placed by the proper authorities upon such articles.

The following is a rough outline of the system by means of which such a result might be attained:—In every manufacturing town or district a committee of experienced men (retired from business) should be elected under the surveillance of the mayor; forming together a council, superintended by a chairman, and assisted by a secretary and an auditor. The board of councillors would meet once or twice a week to examine and decide upon the qualities of such goods as might be submitted to them by manufacturers wishing to have their goods classified, who could send them *ad lib.* to the rooms destined for their examination, accompanied by a declaration stating the class under which they consider their productions ought to come, and the board of examination will class them in "first," "second," and "third class," according to quality, giving the manufacturer a certificate of their decision, upon payment of a small fee to cover the expenses of such salaries to secretary and subordinate *employés*, &c., the services of the chairman and councillors being, of course, honorary.

A register will be kept containing minutes of the declarations and decisions of the board, an extract of which will be sent monthly, with a report, to the different members of Parliament of the manufacturing districts, and an annual report made and sent, with all necessary observations, to a jury or commission established for that purpose in the metropolis, according to which report annual certificates will be delivered to each manufacturer, as a testimonial of the degree of perfection attained by him in his productions during the past year.

To every board of examination a Government department will be attached to mark out the goods submitted to the board of examination, by punching, stamping, sealing, or plumbing the different kinds, according to the quality certified to by the board, for which stamp, a fee or tax of —— per cent., *ad valorem*, will be paid.

The main feature in this classification is that it will be perfectly voluntary, as the interest of each manufacturer will lead him to undergo these proceedings and pay the trifling expense, for which he will be fully compensated, in being able to prove to the buyers the quality of his productions, to which nothing will hinder him from affixing his own mark and stamp, besides the official mark, which secures him from imitation.

The same system could be followed by the importer of foreign goods if he found it proper and applicable.

As the whole system, developed here in a few outlines, is voluntary, it will not be necessary to establish it at once in the whole kingdom; but, if tried at first in one of the manufacturing districts, there is no doubt that, when sanctioned by Government, others would soon follow, and before long the system of classification will be generally adopted throughout the land.

As every question is open to objections, according to the various points of view from which it may be looked upon, I beg to anticipate the principal ones which the present suggestion may be expected to meet with, and to each of which I have taken the liberty of at once adding a fair answer:—

1. It may be looked upon as a retrogressive movement from the system of free trade, having a tendency to afford those persons whose products might obtain a high degree in the classification a monopoly prejudicial to those manufacturers whose goods might not enjoy so high a rank. To this it may be answered, that free trade does not consist in the mere introduction of inferior articles into the market, and that it certainly cannot injure either seller or consumer to have the superior article officially distinguished from the inferior.

2. That manufacturers who have already gained notoriety for the quality of their wares would think their own trade or private mark a sufficient guarantee for those qualities without requiring the protection of Government, or of any other authority, to dispose of their produce. To this I reply, that, although first class manufacturers may not require such protection, second and third class manufacturers will derive all the greater advantages therefrom, inasmuch as it will place their produce (when of similar quality) on a par with those of the first manufacturers, however well known they may be, and thus destroy instead of causing an unfair monopoly.

3. That such a measure would have a backward tendency to the now obsolete "corporation system," which has long been discarded as useless and superfluous, most trade corporations having voluntarily relinquished their ancient privileges, and now confining their attention chiefly to works of benevolence and civic banquets. Although glaring abuses may have contributed much towards the abandonment of those privileges, it does not follow that a total overthrow of the system was necessary. In many foreign countries, where the disadvantages of such a complete reform soon became apparent, it was found necessary to re-introduce similar privileges, but under a modified form. It is not now my intention to restore antiquated customs, but, on the contrary, to introduce a new and better system, entirely voluntary and quite in accordance with the spirit of the times. Looked upon as a financial measure, I firmly believe that it will, in course of time, form such an important addition to the national income as will (without being in any way considered as a tax or burden, but rather as a voluntary contribution) enable Government at least to release the public from that obnoxious and universally condemned impost, the paper-tax. A great item in this revenue will undoubtedly be derived from foreign importations, the collection of which will simply require the addition of a small especial department to the already existing custom-houses.

I can easily conceive that the introduction of such a measure cannot proceed from Government, but that it should rather be proposed by some leading representative of a manufacturing district in Parliament; and for this purpose I intend making a tour, either personally or by some competent person at my expense, through the various manufacturing districts of England, Scotland, and Ireland, in order to sound the feelings of those interested persons who in due time will have to address their petitions on the subject to the proper department.

XYLOPOLIST.

CINNAMON CULTURE IN CEYLON.

BY W. C. ONDAATJE.

The cinnamon tree of Ceylon is about thirty feet high. The root has the odour of cinnamon as well as that of camphor, and yields this principle upon distillation. The twigs are somewhat four-cornered, smooth, shining, and free from any downiness. The leaves are liable to variation, ovate, or ovate-oblong, terminating in an obtuse point, triple, or three-nerved; that is, there are three principal nerves, which sometimes remain separate to the very base, but there usually are, moreover, in many cases, two shorter nerves external to these. Leaves reticulated on the under side, smooth, shining, the uppermost the smallest, with a good deal of the taste of cloves. The leaf buds are naked. Panicles terminal and axillary. Flowers usually bisexual, rather silky. Perianth six-cleft (two), segments oblong, the upper part deciduous. Fertile stamens nine, in three rows, the three inner opening outwards, three abortive capitate stamens (*staminodia*) in the interior of all. Ovary one-celled, with a single ovule. Stigma disk-like. Drupe (or berry), one-seeded, seated in the cup-like six-lobed base of the perianth (7). Seed large, with large oily cotyledons (8-10); embryo above. Native of Ceylon, now cultivated elsewhere, as in the Malabar Coast, in Java, Cayenne, &c. Nees von E., *as Laurus Cinnamomum* 128, *St. and Ch.* 121. (Royle's Mat. Medica and Therapeutics, p. 538).

The tree flowers in February or March, and is an evergreen.

The natives of Ceylon reckon the Rase Corundu as the only genuine species which produces the true cinnamon (*Cinnamomum Zeylanicum*); and six are considered spurious, known to them under the names of—

Cahati	Corundu,	literally	Astringent Cinnamon.	
Swel	Corundu	,,	Slimy	do.
Dawel	Corundu	,,	Flat	do.
Tunpot	Corundu	,,	Three-leaved	do.
Valli	Corundu	,,	Camphor	do.
Cattoe	Corundu	,,	Thorny	do.

But the Rase Corundu has been fancifully called by different names—namely, Pany Corundu, or Honey Cinnamon; Rase Corundu, or Sweet Cinnamon; and Nay Corundu, or Snake Cinnamon, from its extreme pungency, owing to the quality imparted to that plant by peculiar soil and cultivation; these are therefore to be regarded merely as accidental.

The cinnamon plant delights in a silicious soil, with an admixture of vegetable mould, in which only it produces the sweet taste, aromatic smell, and the pale brown, or russet colour, which renders it so valuable as an article of commerce, and useful as a spice; for it has generally happened that plants, even of the genuine kind, when grown in valleys on marshy grounds, or on those subject to inundations, lose their characteristic properties; *e.g.*, the plants growing in Batticaloa and Chilaw, which are allowed to be of the genuine kind, are deficient in smell and taste, and are consequently less useful or valuable; and the cinnamon grown in the valleys of Morawa Corle, the soil of which is marly, yields a bark of but an inferior quality. Again, the plants which were raised in Bombay, from seeds and seedlings sent thither at an early period of the British rule in this island, although they grew luxuriantly, produced bark of an inferior quality, which was not valued as an article of commerce.

Besides the inferiority in smell, taste, and colour, which invariably marks plants grown in any other than a silicious soil, a disadvantage of no little importance to the grower has been observed to follow. Whilst the stumps of plants grown in a silicious soil shoot forth rapidly, and are fit to be peeled a second time within a period of but four or five years, and produce bark superior in quality to that peeled at first, those grown on a hilly or marshy soil require a term of not less than six years before they can undergo a second peeling, and yield bark less in quantity and inferior in quality to that peeled at first.

In the planting and arrangement of cinnamon gardens, a distance of three feet between each shrub should be observed, and a space of nine square feet is required for each plant to grow in.

We come now to the process of peeling, whereby the bark of the cinnamon plant is rendered marketable. Before the shrubs are brought under the influence of the hatchet, it must be ascertained that they are sufficiently mature, and this is done by noticing whether the bark, on being split, separates readily from the woody part of the stem on the withdrawal of the knife. After a sufficient quantity of sticks have been collected, the bark is divided longitudinally on opposite sides with a curved sharp-pointed knife; on being carefully stripped off, it is laid aside to dry for about two days, when the epidermis is scraped off with a broad blunt knife, about two and a half inches long. The smaller pieces of bark are then placed within the larger ones, and after being sufficiently exposed to the influences of the sun and air, they assume the cylindrical form in which they are packed up in bales for exportation.

It is generally computed that in the cinnamon gardens of Colombo, originally planted by the Dutch Governor Falk, ten full-grown trees yield one pound of the bark, and that the shoots springing up from the stumps of the plants which have been cut down, arrive at a state of maturity in the space of three years.

It is well known that the bark yields an essential oil, and from the leaves an oil is obtained which resembles clove oil, and is known in commerce under the name of "oil of cloves." From the root is extracted an excellent camphor. The flowers are also used as a spice, and the pulp of the berries is made into cakes by the Kandians.

The following extract from a translation of a Dutch record, dated Feb. 25, 1697, which appeared in the *Colombo Journal* is subjoined as giving an interesting account of the mode of cultivating the cinnamon tree. It must, however, be remarked, that there is some difference in the kinds of cinnamon, as described in this document and the foregoing account, which is that received as most correct by the natives, who must be considered the best acquainted with the tree :—

" The best season for the purpose of peeling cinnamon is divided into two harvests; the greater commences in the month of June and ends in September, when they gather and deliver their tax into the warehouse; but it is not received or made into bales. This generally takes place by the end of November, when the whole work is fully completed. The lesser harvest commences in January, and terminates in February; but before the cinnamon is made up into bales, the period is generally extended to the end of March; hence during six months the peeling takes place, and again in six months not. The cause of the latter omission, or rather that the tree will not admit of being peeled, is properly this—the tree then grows and begins to shoot out new springs and leaves, which absorb all the sap proceeding from the root, leaving nothing between the bark and the trunk; but as soon as these springs and leaves have attained a certain state of maturity, and the sap required for their growth diffuses itself between the bark and the trunk, it then separates from the bark more readily; but it must be here observed, that for some years successively instructions have been received from the Honourable the Directors by the Governor-General at Batavia, as an indulgence to the Chalias, to peel only during the greater harvest and not during the lesser.

" There are seven kinds of cinnamon to be found in Ceylon, of which only one kind is fit to be peeled. These seven kinds are named as follows :— 1. Rase coeroonde, or sweet cinnamon, the first and only kind which is peeled for the use of the Honourable Company. This is distinguished into fine, middling, and coarse cinnamon, which variety of kinds is owing to the age of the trees, for the older that the trees are the coarser and thicker their bark becomes. 2. Sewel coeroonde exudes a gluish moisture; it is not peeled for the Company's use, but employed by the natives for medicinal purposes. 3. Tunpot coeroonde, or thorny cinnamon; the tree having thorns is not peeled, but used for medicinal purposes. 5. Mal coeroonde, or flower cinnamon, not peeled, but produces good camphor. 6. Welle coeroonde, or camphor cinnamon—the best camphor of Ceylon is to be obtained from the root of this tree. 7. Dawoel coeroonde is only good for medicine.

" The countries, corles, and provinces, producing the best and most cinnamon, extend along the sea coast from the river of Chilaw northward, to that of Waluwe southward, a distance of about 56 miles; and in breadth from the margin of the sea 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15 miles landward.

" The lands without the corles are under the dominion of the King of Kandy. But we have now, with his permission, peeled there eight or nine years, as peaceably and without any disturbance as on our own territory, and for the purpose of peeling during the present harvest we have again obtained permission from the chiefs of that court.

"The following are the provinces where cinnamon is to be had, and where it has been often peeled:—In the desolate Pettigal corle a great quantity of good and superior cinnamon is to be found. Cattagampile corle produces the most cinnamon, which, in point of excellence, does not yield to that of any other corle; but, being a little out of the way, it occasions some difficulty to the Chalias to convey it from thence to Negombo, the nearest station. Belligal corle produces very little cinnamon, as also the Hewegame corle.

"The above four corles are under the dominion of the King of Kandy, and situated beyond the Maha Oya or Caymal river. Cinnamon has often been peeled, but clandestinely, for the Company; but, having since obtained the permission of the King for the purpose, the work is now carried on in public.

"The Alutcoer corle, where Negumbo is situated, produces a good deal of valuable cinnamon; as also Hapittegame, Hima, Hewegam, Halpity, Raygam, and Pasdoon corles; the last mentioned corle being mountainous, the Chalias experience some difficulty in removing the cinnamon peeled. That part of the Wallaluwitte corle, north of the river Alican, also produces good cinnamon in proportion to its magnitude. The Galle corle also yields good cinnamon; but, in respect to its extent, not by far so much as the other corles. The same is the case with the Belligam and Dolosdas corles.

"Morua corle produces a great quantity, but, with respect to its quality, differing from that of Negombo, Colombo, Caltura, and Galle. The cause of this difference is owing to the country being mountainous, and the soil of the valleys where the cinnamon grows being composed of black earth, and often of a marly description, whereon, although the cinnamon grows sufficiently well, yet it does not obtain that luxuriance, nor has it that fine bark and vivid colour, as that growing on the sandy soil at Marendahn; and a tree growing on a marly ground, when it has been peeled and cut, the sprout proceeding from its trunk requires five or six years before it arrives at a peelable state, whereas the other thriving on a white sandy soil, produces not only a greater number of sprouts, and is capable of being peeled within the period of four or five years, but produces also generally a much finer and more pleasant bark than that peeled from its parent tree."

Badulla.

THE SOURCES OF MUSK.

The odour of musk is very widely diffused in Nature, both in the vegetable and animal kingdoms—in the leaves, roots, and seeds of plants—in animals, fishes, birds, reptiles, and insects.

I. In Vegetables may be instanced the common musk plant (*Mimulus moschatus*). All parts of *Guarea grandifolia* smell strongly of musk, so much so that the bark which possesses the property in the greatest degree may be used for the same purposes as that perfume, and the tree is therefore called musk wood. It is a native of French Guiana and the West India Islands. *Moschoxylum Swartzii* also emits from all its parts, when rubbed, a smell of musk, and hence it is called musk tree in Jamaica. The seeds of *Abelmoschus moschatus* have an odour somewhat between musk and amber, and are employed as a substitute for animal musk. Its generic name is derived from the Arabic hub-ool-moosk. The plant is now cultivated in Martinique, whence the seed is largely exported to France, where it is employed by perfumers in the preparation of pomatums, powders, and perfumes; by them it is called Ambrette and Graine d'Ambrette. Under the name of musk-seed, parcels are occasionally imported and sold at the drug sales in London, being worth about 4s. per pound. In Egypt and Arabia the natives bruise this seed, and, mixing it with their coffee, regard it as a cordial and stomachic.

The root of some large umbelliferous plant also enters into commerce under the name of sumbul, or musk-root. It has been known since 1840 in Germany, and was imported into Moscow and St. Petersburg by merchants from Khokand. It has also been received here overland from India. It has some medicinal repute. It seems to be questionable whether the odour is not artificially given. M. Landerer, of Athens, in the "Repert: die Pharmacie," states as follows:—

"The oriental medical men use a number of vegetable substances with a powerful odour of musk in their various compounds. The pilgrims, on their return from Mecca, generally import, among other articles of trade, plants with a musk-like odour for sale. A short time ago I received a few leaves from Jerusalem with so powerful an odour of musk that they quite impregnated the wardrobe in which I placed them with their perfume. The preparation of these vegetable substances is said to be a secret among the Hakims, and is effected by smearing them over with musk balsam; but I could not learn whether this balsam is prepared by digesting musk in spirit, oil, or ether. I have now in my possession a root from Constantinople, with a strong odour of musk, which appears to be that of an iris. If I digest this root several times in spirit, I can deprive it of its odour; and if I then pour ammonia over it, the musk odour is again restored."

II. Animal Musk.—Several of the *Longicornia* are remarkable for exhaling an agreeable musky odour, of which we have an instance in a British species, the *Callichroma moschata*, or musk beetle. In Borneo and Asia an elongated polished Cerambyx diffuses a very powerful odour of attar of roses, like the agreeable perfume emitted by the *Cerambyx rosalia* of the Pyrenees.

Among quadrupeds the musky odour is particularly noticeable in the European bison and the musk ox, although for commercial purposes musk is solely obtained from the musk deer (*Moschus moschiferus*), and only found in adult males. In some individuals the musk pod may contain as much as two ounces. An ounce may be considered as the average from a full-grown animal; but as many of the deer are killed when young, the pods in the market do not perhaps contain, on an average, more than half an ounce. In most of the Hill States the musk-deer is considered as royal property. In some, the Rajahs keep men purposely to hunt it; and in Gurwhal a fine is imposed upon any Puharrie who is known to have sold a musk-pod to a stranger, the Rajah receiving them in lieu of rent. Musk is in demand in nearly every part of the civilised world. The imports into the United Kingdom in the four latest years of which we have any official returns were—1858, 9,489 oz.; 1856, 17,580 oz.; 1857, 10,728 oz.; and 1858, 10,957 oz. The computed value of the imports in the last-named year was £11,733. The musk-bags or sacs, after the grain-musk has been extracted, are used by perfumers to prepare essence of musk. It is stated that a single grain of musk can constantly fill the air of a large apartment with a sensible impregnation for many years, without its weight being perceptibly diminished; and one part can communicate its odour to 3,000 parts of an inodorous powder. It has not been ascertained upon what musk depends for its peculiar properties. It is conjectured that a kind of putrefaction goes on which evolves the peculiar odour. Moisture seems to favour this; and musk which, when dry, yields little scent, becomes powerful when moistened. Musk is one of the most pervading of all odours, and heightens the aroma of many other perfumes.

Gilbert says:—"The hair on the summit of the head of the European bison or auroch gives out an odour of musk, particularly in winter, but this odour is lost by degrees in the domesticated state."

Brookes, in his System of Natural History, states that several Brazilian monkeys smell very pleasantly of musk.

The musk-rat of India, *Sorex Indicus* (*S. myosurus*, Pallas), diffuses a most powerful odour of musk, which impregnates everything that is touched by it. It has been alleged that even the wine in a well-corked bottle, over which the animal has run, has been rendered unfit for use in consequence of the flavour imparted to it.

The European musk-rat (*Mygale moschata*, *Castor moschatus*, Linn.) is met with about the river Wolga and the adjacent lakes, from Novgorod to Saratov. The flesh of the pikes and Siluri, which feed upon it, becomes so impregnated with the flavour of musk in consequence, as not to be eatable. From the region about the tail of this animal a sort of musk resembling the genuine sort is expressed; and the skins and tails are put into chests and wardrobes among clothes for the purpose of preserving them from moths. These skins were also supposed to guard the wearers of them from fevers and pestilence. The price at Orenburg for the skins and tails was formerly twenty copecs (about 7d.) per hundred. They were so common near Nischnei-Novgorod, that the peasants were wont to bring 500 each to market, where they sold a hundred for a rouble (about 3s. 6d.).

III. Alligator Musk.—Chief Justice Temple, in a recent lecture, observes:—"A few years ago, I stated in a letter published in the *Journal of the Society of Arts*, that there was an odoriferous substance in the axillary glands, and under the jaw of the alligator, which might be used as a substitute for musk, and thereby become a valuable article of commerce. In going up or down the rivers of Honduras, you are always warned of the presence of an alligator by a strong, and sometimes almost overpowering, smell of musk.

"Two hundred years ago the musk of the alligator of Yucatan and Honduras was extracted from that animal. Captain Dampier says, 'The flesh smells very strong of musk, especially four kernels, which are always found about them, two of which grow in the groin, near each thigh, the other two at the breast, one under each fore leg, and about the bigness of a pullet's egg; therefore, when we kill an alligator, we take out these, and having dried them, wear them in our hats for a perfume.'

"An extract from the 'Official and Descriptive Report of the Madras Exhibition of 1855,' shows that the musk of the alligator is known and appreciated in the East Indies. It is as follows: 'The largest animal found in the backwaters is the alligator. This vicious animal is sometimes very destructive to those who travel in common canoes, and are found in the northern districts (of Travancore) measuring from twenty to thirty feet in length, and from five to eight feet in girth, and ten feet in circumference. Musk is taken from the glands of the jaw, which is very fine if well prepared and separated from the flesh, otherwise it will give a very bad smell.'"

But the presence of this famous perfume does not alone constitute the value of the alligator. The skin has been tanned. The teeth of the reptile are from four to six inches in length, and are very white and hard. There is no doubt that they might be applied to many useful and ornamental purposes. But there is still another article, of no slight importance, which may be extracted from that amphibious brute. The tail of an alligator, measuring twelve feet in length, when boiled down, gives from sixty to eighty pounds of excellent oil.

In a late Texas paper, it is stated that Mr. J. W. Benedict, of Galveston, has manufactured some of the most beautiful boots and shoes ever seen with leather made of alligator skins. These skins are tanned and prepared so that they resemble the finest calfskin in pliability, and are beautifully mottled like tortoise-shell. He certainly merits a premium for changing the skins of these huge ugly monsters to forms of beauty and usefulness. Here is something really new under the sun. Alligator boots! What next, in the name of wonder? How are their hides tanned? Will the Texas editor explain the *modus operandi?* The back of the alligator is protected by regular transverse rows of bony plates, raised into keel-shaped ridges, of which there are several hundred reaching to the extremity of the tail. Alligators are killed in numbers in South American lakes and parts of the river Amazon for their fat, which is made into oil. The large eggs, as big as those of a goose, are eaten by the natives, but they have a strong musky odour. The flesh and fat are occasionally eaten by the natives in South America, Africa, and Australia. Both, however, have a smell of musk so strong, that few strangers can eat them without violent sickness following.

Mr. Wallace, in describing an alligator hunt on the lakes of Mexiana, an island lying off the mouth of the Amazon, states that about eighty were killed in two days. In some of these lakes a hundred have often been killed in a few days by a party of negroes; in the Amazon or Para river, it would be difficult to kill as many in a year. They are cut open, and the fat which accumulates in considerable quantities about the intestines is removed and made up into packets in the skins of the smaller ones, taken off for the purpose. The fat is boiled down into oil, and burned in lamps. It has rather a disagreeable smell, but not worse than train oil.

These various materials render that animal much more valuable than it was supposed to be in the days of Romeo, when "starved apothecaries, to show that learning and not beef was their aliment, hung up in their 'meagre repertories' alligators stuffed."

The musk glands of the crocodile (according to Dr. Rüppell) form a great part of the profit which results from its capture, as the Berberines will give as much as two dollars for them, the unguent being used as a perfume for the hair. The hawskbill and loggerhead turtles exhale a musky odour. They feed upon crustacea and various mollusca, and particularly upon cuttle fish.

In Western Australia musk is obtained by the natives from the musk duck (*Biziura lobata*), which cannot fly. Colonially, it is called the steamer, from its paddling motion, and the noise it makes as it shuffles along the water with its diminutive wings or flappers.

THE GINSENG OF COMMERCE.

In the Chinese pharmacopœia the root styled ginseng (*Panax quinquefolium*) stands pre-eminent, and, where money is of secondary consideration, no medicine is manufactured without its entering into the component parts. Its very name implies the wonderful powers ascribed to it, signifying the "medicine of immortality." Formerly none but the wealthy used it, as it was at all times worth more than three times its weight in silver, and frequently its weight in gold. Volumes have been written upon it by the most distinguished Chinese savans, and the great aim of their physicians is to produce that compound of ginseng with other productions which shall insure mortality to man.

The plant is small, growing a foot or two in height, and is an herbaceous perennial. In the close of the eighteenth century it was found growing wild on the Rocky and Alleghany Mountains, and is thence collected and also cultivated in many of the United States, and there is a steady export of the prepared root to China. It is now obtained largely in the Northern, Middle, and Western States of the Union, particularly Virginia, Kentucky, Ohio, Louisiana, Pennsylvania, and Minnesota.

The first export from America seems to have been made about 1790, when 813 casks of ginseng were shipped, and in the following year 29,208 lbs. From 1803 to 1807 the annual value of the ginseng exported was about 123,000 dollars, and from 1823 to 1830, 157,000 dollars. The export in 1821 was 352,992 lbs., and from that time it has fluctuated between 75,000 and 641,000 lbs. per annum. The year of the greatest export was 1841, when 640,967 lbs., of the value of 437,245 dollars, was exported, and that of the least, the year 1854, when only 37,941 lbs., worth 17,399 dollars, were shipped.

The root is about three or four inches in length, and one inch in thickness. It resembles a small carrot, but not so taper at the end, and is sometimes single, sometimes divided into two branches. As the root is brought to market after being cured, it occurs in pieces two or three inches in length, is of yellow or reddish colour, and bitter taste. The officinal root differs in appearance according to the country from which it is brought. In Corea and China it is white, corrugated when dry, and covered with a powder resembling starch. In Mantchouria and Dauria it is yellow, smooth, and transparent, and when cut resembles amber. It is found upon the rugged slopes of the mountains which extend through Mongolia, Mantchouria, and Chinese Tartary, and every year conventions of the herbalists of the empire are held near to some great lamesary, or sacred town, for its collection, together with other herbs.

In 1709 a great scarcity of the article was experienced, and the Emperor commissioned ten thousand Tartars to collect it through the northern portions of the empire, on condition that each soldier should give two catties (two ounces) of the best, and receive for the rest its weight in silver. A variety of the plant was discovered some years ago in the Himalaya mountains, and small quantities of the root have been sent thence to China. The Asiatic ginsing is said to be obtained from *P. Schinseng*, of Nies von Esenbeck, the *P. pseudo ginseng*, of Wallich.

The price of ginseng in the Chinese seaports has varied according to supply from 75 to 130 dollars per picul (133 lbs.) for the crude, and from 130 to 200 dollars for the clarified or cured. The latter rate is about six shillings per pound. The quantity and value of ginseng imported into Shanghae in the three undermentioned years was :—

	Piculs.	Dollars.
1856	433	77,940
1857	533	106,576
1858	725	202,882

Taking into account the large per-centage of profit, it seems strange that the export has not advanced more steadily. This may be attributed to the fact that it is not a regular article of cultivation, but the statistics would seem to show that such an undertaking might be exceedingly remunerative. It is of ready growth, and particularly on a high land and rocky situation, producing the purest quality in the cold northern regions of Vermont, New Hampshire, and the Canadas. The quantity at present transmitted from America to China is, in all probability, used only in those portions of the empire accessible to Europeans; for if we are to believe Messrs. Huc and Gabit, it still retains its full ancient value in the interior and northern provinces, showing that the traffic in this article is guarded as vigilantly as that in any other foreign production. The Americans are suggesting the cultivation of ginseng in California, where there is much valueless land, and where there are already more than 50,000 Chinese.

THE MANUFACTURE OF MOCK PEARLS.

M. Jaquin having observed that, upon washing a small fish, the blay or bleak (*Cyprinus alburnus*), the water contained numerous fine particles, having the colour of silver and a pearly lustre, he suffered the water to stand for some time, and, collecting the sediment, covered with it some beads made of plaster of Paris, the favourable appearance of which induced him to manufacture more of the same kind for sale. These were at first eagerly adopted; but the ladies soon finding that when they were exposed to heat the lustrous coating transferred itself from the beads to their skin, they were as quickly discarded. The next attempt of M. Jaquin was more successful. He procured some glass tubes of a quality easily fusible, and by means of a blowpipe converted these into numerous hollow globules. He then proceeded to line the interior surface of these with the powdered fish scales, which he called essence of pearl, or *essence d'Orient*. This was rendered adhesive, by being mixed with a solution of isinglass, when it was introduced in a heated state inside the globules, and spread over the whole interior surface, by shaking the beads, which for that purpose were placed in a bowl upon the table. These hollow beads being blown exceedingly thin, in order to produce a better effect, were consequently very tender. To remedy this evil, as soon as the pearly varnish was sufficiently dry they were filled with white wax, and, being then bored through with a needle, were threaded for sale. An expert workman can blow from five to six thousand small globules in a day; but as some attention is called for in regard to the shape and appearance of these beads, the produce of a man's daily labour will not much exceed one-fourth of that quantity. The closer to counterfeit nature in their manufacture, these beads are sometimes purposely made with blemishes, and of somewhat irregular forms. Some are made pear-shaped; others are elongated, like olives; and others, again, are flattened on one side, in imitation of natural pearls, which are set in a manner to show only one side. The fish whose scales are put to this use are about four inches in length. They are found in great abundance in some rivers, and, being exceedingly voracious, suffer themselves to be taken without difficulty. The scales furnished by 250 of these fish will not weigh more than an ounce, and this will not yield more than a fourth of that quantity of the pearly powder applicable to the preparation of beads, so that 16,000 fish are required in order to obtain only one pound of the essence of pearl. Up to a recent period the heirs of Jaquin, the first inventor, carried on a considerable manufactory of these mock pearls in Paris. The fish are tolerably abundant in the river Seine; but their scales are conveyed from distant parts in much larger quantities than can be procured on the spot, for which purpose they are preserved in volatile alkali, or ammoniacal liquor, to prevent putrefaction.

THE TRADE IN MADDER.

BY P. L. SIMMONDS.

It is discouraging to find that with the progress of our manufacturing industries—for the textile ones, and even some others—we are becoming largely, and in some instances exclusively, dependent on foreign countries. The greatest part of our cotton still comes from the United States. For wool we are less dependent, as we have the produce of our own southern colonies. For flax and silk we are largely indebted to foreigners; and in like manner we draw from foreign sources a great portion of our supplies of dyes and tanning materials. The dyes are of great importance, and offer large returns to the producer. Our Indian possessions furnish us with supplies of indigo; but there is a wide field for enterprise in the supply of colouring substances in many of our colonies. As an instance we may take the article of Madder, for which there is now an immense demand. Why should we pay a million annually for this dye root to the Continent, when it might be produced so easily in many of our colonies? The culture at present centres chiefly in some of the departments of France, in southern Europe, Turkey, Syria, the two Sicilies, and Spain. Although it is a crop demanding care and outlay, yet the return is considerable, the average price ranging at about £2 5s. or more the cwt., while the yield is fully one ton per acre. There is a large demand, not only in Russia, Austria, and other European countries, for madder, but the United States pays annually about £200,000 for this article. Hence attention has lately been prominently directed by the American government to the importance of extending the culture of the root there, many of the States being well suited to its production, both as regards soil and climate.

Madder has occasionally been cultivated in England, but without any very great success or beneficial results, owing to the unsuitability of the climate and the high price of land. Hence, a crop which takes three or four years to mature and harvest will scarcely pay. That, however, there are many of our colonies in which it might be raised to great advantage, we fully believe, especially in Australia and Southern Africa; and with this view we desire to draw attention to the subject, and to collect and arrange a few instructive hints, so that some of the hundreds of thousands of pounds now spent on the Continent may go into the pockets of our countrymen in the Colonies, rather than into those of the foreigner.

In France the culture of madder is chiefly carried on in the department of Vaucluse, of which the town of Avignon is the centre. The soil is peculiarly favourable to the development of the root, being calcareous, light, and rich. A clayey soil will produce good madder, but its working is difficult. A soil, therefore, in which sand enough prevails with the clay to render it friable, is that which is to be chosen. It must be deeply cultivated, as the roots, which constitute the value of the crop, run down very far. The ground requires to be well manured. The rich polders or redeemed meadows, both in Holland and Flanders, are favourite spots for the cultivation of this crop. The fine alluvial "bottoms" produced by the sea abound in soda and siliceous sand. Such differences in the constituents of the soil exercise a great influence on the production of the red colouring matter of this root. Hence, Zealand madder contains more of the yellow and less of the red colouring matter than the better sorts of the French product. In Vaucluse madder is raised from seed sown in spring; in Zealand it is propagated from shoots or offsets planted in May.

We need not follow in detail the culture, which merely requires loosening the soil, keeping clear from weeds, and feeding off the herbage. The roots of the older plants have much more value than those which are younger. The madder which is not taken up until the third year produces much more and of a better quality than that which is gathered in the second; but the increased expense and rent of the land are seldom compensated by the increased product.

The harvesting appears to be a work of much labour. The roots, which in a well-prepared soil extend to a great depth, must be taken up with care, and without injury. Sometimes a plough is passed along the line, and then the work is finished with the spade, but generally it is wholly done by the spade; the intervals between the beds being dug out to the depth of two feet, and the plants carefully displaced and taken out by means of forks or narrow hoes. The excellent condition in which, under such cultivation, the land is left for other crops, is a considerable indemnity for the expense and trouble bestowed upon the crop of madder. The plants lie upon the ground three or four days, in small heaps, in order to dry, and, in case of rain, are covered with straw.

In the preparation of madder for market, there are three modes of drying the roots—by the sun, in the shade, and with stoves. When dried by the sun there is a considerable loss in weight and in the quality of the roots; it is, therefore, preferable to dry them in the shade, exposed to a current of air, although the operation may be more promptly effected with a stove; but by the latter process they lose seven-eighths of their weight.

When the roots are sufficiently dried, they are reduced to a powder, first by placing them on close osier hurdles, where they are lightly beaten with flails, which separates the earth as well as the epidermis and radicles, the smallest of which are used for inferior dyeing. The large roots, which are good and of a red colour, are then dried and cleaned once more, and reduced to a fine powder by passing through a bruising-mill; then packed in barrels or casks for market or use. In Holland the best quality, which is known under the name of "krap," anglicised to crop, is prepared only from the heart of the root, that has been previously deprived of the other parts of less value: there is considerable difference also between these parts of the root, in the loss of weight, which they respectively sustain by drying. When the heart and surrounding layers are separately treated, the amount of this loss is, in the case of the former, 57 per cent., but in that of the latter 76 per cent. The total loss of weight in drying the raw root as it comes from the ground is from 72 to 80 per cent., or on an average 75 per cent. After a preliminary drying, which takes place in the southern parts of France in the open air, the roots before being ground are dried a second time, in kilns or stoves, and undergo further loss, say 7 or 8 per cent. But such a loss, according to experience, is at least from 10 to 15 per cent. of the light red coloured, and from 20 to 25 per cent. of the red roots; the latter, which are in the greatest demand, being on that account not dried quite so well by the cultivators. We have no data as to the quantity of land under culture with madder in France, but, looking at the local consumption and large export, it must be considerable.

Madder produces to France an annual sum of one million sterling. The return varies from £40 to £50 per acre, and the expenses upon its proper culture should not exceed one-half that amount. The colonists would find it to their interest to turn their attention to such products as this, for which there is an extensive demand, instead of confining themselves exclusively to the commoner and bulkier products, which they export at a much less profit, and which, when once the market is fully supplied, may fall to a price at which they cannot afford to sell.

The progressive increase in British consumption of madder is shown by the following statement of imports, both of the root and ground madder. In 1839 it was 179,434 cwts.; in 1849, 254,722 cwts.; and in 1859, 355,552 cwts. To which is also to be added now about 42,000 cwt. of garancine, a concentrated preparation of the dye, obtained by sulphuric acid. On the Continent the root is called "alizari," and the powdered root "garance."

THE PINE-APPLE FIBRE, &c.

The leaves of this plant must be noted as yielding an exceedingly fine fibre, and at the same time possessing great strength. The plant grows wild all through the West India Islands, and indeed in America, Africa, Asia, and almost all tropical regions. Mr. MacMicking gives an interesting account of the manufacture of the celebrated pina cloth in the Philippines.

"There is perhaps no more curious, beautiful, and delicate specimen of manufactures produced in any country. It varies in price according to texture and quality, ladies' dresses of it costing as low as twenty dollars for a bastard sort of cloth, and as high as fifteen hundred dollars for a finely-worked dress. The common coarse sort, used by the natives for making shirts, costs them from four to ten dollars a shirt. The colour of the coarser sorts is not, however, good; and the high price of the finer descriptions prevents it becoming generally a lady's dress; the inferior sorts are not much prized, chiefly because of the yellowish tinge of the cloth. The fabric is exceedingly strong, and, I have been informed, rather improves in colour after every successive washing.

"Pina handkerchiefs and scarfs are in very general use by the Manila ladies, although they are rather expensive; the price of the former, when of good quality, being from about five to ten pounds sterling each, while for a scarf of average quality and colour about thirty pounds is paid. The coarser descriptions can be had for much less money than the sums mentioned; and the finest qualities would cost from three to four times more than the amounts I have set down. Besides the pina there is also a sort of cloth made by the natives called juse (pronounced huse), or siriamaio, which makes very beautiful dresses for ladies. It is manufactured from a thread obtained from the fibres of a particular sort of plantain tree, which is slightly mixed with pine-apple thread; and the fabric produced from both of these is very beautiful, being fine and transparent, and looking, to the unaccustomed eye, finer than the ordinary sort of pina cloth. It can be made of any pattern, and is generally striped or checked with coloured threads of silk mingled with the other two descriptions. The manufacture of both these articles is carried on to a small extent in the neighbourhood of Manila; but in the provinces of Yloylo and Camarines the best juse is produced, the price of which is very much lower than pina, as a lady's dress of it may be got at from seven to twenty dollars; and for the latter amount a very handsome one would be obtained."

The finer qualities excel in transparent delicacy of thread the finest cambric made. It is, as we have seen, exceedingly costly, and probably from that reason does not find much favour as an article of export. Designs drawn upon paper are placed beneath the pina intended for embroidering, and the outlines are traced upon it with a pencil. It is then stretched out about a foot from the floor, and parallel to it the workmen and women (for both sexes are employed) sit all round, with their legs bent under them, as closely as they can ply the needle; and as I witnessed the slow laborious process, I was not astonished that a fully embroidered handkerchief, twenty-four inches square, should cost forty dollars. The artificers are kept at work from seven o'clock in the morning till five in the evening, and are only allowed thirty minutes out of the ten hours for relaxation and refreshment. Both sides of the handkerchief, or whatever the article may be, are embroidered alike, and the workmanship is exquisite. Some of the scarfs, &c., submitted to my admiring notice appeared like transparent tablatures, with figures in relief of beautifully sculptured alabaster.*

The shirts of the civilised Indians (males) are made of the thin grass cloth, a peculiar manufacture of the country, from the fibrous parts of the leaves

* "Rovings in the Pacific."

of the pine apple, as transparent as gauze, exhibiting the entire contour and muscular action of the arms, shoulders, and chest. It hangs loose over the pantaloons, and is always beautifully finished—often richly embroidered around the collar, bosom, and wristbands. Females wear a transparent short gown of this thin muslin, reaching scarcely below the bosom, and hanging unconfined around the form. Another author says:—

"In Manila the most expensive article of manufacture is the pina cloth, made by the natives from the fibres of the pine-apple leaf; the texture is very delicate, soft, and transparent, and generally has a very slight tinge of pale yellow. It is made into shawls, scarfs, handkerchiefs, dresses, &c., and is most beautifully embroidered by the needle. These things take some time to make, and are very expensive; it is much sought after by foreigners. Even orders for Queen Victoria and the English nobility have been received from time to time; and the orders are always beyond what can be executed for many months."

This cloth comes principally from the island of Panay. The web of the pina is so fine, that they are obliged to prevent all currents of air from passing through the rooms where it is manufactured, for which purpose there are gauze screens in the windows.

The threads procured from the stalks of some wild species of the plantain family are used for very fine and delicate-textured linen and muslin. At Manila there is an extensive manufacture of muslins and sinamaya, or grass cloth, from the coarsest to the finest texture it is possible to manufacture; and, sometimes it has been stated, made of fibres so fine, that they require to be manufactured under water, because if exposed to the sun and air they become too fragile to work.* The coarsest fibres of the same plant (*Musa textilis*) form the abaca, or Manila hemp of commerce, used in the manufacture of cordage.

Singapore is celebrated for the great abundance and excellence of its pine-apples, which may be obtained during nearly the whole year, and from which, if the accounts published from time to time of the value of the silky thread obtained from the leaves are to be depended upon, a valuable article of export might be gathered. The small circumjacent islands, which, at a rough estimate, comprise an extent of 2,000 acres, are quite covered with fields of this plant; the fruit only is of any value to the Chinese cultivators, whilst hundreds of tons of the leaves are annually allowed to waste by slow decay on the ground. The enormous quantity of leaves that are thus suffered to decompose would supply fibre for a large manufactory of valuable pina cloth, while at present it is scarcely thought of. The fibres should be cleaned on the spot; fortunately, the pine apple planters are not Malays, but industrious and thrifty Bugis, most of whom have families; these men could be readily induced to prepare the fibres. Let any merchant offer an adequate price, and a steady annual supply will soon be obtained there.

Dr. Manuel Arruda, in a pamphlet treating of the plants of Brazil from

* Abel's "Narrative of a Journey in China," 4to., p. 251.

which fibrous substances may be obtained, adapted to various uses in society, published so far back as 1810, gives some very interesting details respecting experiments he made with various species of Bromelia. He found, he says, on comparing the fibre of the leaves of the common pine apple (*A. sativa*) with that of many other indigenous plants, that it was the strongest and finest, and adapted to the manufacture of cloth even of superior quality. He took the leaves of two of these plants, which weighed fourteen pounds, beat them with mallets, washing those portions which had been beat; they yielded rather more than a quarter of a pound of thread. The operation lasted nine hours, being performed by one person. It is bleached with great ease.

The Malays manufacture a flimsy cambric from the fibre, which is so extremely fine that it can be compared only to the spider's web.

A variety, termed by Arruda *Bromelia variegata*, and known under the name of Caroa, possesses useful properties as a fibrous plant. Many leagues of land are covered with it in the province of Pernambuco; and there are situations, Koster informs us, which are so completely overspread with it that the ground cannot be passed over. This occurs in many parts of Curinatau and of Cariri de Fora. The inhabitants of the banks of the river St. Francisco weave their fishing nets of the fibres of the leaves. These fibres are so tough, that from them cordage may be made, and even coarse cloth, if care be taken in preparing the thread.

There are two methods pursued—1st. Having taken the leaf from the plant (which is easily done), the convex side of it should be clipped at the bottom with a knife, and with the other hand the fibres pulled out, some force being necessary. They will bring with them a quantity of vegetable liquid, with which the pulp is soaked. The fibre which is thus extracted is green, and it is necessary to wash it for the purpose of cleaning it. 2nd mode. The leaves, when taken from the plant, are tied up in bundles and thrown into water, where they remain for four or five days; they are then taken out and beaten in bunches, that the hammers or mallets may not cut the fibres.

This operation being insufficient to separate it from the pulp, the fibre is again tied up in bundles, and steeped for two days or more, at the close of which the beating is renewed. The bundles are a third time soaked and beaten. After this the fibres are usually obtained clean, and should be wound up and braided, so that they may not become entangled. Maceration in stagnant water is more efficacious than in a cold running stream. The fibre of this, like that of all other plants, is subject to rot, if it is left in the water for any considerable time. The fibre of *Bromelia Sagenaria* possesses somewhat similar properties to the foregoing. In Brazil rope is also manufactured from a species of the genus called "Grawartha," probably *B. Acanga*. The leaves of another species of the genus, *Bromelia Pinguin* (very common as a hedge or fence plant in the West Indies), when beaten with a blunt mallet, and macerated in water, produce threads as fine or finer than flax. These fibres can be manufactured into a beautiful fabric.

Bromelia Karatas, common in the West Indies, where it bears the local names of the Maypole and Coratoe, as well as the *Agave vivipera*, have similar useful properties. It is indigenous to Trinidad, and, like all the pine-apple tribe, furnishes a strong, soft fibre. I have seen cloth manufactured from this fibre, which could not be surpassed by any fabric made of flax; and as the pinguin grows universally in the tropical colonies, irrespective of soil or water, there can be no reason why its fibre should not be indefinitely propagated, if approved of by the linen manufacturers.

LATAKIA TOBACCO.

The chief produce of the mountainous part of the Latakia district is tobacco, of which the quantity exported is very great, and is sent chiefly to Alexandria. Of all the different sorts exported from Latakia, the best is that produced in the district of Gebel. When this has been hung up in the rooms of the peasants, and there allowed to absorb the smoke of the dwarf oak, it gains a delightful perfume in smoking. It is then called Abu Richa ("Father of Scent"). It is worthy of observation, that the Abu Richa improves a great deal after having been some days on board ship. In Egypt it is in great demand. The peculiar property which this tobacco derives from being exposed to the smoke was accidentally discovered as follows:—One year, there being no demand for tobacco, the leaves were hung up for the winter in the peasants' huts, exposed to the continual smoke of their fires, and the succeeding year it was sent to Egypt, where it was considered so good that a large order was sent to Latakia for more of the same quality, which was then called Abu Richa.

GENOA LACE.

One of the trades which gives employment to a great number of persons, but, from the delicate nature of the work, chiefly to women, is the manufacture of lace, for which Genoa and its neighbourhood has, since very remote times, been famous.

It is calculated that in Genoa and the Riviera not less than 20,000 women are employed in this trade; and the gain on that part of their productions which is sold in the State is set down at 1,200,000 francs. In the commune of Rafallo, a small town about fourteen miles from Genoa, alone, there are about 8,000 women engaged in this trade. The average export value of these laces in the last five years has been about 1,300,000 francs, but in the years 1853 and 1855 the value exceeded 2,000,000 francs. The chief exports are to South America, especially to Lima, for the thread laces, and to Lombardy, Tuscany, and France, for those of black silk.

Correspondence.

To the Editor of the "TECHNOLOGIST."

SIR,—The article in your first number, on "A Good, Wholesome, and Cheap Substitute for Coffee," recalled to my mind some trials I made many years ago in respect to the analogous properties of plants, or parts of plants. Thus, knowing that the seed of the true coffee (*Coffœa Arabica*) consisted chiefly of horny albumen, I reasoned that any other horny albumen, similarly treated, would, as far as flavour was concerned, resemble coffee. I proceeded to test this notion, by procuring the berries of the *Ruscus aculeatus*, or Butcher's broom. These when roasted so closely resembled coffee, that a West India merchant to whom I submitted them, begged me not to make it known, as it might injure the demand for the real coffee. This plant is abundant in many places, more in the southern than northern counties, especially the New Forest. If the children of the poor were employed to collect them, and their parents to roast them, a good and wholesome beverage would be obtained. As provisions are sure to be dear this winter, this hint may be appropriate. Butcher's broom is used as a substitute for coffee in Corsica: so this is no novelty. The ignorance of our peasantry loses them many a luxury, as, for example, the *Agaricus procerus* and *Cantharellus cebarius*.—I am, yours truly,

ROBERT DICKSON, M.D., F.L.S.

Ruscus aculeatus (Butcher's broom) occurs in the following counties, according to C. Watson's "New Botanist's Guide:"—Cornwall: Lemoure Cove and St. Martin's Isle, Scilly. Devon: Harford Wood, near Sidmouth; Cliffs at Marychurch; Cockington Wood. Hants: Near Portsmouth; near Gosport; New Forest, abundant. Sussex: Sparingly in West Sussex; abundant near Hastings. Cambridgeshire: Anglesey Abbey. Kent: Tunbridge Wells and elsewhere. Surrey: Claygate Common; Coulsdon. Oxfordshire: Caversham. Yorkshire: near Ripon. Durham: near Cockerton. Nottinghamshire: Cliff Wood. Scotland: Ayrshire; Lanarkshire. In Middlesex abundantly, according to Daniel Cooper's "Flora Metropolitana."

Reviews.

On the Presence of Arsenic and Antimony in the Sources and Beds of Streams and Rivers. By DUGALD CAMPBELL.

THIS is a reprint of a paper from the *Philosophical Magazine*, in which Mr. Campbell states, as the result of numberless experiments, that he has not yet met with a sand from the source or bed of a stream or river that does not contain arsenic, and, perhaps, antimony also; and, indeed, considers that there are few sands that will not be found to contain these metals.

On the Action of Hard Waters upon Lead. By W. LAUDER LINDSAY, M.D.

THIS paper of Dr. Lindsay is chiefly directed to the *rationale* of the non-action of certain soft waters, and the action of certain hard waters, on lead. He has brought together not only the result of various experiments of his own, but cited the opinions of the chief medical and scientific men upon the same subject.

On the Advantages of the Study of Botany to the Student of Medicine. An Inaugural Lecture delivered in King's College. By ROBERT BENTLEY, F.L.S., M.R.C.S., Professor of Botany, &c., &c.

THE publication of this excellent introductory lecture to Professor Bentley's course on botany at King's College will be highly beneficial, and cannot but be read with great interest. We cite a passage or two (all our limited space will allow) to prove the importance of the arguments and truths advanced.

"But if a knowledge of botany be so valuable in its results to the medical practitioner in this country, it will become vastly more important to him, if (as constantly happens in a nation like our own, with numerous colonial possessions in all parts of the world) he may be required to practise his profession in an almost unknown country. Then a knowledge of botany will give him a clue to the properties of the plants he will see around him, for its study will have taught him that those which resemble each other in their structure—that is, those belonging to the same natural order—may be expected to resemble one another in their properties. He will know, also, that whilst certain tribes of plants are almost universally poisonous, or to be regarded with suspicion, others, on the contrary, are at least harmless; while others, again, may be expected to possess some important properties, applicable as a medicine, or as yielding some product of value for manufacturing purposes, or in the arts, or domestic economy. . . . . We see, therefore, that by a knowledge of botany a medical practitioner would, in case of need, or in a deficiency of supply in the medicines he was in the habit of employing, possess a clue to the resources by which he was surrounded, and would accordingly frequently find himself almost as much at home in an unknown country as in his own native land; for such a knowledge would enable him to search for new remedies, when he would be almost certain to find something of value, not only for his own use, but for that of the world at large. He might even be the instrument of discovering a most important remedial agent, which, by the blessings it would confer upon mankind, would be the means of handing down his name and memory to posterity, as one of the great benefactors of the human race. What pleasure could excel, or even equal, that of such a man? who would be thus enabled, and when least expected by those by whom he was surrounded, to alleviate their sufferings and minister to their wants; and what distress of mind would be the lot of him who, when placed in similar circumstances, would be unable to avail himself of the means which a bountiful Providence had placed at his disposal, because he had omitted to make himself acquainted with an important branch of his education. In this respect alone, therefore, a knowledge of botany cannot but be considered as of the most essential service to the medical practitioner, whether pursuing his profession in this or any other part of the world."

Adulteration of Food.

WE have to acknowledge the receipt of a very interesting table, showing the more important articles of food and drink, and the substances employed for adulterating them, compiled by Mr. Wentworth L. Scott (C. Mitchell & Co.), which will be found exceedingly useful for ready reference, being clearly and intelligibly arranged. The adulterants are classified into—

I. Results of imperfect purification or preparation, or of improper packing or storing, &c. (fraudulent, or from negligence).

II. (In articles sold in natural state, or nearly so.) Results of natural decomposition, organic disease, certain parisitical plants and insects, or various injurious specimens, apparently resembling the true ones for which they are sold (fraudulent, or from negligence).

III. Adulterants employed as diluents (fraudulent).

IV. Adulterants used for imparting fictitious "strength," flavour, or colour, &c. (fraudulent).

V. Substances not employed as adulterants proper, but for the purpose of additional ornamentation or flavouring (highly injurious to health, but not legally speaking fraudulent).

VI. Substances not employed as adulterants proper, being *substitutions* for or imitations of, the true articles for which they are sold (distinctly fraudulent).

Mineral Statistics of the United Kingdom. Part II. for 1858. By ROBERT HUNT, F.R.S., Keeper of Mining Records. Longman & Co.

MR. HUNT, whose arduous and continued labours in the field of mineral statistics have resulted in the accumulation of a fund of information regarding our metalliferous and mineral industries, unparalleled in any other country, has just added another volume to this stock, and on a branch of industry on which we have hitherto had no reliable information. This part is devoted to returns of the produce of the clay works and quarries of the kingdom. The value of the building stones and clays, &c., used is shown to amount to nearly £8,000,000 per annum, which, added to the metals, metalliferous minerals, and coals produced, shows that our annual mineral produce has the enormous value of thirty-nine and a quarter millions sterling. This book will be invaluable to all interested in earthy and mineral products, serving the purpose of a directory as well as a statistical manual.

THE SILKWORM.—The discovery of an infallible cure for the disease of the silkworm, by electricity, has been communicated to the Academie by M. Sauvageon, of Valence. The result of M. Sauvageon's observations is most satisfactory. The electric current has in every case restored to health and liveliness the unfortunate silkworms suffering from the *guttine*—that inexplicable malady which has extinguished two whole species of the insect within the last few years. Marshal Vaillant, who is one of the greatest naturalists of the day, has also presented his discovery upon the same subject. During his stay at Milan, as Commander-in-Chief of the army of Italy, the marshal had much experience in the study of the silkworm, and has collected a vast number of notes which the Academie has decided upon publishing. His method of treatment, less summary than that of M. Sauvageon, is said to be more efficacious, inasmuch as it prevents the return of the disease. M. Sauvageon's cocoons were the object of the greatest admiration at the *seance*. Amongst the quantity sent by him for examination, none were found wanting in any one quality required for the manufacture of the finest and most brilliant silk. The method of treatment followed by him was simple enough. He placed the silkworms on an insulated iron plate, directing the electric current full upon the insects. In a moment they began to writhe, in their endeavours to escape from the effect of the current. This lasted about ten minutes, at the end of which time, on being replaced on fresh leaves, they began to work with astonishing industry and vigour.

PARAIBA, BRAZIL.—The undeveloped resources of Paraiba are great. Immense quantities of fine woods particularly adapted for furniture exist There are various gums and oils. Gum benzoin, or benjamin, is used in the churches; but the method of collecting it is so impure, as to unfit it for an article of commerce. There are vast tracts of sandy soil, upon which only two shrubs spontaneously grow, and these in boundless luxuriance. The Mangaba (*Hancornia speciosa* of botanists), whose sap becomes, upon exposure, a kind of elastic gum or rubber, but which has not been in any way applied to use; and a shrub with berries, called Battputa, from which a vegetable oil is expressed, much esteemed by the people, who give it the preference to olive oil for culinary purposes. These are but a few items of the resources of Paraiba, one of the smallest provinces of the vast empire of Brazil.

THE TECHNOLOGIST.

RATTANS AND THEIR USES.

BY ARTHUR ROBOTTOM.

One of the most useful of the many wild products of the Eastern forests are the canes known as Rattans, which are now so largely imported and used for a variety of economic purposes. It was only in the early part of this century that the first importation took place, and it is but very recently that they have formed any considerable item in the commerce of the country. As comparatively little is known respecting the origin, sources of supply, and general application of these canes, some few observations thereon may not be without general interest.

The species of *Calamus* yielding the different kinds of rattan, or cane, have little of the appearance of palms (although belonging to that family of trees), as they are usually remarkable for their weak and trailing stems, which often extend to a great length, and ascend the loftiest trees. It is these long stems which, when divested of their sheathing leaves, form the canes of commerce—some so much admired as sticks; others for their flexibility, conjoined with tenacity. These, when their smooth and shining dense outsides are separated in strips, are universally employed for caning the bottoms of chairs, of couches, and for other articles. Some are occasionally twisted into ropes, in the localities where they are indigenous; but they are more generally employed as canes and sticks, and for mat-making and cane work, as their great strength allows of such narrow strips being employed as to admit of large spaces being left, and thus enables strength to be combined with lightness and free ventilation.

The native who collects rattans proceeds into the forest with his parang, or bill-hook, and cuts as much as he is able to carry away. His mode of procedure is this:—He makes a notch in the tree at the root of which the rattan is growing, and, cutting the latter, strips off a small portion of the outer bark, and inserts the part that is peeled into the notch. The rattan now being pulled through as long as it continues of an equal size, is by this operation neatly and readily freed from its epidermis. When the wood cutter has obtained by this means from 300 to 400 rattans—being as many as an individual can conveniently carry in their moist and undried state—he sits down and ties them up in bundles, each rattan being doubled before being thus tied up. After drying, they are fit for the market without further preparation. From this account of the small labour expended in bringing them to market, they can be sold at a very cheap rate. The natives always vend them by tale; but the European residents and the Chinese sell them by weight, counting by piculs. In India and this country they are sold by tale. The species of *Calamus*, furnishing the rattans of commerce, abound in the islands of the Indian Archipelago, as well as in the Malayan Peninsula. The principal places of production are—Banjarmassing, Pontianak, Cotie, Sarawak, and Sambas, in Borneo; Jambi, in Sumatra; Padang, on the west coast of Sumatra; and Perak (Malayan Peninsula). The Bugis traders of Borneo barter them from the natives for various European and Chinese manufactures. The canes are then taken by these traders to Batavia, Sourabaya, Singapore, Penang, and other ports, where they are purchased by European merchants, and by them shipped principally to London and Liverpool. The majority of those produced at Banjarmassing and Cotie are bought by the Dutch East India Company, and find their way to Holland. Those produced at Perak are sent to Penang, and reshipped to London.

The whole of the rivers of the north of Borneo, for miles up, abound in rattans. A writer who had visited the coasts stated not long ago that four thousand tons might be easily cut down every year without exhausting it, and sent by junks to China and Singapore. Two or three vessels of the largest size might annually lade with them in Maludu Bay. The inhabitants would contract to cut them down for a trifle. A few species are found within the Madras territories, but in India they chiefly abound in the forests of the districts of Chittagong, Silhet, and Assam, whence they extend along the foot of the Himalayas as far north as the Deyra Doon, where a species is found which the late Mr. Griffith named *C. Royleanus*, and he applied the name of *C. Roxburghii* to the plant which Dr. Roxburgh called *C. Rotang*, common in Bengal and on the Coromandel coast. Both are called *bet*, and used for all the ordinary purposes of cane, as are *C. tenuis*, of Assam, *C. gracilis*, *extensus*, and others. These canes are abundant in all the moist tropical parts of the East, both on the Continent and in the islands.

At the Paris Exhibition of 1855 two specimens of rattans (*Calamus verus*) were shown by Mr. Layard, measuring 270 feet and 230 feet respectively. The cable cane (*C. rudentum*), a native of the East Indies, Cochin China, and the Moluccas, grows sometimes to the length of 500 feet. In the Eastern Archipelago, the native, too indolent to cultivate the soil, searches the forest for rattans, canes, barks, gums, and materials for mats, roofs, baskets, and receptacles of various kinds. The East Indian rattans imported from Calcutta are glossy, while those from the Eastern Archipelago are not glossy.

For cane work, rattans should be chosen long, of a bright pale yellow colour, well glazed, and of a small size, not brittle or subject to break. They are purchased by the 100 rattans. In China they are sold by the picul (133⅓ lbs.), which contains from nine to twelve bundles. Such as are black or dark coloured, that snap short on their being bent, should be rejected. The imports of rattans into this country, it will be seen from the statistics appended, vary — ranging from one to one and three-quarter million bundles annually, but are on the increase. The Dutch Trading Society import about 400,000 bundles annually from Java and the Indian Islands, while about half as many more are imported and sold in Holland by private merchants.

In Japan all sorts of basket work are made of split cane, and even cabinets with drawers. Cane is also platted or twisted into cordage, and slender fibres are made to answer the ordinary purposes of twine. It is stated that in China, as also in Java and Sumatra, and indeed throughout the Eastern Islands, vessels are furnished with cables formed of canes twisted or platted. The species employed for this purpose is probably the *Calamus rudentum*, of Loureiro, which this author describes as being twisted into ropes in these Eastern regions, and employed, among other things, for dragging great weights, and for binding untamed elephants. So Dampier says: "Here we made two new cables of rattans, each of them four inches about. Our Captain bought the rattans, and hired a Chinese to work them, who was very expert in making such wooden cables. These cables I found serviceable enough after, in mooring the vessel with either of them; for when I carried out the anchor, the cable being thrown out after me, swam like cork in the sea, so that I could see when it was tight—which we cannot so well discern in our hempen cables, whose weight sinks them down; nor can we carry them out by placing two or three boats at some distance asunder, to buoy up the cable, while the long boat rows out the anchor." The tow-ropes mentioned by Marco Polo, as used by the Chinese for tracking their vessels on their numerous rivers and canals, seem also to have been made of cane—and not of bamboo, as sometimes stated—as they were split in their whole length of about thirty feet, and then twisted together into strong ropes, some hundred feet in length.

Mr. G. Bennett says, in his "Wanderings," ii. p. 121, "that he remarked some Chinese one morning near Macao, engaged in making very durable ropes from rattan. The rattans were split longitudinally, soaked, and attached to a wheel, which one person was keeping in motion, whilst another was binding the split rattans together, adding others to the length from a quantity he carried around his waist, until the required length of the rope was completed."

Rattans are also occasionally used in India for making bridges, as described in the following passage extracted from Dr. J. D. Hooker's Himalayan Journals:—"Soon after crossing the Rungmo, where it falls into the

Rungeet, at a most wild and beautiful spot, I saw," says the enterprising traveller, "for the first time, one of the most characteristic of Himalayan works of art—*a cane bridge*. . . . A fig-tree, projecting over the stream, growing out of a mass of rocks, its roots interlaced and grasping at every available support, formed one pier for the canes; that on the opposite bank was constructed of strong piles, propped with large stones; and between them swung the bridge, about eighty yards long, ever rocking over the torrent (forty feet below). The lightness and extreme simplicity of its structure were very remarkable. Two parallel canes, on the same horizontal plane, were stretched across the stream; from them others hung in loops, and along the loops were laid one or two bamboo stems for flooring; cross pieces below this flooring hung from the two upper canes, which they thus served to keep apart. The traveller grasps one of the canes in either hand, and walks along the loose bamboos laid on the swinging loops: the motion is great, and the rattling of the loose, dry bamboos is neither a musical sound, nor one calculated to inspire confidence, the whole structure seeming as if about to break down. With shoes it is not easy to walk, and even with bare feet it is often difficult, there being frequently but one bamboo, which, if the fastening is loose, tilts up, leaving the pedestrian suspended over the torrent by the slender canes. When properly and strongly made, with good fastenings, and a floor of bamboos laid transversely, these bridges are easy to cross. The canes are procured from a species of *Calamus;* they are as thick as the finger, and twenty or thirty yards long, knotted together, and the other pieces are fastened to them by strips of the same plant. A Lepcha, carrying 140 lbs. on his back, crosses without hesitation, slowly but steadily, and with perfect confidence."

Rattans form a very important article of trade in Singapore, Penang, and Batavia, where large quantities are sold for the Chinese ports. In the half-yearly report of the return of the trade of Shanghai, for the first six months of 1860, we find in the imports 4,365 piculs of rattans, and 98 piculs of rattan ware. This would be equivalent to about 104,760 bundles annually for that port alone, exclusive of the numerous others with which trade is carried on. The Chinese apply them to a great number of purposes, especially for cordage; and they are also split into various strips and sent to England, where they find a ready sale. Door mats are made of them by the Chinese; chairs, baskets, and beds; and they build houses or sheds in the south of China of them, for about five dollars each house.

Within the last three years the Americans have been very large buyers of rattans, and one vessel carried nearly 500 tons to New York—I believe, principally for stiffening ladies' petticoats or crinoline hoops. The most important uses that they have been applied to in England are for caning chair bottoms and gigs, whips, stays, stiffening bonnets, boys' caps, for crinoline petticoats, dyed for the ribs of umbrellas, sold in sets of eight; for saddles, and for skips or large baskets. The writer having suggested to Messrs. G. W. Reynolds and Co., of Birmingham, that these canes might be advantageously used for the manufacture of the wicker work baskets for protecting sulphuric acid bottles, several of the leading acid makers were applied to for orders, and the result was of the most satisfactory nature, and has led to a large business. Messrs. Reynolds, assisted by Mr. Dance, thereupon put up machinery for making the baskets, and have protected the same by patent. The manufacture of these baskets is likely to prove one of the greatest boons to the sulphuric and other acid manufacturers, as the old willow baskets are a continual source of annoyance; for when the acid is spilled upon the willow work, it soon becomes rotten, and hence the carboys are frequently broken. The rattans having a large amount of silica on the outer bark, the acid has no effect upon them, and the baskets appear as good after three months' wear as when first made. This species of covering is especially suited for protecting carboys of acid intended for exportation.

Rattan skips are now also superseding, in cotton factories, those made of willow, buffalo hide, &c., having the advantage of durability, smoothness, and elasticity; and the saving to some of the large cotton spinners will be immense. Some estimate of the gain may be formed from the fact, that the cost of a stock of skips, or baskets, to one cotton manufacturer, is £2,600. These skips are also made in very large quantities by Messrs. Reynolds and Dance's patent machinery.

The numerous economic uses to which rattans might be applied in this country are scarcely yet developed. They might be employed with advantage for baskets for fruiterers, gardeners, bucksters, hosiers, potters, and grocers; for coal baskets and clothes baskets; for the cars of balloons; for rustic and garden chairs; for lattice work; for meat safes; for rough door matting and brooms, and very many other purposes. The present wholesale price of rattans is 2d. to 3d. per lb.; and, notwithstanding the great distance they are brought, they are sold as cheap in the London and Liverpool markets as in China. In contrast to this, and as showing the benefits of extended commerce, I may state that a working whipmaker remembers rattans costing 3s. per lb., when whalebone, which was used for the same purpose, was sold at 1s. per lb. From Java 80,000 to 90,000 piculs of rattans are exported annually, and from Siam about 200,000 bundles.

The exports of rattans from the Straits settlements, including Sarawak, for the last three years, have been as follows, in piculs (of 133⅓ lbs.) :—

	1859	1858	1857
To Great Britain	27,171	15,204	6,115
,, Europe	4,779	5,922	7,302
,, United States	14,011	17,536	5,475
Total	45,961	38,662	18,892

Assuming 12 bundles to the picul, this would give an aggregate of 551,532, 463,944, and 226,704 bundles respectively. Three qualities of rattans are quoted in the Singapore prices current, and the following were the prices by the last advices, Oct., 1860:—Loontie, 4 dols. 10 cents. to 4 30; Cotie, 3 to 3½ dols. per picul; and Straits, 1½ to 2½ dollars.

The following shows the number of rattans imported into the United Kingdom in the last six years :—

FROM THE	1853	1854	1855	1856	1857	1858
Hanse Towns	...	176,030	176,030	272,450	619,090	...
Holland	2,456,130	2,072,410	255,125	3,790,405	4,246,425	898,241
Sumatra	...	...	...	...	275,822	462,160
Java	1,680,356	1,780,547	1,265,299	127,017	838,056	587,877
Borneo	...	...	...	...	...	413,653
British East Indies	6,499,843	8,784,830	6,160,281	3,588,769	4,082,019	15,482,893
Other parts	71,925	209,340	58,426	62,060	302,346	780,544
	10,708,254	13,023,157	7,915,161	7,840,701	10,363,758	18,625,368

The computed real value is thus given in the Board of Trade returns :—

1854	£15,736	1857	£28,501
1855	9,616	1858	38,960
1856	15,681		

In 1857 they were estimated to be worth 5s. 6d. per 100; in 1858, 4s. to 4s. 6d. per 100. In 1854 they were only worth 2s. 5d.

Birmingham.

ON THE NATURAL HISTORY OF THE PEARL OYSTER OF CEYLON.

BY E. F. KELAART, M.D., F.L.S.

The Condatchy Bank, which was reported to contain in 1857 large quantities of oysters in shallow water (three fathoms), does not at present contain many matured oysters. A few only of a middle size are found there. But in deeper water, near the former bed, oysters of various sizes are found in small clusters on stones, and a few large ones attached to sea-weeds. This looks as if the oysters are spreading into deep parts of the sea. There not being a sufficient quantity of large oysters in this bank, I have not been able to determine what quantities of pearls these oysters yield. One out of about twelve opened, contained a few small pearls. A few small oysters are found scattered in various parts of the sea, in all depths, but it will be years before large beds can be formed from these scattered ones. The Cheval Paar Bank, fished this year, has, in my opinion, oysters of two different ages, but so intermixed one with the other, that it is impossible to fish for the larger, without bringing up also the smaller ones. The proportion of small to large ones is, in some parts of the banks, one to three; in other parts, as one to two. I totally differ in opinion from the Adigar of Manaar, as to this number of small oysters being of the same age as the larger ones. His comparison of them to "small men and women, and large men and women, though of the same ages," may hold good in a few cases. But when we find so large a proportion of oysters, whose shells and internal parts positively demonstrate their youth, I am certainly disposed to place more confidence in my own opinion, and that of the Maniagar of Jaffna, and natives who are purchasers of the oysters; viz., that the oysters found in this bed are of more than one age. The oysters whose growth has been stunted have very different characters; their shells are thick, and there is not the same length of pliable edge which young oysters have; the adductor muscle and other parts of the oyster bear also the marks of age. The muscle is hard and stouter, in the adult, and further removed from the hinge; the foot is firmer and more speckled, and the groove under the foot is irregular; the liver cuts firmer, and the nacreous part of the shell has a thick edge in the adult oyster. The fact that good pearls are also found in these second-sized oysters, does not show that they are as old as the larger ones. There are other cases which doubtless come into operation here, part of which only can, in this second stage of my inquiry, be demonstrated. The presence of a worm (a species of filaria) found in the oysters, has, I am positive, much to do with the formation of pearls. I would rather reserve this part of my investigation for longer experience. But this much I can say at present, with perfect safety, that whenever I found good pearls in a batch of oysters, I found this worm and its eggs in large numbers in the liver, ovary, mantle, and other parts of the oyster. My researches here have quite proved to me, and will also prove to others, who will carefully and without prejudice examine for themselves, that the ova of oysters and the ova of worms form the nuclei of many pearls found in the soft parts of the animal, and that sand, portions of sea-weed, larva of insects, &c., form the nuclei of the shell pearls, or pearls attached to the shell. I have specimens demonstrating this even to the naked eye.

It was the celebrated Sir Everard Home who, I believe, first started the doctrine of eggs being the nuclei of pearls. But this theory has been contradicted by other writers. I have, however, in my report of last year, stated how escaped ova could readily form such nuclei; and now I have the pleasure of announcing to the scientific world, that I found the ovaries of a pearl oyster filled with pearls of various size and shape. I have preserved the specimen for transmission to Professor Owen, to be by him placed on the shelves of the Museum of the Royal College of Surgeons, as a proof of the accuracy of the late Sir Everard Home's doctrine, which has for many years been exploded. I obtained from one of the ovaries as many as thirty-two pearls, and the other egg bag, still unopened, seems to contain as many more.

It will now, indeed, be a curious question, where the pearly matter forming the pearl found in the ovaries was derived from. Sections of these pearls show the same form of nuclei as pearls found in some parts of the mantle; and the large irregular ones have more than one such nucleus. The mantle was found adhering to the ovaries as if it was the result of adhesive inflammation. And, as the mantle is acknowledged to be the secreting organ of pearly matter, could this matter have been introduced into the ovation? or is it likely that other parts of the oysters, such as the walls of the ovaries, occasionally secrete pearly matter under abnormal circumstances? It will be premature now to decide upon this interesting physiological subject.

The Modregam Bank, which is intended for fishing next year (1859) contains oysters in clusters of three, four, or five, attached to each other. In most parts of the bank the clusters are formed of oysters of the same size, but, in other parts, oysters of various sizes are clustered together. In one or two places, very small oysters adhere to larger ones ; some of these small oysters could not be more than a few months old. This is a very favourable sign. Very rarely, indeed, was a young oyster fished up this year in the Cheval Paar Bank. This difference leads us to an inquiry of a very practical nature, which may, perhaps, require years for its solution ; viz., why there are so few young oysters in the old banks ? What became of the spawn, which even middle-sized or young oysters certainly have ? Are the spawn of young oysters of speedy decay ? Analogy leads me to think that the progeny of the old oysters are more likely to reach maturity. This, indeed, will form the subject of further inquiry, particularly as in banks, in shallow water, oysters of all ages are found together. It is reported to me that, some years since, the clusters found in the Modregam Bank were formed of more oysters ; if so, it is natural to conclude that, as oysters grow large, they detach themselves and form clusters. Their faculty of doing this, I have proved, by my investigation in Trincomalie, which is recorded in my report of last year. The larger oysters of the Modregam Bank are at the present moment of about the same size as those fished this year from the Cheval Paar, but there are other marks of difference of age about them, which make me inclined to believe that they are younger than the larger sized oysters found in the Cheval Paar. The shells of the generality of them, although broad and long, are very thin. These oysters also have the worm above mentioned. But I have not been able, as there is no fishery of this bank, to open a sufficient number, to ascertain what is the relative proportion of pearls to the worms found. The pearls I have found in these oysters are in general small, less irregular shaped, of a whiter and more brilliant lustre than the pearls found in the Cheval Paar oysters. The superintendent of the pearl banks has washed five or six thousand of these oysters, but I have not yet ascertained the result of this washing.

Had there been inspections by the inspectors, of other parts of the sea during my stay here, I could perhaps have ascertained many other facts. But as the inspector has neither time, nor can I, single handed, without boats, find out other banks with oysters, I must hope for other opportunities. It would have been more satisfactory to have extended my researches to large banks with smaller oysters than at present found in the Cheval Paar and Modregam ; but as there are no such banks known, even to the inspectors or native headman, my observations have been so far limited. But as I hope that Capt. Higgs and his assistants will bring to light other banks before next year's fishery, I may have the opportunity then of completing my researches, and bringing them to a conclusion.*

* Mr. Vane has inspected the banks in October last and found extensive beds of young oysters. These young oysters are not likely to be fit for fishing for the next

Suggestions for the better Preservation of Pearl Oysters.—Being convinced from what I have seen, heard, and read on the subject of pearl banks, that the method of fishing them from one end to the other, and only leaving small patches, or detached masses behind, is not the most likely one of keeping up the breed of oysters, or rather of encouraging the formation of banks worth fishing, or from whence even a moderate revenue could be derived; I have therefore advised Mr. Vane, the superintendent of the pearl banks, to reserve a portion of the bank, say alone half a day's fishing, for breeding purposes; in fact, to do that as a rule which he, to use his own words, "unwillingly" did last year. Owing to bad weather and other causes, the fishing was brought to a conclusion sooner than intended, and, consequently, a tolerably large part of the bank was left unfinished.

As Mr. Vane and Capt. Higgs, the inspector, while agreeing to do what I recommended, have thought proper to r l ı ei r dissent from my opinion on this subject, I shall briefly give, in writing, my reasons for making this proposal, as I have already done verbally to the superintendent and inspector, I regret to say, without convincing them.

It is my opinion, and that also of abler men, that while oysters have no sexual differences, the ovaria of some secrete a seminal fluid, and that this fluid is the fertilising fluid; or, to use a popular phrase, there are male and female oysters; and as I have found the former bear a very small proportion to the latter, having frequently examined fifty oysters without finding a single one with the seminal fluid, I believe, therefore, that the chances of females reaching the influence of males, will be far greater in a large portion of oysters than in small ones.

Supposing even that fertilised ova are formed in small clusters of oysters, such as those which Capt. Higgs and others allow to remain in the banks after fishing for the season, these eggs, comparatively small in number, are likely to be drifted about in various directions, their contiguity destroyed, and they are likely to settle down in small numbers in various parts of the sea; but it may take many years, till the patience of Government is exhausted, before, by the aggregation of small clusters, a large bank be formed out of these small original elements. The contrary is observed, when the ova proceed from a large area—the spawn is seen floating in hundreds of yards, and wherever it settles large banks must be formed; and the history of the banks now being fished, and the one to be fished next year, show that they were formed by large deposits of oyster spawn, and not by the gradual introduction of small quantities. When the condition of the small banks of Trincomalie is compared with that of the larger banks of Arripo, the cause of the difference is very evident.

There have been for years no deposits of spawn in large masses in these waters; and why? Because for years these banks have been fished on the old plan, a plan older than the period when Cleopatra obtained the famous pearl, and under which plan and regime the banks of the Red Sea,

four or five years. It is therefore to be hoped that older beds will soon be discovered.

North America, and India failed, and are now mere matters of history. And I must add, that under this plan the Negombo, Chilaw, and Calpentyn Banks were lost to the Ceylon Government, and this plan, long pursued by Capt. Steuart, terminated in the failure of the fisheries at Arripo for nearly twenty years. Would it do now, when science has thrown some new light on the subject, to persist in what is objectionable? Capt. Higgs may say, he leaves a sufficient number of oysters, perhaps even a larger number that that which can be found in the patch which he has reluctantly spared for this year; but in what condition will he leave the small clusters? In a condition anything but natural. It is true, that the oysters I have shown him were in spawn, but he did not wait until I could explain to him under what conditions the oyster spawn could come to maturity, or become fertilised. I have reason to believe, that the injury done to the bank by the divers, and the anchors of their boats, has a fatal effect from which it does not recover for years.

In my former report, I stated that the oysters will die, if the water is impure. Now, let us examine what takes place, when the divers have kicked, splashed, and torn everything before them while in the water. Not only do some oysters left behind die immediately, but other molluscs, Zoophytes, and sea-weeds die, and must necessarily stagnate the water at the bottom of the sea. The result of all this must be, the gradual dying off, not only of the oysters left on the bank, but also of the young. I have seen sufficient numbers of fresh dead oysters brought up, from that portion of this year's bank already fished, to show what the higher rate of mortality must be in a very short time. Capt. Higgs, in his letter to the superintendent, states that the oysters I thought had died since the fishery began, looked as if they had been recently opened. The matter is too serious to remain uncommented on, and I take this opportunity of giving the *post mortem* appearances of gradual decay of oysters, and those dead from death caused by the divers or other men in the boat, killing an oyster with the hope of obtaining pearls. When an oyster dies, the two valves of the shell remain for months united at the hinge. When an oyster is opened, the valves are disunited. The so-called recently opened shells, brought up from the fished part of the pearl banks, had all the shells with the valves united at the hinge; a few were separated by me after they were brought into the boat.

I have recently gone through most part of the bank fished last year, in company with the Maniagar of Jaffna, and was not surprised to find grounds of oyster shells of all sizes, and dead shells of so young oysters as to be considered of one or two year's growth. From amid this wreck and ruin, the divers brought up occasionally a large live oyster, but not small ones. But on coming to that part of the bank which was "unwillingly" left unfished last year, the oysters were alive and in good condition, and very rarely was a dead shell brought up. I have also gone through many of the parts of this year's banks, and found, wherever the divers have been, there were many dead shells, and only a few dead ones were obtained from those parts which have not yet been fished.

When we examine the old method pursued in pearl fisheries, we must acknowledge it to be sadly defective, as too much is left to the divers and the interests of native headmen. Sixty or more boats, manned by ten divers each, are sent on a bank to dive for oysters. The divers go on, from day to day, fishing up oysters from one end of the bank to the other, and, after the whole bank is gone through, a large number of boats are employed for two or more days to go over the bank again; and it is only when the boats do not bring up a remunerative quantity that the fishery is closed. By this method the quantity of oysters left cannot be regulated. It all depends on the diver's exertion. In some fisheries, a large number may in the aggregate be left in small patches, or single ones widely scattered. But it will happen, sometimes, that very few are left. The quantity cannot be well regulated by the inspector or his assistants, for all the information is got from the divers, who are interested in giving a false impression. Whereas, by buoying out a portion of the bank at the commencement of the fishery, the inspector can calculate, almost to a nicety, the quantity he reserves for reproductive purposes. Surely it is not too much to claim for this wise purpose 1-40th portion of the bank.

For the sake of meeting the objection of some to my plan, on the score that I cannot be sure of the spawn proceeding from one bank being deposited on the banks of Arripo, I would ask them where did the spawn which formed the oyster banks of Arripo come from? The answer given is, I believe, that they came from a distance—from banks unknown. Supposing this to be really the case, are we not to reciprocate the benefit? How are other banks from whence Ceylon derived the spawn to be kept re-forming, if we do not preserve our banks on reciprocal principles. My opinion is, that while some of the spawn is carried to some distance, other portions find prepared beds in the neighbourhood of the old banks. To no other conclusion can we come, if even we only consult Capt. Steuart's maps, on which are inserted the dates of fishing, and the distance of one fished bank from another.

Arripo, *March*, 1858.

The oysters fished this year (1859) at the Cheval Paar Bank, and the oysters fished on other parts of the Cheval in the years 1857 and 1858, appear to me to have been the product of the same brood of oysters, though deposited in various seasons of the same year; *i.e.*, that they were derived from the spawn of the same year, and that the general difference of size in the oysters is no more than what may be expected in oysters developed in various periods of the year, or within one twelve months. The oysters formed from the spawn deposited in the months of January or February, will, *cæteris paribus*, be of larger dimensions than the oysters developed from spawn deposited in the months of Nov. or Dec. following. This is very evident in the great difference observed in the various large masses of young oysters found this year in the Cheval Paar Bank, and which doubtless have been deposited since the fishery of 1858, when, if these extensive beds of young oysters had existed, the numerous native divers employed could not have failed to have seen them. These beds were first observed by Mr. Vane, and Capt. Duncan, of the colonial steamer "Pearl," in Oct., 1858, when none of the young oysters (judging from the shells Mr. Vane sent to me for examination) could have been more than six or seven months old; most of them under six months.

The observations made on the shells of the fisheries of 1857, 1858, and 1859, lead me to infer that the fishery of 1857 was premature. The same series of observations led me to conclude that the last fishery of the Cheval Paar oysters, in March, 1859, was the latest safe period that oysters could have been left unfished in this bank, and that these oysters could not have been less than seven years old. The general appearance of the shells, their weight, and the characters of the internal soft parts of the oyster, showed very distinctly to one who has carefully observed the oysters fished in 1858, that the oysters of 1859 were older, and near the termination of their life. These external and internal characters will serve for guidance hereafter to all employed in the pearl fisheries of Ceylon, and will be faithfully detailed in my final report, or treatise, on the natural history of the pearl oyster. In the meantime, I can assure those sceptical of the possibility of the zoologist determining the age of the oyster, as the veterinary surgeon does the age of the horse, by looking into its mouth, that the age of the pearl oyster can only be determined satisfactorily by looking into the contents of its two valves, and remarking the characters of the internal parts, and their relative position in different periods of their life. I am only waiting for some more information on this head, before full particulars are laid before Government. In such an important matter, a zoologist cannot be too cautious in giving an opinion, which, if found hereafter to be erroneous, may not only affect his reputation, but likewise make the Ceylon Government a pecuniary loser. It is my object and wish to give, at the conclusion of my labours, such rules for the guidance of future inspectors of pearl banks (who, I hope, will be intelligent persons, with even a little taste for natural history), that the pearl banks of Ceylon will have, in future, less chance of being prematurely or over-fished.

From information conveyed to me by Mr. Worsley (the late inspector), and the English divers employed under him, I find that I was quite correct in stating, in my former reports, that the rude and rough process of native diving caused the destruction of the old oysters. No old oyster was found in that part of the Cheval Paar Bank fished in 1857 and 1858, and, as there were many oysters left there at the end of those fisheries (though not in aggregate masses), it is natural to infer that, had they not been disturbed, some of them would have lived as long as oysters brought up this year from unfished portions of the same Paar, which, doubtless, were of the same ages. It follows, therefore, that my proposal to leave portions of banks unfished, for breeding purposes, is a justifiable one, and of great practical importance. From the prevalence of cholera, the fishery of 1858 was abruptly stopped, consequently large masses of oysters were left unfished, in portions which divers had not worked. How large this quantity, so fortunately reserved, must have been, can be imagined, when it afforded a revenue the following year of upwards of £1,900.

I have no doubt in my own mind, that the myriads of young oysters now found in the Cheval Paar, were formed from the spawn of these reserved oysters. He would, indeed, be a bold naturalist, who, in order to establish a favourite theory, would maintain that the spawn floating about the sea and derived from banks far off, found a resting place last year on the Cheval Paar, when he finds, contrary to former observations, that the majority of the old oysters were covered this year with young ones of from four to twelve months' growth, and that few of the old oysters examined contained eggs in their ovaries or genital glands. At the end of the fishery of 1858, the oysters on all the banks were in a most favourable condition for the multiplication of species and replenishing the seas. The ovaries of all the thousands of oysters examined by me were full of spawn, or spermatozoa.

Owing to the reappearance of cholera this year also, a very large quantity of matured oysters, full of eggs, were left unfished in the Modregam Bank, and it is to be hoped that no unforeseen or untoward circumstance will prevent the spawn of these oysters being deposited in or near the already known banks. Whether the divers detect this expected new brood or not, the Ceylon Government may feel assured that the product of the spawn will not be very far off the present Modregam; at all events, it will be a very satisfactory result if these oysters, too, after performing their natural functions, yield next year a revenue of £20,000. Had cholera not prevailed, this amount would probably have been added to the already collected revenue; but then the millions of young oysters which the old ones are likely to have produced would have been lost. Now, there is a very fair prospect of not only securing the value of the old oysters, but a new generation of the species for future years, when this colony may be more in want of money than at present.

The future prospects of the Pearl Oyster Banks are very brilliant indeed, although the fisheries (after the probable one of next year) are not likely to be resumed before the year 1864. It does not appear on record that such numerous and extensive deposits of young oysters were ever known to exist, in almost one continuous layer, as the two intelligent and skilful English divers have discovered this year on the banks of Arripo. There were few oysters fished this year on the Cheval Paar that had not from ten to twenty or more young oysters attached to their upper shells. On one *pinna* (fan shell) I counted as many as sixty, and on one piece of coral, about two feet in circumference, there were at least 300 one-year old oysters. At the lowest calculation, the quantity of young oysters now on the Cheval and Modregam Banks, according to the reports made by the divers, cannot be less than fifty times as many as were fished during the last three fisheries. If, then, even half this number arrive at maturity, and reach the age of six or seven years, the revenue that will be derived from this source (if present prices are maintained) will be more than sufficient to pay the cost of the Ceylon Railway. But I shall not be performing my duty as naturalist if I do not also place before the Ceylon Government the dark side of this bright future. The mortality among oysters from natural and violent causes is very great, as has been observed in small banks in Trincomalie harbour. Scarcely half of them reach the third year. The ratio of mortality decreases after that, and among older oysters it is probably not more than five or six per cent. per annum, until they arrive at the last year of their existence, when they die off very rapidly; so that it cannot be expected that more than a fourth or fifth of the young oysters discovered this year on the banks of the Arripo, will live to maturity or to the age fit for fishing. Even this is a good prospect for the future, but there are other causes which may operate in diminishing this number. Oysters, particularly the young, are likely to be smothered by sand. Although the divers report that there is scarcely any ground current on the bank, there is reason to believe that at some seasons the force of water is increased, and that oyster banks may be partially covered over by sand or sea mud. I have no doubt in my own mind that the sudden disappearance of young oysters from banks is owing, sometimes, to these sand or mud deposits. I have seen the fatal effects of even a few inches of sand on my artificial beds in shallow water; and that such deposits will kill even old oysters is evident, as I have ascertained that they cannot live for more than a day or two when thus covered. That such sudden deaths do occur on the Pearl Banks of Arripo is more than probable, from the fact that the divers frequently bring up large quantities of dead oyster shells of all sizes from parts of the sea where no living ones were found the year before; and sometimes, when I have asked for sand or mud, they brought up oyster-shells with it. The natural inference follows, that living oysters were at one time buried under the sand, and that, subsequently, the sand being washed away, the shells were left exposed. This I have observed in the harbour of Trincomalie, where some clusters of oysters that I translated had disappeared, but in a few months their shells were discovered on the spot where they had lived.

Recent observations corroborate the statement I had previously made, that Pearl oysters exert their locomotive powers frequently, and that in the act of doing so they may be washed away to some distance, while their progress is only arrested by meeting with impediments, such as a stony surface or shell, and that there, after a time, they refix themselves by forming new beards. One of the reasons of the oyster casting off its beard is, doubtless, that it may form a longer one more suited to its enlarged body. If we consider that the beard (fibres so called), when once formed, does not grow longer or thicker, the fact is of importance to the naturalist who first maintained that oysters change their position by casting off their old beards, or cables, and forming new ones. In old oysters a young beard is not found.

A deficiency of hard substances, on which the oyster can reattach itself, must sometimes occur, from either a natural scarcity of coral, stones, or shells; or from these substances being covered over for a time with sand. This, probably, is also a temporary hindrance to the formation of new banks. Taking all these well ascertained circumstances, and also the probable ones, into consideration, I have to propose to the Ceylon Government not only the adoption of M. Coste's plan of placing fascines on oyster-beds, for the collection of the spawn, but that a barrier be placed round each bank, in order to prevent the oysters from being forced away by currents or other causes, to regions unknown.

That young oysters will attach themselves to any hard substances placed in the sea, cannot be doubted. An iron boat anchor accidentally dropped over-board during the fishery of 1857 was brought up this year by one of the English divers, covered with young oysters, and in my experiments at Trincomalie, I found that even very old oysters will reform their beards and refix themselves to old shells, wood, iron, coir matting, zinc plates, cocoa nut shells, chatties, &c. The piles supporting the piers in the harbour are covered with young edible oysters. We have thus every encouragement for the adoption of the method I beg to suggest, for the future conservation of the pearl banks of Ceylon and India.

The plan proposed, is, to girdle or barricade the oyster banks with coir matting supported on iron frames, and placed round each bank about ten yards beyond the edge of the oyster bed; fascines, dead oyster shells, corals, &c., being deposited between the barricade and the edge of the bank. The interspace will allow of sufficient room for the roaming disposition of the oysters; and the impediments thrown in their way will give new surfaces for their attachment, while at the same time they will form a sufficient barrier to prevent the oysters escaping to distant parts of the sea, where they would not readily, if ever, be found again. This barricade of coir and iron, with the fascines, will also attract and fix any spawn that may be floating about. I placed, last year, with the aid of the English divers, a few wicker work and coir fascines, or rather cages, on both banks, and I shall be very glad to have their condition examined and reported upon by the divers, after their next inspection of the banks.

It will be of little value to carry on any experiments of the above kind, in Trincomalie harbour, for the nature of the Arripo banks is very different, and the influences of the sea on the two banks are not the same; I have, therefore, to propose, that before Government decides upon any plan, a fair trial of it be made in one of the Arripo banks; say, even on one of those large scattered masses of young oysters near the large banks—a trial of six or twelve months will, perhaps, be sufficient to test its value.

Before concluding this report, I have another proposal to submit for the better preservation of oyster beds.

It is now quite established, that young oysters will live after being once removed from the sea. I had the pleasure of exhibiting to his Excellency the Governor, when he visited Arripo during the last fishery, a quantity of young oysters living attached to a glass vivariam. These I had picked up at the Coottoos, after they had been out of water for more than four or five hours. It is therefore more than probable, that young oysters detached from the old ones during a fishery, if properly cared for and translated to some favourable parts of the sea, will live and grow to perfection. But to do this satisfactorily, there must be some well organised system adopted in future. It was lamentable to see the myriads of young oysters committed to almost certain destruction by the divers throwing them overboard immediately under the boats, and in the very places where the diving stones were crushing and bruising the delicate creatures. On my representing the matter to his Excellency the Governor and to Mr. Tane, the divers were ordered to desist from this cruel and destructive practice, and to collect the young oysters (of which I should say that there were more than two millions brought up daily from the Cheval Paar banks), and after the day's fishing to deposit them in a part of the sea (previously buoyed out by the inspector), as the boats were leaving the banks. From the want of proper officers to see this order carried out, I fear many hundreds of young oysters met with an untimely end. To avoid this in future, I would suggest, that every preparation be made beforehand, for the safe removal of the young oysters, whenever they are found to be attached to old ones brought up by the divers. Let each diving boat be provided with a large basket suspended in the sea from the side or stern of the boat, and let strict injunctions be given, and the divers compelled, carefully to remove the young oysters from the old, and place them in these baskets, which can be emptied into any part of the sea previously selected by the inspector. Or let boats be employed during the diving to collect the oysters for deposit elsewhere.

For the better security of these young oysters let the part selected for the formation of a new bed be surrounded with coir matted fascines, and let the part so selected be ascertained to have a large quantity of coral and dead shells, that the young oysters may not be forced away from the spot owing to the want of holding ground.

In conclusion, I beg to observe, that although my plans may appear chimerical, especially the one of girdling or barricading banks in six or seven fathoms of water, it will not appear to be so impracticable, if the service of the English divers now in the island are made available for the purpose. Nothing of this kind should seem impossible to a nation that can lay down wire cables across the Atlantic or in the beds of the Red Sea and Persian Gulf. The expense likely to be incurred is very trifling, compared with the value of the oysters that may be preserved. The present market value of a bed of pearl oysters, two miles in circumstance is, say, from £30,000 to £40,000 and the expense of fencing a bed of this size cannot be more than £200, or say £300. If, then, the experiment I have proposed should prove successful, such an outlay is too small to deter any Government from undertaking the work on a greater scale. I hope that the presence of young oysters in such large quantities on the pearl banks of Arripo will not make the Government less anxious about the better conservation of the banks. Who can tell what may happen during the next four or five years?—that many of the oysters will die a natural death, and that many more will be used as food by thousands of voracious marine animals in the interim, is a certainty; but we should not forget that there is a probability of whole masses being carried away from other causes. What may now appear likely to yield a revenue of many hundred thousands, may not produce more than a few thousands at the end of five or six years. It is time, now that the Emperor of France has acted upon the suggestion of a French naturalist, and thereby increased the production of the edible oysters of France, that the Ceylon Government should treat the pearl oysters with more care and consideration than it has hitherto done, so that the profit derived from this source may become a permanent or less fluctuating revenue, and that the plan proposed by their naturalists should be at least fairly tried, even on a small scale, before any decision adverse to it be adopted.

I have not in this paper detailed some very interesting discoveries made since my last report on the anatomy and physiology of the pearl oysters, believing that they are better fitted for a treatise on the subject, than to be embodied in a report to the Ceylon Government, which must necessarily be written in a popular form. However, as this report may, like the preceding ones, fall in the hands of scientific men, I shall merely mention here, that Monsieur Humbert, a Swiss zoologist, has, by his own microscopic observations at the last pearl fishery, corroborated all I have stated about the ovaria or genital glands and their contents; and that he has discovered in addition to the filaria and circaria, three other parasitical worms infesting the viscera and other parts of the pearl oyster. We both agree that these worms play an important part in the formation of pearls; and it may yet be found possible to infect oysters in other beds with these gems. The nucleus of an American pearl drawn by Mobius, is nearly of the same form as the circaria found in the pearl oysters of Ceylon. It will be curious to ascertain if the oysters in the Tinnevelly banks have the same species of worms as those found in the oysters on the banks at Arrippo.

Trincomalie, *Ceylon*, 1859.

NEW EDIBLE ROOTS.

BY THE EDITOR.

It is surprising how little we have experimentalised in this country upon new edible roots, which might come in as useful aids to the potato for food purposes. But two or three attempts are all that we can call to mind; and yet the field of research is a wide and a promising one, especially now that our trade with foreign countries, and quick steam navigation, places so many tuberous-rooted plants within our reach for trial and cultivation. The attempt to introduce some one that might prove suitable to our climate, and enlarged by cultivation, is surely a patriotic one, and within the means of any enterprising cultivator who chooses to give himself to the task.

The introduction and success of the common potato is an example worth following. Two centuries and a half ago this root was recommended by old Gerarde, in his "Herbal," to be eaten as a "delicate dish," but not as a common food; and within little more than a century, its culture has been so extended over the United Kingdom, Europe, and America, that it has not only become a *common* food, but the various economic uses to which it is applied are almost infinite. And yet, if we trace it to Chile and Peru, we shall find that in its indigenous condition it bears but a poor resemblance to the magnificent tubers resulting from continued careful cultivation.

Protracted nursing has alone produced such effects on wild vegetable productions as to render them our commonly cultivated plants. The large and juicy Altringham carrot is only the woody spinal root of the wild carrot, luxuriously fed. Our cabbages, cauliflowers, kohl-rabis, and turnips in all their varieties, spring from one or more species of *Brassica*, which in their natural state have poor woody bitter stems and leaves, and useless spindle-shaped roots. Our cultivated potato, with all its varieties, comes from the tiny and bitter root of the wild potato, which has its native home on the sea-shores of Chile; and our apples, plums, grapes, strawberries, and other prized fruits, from well-known wild and little-esteemed progenitors. Our gardens are full of such vegetable transformations. It is so also with our corn plants.

It is the new chemical conditions in which the plants are placed which cause the more abundant introduction of certain forms of food into their circulation; and the more full development, in consequence, either of the whole plant or of some of its more useful parts. It has been well observed that if a new plant has a chance of becoming useful in rural economy, it must fulfil certain conditions, in the absence of which its cultivation cannot be profitable. In the first place, it must have been domesticated in some measure, and must suit the climate; moreover, it must in a few months go through all the stages of development, so as not to interfere with the ordinary and regular course of cropping; and, finally, its produce must have a market value in one form or another. If the plant is intended for the good of man, it is also indispensable that it shall not offend the tastes or the culinary habits of the persons among whom it is introduced. To this may be added, that almost all the old perennial plants of the kitchen garden have been abandoned in favour of annuals, wherever the latter could be found with similar properties. Thus *Lathyrus tuberosus*, *Ledum telephium*, &c., have given way before potatoes, spinach, and the like.

Let us glance at some of the roots and tubers eaten in different countries which are worth notice. We need not specify the sweet potato, the cassava or mandioc root, the yam, and other tropical tubers which can scarcely be acclimatised here; although some may be so modified, as we have seen in the Chinese yam, as to be raised with care here. It is a curious investigation to run over the different roots that are eaten as food by various tribes and people, many of which would not be very acceptable to the dainty palates of Englishmen. Very few of the coarse fibrous yams, for instance, would find favour with those used to the mealy potato. The root of the common carraway plant, when improved by culture, resembles the parsnip, and is used as food by the inhabitants of the North of Europe.

Many of the water-plantain tribe have a fleshy rooting stem which is eatable. At the root-stock of the arrowhead (*Sagittaria sagittifolia*) there is a tuber composed almost entirely of starch. The fecula of these tubercles Martius compares to arrowroot. The Calmucks, the Chinese, and the Japanese eat these as articles of wholesome food. By the two latter the plant is cultivated for these tubercles. From the bulbous roots of the cacomite, a species of *Tigridia*, a good flour is prepared in Mexico.

The roots of several species of *Caladium* are nutritious, and furnish an abundance of food. The very large roots of *C. esculentum* and *C. arbores cens* especially furnish a great quantity of fecula. Several species of *Arum*, the same family which furnishes the indigenous Portland arrowroot, formerly held in some repute, are eaten in different countries. *A. indicum* is much cultivated in Brazil, about the huts of the natives, for its esculent stem and pendulous tuber. The roots of *Arisarum vulgare* are boiled and eaten in the South of Europe. *Amorphophallus campanulatus* is extensively cultivated in the Northern Circars, India, for its roots, which are highly nutritious. The roots of *Colocasia microrhiza*, a native of the Moluccas and the South Sea Islands, are very large, and when washed to deprive them of their acid principle, are eaten in Tahiti. *Colocasia esculenta* grows in Spain, Portugal, Sardinia, and particularly in Egypt, where it has been cultivated from time immemorial for its roots, which serve as an article of food. They contain an immense quantity of fecula, and are eaten by the inhabitants of Egypt and some parts of India as potatoes, forming the principal food of the inhabitants; their flavour is like that of potatoes. The roots of *C. himalensis* form the principal part of the food of the hill people of the Himalayas. The bay root, which grows about the out-islands of the Bahamas group, was found of great use as a food plant to the inhabitants of Long Island during a scarcity of food occasioned by the drought of 1843. The root grows in the form of a large beet, and is from twelve to sixteen inches in length. It is entirely farinaceous, and when properly ground and prepared makes excellent bread. The bulbous roots of *Ornithogalum umbellatum* have been commonly eaten in Italy, in Syria, and the neighbouring countries. Dioscorides says that it was sometimes dried, pulverised, and mixed with corn flour; and that it was also eaten both raw and washed. Lamerteus, in his "Essay on Bulbous and Tuberous Roots," states that in his time the peasants of Italy and the neighbouring countries often roasted the roots of the *Ornithogalum*, and eat them like chestnuts, or lightly boiled them, and peeled and used them as salad, with oil, vinegar, and pepper.

The French have been much more zealous than we have in this inquiry for new edible roots. Among others brought under the notice of the Academy of Sciences have been the bulbous-rooted cicely (*Chærophyllum bulbosum*), an European plant of the most easy culture, which will grow in any soil. It yields an abundance of tubers about an ounce each, very wholesome, containing 21 per cent. of starch. The turnip-formed tubers, when taken up early in the spring, are eaten in France and Germany, boiled with oil and vinegar. The roots only contain 63 per cent. of water, while the potato consists of 74 per cent. and more. We are not told, however, whether the root can be presented at table in its native form, like the potato, or without any other cooking than simple boiling. Comparative analyses made by M. Payen show that it contains less water, more starch, albumen, and other nitrogenous substances than the potato, and a small proportion of cane sugar. Another plant brought under the notice of the Academy was introduced from New Granada, under its native name of Shicarra only, which has white, juicy, and sweet tubers, that can be eaten raw. It is an annual shrub, growing to the height of about three feet, and as it stands cold well, it was thought it might prove a rival to the beet-root in Europe, being richer in sugar.

The roots of *Apios tuberosa* are eatable, and are sold in some of the German markets. Professor Eaton, in his "Manual of Botany for North America," remarks that this nutritive root ought to be generally cultivated. The tubers are, however, not larger than cherries, but very farinaceous, with a large per centage of starch. The roots of *Claytonia tuberosa* are eaten in Eastern Siberia: and an American species, *C. acutiflora*, has been recommended for experimental culture. The tuberous roots of *Bunium bulbocastanum* in Europe, like those of our British species, *B. denudatum*, contain well-known nutritious qualities. When boiled they are very sweet and delicious. In Holland, the Alps, and in some parts of England, they are used in soup, and also roasted under the embers, when they eat like roasted chesnuts. The tubers of *B. ferulaceum* are used the same way in Greece. The Apios (*Arracacha esculenta*), a perennial, is extensively cultivated for culinary purposes in the temperate mountain regions about Santa Fe de Bogota. The large roots are cooked and eaten like parsnips, but considered better and easier of digestion. It has been introduced into the South of Europe. A very promising tuber seemed to be the Ocas of South America, various species of *Oxalis*, but they have not been persevered in long enough to ascertain whether the roots could be enlarged by continued culture. *O. crenata* was introduced a few years ago from Peru, as an object of cultivation in this country for its tubers. These, however, are rarely more than two ounces in weight; and although they are of a mealy consistency, and by some considered, if not equal, at least a good substitute for the potato, it has not been found profitable to devote any attention to their culture as an esculent, since the average produce of a plant did not exceed half a pound. Hence the experiment was dropped. *O. tuberosa* is extensively cultivated in Bolivia for its numerous tubers, which are like small potatoes, and about an inch in diameter. They have a slightly acid flavour, which is disagreeable to most persons; this is lost by exposing them to the sun, the acidity being thus converted into saccharine matter, and the tubers become as floury as the best varieties of potatoes. The tubers are exposed in Bolivia for ten days in woollen bags, which appear to facilitate the conversion of the acid. If the action of the sun is continued for several months, the Ocas become of the sweetness and consistency of dried figs; they are then called Carri.

Bryant describes a root, which he met with on the great prairies of California, and which he called the prairie potato. He considers it in many respects superior to the common potato, and that it might be useful to introduce into cultivation. As no scientific description of the plant is given, it is difficult to determine what it is; for prairie turnip and prairie potato are terms for a very large number of esculent roots in North America, and include some species of *Psoralea*. A little town called Stowe, in Vermont, uses some 20,000 bushels of a peculiar kind of coarse potato, called the California potato, which yields eight pounds of starch to the bushel. Whether there is any relationship between these potatoes, we cannot state. At least, this subject of new esculent tubers is well worth looking into and testing practically, systematically, and perseveringly.

NOTES ON GALLS.

BY M. C. COOKE.

These excrescences are of so much importance in the arts, that an enumeration of the chief varieties known to commerce may not be altogether devoid of interest to your readers. The papers on dye-stuffs, which have already appeared in these pages, will be hereby augmented by the enumeration of the galls of Southern Asia, which were purposely excluded from those communications. No attempt has been made at classifying those galls, which are the habitation of a single insect, and are generally of a more or less ligneous character, separately from such as are the home of a colony, and which are commonly hollow and of a horny texture. This paper makes no further pretence than its name indicates, leaving still an opportunity for more precise scientific details.

LEVANT GALLS.—These are the ordinary galls of commerce, and are produced by the punctures of *Cynips gallæ tinctoriæ* on the gall oak (*Quercus infectoria*). They are too well known to need any description. The varieties of these galls most recognised are: *Mosul* galls, named from the place of production, Mosul on the Tigris; these are the most esteemed. The *Bokhara* galls are similar, but must not be confounded with another *Bokhara* gall, produced on a *Pistacia*. *Aleppo* galls are not equal to those of the Tigris, for which they are often sold. *Tarablous* galls are from Tripoli, or Taraplus, and are considered inferior to the Aleppo galls, but are now rarely met with in commerce. *Turkey* galls are the produce of

Anatolia, and are usually received from Constantinople. *Smyrna* galls contain a larger admixture of white galls than those of Aleppo; they are not so heavy, and are lighter coloured.

CORIANDER GALLS.—These are a small variety of galls sometimes imported from Aleppo. There is also another kind called the Small Crowned Aleppo, about the size of a pea, and crowned by a circle of tubercles like the fruit of the myrtle. Although small, their perforations show them to have completed their full size.

TURKISH DIAMONDS.—Another variety of galls has received this name. They are rather larger than the Small Crowned Aleppo, and possess a speckled surface.

ISTRIA AND ABRUZZI GALLS.—These galls are, in size, rather inferior to the common Turkey gall, but larger than the small blue Aleppo gall. They are described as "somewhat turbinate or pear-shaped, wrinkled, and usually with a short peduncle. They are mostly used by the silk dyers of France."

MOREA GALLS.—These are rather smaller than the ordinary Levant galls, and differ from them still more in appearance by being "crowned." This kind of gall is chiefly employed on the Rhine.

FRENCH GALLS.—These are spherical, light, and smooth or polished; occasionally, slightly wrinkled.

MARMORINE GALLS are the produce of Capitanata, in the kingdom of Naples. They are the *Galles marmorines* of French writers, and are of the size of blue galls, but without tubercles or warts. The surface is dull and rough, resembling orange berries. Trieste is the principal market for these galls, whence they are transmitted to Germany.

HUNGARIAN GALLS.—The galls of *Quercus cerris* are of a brown colour, prickly on the surface, and irregular in shape. They are used chiefly for tanning in Hungary, Dalmatia, and the southern provinces of the Austrian States, where they abound.

OAK APPLES are the largest species of gall produced on the oak in Great Britain, and are caused by *Cynips quercus terminalis.* Oak apples are astringent, like other galls, and have been employed in tanning and dyeing, though not generally collected for that purpose.

DEVONSHIRE GALLS.—For some years past these galls have been annually increasing in number on the oaks of Britain. They are produced by *Cynips quercus petioli*, in such quantities that the trees thus infested have somewhat the appearance of being covered with a crop of green Portugal grapes, though the seeming fruit is more generally distributed over the branches than that of the vine, seldom appearing in clusters of more than three or four. These galls are as spherical and smooth as marbles, as a substitute for which they are employed by schoolboys in the south-western counties. Chemical analysis has pronounced them unfit to compete commercially with the Levant galls, through deficiency in gallic and tannic acids.

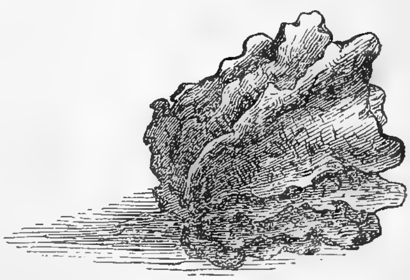
EAST INDIA GALLS.—These are principally shipped from Bombay. They are heavy, but not so sightly as those of the Levant. The bloom generally seen on the Levant galls is lost from the Indian in their transit. Dr. Pereira considers this kind to be the produce of Persia and the neighbouring parts.

ASSAM GALLS.—Galls have been received from Assam of a very dark brown, almost black colour. The size and shape is that of large white Turkish galls, each containing a hole through which the insect has escaped. This orifice is larger than those of the Turkish galls.

APPLE GALLS.—The large galls called indiscriminately Mecca, Bussorah, or Apple galls, are produced by *Cynips insana* on the *Quercus infectoria*. The Hon. R. Curzon states that the tree which produces them grows in abundance on the mountains in the neighbourhood of the Dead Sea. These are believed to be the far-famed mad apples (*Mala insana*), or apples of Sodom (*Poma Sodomitica*), mentioned by Josephus and other authors. These galls are pear-shaped, sometimes round. Their size varies from that of a large hazel nut to that of a small apple. Towards the middle or upper part of the gall are one or more circles of small protruberances. In each of the larger galls there is an aperture through which the insect escaped, and in the centre there is a small round hole or nidus where it has lodged. The substance of the interior is soft, spongy, and friable. To the taste it is somewhat astringent, and scarcely bitter. The colour is of a rich or warm brown, shining as if varnished. These galls are alone used in the countries where they are produced for dyeing, and are more esteemed there than common galls. The contain about 28 or 30 per cent. of tannin.

ALGERIAN GALLS.—Galls are abundant in Algeria, on the evergreen oak *Quercus ilex*, and serve to dye black. France had a consumption of this article, in 1853, to the value of between 600,000 and 700,000 francs, and Algeria could well supply it all.

KNOPPERN.—These galls are produced by *Cynips quercus calcycis*, on the cups of *Quercus pedunculata* and *Quercus pubescens*, in some parts of Europe. They abound more in certain seasons than in others, and an abundant harvest of Knoppern yields an immense revenue to the proprietor of the forest thus affected. These galls were exhibited at the Paris Exhibition of 1855, and the exhibitor states that "they are found on a variety of the oak called *Quercus stagnosa*, which inhabits valleys and damp marshy places. Even on this tree they only appear when the nights are warm and rainy, and towards the end of July and beginning of August. It is then that the outer coat of the acorn is softened and punctured by the insect, and the heat of the sun draws out the sap, which forms the curious excrescence shown in the wood cut. The hotter the weather is, the larger are the Knoppern, and the more easily do they drop to the ground, where they are regularly



KNOPPERN.

gathered up with the least possible delay, as the damp earth would spoil their quality and colour; for which reason the Knoppern should be dried for five or six days in the sun, and then turned over many times in the day for some weeks, to prevent their becoming mouldy. Thus dried, they sell for various purposes, and chiefly for tanning leather. In a favourable season, these galls are so abundant that a single large oak will produce as many as fetch 250 francs on an average; but the price varies from ten to forty francs the kilogramme ($2\frac{1}{3}$ lbs.), according as it is a good or bad season for them. They are chiefly exported to Germany and other parts of Austria, and the trade is now in the hands of the Jews. It is stated by Martigny that these galls are produced in Hungary, Moravia, Sclavonia, Styria, &c., and that the towns of Pesth, Oldenburg, and Trieste are the places where the trade in them is chiefly carried on. They appear to be identical with the *Galles de Hongrie ou du Piemont* of M. Guibourt. An extract is made from these galls which resembles *kino* in appearance, and is used for dyeing silk. One firm in Ratisbon manufactures this extract to the extent of about 250,000 lbs. per annum. A similar gall is said to be sometimes found mixed with these, called by M. Guibourt, "horned galls."

VALONIA GALLS.—A kind of gall is found on the Valonia oak, *Quercus Ægilops*, somewhat similar to that on *Quercus infectoria*, and which is employed for the same purposes. These galls are rugose, of an angular form, and are either the fruit itself disturbed by the puncture of an insect, or merely the scaly cup which is enlarged into a gall.

MEXICAN GALLS.—Dr. Farre exhibited specimens of these galls to the Linnean Society in 1840. They are formed on the leaves of a species of oak in Mexico. The galls consist of an aggregation of hollow cylindrical tubes, nearly an inch in length, and furnished with a fringed orifice. The tubes are remarkable for their elegance and uniformity; their colour is white, suffused with red, especially towards the apex.

GOOL-I-PISTA.—Dr. Royle states—"From Cabool, or, as I was informed, from Bokhara, the almond, as well as its pericarp, is imported into India, together with a kind of gall called Gool-i-pista, stated to be found on the pistachio tree. The pistachio nut," he adds, "is yearly brought down to India, and I was told by people who well knew the tree, that the Gool-i-pista, literally 'Flowers of the Pistachio,' were produced by this tree." It is, moreover, mentioned in Persian works as *Bar-durakhl-pista;* that is, "fruit of the pistachio tree," and they give as the Arabic name, *Buzghuriq*. The largest galls are nearly equal in size to a small cherry. They are brownish externally, hollow, and greatly resemble abortive germens. Some of them are lobed or doubled.

BOJEKIND.—Under this name the galls of *Pistacia vera* have been received from Cabool, with the sole information that they are employed for dyeing silk *green*. A specimen of galls from Scinde, under the name of *Boojkund*, is shown in the museum of Kew Gardens, which are evidently the same, although labelled *Pistacia terebinthus*.

BOKHARA GALLS.—This species of *Pistacia* gall has been imported, specimens are exhibited in the museum of Kew Gardens. They present no difference in appearance to the *Bojekind*, or the drawing of *Gool-i-pista* accompanying Dr. Royle's account. The three kinds are without doubt identical, and the produce of *Pistacia vera*. With the above-named sample of Bokhara galls, a quantity of Pistacio nuts are shown, which were found mixed with the galls.

FISTUK and KHIMSUH are local names in parts of India for Pistacia galls, which are doubtless identical with *Gool-i-pista.*

TEREBINTH GALLS.—The galls produced on *Pistacia terebinthus* by *Cephis pistaciæ* are collected by the peasants of Thrace and Macedonia about the end of June, under the leaves or at the foot of the branches which bear the fruit, and there they find a small gall the size of a hazel nut, which, if allowed to grow, would become long like a small horn ; but they gather it while very small, and sell it at a high price to dye fine silks in the town of Brusa. They use annually above 6,000 pounds of these galls. They are hollow within, of the size of small Roman galls, growing on the leaves of the male teberinth. When they are not gathered they grow half a foot long, and horn-shaped.

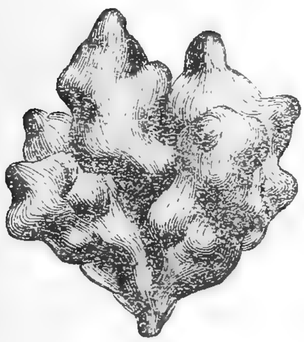
AFRICAN GALLS.—These galls, produced on *Pistacia atlantica*, resemble the Bokhara galls, or Gool-i-pista described by Dr. Royle. They are of a reddish colour—a brighter red than those of *Pistacia vera*, hollow, and vary in size from that of a pea to a filbert. Internally, they are occupied by the remains of the insects causing them. Their shape is very irregular, and their substance horny. They are produced in the northern countries of Africa bordering on the Mediterranean, where they are used as a dyeing material. Hitherto they have not, to our knowledge, been introduced into European commerce.

NARBONNE GALLS.—Galls are produced also on another species of Pistacia (*Pistacia narbonensis*), of two kinds : one in the form of a spindle, nearly straight, and lengthened to a point at the extremity; the other, short, angular, rounded, and double. The spindle-shaped galls are from four to six centimetres in length, and from eight to fifteen millimetres in breadth, more or less bent, and terminated by a sharp point. They are tortuous, covered with a dark grey epidermis, and sometimes have on the surface small flat and circular glands, from which a yellow resin exudes. The substance of the gall is quite black, light, fragile, and from one-third to one-half a millimetre thick. The taste is simply mucilaginous, with an aromatic flavour. This gall is entirely without astringency.

KAKRASINGHEE GALLS.—These are produced on a species of *Rhus*, which Dr. Royle names *Rhus kakrasinghee*, and Sir William Hooker *Rhus semialata.* The galls are elongated, contorted, hollow excrescences, attaining to three or four inches in length, and from a quarter to half an inch in diameter, tapering to a point at one extremity and open at the other. They are very thin and brittle, of a dark, dirty brownish colour, and slightly astringent taste. The Kakrasinghee galls are found in Scinde, where they find employment in the arts.

Woo-pei-tzse or China Galls.—Concerning the tree upon which these galls are produced there has been much discussion, and some uncertainty still remains. It is, however, extremely probable that they are the leaf galls of *Rhus semialata*, caused by a little insect described as *Pemphegus sinensis.* The China galls are now an established article of commerce, and are imported in considerable quantities. They are hollow vesicles, presenting great varieties in shape and size. Most of them are tuberculated, some are rounded, others branched. Externally, they are smooth and occasionally velvety, of a fawn grey colour, and brittle, with a resinous fracture. Internally, they are occupied by a white powdery substance, and insect remains. In the half year ending June, 1860, 203,600 cwts. of China and Japan galls were exported from the port of Shanghai.

Japan Galls present much of the external appearance of the *Woo-pei-tzse*, with which some botanists consider them identical. There are, however, some points of difference worthy of note. The Japan galls are more tuberculated and velvety than those of China, and smaller in size. They are also often clustered together in a manner not yet observed in the other variety. On the other hand, it must be conceded that, upon microscopic examination, no specific difference can be detected in the insects producing the two galls. There is just sufficient difference in them to warrant a doubt as to their being produced upon the same plant, although not sufficient to render such a circumstance improbable.



JAPAN GALL.

Souan-kio.—The *Souan-kio*—literally, "Sour Horns"—are a kind of gall very common at Sin-quan-fou, in Sunan. These galls are said to have the qualities of the best vinegar.

Ou-chi-tse.—These Chinese galls are said to be produced on a tall tree, with a white flower tinged with red in the centre. The trees are often covered with round galls, known in China by the above name.

Kow-tou-tse.—These galls, called also *You-sou-no-mi* or *Ko-to-si*, are found on the leaves of a tree abundant in the islands of Sikok and Kion-sion, and believed to be the tree known as *Distylium racemosum.* These galls are known and used in China and Japan.

Ko-tse.—These are a species of round gall, which are in frequent use in Canton for dyeing black.

Sumrut ool Usk.—The galls of a species of tamarisk are used in tanning in Lahore, under the above name. They have been referred both to *Tamarix articulata* and *T. Indica.*

Sakun Galls is a local name for the tamarisk galls of Scinde. Sir W. Hooker refers to *Tamarix articulata* as the species upon which they are found.

Mahee Galls are produced upon *Tamarix indica*, in the Bengal Presidency of India, and are there employed for tanning. One or two instances have occurred of their importation into England; but tamarisk galls are not commonly met with in British commerce. They are very small, seldom exceeding the size of a pea, and many being as small as a coriander seed.

Atlee.—Sonnini says that "the tamarisks (*Tamarix orientalis*) are in general covered with gall nuts adhering to the branches. These nuts are filled with a liquor of a very beautiful deep scarlet, from which the arts may perhaps be able to derive considerable benefit; for the galls are extremely numerous, and the trees that bear them grow all over both Upper and Lower Egypt." This species of tamarisk is called *Atlé* by the Egyptians.

Amteric.—The substance shown under this name at the Great Exhibition of 1851, from Tripoli, consisted of small tamarisk galls, greatly resembling those obtained from *Tamarix indica*, in Bengal.

Tamarisk Galls.—Dr. Lindley states that galls are also produced on other species of tamarisk, as *Tamarix dioica* and *Furax*.

Majoophul.—The gall nuts of *Ficus infectoria* are used for tanning in the Chota, Nagpore, and Rohilcund districts.

Cadooca-poo, or "Flowers of the Kadookai," are the galls of *Terminalia chebula*. Roxburgh says that they are powerfully astringent, as fit for making ink as oak galls. They yield the chintz painters on the coast of Coromandel their best and most durable yellow. With a ferruginous mud, they strike an excellent black. When dyeing with *Morinda tinctoria* in the Circars, the native dyers first prepare the cloth or yarn by immersing it in a cold infusion of these powdered galls in milk and water.

Serjacoy.—These are gall-like excrescences, produced in India apparently on a species of *Terminalia*. They resemble in form, structure, and qualities the Cadooca-poo, but are much larger. Their uses are identical.

Shukur-teeghal.—We are informed that these galls, produced upon *Asclepias gigantea*, are astringent, and are employed in India for tanning leather.

PRODUCTS OF NEW GRANADA.

BY WILLIAM BOLLAERT.

New Granada produces cocoa, tobacco, cotton, indigo, rice, and sugar in its fruitful valleys or savannas; also timber, dye-woods, and cinchonas. There are pearl fisheries on its coasts. Its mountains and streams yield gold, silver, platina, and other metals: the mines of rock salt, coal, and emeralds are important. In the Magdalena the magnificent Victoria Regia is found in such abundance as to be a troublesome weed. Farther south it is also abundant; for Lieut. Page, of the United States Navy, states that down the Panama drift camilotes, or large water-lilies, and in the lagoons are anchored islands of the Victoria Regia, or Maiz del Agua (corn of the water). Its seeds are pounded into meal, from which is made excellent and nutritious bread. The natives cultivate maize and other plants, including the potato and batata (sweet potato). The potato grows wild in the mountains of Palitera. In the Chibcha language the potato is Yomi; in Peru this root is known as Papa. The batata is called camote in Peru, but its Quichna name is Apichu. With respect to the cultivation of the quinoa (*Chenopodium Quinoa*), now abandoned, we have no particulars. The seed of the plant is very nutritious, and it is probable it was eaten in the form of a porridge, such as they made with maize, seasoning it with salt, red pepper, and savoury herbs. In the hot valleys they had the yucca (*Jatropha Manihot*), the arracacha (*Oxalis crenata*) in the temperate region, and some vegetables; but we do not know if they used the fecula of the Choco blanco (*Lupinus*), as they did in Quito. We are ignorant if they, as the Mexicans, extracted sugar from the maize cane, not having the sugar cane, which was brought from the Old World; or if they only used honey, found abundantly amongst the declivities of the Cordillera. The plantain —now so abundant in New Granada, that it may be said to form half the food of the population—was not cultivated in olden times, or known, excepting in the province of Choco. It is calculated that ground, yielding wheat for the sustenance of one man, would grow plantains for twenty-five men.

The eastern and western slopes of the Cordilleras are densely covered with every species of timber, including a large mahogany, out of which the Indian scoops his canoe. The cotton and India rubber plants grow wild, as also cocoa, canella (called by some cinnamon), coffee, the guayusa or tea plant, vanilla, tobacco, indigo, orchella, wax palm, copal, storax, spices, dyes, sugar cane, rice, maize, cinchona bark, cedron, &c.—indeed, a paradise for the botanist. In the more temperate parts, there are large grazing and arable farms. The mean temperature of the cinchona region is about 62° F.; from 4,000 to 10,000 feet above the level of the sea; and the region extends from 10° N. to 19° S. lat. As to mineral productions, they are in abundance. The entire range of the Cordilleras abound with gold, silver, and copper. Gold is also found on the banks and in the channel of every river which has its source. It is often stated that Peru is rich in emeralds: it should rather be said, the coast of Equador. I have never heard of this gem having been found in Peru. At the Museum of Practical Geology in London, there is an instructive collection of emeralds, and rocks in which they are found.

EVERLASTING FLOWERS.

BY T. D. ROCK.

Amongst the rich variety of natural objects with which a bountiful Providence regales the sense of vision, few rank higher in the estimation of mankind than flowers. We love these bright gems of the vegetable world with a sort of intuitive affection; and, whether savage or civilised, become spell-bound, as it were, under their magic influence.

Profuse as nature is in the distribution of her choicest gifts, there are yet places on the face of the wide earth where flowers are rare and scanty. In some cases it is a barrenness of soil; in others, rigidity of climate; whilst in not a few instances, it is the confined and poisoned atmosphere surrounding the habitations of men that checks and prevents the growth of flowers.

By a sort of natural law, flowers are most appreciated where they are most difficult to obtain. In all large cities, where the atmosphere is inimical to vegetable life, continual efforts are made to supply the demand for flowers by artificial means; the trade both in plants and bouquets, especially in a place like London, being enormous. Great progress has, indeed, been made of late, in supplying the floral requirements of the metropolis. Costermongers, and other itinerant vendors, have their flower season now, as well as their fish and fruit season; and bedding plants can be purchased late in the spring at most moderate prices.

The result of all this is visibly apparent in the increased number of neat little gardens, ornamented windows and verandahs, imparting an air of cheerfulness and contentment to our otherwise dingy city; and in this way exercising a moral influence which can scarcely be over-estimated.

Yet in spite of the growing demand and increasing supply, the wants of London, in respect of flowers, are not by any means adequately supplied. The rich can always obtain them, but not so the middle classes and the poor, whose taste and desire for flowers is equally great with their more favoured brethren.

The flower season over, and the price of bouquets rising from 3d. to 5s., or of potted plants from 4d. to 2s. 6d., the great bulk of the population then fall back upon the artificial substitutes. Cambric, wax, paper, shells, feathers, vegetables, &c., are the materials which, worked up with more or less skill, vie with each other in their resemblance to nature's own productions.

It is surprising that, amidst this universal taste for flowers, and the enormous traffic in the artificial, so little attention has been hitherto bestowed upon those flowers commonly known as *Everlasting*, and which are so well adapted for purposes of decoration.

The general idea seems to be that everlasting flowers are confined to that small yellow variety (*Gnaphalium arenarium*) known as *Immortelles*, and occasionally dyed blue and red for the sake of contrast. But, as we shall presently prove, the choice of these flowers is confined within no such narrow limits.

Everlasting flowers are chiefly, if not entirely, produced by plants belonging to the natural order *Asteraceæ;* but although approximating in form, they vary considerably as to size, and in colour there is almost an unlimited choice, as the following enumeration of a few of them will illustrate.

NATURAL ORDER—*Asteraceæ.*

NAME.	LOCALITY.	COLOUR OF FLOWER.
Acroclinium roseum	S.W. Australia.........	Rosy.
Ammobium alatum............	N. Holland	White.
Gnaphalium fœtidum.........	Cape of Good Hope...	Light yellow.
Helychrysum bracteatum ...	N. Holland	Yellow and white.
H. roseum	,, ...	Rose colour.
,, aurantiarum	,, ...	Orange.
,, brunneo rubrum	,, ...	Brownish red.
,, coccineum	,, ...	Scarlet.
,, flavum	,, ...	Yellow.
,, purpureum	,, ...	Purple.
,, macranthum	Swan River	Large flowered.
,, speciosissimum	Cape of Good Hope...	Most showy.
Morna elegans..................	Swan River	Yellow.
Stæhelina dubia	South Europe	Pink.

The property possessed by these flowers of resisting decay, may be attributed to the presence of large quantities of silica in the juices of the plants; and this appears the more certain from the fact, that at whatever stage of their development the flowers are gathered, they are still *everlasting*, and resist all change after the little sap that remains in the stem attached is exhausted. Although these plants are many of them natives of warm climates, yet they are easily cultivated in this country, and most of them will thrive in the open air, and flower profusely.

A quiet trade in these imperishable flowers already exists. On the Continent as well as in this country, wreaths made of the small yellow variety (*Gnaphalium arenarium*) are sold in large quantities for adorning the graves and monuments of the departed. The railings which surround the column of Napoleon, in the Place Vendome at Paris, are literally covered with these wreaths, producing a singular effect. In Germany, baskets and bouquets of everlasting flowers and wreaths are sold in the bazaars for decorative purposes; and within the last few weeks, a quantity of these elegant posies, &c., have been imported into this country, and readily realise from 1s. to 7s. 6d. each, according to size and quality, whilst they certainly surpass, both in form and colour, anything ever produced of an artificial kind. Mixed with the everlasting flowers in these German nosegays appear several of the beautiful grasses, recently in high favour with horticulturists, as well as a sprinkling of flowers not naturally everlasting, but which our ingenious friends profess to have preserved by *a peculiar process.*

Wreaths of a yellow variety of everlasting flowers, about the size of a farthing, and strung together transversely, are worn by the natives of the Sandwich Islands as a kind of head ornament.

It only remains for us to suggest the extensive cultivation of all the varieties of everlasting flowers in this country, for the formation of winter decorations; and the artistic grouping of them with grasses, &c., would furnish another branch of employment to our large surplus female population, who ought to be encouraged and educated in the manufacture of many little elegancies, for which we are now entirely dependent upon the foreigner.

ON THE AMOUNT OF STARCH IN RICE.

BY DUGALD CAMPBELL, ANALYTICAL CHEMIST TO THE BROMPTON HOSPITAL, ETC.

A few weeks ago, I was called upon, professionally, to examine some Pinky Madras rice, in order to ascertain what per-centage of starch it contained; and as there appears to be considerable obscurity upon this point generally, and even among persons who use rice for manufacturing purposes, it occurred to me that the result of my experiments, together with a few remarks upon the subject generally, might not be judged valueless by the readers of the TECHNOLOGIST.

There were four specimens, representing four qualities, of this rice examined. These I procured from a broker of the highest respectability in the City. The first specimen examined was of a very superior quality; the fourth was of a low, but still of a good low quality; the other two were intermediate between these.

The process I followed for obtaining the starch was based upon the first of two processes described in the specification of a patent granted to the late Mr. Orlando Jones in 1840. Only I steeped the rice, whilst whole, with an additional solution of caustic soda; and I likewise drew off the water, holding the starch in suspension "from the other matters which deposit much quicker than the starch," without allowing it to stand for more than one-eighth of the time stated by him; but this decanting I repeat several times. I also ascertained the per-centage of water contained in each of the specimens. It was, on the whole, uniform, considering that there was a very apparent difference in their quality, and was as follows:—

No. 1, First quality	13.64	per cent.
No. 2, Second ,,	13.21	,,
No. 3, Third ,,	13.72	,,
No. 4, Fourth ,,	13.72	,,
Average per-centage on the four samples...	13.57	

Hitherto I had only been familiar with the results of the analyses of rice by Braconnot, which are quoted in most books, and which in one case gives 5, and in the other 7, as the per-centage of water. I was, therefore, somewhat surprised on obtaining the large amount which I did; but on looking further into the subject, I found that the late Professor Johnston, in his "Lectures upon Agricultural Chemistry and Geology," published in 1847, page 891, gives the quantities of water, which he found in five varieties of rice freed from the husks, as my specimens were, as follows :—

Madras rice	13.5
Bengal rice	13.1
Patna rice	13.1
Carolina rice	13.0
Carolina rice flour	14.6

These results of Johnston's so closely come up to my own, that I am induced to think the rice examined by Braconnot must have undergone some drying process before examination.

I was somewhat further confirmed in this by obtaining a much less per-centage of starch than he had obtained. I did not in any way pick or prepare the specimens for analysis, but endeavoured, as far as I could, to take an average of each as I received it. And, perhaps, in this way I might have obtained a somewhat less per-centage of starch than he did, operating probably upon a perfectly clean specimen; but any difference in this way would not account for the much larger per-centage of starch which he got beyond me. My results were as follows :—

No. 1, First quality	76.6
No. 2, Second ,,	73.0
No. 3, Third ,,	70.2
No. 4, Fourth ,,	69.1
Average percentage on the four specimens	72.2

Whereas Braconnot's results are in the one case 85.07, and in the other 83.8; but from the results of Boussingault, Horsford, and Payen, obtained since Braconnot's analysis, no doubt exists that some of the nitrogen and protein compounds in the rice were set down by the latter analyst as starch, and Payen has made an analysis of *dry* rice, showing 86.9 per cent. of starch. If I deduct from this the water found either by Johnston or myself, this would reduce the per-centage to rather more than 73 per cent., a result closely approximating to my own, and which I had obtained without knowing of these results.

I endeavoured to check my per-centages of starch by boiling the rice with dilute acids, without and also with pressure, neutralising the acid, and fermenting and distilling to obtain the alcohol, from the amount of which I endeavoured to calculate the per-centage of starch. But the results which I obtained I found to vary very much, and in no case did I get anything like the per-centage of starch I got by the first process; showing that a considerable loss of starch is occasioned in its conversion into sugar by the processes now in use for so doing. If some means were devised whereby little loss were occasioned in this process of conversion, rice would become, taking my per-centage of starch even to be the true one, a very cheap source of spirit, especially applicable for manufacturing purposes.

THE TECHNOLOGIST.

THE NATIVE FARINAS OF JAMAICA.

I have given some attention to the varieties of food which are available from our own soil; and I am convinced that we may, if we please, be very independent of other countries as respects farinaceous substances, besides being able to add items of food now imported to our list of staple exports.

1st. *The Flour of the Bread Fruit.*—In the parish of Portland, in which I have a residence, the bread-fruit tree abounds, and is very productive of fruit. It requires no care, and bears in about five years after being planted. The parish is healthy, and abounds in water; and there is, throughout the year, much rain. The soil, generally, is excellent, and its productive power remarkable; but of all of its products none appear to me more deserving of notice than the bread-fruit.

The fruit begins to ripen about July or August; and the tree continues more or less productive until Christmas; but in other parishes trees may be found in bearing throughout the spring and in early summer. Indeed, I believe there is not a month of the year in which ripe bread-fruit might not be had in some quarter or another of the island.

But after becoming ripe, it quickly perishes; consequently an enormous amount of it is lost or wasted. It is a beautiful substance, and of a delicate and agreeable taste; and it occurred to me that, could it be sliced and dried, and made into flour—and if that flour would be kept good for any length of time—that a great additional value could be imparted to the product. Accordingly I had it cut into thin slices, and dried in the sun for a couple of days, and then made it pass through a corn-mill, which easily reduced it to meal of a beautiful very pale yellow colour. By passing this meal through a fine sieve, we got a beautiful flour fit for baking. I have a large barrel of the meal of the crop of last year, which is still very good. It has not been assailed by insects, nor has it fermented. It is sweet and good, and retains its pleasant delicate flavour.

I have had it baked with yeast and a proportion of wheat flour, say from one-half to one-third of wheat flour to one-half or two-thirds of bread-fruit flour, and the result is an exceedingly pleasant tasted brown bread, which would be acceptable at the table of the most fastidious.

Again, one-third wheaten flour being mixed with the bread-fruit and made into breakfast cakes with an egg, the result is equally satisfactory. The cakes so made are remarkable for delicacy of taste. Mixed with a like proportion of flour, it makes excellent puddings and dumplings. In all these things not only have we the advantage of a substitute, to a considerable extent of an article of our own, for the expensive imported one, but we have what, in several respects, is really more valuable, from its superior lightness and delicacy of flavour. For confectionary cakes, I think it would be peculiarly suitable.

It is also excellent when made into pap or pottage, *Scotice* porridge. It should be made with a little sugar, and eaten with milk; though Scotch people, I dare say, would prefer it with salt. As a food for children and invalids, or generally for those who seek agreeable food easy of digestion, the flour of the bread-fruit will be esteemed a valuable acquisition to the dietary.

In the course of reading, lately, I saw it stated that there never had been an analysis of the bread-fruit. I shall be glad if this notice of it should lead to one. However, I can in the meantime say that it produces a beautiful starch in great abundance; and that the residue, after the starch is drawn off, is a pure white substance, capable of being easily reduced into a meal or flour, which is very similar in taste or appearance to ground rice; and I am sure it might be available for various kinds of food, and be kept for years perfectly good. For the sake of distinction I call this "Bread-Fruit Tapioca."

I have thus given my testimony on this interesting subject, and would only further remind my readers of the Rev. Mr. Wharton's important experiment in biscuits of the bread-fruit. He boiled or baked the fruit, and then sliced and dried, and packed it in tin cases. In this form it may be kept for a very long time; and, when toasted and buttered, eats admirably. It would be an excellent article of cabin stores for large passenger steamers.

In the parish of Portland, where, as already stated, we have much damp and rainy weather, I found it necessary, on many occasions, to dry the slices in an oven. The erection of drying-houses, therefore, would be a great advantage to the former in such a parish, especially to those whose lands are far in the interior, where the soil is eminently fruitful; but the carrying of such heavy commodities as bread-fruit, or plantains in their green state, over bad roads to market, incurs an expense and trouble so disproportioned to their value, that they would be almost valueless to the raisers. But if the weight be lightened by paring off skins and stalks and drying, and their valuable parts manufactured into flour, starch, or biscuit, the value would amply afford the carriage. Indeed, it would be found that to carry out these suggestions there will be value given to entire districts which are now almost abandoned, or the inhabitants sunk in deep poverty, and sources of wealth opened that will certainly alter the character of property and people. How often have I seen poor women carrying a load on their heads a distance of ten miles to market, which, when sold, would not yield above one shilling or one sixpence! It was of the green fruits, or roots, and therefore heavy, and of small value; while, in its prepared state, they could carry a burden of six times its value, and thus introduce wealth and many comforts into these now poor interior districts.

It is important to inquire the value of the starch of the bread-fruit, as a starch for the manufacturer? As an edible it is quite equal, I believe, to arrowroot. But what will Manchester or Glasgow manufacturers give for it? Who knows but it may equal the far-famed Glenfield starch!

2nd. *The Flour of the Plantain.*—This is well known in many parts of the West Indies under the name of Conquintay, and is highly esteemed, and extensively used as a food for invalids and children. It is decidedly superior in these respects to arrowroot, in consequence of its nourishing and strengthening qualities. It may also be stated that it is curative of diarrhœa and similar bowel complaints, in consequence of the tannin which it contains. Hitherto it has been little known here; and it is hardly known at all in Europe, where, however, we believe it would be greatly prized, and would supersede the patent groats and patent barley, and similar preparations.

The plantain for flour must be cut not only before it is ripe, but a little before it is what is called "full." It must not, in any of the processes to which it is to be subject, come in contact with iron or steel, which instantly impart to it an inky black colour. It must be sliced with nickel, or silver plate, or even ivory or hardwood knives, and dried, and in all other respects treated like the bread-fruit, as above stated, and it is available for the same uses, only it must be manufactured by stamping in a wooden mill or mortar, and cooked in tin or an enamelled vessel. There is a pleasant soft fulness in the taste of cake or pottage of the plantain flour, which will always recommend it, in whichever of the forms above recommended it is used, except baking it into bread. It is capable of being combined with flour, so as to make a tolerable coarse baker's bread; but it is not, so far as my experiments have gone, likely to be in request for that object. But for all the others above enumerated it will be found (the one precaution as to iron being attended to) a most valuable addition to articles of diet. Plantains, from their bulk, cannot be transported from interior places in the green state, but when made into flour the value will bear the charges of transportation, aye, and of exportation, too.

The starch drawn off from the green grated plantain appeared to me unusually thick and clammy. I wish that some one better acquainted with the qualities, on which the commercial value of the article to the manufacturer depends, would examine and report on it.

The residue, after the starch is separated, which I call "Plantain Tapioca," is a pink coloured substance, which crumbles easily, and when cooked (always avoiding iron vessels) by boiling, as is done with arrowroot and tapioca, and seasoned with sugar, it forms, when eaten with milk, a pleasant food, of a delicate and agreeable flavour. But, besides being a good strengthening food for children, and persons of sedentary habits, from its lightness and easiness of digestion, it would, I think, be a substantial food for labourers, especially European.

The substances to which I have sought attention by this paper are:— 1st. The bread-fruit flour and meal; 2nd. Bread-fruit biscuits; 3rd. Bread-fruit starch; 4th. Bread-fruit tapioca (that is, the residuum, after separation from the starch); 5th. Plantain flour and meal; 6th. Plantain starch; 7th. Plantain tapioca.

Should any of my readers, especially intelligent ladies, be induced to try the qualities and uses of some of these articles in any of the ways I have suggested, the results will be a communication of much importance to the domestic well-being of the community, especially to the inhabitants of interior districts, and I hope they may be persuaded to communicate these to the public.

I cannot help suggesting for consideration how much these facts show the value of the interior, cool, healthy lands of this island to intending European emigrants. I have observed farm and emigrant life in America and Canada, and I feel certain that there is no country on earth where, with so little labour, the "gushing abundance" of the farmer's table could so quickly, and with so small a cost of labour, be established, as in the cool, seasonable districts of this island. It is a low, a very low estimate, to say that one-third of the labour which is expended on agriculture in Canada on a farm would, if expended on a settlement in this island, accomplish a far larger return in comfort and substantial profit to the cultivator. Farinas—roots, pulse, fruits, and oils, without end, and the indispensable groceries of civilised life—coffee and sugar—can be had growing at the door, to all of which add our infinite variety of fibres, the cultivation of which cost almost nothing, and the prepartion might be rendered easy and inexpensive.

Kingston. W. W. A.

ON THE NATURAL HISTORY OF THE LAC INSECT (COCCUS LACCA).*

BY H. J. CARTER, F.R.S.

[Reliable scientific information respecting the Natural History of the lac insect has hitherto been much wanted. The only details we have previously met with were contained in a paper communicated to the Royal Society so far back as May 24, 1781, by Mr. James Kerr, of Patna.]—Editor.

* From the Annals and Magazine of Natural History.

Having had an opportunity of examining the lac insect just previous to the evolution of its young, and of watching the latter part from this period up to the time at which they become incarcerated in the resinous substance which they secrete around themselves, known in commerce by the name of "lac," and finding that a description of the changes which the insect undergoes still remains unpublished, so far as I am aware, while that which has been stated on the subject is more or less incorrect, I am not without hope that the following observations may prove both new and acceptable. Thus much is known—that the substance called "lac" consists of a resinous incrustation, partly encircling or scattered over the small branches of several trees and shrubs of different kinds in India; that the incrustation is cellular, and that each cell indicates the position of one of the insects which secreted it; that the insect contains a red colouring matter, called "lac-dye," which is also an article of commerce, and is allied to cochineal; and that, at a certain period of the year, vast numbers of young animals leave these cells, and, spreading themselves over the neighbouring branches, fix themselves to the bark, which they pierce with their beaks, and begin to pour forth from their bodies the resinous substance above mentioned.

On the 25th of June last (1860), my attention was drawn to the subject, more particularly by a fresh branch of the custard-apple tree (*Anona squamosa*), bearing portions of the lac, having been presented to me by my friend Major Burke. The branch was taken from a tree growing in the enclosure of the Bombay Mint, within a few yards of the sea, and in the midst of the smoke of steam-engines, smelting-furnaces, and the atmosphere of a crowded population; while the resinous incrustation and the red colouring matter, both in quality and quantity, did not appear to me to be less than that which is produced by the insect in localities widely separated, as well from the sea as from all human habitations. On receiving this branch, and observing that it was fresh, and that the insects in the incrustation were also living, my curiosity was directed to ascertaining the form and organology of the latter. Meanwhile the young began to pour fourth —that is, on or about the 1st of July, and by the middle of that month the whole branch had become covered by them; but, for want of nourishment, as they became stationary, so they died, without, apparently, secreting any of the resinous substance around them; and thus I was obliged to visit the custard-apple tree itself, for the purpose of examining the subsequent changes the insect undergoes, which changes, together with a description of the form and organology of the full-grown insect, so far as I have been able to ascertain them, will now be related.

The first feature that strikes the eye on looking at the surface of the incrustation, when the insects which are within it are alive, is the presence of a kind of white powder, like that observed about the cochineal insects; this is concentrated here and there into little spots, and, on being more closely examined, will be seen to be chiefly confined to three branches of curly, hair-like filaments, which radiate from three small holes in each spot. The holes are situated triangularly with respect to each other, two being closer together than the third, which is the largest, and which, by and by, will be found to be the anal, while the other two will be found to be spiracular apertures: all three are continuous, with corresponding apertures in the insect, from which the white filaments originally proceed, which filaments we shall hereafter observe to be the attenuated extremities of the tracheæ. If we now examine the contents of the interior, which we may easily obtain entire by dissolving off the lac in spirits of wine (for, from their tenderness, they can hardly ever be extricated without rupture by simply breaking the incrustation), it will be observed that each cell is filled with a single insect, which is now almost as much unlike one as any object can well be unlike another—consisting of a pyriform sac of a dark red colour, smooth, shining, and presenting at its elongated end one, and at its obtuse end three papillary processes; the former, which is a continuation of the elongated end, is fixed to the bark; and the three latter, which project from the middle of the obtuse end, are respectively continuous with the three holes in the lac above noticed. As with these holes so with the three processes: one is much longer and larger than the other two, which latter are of the same size; the former is also further distinguished by having several hairs round the margin of the aperture which exists at its extremity—a point which it is desirable to remember, as it will serve by and by to identify it with the anal extremity of the animal when in its insect form. So far, the spirit of wine assists; but when we come to the contents of the body, it is not only necessary to avoid using spirit of wine, from the disfiguration which it occasions by causing the tissues to contract, but also to extricate the body by fracturing the lac, and dissect its contents as quickly as possible on account of the rapidity with which they pass into dissolution after death: this is probably the reason why this part of the history of the insect has remained unpublished up to the present time. Directing our attention to the interior, after the rupture of the insect, which takes place more or less with that of the lac, we are at once struck with the voluminousness of the organ containing the red colouring matter, which organ thus obscures everything else; and it is not before a quantity of it is removed by gentle edulcoration, that we can (still under water, for the anatomy of this insect can be studied in no other way) arrive at a view of the other organs of the body, when it will be observed that there is an alimentary canal, liver, tracheæ, and, last of all, the organ containing the red colouring matter, which we shall presently find to be the ovary. To each of these organs, then separately and briefly, we will now give our attention. The alimentary canal commences with an attenuated shapeless œsophagus at the elongated end of the body, which is thus seen to be the oral extremity, and after passing upwards for about two-thirds of the abdominal cavity, where it becomes enlarged and convoluted, turns back to make a single revolution, in the course of which it soon becomes diminished in calibre, and receiving the hepatic duct at this point, terminates at length in the rectum, which opens at the great papillary process. The liver consists of a single straight sacculated tube, of the same size throughout, presenting a yellow colour, and giving off the hepatic duct a little nearer one end than the other, while the tracheæ are amassed into bundles, apparently without order, and send forth many of their extremities through the two small, as well as through the large anal apertures to terminate on the surface of the lac in the way above mentioned. Lastly, we come to the ovary, which consists of a voluminous tree of tubes, apparently branched dichotomously, with each branch, large and small, bearing long elliptical pouches, in each of which, again, is a correspondingly shaped ovum—the whole nearly filling the body, and terminating in a single oviduct, which opens (probably through the rectum) at the anal aperture. The ovum, on the other hand, consists of an elliptical transparent envelope filled with little cells, each of which contains oil (?) globules, and globules filled with the red colouring matter. The oil-globules are spherical, uniform in size, and much larger than the red globules, which are also spherical, but distinctly separated from the oil-globules and from each other. Whether these bodies respectively have delicate cell-walls or not, I am ignorant; but, while they are both distinctly defined in the ovum when the insect is first opened under water, both soon burst by imbibition, and become lost to view by dispersion of their contents. Thus, the red colouring matter exists originally in the form of distinct globules, or in cells in the ovum. The further changes in the ovum, preparatory to the full development of the embryo, I have not followed; but about the beginning of July the young ones are perfectly formed, and, issuing through the anal aperture in the incrustation, they creep on to the neighbouring parts of the branch, and, soon fixing themselves by inserting their beaks into the bark, as before stated, commence secreting the lac or resinous substance, in which they soon become incarcerated. Myriads issue in this way, as may well be conceived, when, at a guess, I should think, each insect contained a thousand; but by far the greater number die; for, although the branches become quite red with them, it is only here and there that a few, scattered or in groups, live; the rest still remain attached to the bark, but dried up and dead, which may arise, perhaps, from not having been sufficiently developed, or not being strong enough at their delivery to pierce the bark for sustenance. On leaving the parent the young coccus is of a minium-red colour, about one-fourtieth of an inch long, elliptical, obtuse anteriorly, without any division between the head and body, possessing six legs, two antennæ, two small eyes, marginal and lateral, and two long hairs, growing from the penultimate segment of the abdomen; the body segmented regularly; the oral aperture ventral, and placed at some distance from the anterior extremity; two tufts of white, powdery, hair-like filaments budding from the sides of the thorax respectively, in the place of wings, and a tuft of the same kind, bifurcated, and curling outwards on each side, projecting from the anal orifice. Anal orifice surrounded by a row of short, strong hairs. At this period the insect is almost too small for examination organologically; but after it has crept off the incrustation and on to the bark of the branch, it soon becomes stationary, and enlarging as the resinous secretion exudes from the surface of the body so as to surround all parts except the oral orifice and the three apertures from which the three white tufts issue, at the expiration of a month (that is, by the middle of August) it measures in length almost the eighteenth part of an inch. If we now examine it minutely, it will be observed that the legs, antennæ, and the whole of the chitinous parts of the body have become almost undistinguishably incorporated with the resinous secretion, which, when dissolved from the insect by spirit of wine, leaves the body almost in a larval or caterpillar form, but without eyes or any other appendages, save the three white tufts of hair-like filaments, and the proboscis, which is now fully developed. The proboscis consists of a fleshy projection, situated at a little distance from the head, ventrally, presenting a depression in the centre, from which issue four long hairs of setæ, based internally upon as many pyramidal inflations, situated almost at right angles to each other, and supported by other horny elements, which also appear to belong to the machinery of the proboscis. These hairs together form the penetrating organ through which the juice of the tree is extracted; but whether they are hollow, and do this individually, or form a single tube by combination for this purpose, I have not been able to determine. On the other hand, the three apertures from which the white tufts proceed, and which are now seen to open through the incrustation, are observed to be situated in the thorax and at the tail respectively—thus identifying the latter, which still presents the circle of hairs round the anal orifice, with the large papilla or anal orifice of the full-grown insect, and the former or thoracic apertures with the two other papillæ, which appear to replace the wings. The white projecting from these we have already seen to consist of the extremities of the tracheæ, covered with a white powder. Thus we see that the increase of size, which takes place in the female insect, from its locomotive form to its ultimate development in the fixed state, is chiefly effected by an enlargement and elongation of the body between the mouth, on the one hand, and the parts from which the three white tufts project, on the other; for the oral extremity simply becomes elongated, and the three other openings of the body remain as near together, in the resinous incrustation, at the end as they were at the commencement. Of what the white powder on the tracheæ consists, I am ignorant, further than that it does not dissolve in spirits of wine like the lac, which, on the other hand, appears to be a secretion from the skin generally, analagous to the chitinous one which would be required under other circumstances.

Male Insect.—On the 8th of September I visited the custard-apple tree again, to see how the incrusted young were progressing; and on close examination of the parts where they were most congregated, observed, here and there, little red insects actively crawling over them, which insects appeared so like the original young ones, that I thought they must be a few stragglers of a later evolution; but on inspecting them more particularly, they were observed to possess much longer antennæ; and therefore it was concluded that they were males, which afterwards proved to be the case. Several of them were collected for description, and a small portion of one of the branches, more or less covered by the incrusted young, brought away, to show how the secretion of the lac was progressing. The male is a little larger than the young ones at their exit from the parent; it has larger antennæ, which are hairy-plumose, and consist of seven articulations, not including the two basal ones; four eyes, two lateral and two underneath the head; two long hair-like appendages; covered with white powder, proceeding from the penultimate segment above; and a beak-like horny extension from the last segment, which is curved a little downwards, and composed of two members, an upper and a lower one, both grooved, and forming together a cylindrical channel, through which the semen is conveyed into the female. Thus the changes which the larva undergoes during incarceration, to produce the male, consist in an enlargement and alteration in form of the antennæ; in the differentiation of the head, and the addition of two large eyes underneath it, which appear to be for the purpose of enabling the male, as he crawls over the lac covering the females, to find out the apertures in it that lead to the vulvæ; in the addition of the male organ, and in the replacing of the two hairs growing from the penultimate segment on either side of the tail by two delicate white twisted cords, composed of the attenuated extremities of the tracheæ. There are further differences between the sexes at this period, in the female having lost all traces of eyes, antennæ, and legs; whilst, no differentiation having taken place between the head and body, the female is reduced to a mere elliptical sac, with but faint traces of the original segmentation. From the thorax, however, project the two white tufts of tracheæ, which are absent in the male, and also a tuft from the anal extremity, the two hairs before alluded to having disappeared altogether; but the row of hairs round the anus, which are now absent in the male, still remain in the female, and appear to serve the purpose chiefly of preventing the secretion of lac from covering up the anal aperture. At this period only, the bodies of both male and female are about the same size (viz., about 1-27th of an inch long); but while the former has become more highly developed and eliminated, for the performance of his special function, the latter has become retrograde and permanently incarcerated for hers. So unsparingly does nature deal with her forms for the development of the new being.

Impregnation.—After having taken home the small portion of the branch above mentioned, which was covered more or less with the newly incrusted brood, on which there were no free males, I was astonished, on taking it up an hour or two later, to observe that two had made their appearance, and were actively engaged in impregnating the females. This they do by drawing the organ before described downwards and a little forwards, just over the hole in the lac which leads to the anal orifice of the female, and then inserting it; after which the male sits on the hole, as it were, for a few moments, and then, withdrawing the penis, goes to another female, and so on till his office is fulfilled.

I now watched the process for some time; and having sufficiently satisfied myself of the fact as just stated, the two males were removed for microscopical examination, and the branch left as before without any. Next morning, to my astonishment, I again found two more males on it, actively engaged in performing their duty like the former ones; and then it struck me that they must come from some of the incrustations; so I examined the latter, and soon saw that there were two distinct kinds of incrustations on the bark—one circular, slightly larger than the other, and, when isolated from the rest (which for the most part are agglomerated), presenting twelve notches or teeth symetrically arranged round the base, six on each side, with the three holes above, and the white tufts projecting from them as before described: this, of course, was the female. The other form of incrustation was narrower and elliptical, like that of the young insect at evolution, but without serrated base, holes, or white hair-like appendages.

Finally, it was observed that the latter were frequently empty, and open at their unfixed and elevated end, while from others the tail of the male insect itself was projecting. Thus the origin of the male and the process of impregnation as to time and act were easily determined; while it was also observed that in some parts there were almost, if not quite, as many male as female incrustations present, in others not so many. On the evolution of the young, therefore, all at first would appear to attach themselves to the bark, and pierce it for nutriment—at least, all that live—preparatory to undergoing further general and generative development (for all are alike, apparently, when first hatched), and that then they respectively become changed for the fulfilment of their ultimate functions—the males for impregnating the females, and the females for secreting the lac and developing the new brood; but the latter, as before shown, does not appear till the month of July of the following year.

Thus we see that the young *Coccus*, as we have termed it, merits rather the term of "larva" (from the metamorphosis which it subsequently undergoes to pass into the matured forms of male and female respectively) than that of "young insect." Again, all begin to secrete from their bodies the resinous substance, even before they have fixed themselves to the bark; for those had it which were hatched from the lac on the branch that was first presented to me, after the latter was dry and dead; so that no doubt can exist of the lac being produced by the insect itself, and that it is not a mere exudation from the tree, which follows the insertion of its proboscis into the bark, as has been stated. But while those which are to become males are entirely, though but temporarily, shut in by the lac, which they subsequently elaborate from the juices of the tree on which they may be located, those which are to become females preserve throughout the three apertures before mentioned, from which project the white tufts of tracheæ.

These tufts, which, previous to impregnation, consisted of but a few filaments from each aperture, and thus in no way impeded the functions of the male, had so increased immediately after impregnation (that is, by the 20th of September), that every part of the branch covered with new lac was rendered white by it; and although there were still a few females which were not enveloped by it (and probably, therefore, were not impregnated), yet, for the most part, they were thickly covered by this cottony substance; and the few remaining males that were present were so inextricably entangled in it, and prevented from coming into contact with the females by it, that, together with the presence of dead ones, also entangled in the mass, it may be inferred that this rapid evolution of the cotton-like substance at once indicates the death-season of the males, and that impregnation has been fully performed. One other observation I would add, which is more practical than scientific—viz., that, to obtain as much resin and as much colouring matter as possible, the gathering of lac should take place towards the end of May, or the beginning of June, just before the evolution of the young, which, as will have been seen above, carry away with them the greater part of the colouring matter. In Ure's "Dictionary of Arts and Manufactures," which contains by far the best and least incorrect account of this insect that I have met with, it is stated that the evolution of the young takes place in "November or December," and afterwards in "October or November," while the lac is gathered twice a year, in "March and October." It is also stated in the same article that the male insect has "four wings," and that there is one to every 5,000 females; while we are not a little surprised to see in P. Gervais and Van Beneden's "Zoologie Médicale" (1859), p. 374, that lac "exudes from certain trees through the punctures which have been made by the females." It was this and sundry other statements, together with seeing that the insect could be examined successfully only in the country where it lives, which induced me to avail myself of the opportunities presented to me of obtaining as much of its history as I could for publication. On the 25th of *June* I received the branch of the custard-apple tree with the living matured lac insect on it, in its incrustation. About the 5th of *July*, the young or larvæ, about 1-40th of an inch long, began to issue. On the 14th of *August* all were fixed to, and progressively enlarging in, incrustation, on the custard-apple tree. On the 8th of *September* the males were leaving their incrustations and impregnating the females, each sex being now about 1-27th of an inch long; and on the 20th of *September* the females were almost all concealed under an exuberant evolution of the white cottony substance (which we now know to be the attenuated extremities of the tracheæ, covered with a white powder), with a single male insect here and there alive, and many dead ones entangled in it.

SOME REMARKS UPON SHELLAC, WITH AN ESPECIAL REFERENCE TO ITS PRESENT COMMERCIAL POSITION.*

BY JOHN MACKAY.

We have now and then rapid and unexpected changes in the drug market. At times there are certain premonitory symptoms of such changes, of which those resident in London and Liverpool, and even some at a distance, not unfrequently take advantage. Immediate purchases are made, or contracts for forward delivery entered into, which very often result in large gains to the successful buyer. Or, again, there have been instances of a millionnaire stepping into the market and purchasing all that could be had of a certain article, holding the same, and only selling at an advanced price. Such instances are comparatively rare, because there is in all transactions of this kind, not only an almost unlimited command of capital required, but such a course is necessarily accompanied by considerable risk. A very successful and notable instance of such a case occurred some years ago, when a well-known banking firm bought up all the mercury that could be got, either at home or abroad, stored it up, and held until the price advanced so considerably, as to yield a very large and handsome profit, at the expense, of course, of those who were in the habit of using this valuable metal in medicine or in the arts. More recently a house abroad gathered together all the fine Vanilla pods which could be obtained, and in like manner kept this market so bare, that most extravagant prices were paid for the article. So thoroughly was this game played, that at times large tins of Vanilla were consigned to certain parties in London, and if these individuals failed in realising an increased price, their instructions were quite definite—to return the whole to Paris, there to be stored up, or sold at a limit previously determined upon. At other times a real scarcity may be cited as the cause of an advance, and this frequently owing to circumstances over which no one can exercise any control; such as ungenial and unfavourable weather during the season of vegetation, of which we have at the present time very good examples in the scarcity and consequent high price of belladonna, peppermint, and lavender, or in the cream of tartar market, where the continued high price is owing to the effects of the oïdium or vine disease interfering with the production of wine, and thus reducing the quantity of deposit from which this article is procured. But to go still further from home, and to come more especially to speak of the article it is my intention now to introduce to your notice, I may at once refer to the extraordinary position which shellac holds at the present time in the commercial world. This substance is known to us all, for although not used in medicine, it is extensively employed in the arts. Thus, it is the principal ingredient in our finer kinds of sealing-wax, while in that very important manufacture, hat-making, it is not only largely employed, but

* From the *Pharmaceutical Journal.*

no substitute can be found. For wood polish it is a necessary ingredient, and our pianos and other pieces of beautifully polished furniture would be less pleasing to the eye were we deprived of shellac. In varnishes used by the upholsterer and others, its presence cannot be dispensed with; while the dye, which forms an integral part of this gum resin, is so much used by the woollen manufacturer, that even the gay clothing of our soldiers would be dull and dim without the aid of the permanent and beautiful lac dye.

Before speaking of its commercial relations, it may not be uninteresting to refer more particularly to the manner and places of production. Our supplies are obtained chiefly from the East Indies, the districts most noted being Assam, Pegu, Bengal, and Malabar, and along the course of the Ganges.

The shipments are, however, made principally from Calcutta. In the districts above named there are two or three very large establishments at which they employ more than a thousand hands. Besides these factories, there are numerous makers on the small scale. A feeling of secrecy pervades the establishments, and strangers are refused admittance. On the twigs of certain trees, known as the *Ficus religiosa*, *Ficus indica*, *Rhamnus jujuba*, *Croton lacciferum*, and the *Butea frondosa*, found in the jungle and forests of India, a small insect called the *Coccus lacca* fixes, and there deposits a certain quantity of a dark coloured resinous matter. This, on careful examination, has been found to be the stomachs of those insects left there after death as food for their larvæ, the outer or specially resin coating being intended for the shelter and protection of the young. It is about the months of November or December that the brood make their escape from their previously protected habitations, and fasten themselves in their turn upon the small branches. As these increase (which they do very rapidly) the twigs or stems become completely covered, and at a particular season of the year are collected, placed in sacks, and carried to the manufactory. These encrusted twigs are first ground in a mill to rough powder, and then carried away to what is called the dye work of the establishment. Here troughs are ready for their reception, and after being immersed in water, the natives commence to tread upon the material, so as to remove the dye from the resin, &c., and as this colouring matter is soluble, it is in a short time taken up by the water, run off into other suitable vessels, water again added, and the process continued, with the addition of fresh quantities of water, until the whole is completely exhausted. The remains are then collected, the woody fibre, &c., got quit of, and the little particles which remain freed almost entirely from colour, called and recognised in our market as seed lac. The different waters which have thus taken up in solution the colouring matter of the stick lac, is run into cisterns or vats, where the deposition in course of time takes place, and then the powder in the form of paste is partially dried, put into square cases, stamped, and thoroughly dried, forming the regular lac dye of commerce. It is sent home to this country in those small square blocks, and reduced to powder for the purpose of trade. I may as well dismiss this part of my subject by stating, that the dye is used very largely and very extensively in dyeing woollen goods. Struck with a perchloride of tin, it becomes a fine and very beautiful scarlet. This preparation is well known, being made by boiling tin in hydrochloric and nitric acids, and from its general use for the above purpose has commercially received the name of lac spirits.

The great commercial importance of this article may be better understood when I mention that from Calcutta alone the annual export is supposed to be very nearly four millions of pounds' weight.

The different kinds of shellac may be named as follows :—Stick lac, shell lac, button lac, seed lac, lump lac, white lac. Various shades of some of the above receive the names of garnet, liver, and orange. These are dependent upon the quantity of natural dye left in the seed lac before it is prepared, as will be immediately noticed. The five kinds first enumerated are imported; the last is prepared in this country.

Stick and seed lac require little notice. The former is the natural production of the insect already described, and the latter is the remains after the extraction of the colouring matter to form the lac dye. The small granular pieces of gum resin left are collected as free from extraneous matter as possible, and dried in the sun, Button and shell lac are the two descriptions most employed in this country, and are both prepared from the seed lac as follows :—The grains are placed in long sausage-shaped bags and heated before fires, until the liquid resin exuding slowly through the interstices of the cloth is scraped off, and immediately transferred to the highly polished surface of earthenware cylinders, heated by being filled with hot water. The melted lac is spread over these cylinders by men, women, or boys, who use for this purpose a palm leaf, and thus produce cakes about twenty inches square. It is then, when cool, thrown into chests, and by the transit becomes much broken ere it arrives in this country. The finest bright orange shellac is believed to be coloured artificially, and I think correctly, having had occasion more than once to reject samples from their peculiar light yellow shade. Orpiment is thought to be the colouring matter employed.

Button, block, garnet, and liver lac, are all produced more or less carefully from different qualities of seed lac, the colour and appearance depending entirely upon the districts from whence the seed lac has been obtained, and the completeness of the removal of the lac dye. Nothing more need be added as to the preparation of these lacs—and, indeed, I believe no further particulars are known. White lac is prepared in this country from ordinary shellac, by being first boiled in a solution of carbonate of potash, through which a stream of chlorine is then to be passed. Hydrochloric acid is added, and last of all red lead. The white pulpy mass is then collected, washed, and pulled into sticks of different lengths. This description of lac is not much employed, being chiefly consumed in manufacturing the different light shades of fancy sealing-wax. Before proceeding to the closing part of these remarks—viz., the present commercial relations of this article—it may be stated that good shellac should contain from 84 to 90 per cent. of resin alone, with varying quantities of colouring matter. When not carefully prepared, a quantity of sand is often present, which deteriorates the lac, and depreciates its value when used for varnishes, &c.

For about two years there has been a steady, but most unaccountable, rise in the price of all descriptions of lac. Thus, in October, 1858, the price in the London market, as well as in Liverpool, was 82s. per cwt. During the same month in 1859 it reached 123s. per cwt., and in October, 1860, it sold in the same market at 260s. per cwt.; while in both the enormous price of £14 was obtained in December. At first sight, one is very apt to consider such extreme prices the result of speculation, but I have ascertained the last quotation from Calcutta—I mean in the market there—to be 57 rupees per maund. There are, I understand, 3 maunds to every 2 cwt., or a maund and a half to each 112 lbs.*; so, allowing each rupee to be worth 2s. of British currency, we have the cost in India before shipment as £8 11s. The estimated expense of freight, &c., may be roughly stated as £2, which brings up the price on landing to £10 11s. This appears a very good margin for the importers. But it is said on pretty good authority that there are not at present fifty chests of really good, fine, orange shellac to be got in London. If this be correct, then the difference given above, between the net value as imported and the price realised here, is not to be wondered at, nor can it be called excessive. It might, however, very naturally be asked, what is really the cause of such high prices and such scarcity? The most feasible reason, and I believe the true one, is, that the native forests where lac has hitherto been found in such abundance, have suffered so dreadfully from the ravages and devastation of war, that the native collectors have failed entirely in obtaining supplies of the raw material. Now this is highly probable, for we know that some of the largest lac factories are on the banks of the Ganges; but then in more peaceful districts this reason cannot be considered tenable. I am somewhat inclined to suppose that there is really a natural scarcity in the jungle of the little lac-producing insect, and that these two causes, operating together, have brought about the present state of matters. One very incomprehensible thing is, that the prices of lac dye have not risen, and that there is a plentiful supply of this article in the market. This, of course, can only be accounted for in two ways—either, that the supply meets the demand, or that very large quantities have been stored up before the scarcity of lac began.

The quantity of all kinds of gum lac exported from Calcutta annually about eight years ago was supposed to be about 1,800 tons, while, in 1858, it fell to about 700 tons, in 1859 about a fourth less, while during the present year the quantity has considerably increased. But in November, 1858, the stocks on hand in London and Liverpool were 3,959 chests and bags; same month in 1859, 1,316, and in November, 1860, 1,345. Of these

* The factory maund of India is about 74 lbs. 10 oz., and the bazaar maund 82 lbs. —EDITOR.

I cannot tell the relative proportions of orange, garnet, or liver coloured. Of course, all descriptions are included. There are vessels, however, now afloat and expected to reach England in due course, having on board no less than 3,192 chests and 363 bags of shellac, which, doubtless, if they do not sink to the bottom of the sea, ought to raise our home stocks, and tend to reduce prices; but we are told, on the other hand, that there is a large demand for the American and foreign market, while all our drug and other merchants at home are so bare of stock, that they will be ready to buy whenever the price moderates.

I dare say it must have occurred to more than one to inquire why, with such extravagant prices, some other substance or compound has never been thought of and introduced instead of shellac. This has been done, but most unsuccessfully. When in London, about eight months ago, I was shown an article which a company just established were about to make and sell instead of shellac. The price was £3 per cwt. cheaper, and those about to engage in its manufacture were sanguine as to the ultimate results. I was told, whenever it was ready to send out in quantity, a sample would be sent. Accordingly, about a month afterwards, a parcel arrived, regarding which my opinion was requested. After carefully trying the article I gave a report condemnatory of its use in any of the arts or manufactures in which the regular lac had hitherto been used. Although I was little thanked for this opinion at the time, I do not think the stuff I now show continued long to be made. Indeed, it really appears to be little else than a mixture of shellac and some aloetic resin, very probable Cape aloes. Be that as it may, I am satisfied from experiment that it could never come into competition with even inferior kinds of shellac.

In closing these few remarks, I may be allowed to express a hope, that lac has seen its highest price, and that during 1861 it will be considerably reduced. I am very unwilling to believe, that native supplies have really become extinct; while the enormous comparative prices still existing, cannot but tend to increase that activity and energy in searching for fresh supplies, which will, I trust, result in sending more raw material to the native lac manufactories, and thus, by increasing stocks at home, gradually reduce the market price to something more moderate, and approximating the steady prices at which shellac has until lately stood on the price list.

[Lac is a staple produce of the wild tract of country to the eastward of the Godavery river. Within a round of twenty miles of Mahadcopore alone, some thousands of rupees' worth is yearly produced. By making advances to the Goands, a correspondent says he has collected large quantities of it for the Hyderabad market, and a great deal more for the same place was carried away by others. If it was an object to encourage the supply of this article, which grows wild in every part of the vast tract, without any artificial aid whatever, very considerable quantities might be collected annually. The native process of preparing it is very crude, and, in consequence, perhaps much of its value is deteriorated. Under European superintendence that would be soon rectified. The lac insect, according to Crawfurd, exists in most of the forests of the Indian islands, but especially in those of Sumatra and the Malayan Peninsula. Its produce is, however, inferior to that of Bengal, and especially of Pegu, which countries chiefly supply the large consumption of the market of China, while the lac of the Indian islands is principally confined to home consumption. The *Coccus lacca* is found chiefly on the hilly parts of Hindostan, on both sides of the Ganges. A white wax kind of lac has lately been found near Madras.]—EDITOR.

BOTANICAL SOCIETY OF CANADA.

A meeting was held in Queen's College, Kingston, on Dec. 7, to consider the propriety of organising a Botanical Society. There was a large attendance of gentlemen. The Rev. Principal Leitch, D.D., was called to the chair, and announced that the object of the meeting was to consider the propriety of originating a Botanical Society, having for its object the investigation of the Canadian Flora. Universities (he said) do not discharge all their functions by merely teaching the acknowledged truths of literature and science: it is a part of their duty to organise and instigate original inquiry in the different departments of knowledge. Systematic research must not only be directed, but to a large extent carried out, by the personal labour of those who are connected with universities. This is especially the case in a comparatively new country, where amateur labourers are few, and scientific appliances not generally available. In a new country the prosecution of scientific research is needful, for various reasons: we have here commenced at the right point. Industrial production and commerce are all important to a new country; and botany, as now pursued, yields to no other science in its bearings on field industry and other useful arts of life. The country, too, is comparatively unexplored. The shores of the St. Lawrence, along which settlements have existed from an early period, have no doubt yielded up most of their botanical treasures to travellers and residents; but we have still an extensive back country that is comparatively unexplored. There is ground, therefore, for the establishment of a Botanical Society, for we have here the great stimulus of being able to add to existing knowledge. In old countries a botanist may long pursue his studies, not, indeed, without great benefit to science, but without having his labours rewarded by meeting with anything new, with plants that had not been collected and described by his predecessors in the science. But here there is room for new discovery: the student may go forth to the woods, and hope, sooner or later, to set eyes upon a plant which no human eye has seen before. His name, it may be, will become associated with it, and thus a permanent record of his discovery will be inscribed in the book of science. All sciences have not such advantages: some have not the same direct appeal to commerce; some may be as well pursued in other countries as in Canada, and thus do not present the same attraction to the Canadian resident, who desires to extend the sphere of knowledge. An Astronomical Society, for example, would not have the peculiar advantages of a Botanical Society in a country like this. It may be said that now is scarcely the time to commence a Botanical Society, that the country is not yet far enough advanced, that botany is not sufficiently studied, to warrant the establishment of a Botanical Society. It is true that botany has been neglected in this country. While this is a reproach to Canada, it affords no reason why a society should not be established. On the contrary, it is a strong reason why an attempt should be made to form one. There is a patriotic feeling rising up in Canada which is especially strong in the youth of the province, and every well-wisher of Canada must be delighted to see it. Here then is an opportunity, by the establishment of this society, to wipe off a reproach that has long hung over the country, by prosecuting a path of research that has been neglected. The proper method, then, is to begin early to engage in the work, and the society will progress, increasing not only our botanical knowledge, but fostering the taste for its study. Thus, as the science progresses among us, the society will extend, so that we may hope in time to see the germ which we this evening cast into the soil grow up into a goodly tree, spreading its branches over the length and breadth of Canada, which is yet destined to be a great country.

Professor Lawson pointed out the peculiar sphere in which the botanist is called to labour, the range of his studies, and the means required for their pursuit. It was of great importance that at the outset the real object of the proposed society should be understood. The establishment of a Botanical Garden and other appliances must be regarded as secondary to the great object of the society, the prosecution of scientific botany. Botany is at a low ebb in Canada, at a lower ebb than in most civilised or half civilised countries on the face of the earth. At the close of the eighteenth century only five dissertations on botanical subjects had been published by the whole medical graduates of the great continent of America. Since then the indefatigable labours of such men as Michaux, Torrey, Harvey, Curtis, Boott, Engelmann, Tuckermann, Sullivant, Lesquereux, and especially of one whose name and fame rise above all the rest, Asa Gray, have brought our knowledge of the botany of the United States on a level with that of the best botanised countries of Europe. The Flora of Canada has also been elaborated since then by one who still presides over the destinies of botanical science, not in England alone, for his authority is recognised wherever the science is pursued. But during a period of nearly thirty years very little has been added to our published knowledge of Canadian botany. Information respecting our indigenous plants must still be sought in the work of Sir William Hooker, issued from the Colonial-office in England, in 1833. That work, founded as it necessarily was on dried specimens carried home by passing travellers, afforded to the botanical world an admirable example of how much could be made out of slender material when in good hands. Unimpeachable as a work of science, unsurpassed in the whole range of botanical literature in the accuracy and beauty of its illustrations, the *Flora Boreali-Americana* afforded the means of developing still more fully a knowledge of the Canadian Flora. The North American Flora of Torrey and Gray, and the Manual of the Botany of the Northern States, offered additional temptations to the pursuit; but advances have not been made commensurate with the advantages that were offered. We have still, therefore, the singular anomaly of a country distinguished by its liberal patronage to science, dependent for its information respecting its native plants on the descriptions of specimens culled by early travellers. What was thirty years ago, and is now, of the highest value can only in a partial manner meet the wants of the country in these days, when new manufactures and new forms of industry, seeking new products to work upon, are daily springing up around us. We desire to place the science of botany on a more satisfactory footing in Canada than that which it now holds; we desire to increase the existing stock of knowledge; we desire to diffuse a taste for the study, so as to add to the number of labourers now in the field; and we desire to place on record new observations and discoveries as they arise. The Botanical Society is, therefore, designed as a means of carrying out purposes such as these. Canada must follow the salutary example of other old established British colonies, and conduct for herself investigations into the nature and distribution of her indigenous productions. We already possess in Canada several important scientific societies in active operation. While the Canadian Institute is of a comprehensive character, embracing all branches of science, literature, and philosophy, the special department of geology is amply cultivated by the Natural History Society of Montreal, which has also, however, made valuable contributions to zoology and botany. In addition to such institutions as these, we have, of still more special character, the Government Geological Survey, which has been instrumental in carrying out investigations of the greatest importance to the country, whether their results be viewed as intellectual achievements or as contributions to material industry. It is proposed that our society shall have for its object the advancement of botanical science in all its departments—structural, physiological, systematic, and geographical; and the application of botany to the useful and ornamental arts of life. The means by which this object may be accomplished are various, and will come before us for discussion from time to time. In the meantime, it is proposed that there shall be monthly evening meetings in Kingston during the winter for the reading of papers, receiving botanical intelligence, examining specimens, and discussing matters of scientific interest in relation to the science; also that there shall be field meetings during the summer in distant localities in Canada, as well as in the other British Provinces of North America, and occasionally also in the adjoining States, whereby our members may have an opportunity of investigating the botany of districts that have been imperfectly examined. By the above, and similar means, much important information may be brought together. Such facts and results, new to science, as are laid before the society, from time to time, will afford materials for the publication of "Transactions," whereby our stores may be rendered available to the public in Canada, and to botanists in other parts of the world. In addition to such means, the society may greatly promote its objects by correspondence with botanists in other countries, and especially with those who are located beside the extensive public herbaria, botanical libraries, and gardens, in various parts of the United States and Europe. By correspondence with such persons, many doubtful points in nomenclature may be set at rest, while the existence of information relating to Canadian botany may be ascertained that might otherwise remain unknown. Botanists distinguished in certain branches of the science may be called upon to furnish reports on their special subjects, for which materials may be brought together by the members. Such aid will be of the greatest value to the society, and I have therefore gratification in informing you that communications have already been received from some of the most active botanists in the United States, England, Scotland, and Prussia, promising cordial co-operation. So soon as preliminary operations enable us to proceed to the discussion of scientific business, you will also have an opportunity of ascertaining that we already have observers throughout the length and breadth of Canada, as well as in the other North American provinces, from the Red River in the far west to the island of Prince Edward in the east. In common with the botanists of other countries, we must necessarily take cognisance of those discoveries in structural and physiological botany which are daily challenging a careful examination. But our position in a comparatively new country points out to us a special path of research which it will be our duty to follow—that which has for its object the investigation of the species botany of Canada, the geographical and local distribution of the plants. The indigenous plants, whose products are now used or are capable of being applied to the useful arts, will deserve a large share of attention, and no doubt regard will also be had to those that are suited to our climate, but have not yet been introduced. Strewed around our path in the woods and on the shores of our lakes are many plants capable of yielding food and physic, dyeing and tanning materials, oils, bres for spinning and paper-making, &c. Even in the midst of the city of Kingston, growing on vacant lots, and in court yards, there are drug-plants enough to stock a Liverpool warehouse. Such will no doubt be brought into use when better known, and thus an increase will be effected in the production of the country. Two things are necessary for the successful prosecution of such researches—a good botanical library and a good herbarium. During the past year botanical works of great value have been added to the library of Queen's College, and these, together with others in private hands, which will be accessible to members of the society, embrace almost all the works that have a direct bearing on the Canadian flora. There is thus laid in Kingston the basis of a botanical library, which it will be the object of this society to foster, by additions obtained by purchase or exchange with other scientific bodies, provided a suitable arrangement is made with the university authorities. With respect to a herbarium, or collection of dried plants, this is justly regarded by every Botanical Society as absolutely necessary to enable members to refer specimens correctly to their species. It will therefore be satisfactory to know that arrangements are now in progress, whereby the herbarium, presently attached to the Natural History Chair of Queen's College, will be re-arranged in a convenient room, so as to become available for this purpose. The herbarium embraces a fair representation of the floras of Europe, Asia, Africa, and Australia, and is especially rich in American species; it has been named with great care, under favourable circumstances, many of the specimens, in difficult and obscure families, having passed through the hands of such botanists as Balfour, Greville, Gray, Babington, Heldreich, Hooker, Lindley, Bruch, and Schimper, Syme, Wilson, Berkeley, Moore, Mitten, Tuckermann, Carrington, Watson, Lowe, Lindsay, Harvey, Leighton, and other authorities in nomenclature. In addition to such means as the above, there is now an abundant supply of excellent microscopes in Queen's College, with all needful apparatus for the prosecution of minute researches and microscopical analysis. It will be observed that we propose to occupy a new field of research, to cut a new sod that has hitherto been walked over by Canadians in comparative neglect. And, as before cultivation can take place, a clearance must be made, so I have endeavoured to answer some of the objections that might be started to the formation of such a society, and to point out the nature of the ground which it proposes to occupy. While leaving to other societies the discussion of the more general questions of science, and to special societies their peculiar topics, we propose to employ the Botanical Society as an instrument for the collection of facts and the working out of details, which are of immediate interest to the botanist alone, but of the greatest importance in leading to correct results in general science. Scientific societies on a broader basis have too often degenerated into popular institutions, calculated rather for the amusement of the many, than for the encouragement and aid of the few who are engaged in the prosecution of the original discovery. We shall be guarded against such a result, in a great measure, by the special object of our institution, but it will be needful, also, while we attempt to spread a taste for botany, and to diffuse correct information as to its objects, its discoveries, and its useful applications, that we should seek rather to bring our members and the public into scientific modes of thought and expression, than to allow our society to yield up its scientific character to suit the popular taste. There is much reason to believe that the want of an organisation of this kind, whose duty it is to collect and record facts and discoveries, has been the means of losing to science materials of great value. There have been casual residents in Canada, at different times, who have made collections of greater or less extent, and who have, in some cases, carried out special investigations in botany, without leaving any printed record of their labours. Some of these may still be rescued from oblivion; but there are also other observations and discoveries made by present residents in the country which, we may confidently hope, will be made available to the society's purposes. Professor Williamson's long residence in Kingston has enabled him to make an extensive series of observations on our local flora, which are of the greatest interest, and other professors of Queen's College have followed his example. Some of our graduates and students have also, of late years, made collections of greater or less extent, during their vacation residence in different parts of the country. The neighbourhood of Kingston and the adjoining islands have been investigated by Mr. Andrew T. Drummond, B.A., who obtained a prize for his valuable collection, in the Natural History Class, two years ago. Dr. Dupuis has collected the plants of the rear of Frontenac and Ernestown, while Newboro', Perth, the Ottawa country, have each their collectors. Dr. Giles has, I believe, been devoting special attention to Lichens. Mr. Schultz has had an opportunity, during the past season, of botanising the Red River Settlement, and I have received notices of collections, formed by our students in other distant localities, that may prove of great interest. Circumstances such as these give us reason to hope that our efforts to raise up a Botanical Society will be attended with success, and that its labours will be beneficial in leading to a more extended knowledge of the indigenous productions of Canada. The objects sought by the establishment of a Botanical Society in this country are of great importance, both in a scientific and economical point of view. The field is broad, and the soil is rich. The extent to which we can cultivate it will depend entirely upon the number of the labourers, and the zeal and industry which they display. Let us, therefore, be not disappointed with our first results. Let us lay a foundation, and persevere in the work, and workers will gather around us as they have done before in the Botanical Societies of other countries. To organisations of this kind, more than to any other means, are we indebted for the advanced state of botanical science at this day; and in a country such as this, it is especially needful to have a wide-spread organisation in order to elicit satisfactory results. In an attempt to organise a society such as this, we may confidently appeal to many classes of the community. The theologian and moralist see in the vegetable kingdom a display of the power, and wisdom, and goodness of our Creator, and beautiful types of spiritual teaching; the medical man recognises in it the source of his most potent drugs; the sanitary reformer knows that the simpler forms of vegetation are often the cause, and more frequently the index, of widely-spread diseases; the lawyer finds, in the microscopical structure of vegetable products, a ready means of detecting frauds, adulterations, and poisonings; the commercial man recognises the value of a science having such bearings, and directly devoted to the extension of the sphere of industry; the spinner and paper-maker must here obtain their knowledge of the mechanical condition of vegetable fibres; the farmer, the gardener, the orchardist, the vine-grower, the brewer, the dyer, the tanner, and the lumberman, must all apply to botany for an explanation of matters that daily come before them in their various avocations. As an utilitarian institution, then, our society is worthy, and will no doubt receive warm support; but it is to be hoped that many zealous labourers will enter the field from higher motives —a desire to promote the cause of science.

PROFESSOR LITCHFIELD'S NOTES AND SUGGESTIONS.

Dr. Litchfield aided in the formation of the London Botanical Society, and will do all in his power to aid a similar society here. Canada is interested in diffusing a knowledge of her botanical productions, and equally so in acquiring productions from other countries suited to her soil and climate. The University of Queen's College is interested in the formation of a Botanical Society and Garden, botany being taught in the College. The piece of land in front of Queen's College has a fine aspect and excellent drainage. It is well situated as a site for glass hot-houses. If the College land is found insufficient in quantity for a botanical garden, other lands might be obtained for extending the garden. The new garden of the London Horticultural Society will be small in extent, but promises to be all the more perfect in its arrangements, partly perhaps in consequence of its circumscribed area. The gardens of the Apothecaries' Society at Chelsea, and of the Botanical Society in Regent's Park, London, are of comparatively small extent. A garden of small size, with space for subsequent extension, involves less outlay, and is more easy of accomplishment. Half an acre of hot-house on the new and economical plan invented by Sir Joseph Paxton could be conveniently and cheaply placed on the ground referred to in front of the main building of Queen's College. I append sketches of the plan. The cost would be small, the frames being made by machinery of Canadian wood, and the glass procured from Birmingham, St. Helens, or Newcastle. The glass houses are portable, as well as cheap, when constructed upon this plan. If a terrace walk was constructed to run parallel to the broad balcony in front of the College building, and beneath this terrace was placed a Paxton or Ormson glass house, it would afford good space for delicate or exotic productions during the Canadian winter, and admirable exhibition buildings during the summer and autumn. From the balcony, in fine weather and during exhibitions, addresses and announcements might be made to members and visitors on the terrace beneath. In the College class-rooms lectures might be delivered, and scientific meetings and conversaziones held. The balcony would serve the purpose of a music stand when music is deemed desirable. To establish a Botanical Garden as well as a Botanical Society in connection with the College it would be necessary, first, to obtain the sanction and assistance of the College authorities; second, the cordial concurrence and co-operation of the public, and more especially of those who take an interest in horticultural pursuits. The equivalent to the College would be that the Botanical Garden would render its organisation more complete, and would furnish the Professors of Botany and Materia Medica with specimens to illustrate their lectures and teachings. The interest excited in a scientific subject taught in the College would add to the number of pupils in the classes. The public would find an equivalent in having, in the very centre of the city, and of easy access, a Botanical Garden furnished with all that is needed for horticultural and floricultural displays—a place of high intellectual resort, to which they may hereafter proudly point as one of the first institutions formed in Canada for the advancement of botanical science. The Electoral Division Society for promoting horticulture, agriculture, &c., and the City of Kingston Horticultural Society, which this year united to render their exhibitions more complete, would doubtless come frankly forward to aid a society whose objects are in a great measure identical with their own. These two societies collected in the locality in 1860, with the addition of a Government grant for the furtherance of the objects, a sum of nearly 1,500 dols. One-half this amount would be sufficient, on the simple and economical plan of Sir Joseph Paxton, for the construction of a glass house 100 feet long with twelve feet lights. I quote these figures to show that the object is not unattainable if there is a desire to accomplish it. The proposed Botanical Society would materially strengthen itself by opening communication and exchanging courtesies with older societies in other parts of the world. Contributions to the gardens might be procured from London and Paris, Edinburgh, Glasgow, and other places. Such men as Professor Lindley, Sir W. J. Hooker, Dr. Balfour, and others connected with Botanical Societies and Gardens, should be invited to take an interest by being nominated associates of the society. * * * After all, however, the success of the proposed Botanical Society must depend upon the intelligence, earnestness, and activity of its members. Botany is a science that may be taught in a popular, as well as scientific, form to the young as well as to the old, and to one sex as well as to the other. The botanical garden has charms which can be appreciated by all. The country around is rich in specimens of interest to the botanising student, and the formation and labours of the society may alike tend to develope latent talent, improve our knowledge of the North American Flora, and extend the area of scientific knowledge and research.

The Rev. Principal reviewed some of the leading points brought forward in the addresses, and referred briefly to some of the more important advantages that might accrue to the country from an institution such as the one that had been proposed, alluding especially to the inducements which it would give to botanical research. Dr. Lawson, he said, when enumerating the grounds for the establishment of a Botanical Society, omitted the weightiest of all—viz., that we can count upon his services. Without his large and valuable experience in the management of such societies, I fear we would have little heart to carry out the scheme. He for a long period acted as the secretary of the Edinburgh Botanical Society—one of the most active in the world; and, from his accurate knowledge of the details of management, and his well-merited distinction in botanical science, he is qualified, in no ordinary measure, for organising such a society as the one we contemplate. The labour will fall chiefly upon his shoulders, but we must pledge ourselves to lend him every assistance in our power.

THE SHEA BUTTER OF AFRICA.

Small quantities of this soft solid oil, mentioned by Mungo Park in his Travels, have recently come into commerce from the West Coast of Africa; and, as comparatively little is known of its origin, the following particulars may prove of interest.

This oil or butter is obtained from the fruits of *Bassia Parkii*, by boiling them in water. It is called by the natives in some parts *ori*, and is now exported from Abbeokuta. Like the butter of *Bassia butyracea* and other allied species in the East, it has a medicinal repute, being esteemed in rheumatism and contraction of the limbs. In India Bassia butter is used by natives of rank, perfumed, as an unction. Before describing the African shea butter, we may allude to the Indian fats.

1. That obtained from the fruits of *Bassia longifolia* by expression is called Illoopei oil. It is used for burning in lamps, and for making soap, and is a common substitute for ghee and cocoa-nut oil in the curries and dishes of the common people.

2. The seeds of *B. latifolia* also yield a large quantity of oil by expression, which is only used by the common people for burning. It has been imported into this country under the name of Mohwa oil, and recently under the name of vegetable oil, from Calcutta. It is usually of a greenish white colour, having hardly any taste or smell, and of the consistence of common butter. It melts at 97° Fahr., and is composed of 56 parts solid and 44 of fluid oil. The *Bassia latifolia* is produced plentifully in Bengal.

3. *Bassia butyracea* produces a fine vegetable butter, which bears the name of Fulwa or Phulwara butter in Nepal and Almora, and is a soft solid at 95°. The kernels of the fruit are bruised to the consistence of cream, which is then put into a cloth bag, with a moderate weight upon it, and left to stand till the oil or fat is expressed; it becomes immediately of the consistence of hog's lard, and is of a delicate white colour. Dr. Adams, in the "Voyage of the Samarang," says a concrete oil is obtained in Borneo from the expressed boiled fruit of either *Bassia longifolia* of Linnæus, or *B. butyracea* of Roxburgh. It is made up into large round flattened cakes of the consistence and colour of cheese, and also in cylindrical masses, which have assumed the form of the bamboo-joints, into which it had been poured when in a liquid state. Judging from some cotydelons which were imported not long since, as the source of the Borneo vegetable tallow, that concrete oil must be referred to another, at present undefined, tree.

4. Shea butter (*Bassia Parkii*). The following extract from "De Caille's Travels," vol. i. p. 311, furnishes the most full details we have met with:—

"The butter tree or cé is very abundant in the neighbourhood of Timé. It grows spontaneously, and in height and appearance resembles the pear tree. The leaves grow in tufts, supported by a very short foot stalk. They are round at the top, and, when the tree is young, they are six inches long.

When the tree grows old the leaves become smaller, and resemble those of the Saint Jean pear tree. It blossoms at the extremity of its branches, and the flowers, which are small, grow in clusters, and are supported by a very strong pedicle. The petals are white, and the stamins are numerous and scarcely perceptible to the naked eye. The fruit, when mature, is as large as a guinea hen's egg, of oval shape, and equal at both ends. It is covered with a pale green pellicle, beneath which is a green farinaceous pulp, three lines thick, of an extremely agreeable flavour. The negroes are very fond of it, and I liked it myself. Under this pulp there is a second pellicle, very thin, and resembling the white skin which lines the inside of an egg-shell; this covers the kernel, which is of a pale coffee colour. The fruit being disengaged from the two pellicles and the pulp, is inclosed in a shell as thick as that of an egg, and the kernel is of the size of a pigeon's egg. The fruit is exposed several days to the sun, in order to dry it, then pounded in a mortar, and reduced to flour, which is of the colour of wheat bran. After being pounded, it is placed in a large calabash; lukewarm water is thrown over it, and it is kneaded with the hand until it attains the consistency of dough. To ascertain whether it is sufficiently manipulated, warm water is thrown over it, and if greasy particles are detached from the dough and float, the warm water is repeated several times until the butter is completely separated, and rises to the surface. The butter is collected with a wooden spoon and placed in a calabash. It is then boiled on a strong fire, being well skimmed, to remove any pulp that remains with it. When sufficiently boiled it is poured into a calabash, with a little water at the bottom to make it turn out easily. Thus prepared it is wrapped in the leaves of the tree, and will keep two years without spoiling. The butter is of an ash-grey colour, and as hard as tallow. It is an article of trade with the negroes, who use it both for food and for anointing their bodies. They also employ it to burn for light; and they told me that it was an excellent remedy for pains and sores. The fruit of the cé is much larger in Baleya and Amana than in Timé.

There is at Timé a fruit called *taman*, which also produces an unctuous substance, very good for eating, and more pure than the cé. It might be advantageously employed in Europe for burning. The grease or fat, called by the natives *tamantoulon*, is extracted by the same process as that employed with the cé. The tree which produces the *taman* grows on the banks of rivulets, and is very common in the south. The kernel of the taman is of the size of a horse chestnut, somewhat elongated, of a beautiful pink colour, deepening a little towards the outside. It is exceedingly hard, and the women, after setting it on the fire in earthen pots, crush it between two flints, previously to pounding it in a mortar. The butter of the taman is of a light yellow colour. It is purer than that of the cé, and has no smell. I preferred this to the other (the cé)."

Shea butter is now being brought down by the natives in considerable quantity from the interior of Africa, particularly from the southern banks of the river Niger, where the trees bearing the fruit from which the oil is extracted, grow in great numbers, forming miles of forests. The value of this tree and its product have been pointed out to the natives by the officers attached to the Niger Expedition, some of whom have made frequent journeys between Lagos and their encampment, near Rabba. Hitherto only very small quantities of shea butter have been brought down to the coast.

MOTHER OF PEARL AND ITS USES.

BY THE EDITOR.

Mother of pearl is that beautiful white enamel, or nacreous lining, which forms the greater part of the substance of most oyster shells, but especially the larger ones found in the seas of the Pacific and Indian Oceans. In 1845 it was admitted duty free, but it was only in 1853 that mother of pearl shells were deemed of sufficient importance to appear in the Board of Trade returns. The imports since then have been as follows :—

	Cwts.	Value.
1853	15,480	—
1854	36,644	£88,305
1855	20,120	34,634
1856	42,032	76,544
1857	34,324	57,819
1858	25,108	60,448
1859	40,003	67,859

The imports of 1859 were drawn from the following sources :—

	Quantity. Cwts.	Declared value. £
Hamburg	956	1,500
Holland	936	4,212
France	633	1,510
Egypt	311	1,570
Philippine Isles	349	2,017
South Sea Islands	3,424	9,000
New Granada	19,150	15,658
Chile	5,296	11,478
East Indies	5,092	15,107
Australia	1,102	3,065
Other parts	2,754	2,742
	40,003	67,859

The places from whence we import them are no guide as to the sources of supply—for instance, large quantities reach us from Holland, the United States, Cuba, Australia, and Chile, which are chiefly brought there for transhipment. There are about six commercial varieties of these, usually designated as the white edge, brought from China and Singapore, worth now £140 to £150 a ton; the yellow edge, from Manila, £110 to £120; from Bombay, £28 to £56; pure white, from Egypt, £18 to £36; and from South America, £18 to £21 per ton; and the black shell, from the South Sea Islands, worth £50 to £70 per ton. These shells are again subdivided into size and quality, and it may not be inappropriate to mention the average weight of the different shells. Thus, the smallest are the South American, weighing about half a pound per shell—that is, one valve, for they never come in in pairs. The Bombay and Egyptian weigh about three-quarters of a pound; the South Sea black shells, one pound; while the largest are the Singapore and Manila shells, weighing on an average $1\frac{1}{4}$ lb. The prices for these shells have much advanced of late years —thus resembling ivory; inasmuch as the imports have at the same time so largely increased, but not in proportion to the extent of the consumption. The advance has been from 40 to 50 per cent. all round, and in some cases more. Thus, the black or South Sea shell, which was formerly little valued, since the change of fashion which has brought the large dark pearl buttons into use for ladies' paletots, for gentlemen's waistcoats, shooting coats, &c., have risen 100 per cent., being double the price they were five or six years ago. These buttons are called smoked pearl by some dealers, but from the same shells white buttons are also made, when the part nearest the "knot" is used. The extreme edge or skirt serves to form the black or dark buttons. Even the small true pearl oyster shell from the fisheries of Ceylon, which were deemed worthless, have now come into use for the nacreous substance which they furnish, for, although thin, it serves for inlaying and other purposes. The only nacreous shells possessing sufficient thickness for Sheffield purposes, are those received from Manila and Singapore. The smaller shells from Bombay, Panama, and other places are used chiefly in Birmingham, and are there worked into buttons and counters, and paper knives, or else used for inlaying purposes in papier-maché work, ladies' portmonnaies, card cases and working implements, book covers, and such like. Small fancy devices for inlaying are punched out of the shell. Button blanks are drilled out of the shell. One firm alone, at Birmingham, makes nearly half a million gross of pearl buttons annually. Mother of pearl shells were formerly more extensively used than at present in the manufacture of "scales," as they are termed, for the handles of penknives, dessert and fancy knives and forks. These scales are the two flat pieces riveted to a central plate of the haft or handle, as in penknives. There is now a great dearth of material for knife and fork handles, and any new substance adapted to the purpose, and coming in to the aid of bone and ivory, would be hailed as a great boon by the cutlery trade.

Pearl shells will average about six inches in diameter, and are so extremely hard, that they have to be wetted, while being cut with a circular saw, to prevent the saw being softened by the heat. This is a dirty occupation, and is accompanied by a "very ancient and fish-like smell," elicited by the heat from the shell itself. The pieces have afterwards to be ground down on stones singly, and by hand, to a level surface and a required thickness. This tedious process aids in making shell a costly covering for cutlery; and, as the substance is both hard and brittle, when the handles or scales are fluted or carved, the price is, of course, still more enhanced. The beautiful iridescent appearance of the pearl shells is attributed to their laminated structure, which disposes their surfaces, in minute furrows, that decompose and reflect the light, and, owing to this lamellar structure, admit of being split into leaves, for handles of knives, counters, the purposes of inlaying, &c.; but they are very apt to follow, and even to exceed the curvature of the surface, and therefore splitting is not much resorted to; but the different parts of the shell are selected to suit the several purposes as nearly as possible, and the excess of thickness is removed upon the grindstone, in preference to risking the loss of both parts, in the attempt to split them. The usual course in preparing the rough pearl shell for the arts is, to cut out the square and angular pieces with the ordinary brass-back saw, and the circular pieces, such as those for buttons, &c., with the annular or crown saw fixed upon a lathe mandrel. The sides of the pieces are then ground flat upon a wet grindstone (running in soap and water), the edge of which is turned with several grooves, as the ridges are considered to cut more quickly than the entire surface, from becoming less clogged with the particles ground off. The pieces are finished upon the flat side of the stone, and are then ready for inlaying, engraving, polishing, &c., according to the purposes for which they are intended. Cylindrical pieces are cut out of the thick part of the shell, near the joint, or hinge, and they are rounded upon the grindstone, ready for the lathe, in which they may be turned with the ordinary tools used for ivory and the hard woods.

The articles made from this shell are comparatively expensive, in consequence of the large amount of labour spent in reducing or grinding the shell to any given size or shape, a process which eventually will, no doubt, be rendered more facile by the introduction of machinery.

In the process of polishing, which is simple and inexpensive, the shell articles are first smoothed with Trent sand or pumice-stone and water, or a buff-wheel or hand-polisher, and then finished off with rotten-stone. The latter powder, although sometimes used with oil or water, is more frequently moistened with a little sulphuric acid, nearly or quite undiluted; this produces a far more brilliant polish, which may possibly arise from the partial destruction of the surface, thus developing in a more decided manner the striated formation of the pearl shell, and to which peculiarity of structure its variegated lustre is ascribed.

The exports of mother of pearl shells from Bombay have been as follows:—

	Cwts.	Value.		Cwts.	Value.
1851	1,633	£890	1855	—	£1,406
1852	1,851	1,481	1856	—	1,861
1853	2,244	1,796	1857	—	1,658
1854	—	1,810	1858	—	3,063

Pearl shells shipped from Tahiti, chiefly to Valparaiso and Sydney, and thence to Europe:—

	Tons.	Value.		Tons.	Value.
1845	324	£1,814	1851	340	£2,593
1846	210	1,176	1852	589	7,524
1847	160	1,560	1853	649	13,460
1848	212	3,380	1854	266	5,503
1849	259	3,902	1855	250	3,752
1850	178	1,256	1856	204	4,080

In China there is a good demand for mother of pearl shells. They are used for inlaying, and also manufactured into beads, fish-counters, spoons, &c., but they do not seem to be used for buttons, as in Europe. Three sorts of beads are made in China from these shells, one perfectly round, the second not quite round, and the other cut. The fish-counters are cut of various shapes, round, oval, and oblong, and figured or engraved. They are put up for sale in sets of 140 pieces.

Mother of pearl shells imported into Great Britain from China:—

	Cwts.	Value.		Cwts.	Value.
1811	2,038	£11,964	1821	3,351	£30,005
1812	3,838	5,674	1822	2,013	17,346
1813	730	3,315	1823	964	7,848
1815	3,955	18,820	1824	2,575	8,910
1816	2,972	12,040	1825	1,052	5,967
1817	2,331	12,012	1826	181	774
1818	1,421	14,334	1828	296	1,783
1819	1,308	18,786	1829	1,836	7,001
1820	2,074	20,801	1830	1,431	6,257

The receipt of mother of pearl shells from Panama has been largely on the increase of late years. In 1855 four vessels with 650 tons of pearl shells collected at the islands in the Bay of Panama, sailed for Great Britain. Of these Victor Plisé, Esq., loaded three at his islands. The shells from the island of St. Joseph, one of the group known as the Pearl Islands, are said to be the largest, purest, and best in the bay. In 1859 we received 957 tons of pearl shells from Panama.

Worthy of note is the cathedral and some of the churches of Panama; the upper portions are studded with pearl shells, giving them a quaint and sparkling appearance. Mr. Mac Micking, in his "Recollections of Manilla and the Philippines," states that in many of the houses in the capital the outer side of the verandah or corridor is composed of coarse and dark-coloured mother of pearl shells of little value, set in a wooden frame-work of small squares forming windows, which move on slides. Although the light admitted through this sort of window is much inferior to what glass would give, it has the advantage of being strong, and is not very liable to be damaged by the severe weather to which it is occasionally exposed during some months of the year.

Many of the Dyaks of Borneo have a large polished pearl shell appended in front to their corslet, and their shields are ornamented with shells.

All that extensive range from Cape Unsing, passing by the Tawi Tawi Islands and Sulo as far as Baselan, is one vast continued bed of pearl oysters, principally of the mother of pearl shell species; these are called by the natives *tipi.* There is likewise an extensive bed of the Ceylon oyster, called by the Malays *Kapis*; the principal banks of the latter are found in Maludu Bay. The Sulo pearls have from time immemorial been the most celebrated, and praised as the most valuable of any in the known world. Pigofitta, the companion of Magalhaens, mentions having seen in 1520 two Sulo pearls in the possession of the Rajah of Borneo as large as pullets' eggs. Very large ones, from 100 to 200 chow weight, are at all times to be purchased at Sulo, and there are altogether sold here to the China junks, the Spaniards, &c., more than two laks of dollars annually. The quantity of mother of pearl shells sold there is 2,000 piculs at six dollars a picul. The fishery is partly carried on by the Malays and partly by the Chinese; the large pearls they endeavour to conceal as much as possible, from a law that all pearls above a certain size, of right belong to the Sultan.*

Scientific Notes.

Caseine Cement.—Dr. Wagner recommends using a cold saturated solution of borax or alkaline silicate for dissolving caseine, instead of alkaline carbonate, as recommended by Bracconot. The solution of caseine with borax is a clear viscous liquid, exceeding gum in adhesiveness, and applicable to many purposes as a substitute for glue. Woollen and cotton fabrics saturated with the solution may be tanned with tannic acid or acetate of alumina, and rendered waterproof. Marsden, in his "History of Sumatra," states that the chief cement used there is made of the curd of the buffalo milk called *prackee.* It is to be observed that butter is made (for the use of Europeans only) not as with us, by churning, but by letting the milk stand till the butter forms of itself on the top. It is then taken off with a spoon, stirred about with the same in a flat vessel, and well washed in two or three waters. The thick sour milk left at the bottom when the butter or cream is moved

* Sketch of Borneo.

is what is termed the curd. This must be well squeezed, formed into cakes, and left to dry, when it will grow as hard as flint. For use you must scrape some of it off, mix it with quick lime, and moisten it with milk. I think that there is no stronger cement in the world, and it is found to hold, particularly in a hot and damp climate, much better than glue, proving also effectual in mending China ware.

Paper Neck-Ties and Collars.—Messrs. Smith and Brower, of New York, have taken out a patent for paper neck-ties. They are printed in imitation of gingham, silk, &c., and counterfeit the textile fabrics with wonderful exactness. The wholesale price is from 1s. to 2s. 2d. per dozen! This firm sold last season of one single style of cloth neck-ties 17,000 dozen. The introduction of paper neck-ties, as a new article of manufacture, goes considerably ahead of paper collars, which have been so extensively sold for the past two or three years, and are sold for about the same price. Who will go in future without a clean collar and handsome neck-tie of the latest style when he can purchase both for threepence?—*Scientific American.* [In India and the colonies, and at sea, where washing is so dear, these paper substitutes may perhaps prove useful.]

Palo Santo Wood.—A letter from Buenos Ayres says:—"A few days since there arrived at Parana a small vessel built at Oran, which is within about thirty miles of the south central Bolivian frontier, upon the river Vermejo. According to the account of the captain, his vessel (named the Esperanza) is of fifty tons capacity, built of cedar of the best quality, and draws but five and a half feet water when loaded. Her cargo consisted of cedar, 'palo santo,' hides, cheese, and grease—articles abundant in the province of Oran. The wood called 'palo santo' is very rare, and similar in appearance to the "caoba" of Central America, with which it might be confounded when once worked. It takes a magnificent polish, is of a green colour, very solid and elastic, and moreover has a fine odour, which it never loses. It may be used for furniture, wind instruments, and would make magnificent pianos. One log brought by the Esperanza measured twenty-seven feet in length, with a section of seventeen inches square. The voyage of the Esperanza may be said to open at least 40,000 square miles of new country. The first made, it will be, doubtless, the cause of opening a large trade with almost the centre of South America."

New source of Truffles.—After the depression occasioned in the minds of the *gourmands* by the announcement of the failure of the truffle crop in France, it is but just to raise their spirits by the account of the discovery of the luscious production in such large quantities in Africa that several of the great truffle growers of Perigord—armed with their knowledge, which is power, and their experience, which is wealth—have set out to this promised land, and have sent back the most flaming reports, backed by the most splendid proof of the existence of a magnificent species of truffle, produced in great abundance beneath the pine trees and cedars in the brakes of some Algerian forests, more delicate in flavour and more powerful in perfume than those belonging to the oak and hazel bush of Perigord.

THE TECHNOLOGIST.

THE SOURCES OF MANNA.

The Manna of commerce is the concrete juice of the flowering ash *Ornus Europœa* and *O. rotundifolia*, which flows out after incisions or insect punctures. Manna is also procured from *Fraxinus excelsior* and *parvifolia*. It is imported into this country under the name of flake manna, principally from Palermo, Messina, and other ports of Sicily, and we obtain some through Trieste and Leghorn. In 1842, 2,565 cwts. of manna, valued at £70,584, were exported from Sicily. The manna is collected in August and September, and terminates when the rainy season sets in. Incisions, about two inches long, are made with a hooked knife, first in the lower part of the stem, and are repeated daily, extending them perpendicularly upwards. In the districts of Capace, Cinesi, and Fabarotto, where the best manna is obtained, the manna ash does not form woods, as is commonly supposed, but is cultivated in separate plantations. These plantations generally present regular squares, hedged in with *Cactus Opuntia*. The trees are planted in rows, and are from two to eight inches in diameter, with stems from ten to twenty-five feet high, which, from the first shoot, are kept smooth and clean. The soil is carefully loosened, and kept free from weeds. After the eighth year the trees yield manna, which they continue to do from ten to twelve years, when they are cut down, and young shoots from the roots trained; one root-stalk frequently yields from six to eight new trees and more. For the production of the manna young and strong shoots are requisite; but they are not tapped till the tree ceases to push forth any more leaves, and the sap consequently collects in the stem. This period is recognised by the cultivators from the appearance of the leaves; sometimes it occurs earlier than at others, and the collection of the manna takes place either at the beginning of July or only in August. Close to the soil cross sections are made in the stem, and in the lowermost sections small leaves are inserted, which conduct the sap into a receptacle formed by a cactus leaf. This is the way the manna *in sortie* is obtained. The incisions are repeated daily in dry weather, and the longer they continue the more manna is obtained. The stems are left uninjured on one side, so that the manna runs down the smooth bark more easily. The next year the uninjured side is cut. The *Manna cannelata* is obtained from the upper incisions, more than forty of which may be counted on one tree. The sap there is not so fat as below, and consequently dries more easily into tubes and flat pieces. After the manna has been removed from the trees it has further to be dried on shelves before being packed in cases. The masses left adhering to the stems, after removing the inserted leaves, are scraped off, and constitute the *Manna cannelata in fragmentis*. *Cannelata*, *can. in fragm.* and *Capace* are collected at the same time from one stem—the more *Cannelata* from the younger, and the more *Capace* or *Gerace* from the older part of the stem. In Sicily the latter is designated *in sortie*, and is probably the most active. Dry and warm weather is essentially requisite for a good harvest.

Manna is a gentle tonic, usually operating mildly, but in some cases produces flatulence and pain. Mannite is white, inodorous, crystallisable, in semi-transparent needles, of a sweetish taste, soluble in five parts of cold water, scarcely soluble in cold alcohol, but readily dissolved by that liquid when hot, and deposited when cool. Unlike sugar, it is incapable of producing the vinous fermentation. Manna sugar, or Mannite, differs from the other sugars in not being fermentescible. Its composition is $C^6H^7O^6$, while that of cane sugar is $C^{12}H^9O^9 \times 2HO$. It is the chief ingredient of manna.

The imports of manna into the United Kingdom are very variable. In 1855 as much as 94,274 lbs. were imported, and in 1856, 30,917 lbs. In the subsequent three years the imports were smaller.

	Imports. lbs.	Computed value.
1857	15,365	£3,329
1858	26,752	6,303
1859	23,271	5,110

M. A. Leuchtweiss (*Annalen der Chemie*) has examined the three varieties most commonly met with in the market, and the following are the results of his analyses:—

	Manna Cannelata.	Manna Cannelata in pieces.	Manna Calabrina.
Water	11·6	13·0	11·1
Insoluble substance	0·4	0·9	3·2
Sugar	9·1	10·3	15·0
Mannite	42·6	37·6	32·0
Substances similar to vegetable mucus with mannite, resinous and acid substance, with a small quantity of nitrogenous matter	40·0	40·8	42·1
Ashes	1·3	1·9	1·9
Total	105·0	104·5	105·3

In Styria the common larch exudes from its leaves and branches a honied juice, which, becoming hard, forms a kind of manna, called Manna of Briancon. A kind of manna is found in small quantities on the branches of the cedar of Lebanon, in the form of transparent resinous drops, indubitably the result of the punctures of an insect. The monks collect it, and prepare with it various electuaries and ointments, which are sold to strangers visiting the monasteries. This cedar manna enjoys a considerable reputation in Syria as a remedy in phthisis.

Burchardt states that a species of manna which exudes from a variety of the tamarisk (*T. mannifera*) is used by the Bedouin Arabs of the neighbourhood of Mount Sinai with their food; it does not, however, contain any mannite, but consists wholly of mucilaginous sugar.

The tamarisk manna is produced through the puncture of *Coccus manniparus*, an insect inhabiting the tamarisk trees which grow abundantly in the neighbourhood of Mount Sinai. The monks from the monasteries of the district collect the saccharine secretions which exudes as a thick, transparent syrup, covering the smaller branches from which it flows. The collection of the manna takes place in August; it requires to be performed very early in the morning, at which time, owing to the coolness of the night, the saccharine juice has become to some extent congealed. Later in the day the solar heat causes it to drop upon the ground. When collected it is usually stored away in large earthen vessels, which are preserved in cellars during the entire year. To strangers the tamarisk manna is sold in little vessels of tinned iron. Dr. Landerer says that he purchased one of these of a pilgrim who had been in Palestine. The manna was a yellowish granular syrupy mass, very sweet, and intermixed with the little leaves of the tamarisk. It dissolved in water or in alcohol, and the aqueous solution readily fermented; the alcohol obtained by distillation had a peculiar odour, resembling that derived from the fruits of *Ceratonia siliqua*, which contains butyric acid. The manna is eaten in Palestine and in the neighbourhood of Sinai as a delicacy, and is reputed efficacious in diseases of the chest.

Manna of the desert is the exudation of the camel's thorn (*Alhagi maurorum*, Dec.; *Hedysarum Alhagi*, Linn.), an erect thorny shrub, belonging to the natural order *Leguminosae.* Extensive plains are entirely covered with the plant in Arabia and Palestine, and especially in Egypt and Syria. It appears to afford the manna chiefly through the wounds occasioned by the browsing of the sheep, goats, &c. It is collected by the leaders of the caravans, and by the Arabs who cross the deserts, and who avail themselves of this manna as nutriment. This substance occurs in small, round, unequal grains, the size of coriander seed, of yellowish-white or greenish-yellow colour, caking together and forming an opaque mass, in which are found portions of the thorns and fruits of the plant. This manna is inodorous, its flavour is sweetly saccharine, followed by slight acidity. A good analysis of it is still a desideratum. As a medicine its effects correspond to those of the ash manna. The inhabitants collect these exudations and make them into loaves or cakes. These soon become of a black colour, owing to a kind of fermentation produced by the influence of the air and moisture. Little care is bestowed upon the collection of the manna, and hence it is always mixed with a large proportion of broken leaves and branches, by which its value is diminished. The odour of these manna loaves or cakes resembles that of senna; in taste also they resemble senna, combined with sweetness. These two characters would lead us to suppose that this manna is more purgative than nutritive. The manna should be collected, according to the statements of travellers, in the morning, as the rays of the sun cause its liquefaction. In many parts of the East it is used as a substitute for sugar. Tournefort states that it is common on the Alhagis, in the environs of Taurus, in Persia. At Bussorah the manna is collected on a small thorny bush, also common in Khorasan, and called *el hadsji*. The Nepal alhagi is also stated to afford this secretion. Some authors, as Hallé and Guillemin, supposed that this manna of the *Alhagi maurorum* was that which constituted the manna of the Hebrews; but at the present day it is more generally supposed that the *Lecanora affinis*, Everem, was the substance upon which the Israelites fed in the wilderness.

A species of Australian *Eucalyptus*, named by Mr. Allan Cunningham the *E. mannifera*, is met with in the cool regions of Argyle and Bathurst, New South Wales, which produces the finest manna, and that in very considerable abundance. It is found in flakes upon the grass, and also adhering to the branches and trunks, and several pounds may often be collected in a very short space of time. It must be looked for in the morning, as, should the sun shine out strong, it gradually dissolves. Manna is one of the safest and almost the only pleasant purgative we possess; and it is only its scarcity and high price that have prevented its coming into more general use. The average price of manna is above 4s. per pound. It once was as high as 10s. 6d. Here, then, is an excellent remunerating price for both the collector and shipper; and if these trees are found to produce it in sufficient quantity, I see nothing likely to answer better than making plantations thereof at some future period. Supposing each tree to produce half a pound of manna, worth but 3s. per pound to the producer, there would be, with 160 trees to the acre, a clear revenue of £12 per acre, at the expense of a few days annual labour, besides having the benefit still of this acre throughout the year for grazing.

This Australian manna has been shown to contain a saccharine matter, different from mannite, and, though similar to glucose, differing from it, as well as from other varieties of sugar, in properties. Another manna found in Australia is produced by exudation from the leaves of *E. dumosa* when very small; it sometimes appears spread over large districts of country, like a kind of snow, and is used by the natives as food. In Tasmania manna is obtained in small quantities from the *Eucalyptus Acervula*, Seib., after punctures by some insect.

ROYAL SOCIETY OF TASMANIA.

At a meeting of this society at Hobart Town, in Dec. 1860, the secretary, Mr. W. Archer, read a valuable paper "On the Indigenous Plants of Tasmania which may possibly be available for the Manufacture of Perfumery," pointing out a variety of plants which possessed a pleasant odour either in the flowers, leaves, wood, or roots, and some grasses which yielded an agreeable perfume.

After alluding to the export of perfumery from England and France, he proceeded to enumerate some of the plants referred to, expressing a hope that the initiation of the subject would give rise to a general interest in it, and that such information might be imparted to the Society as might prove not only interesting but valuable. He arranged the plants enumerated under five heads; namely, the flower series, the leaf series, the wood series, the root series, and the grass series.

Under the flower series he mentioned the sassafras, Hooker's whitebeard, the crowberry-leaved Monotaca, three species of an Orchid called Prasophyllum, and a variety of the spider orchis, as possessing an odour belonging to the same class as the jasmine; the native lily and the fragrant houndstongue, of the tuberose class; also the almond-scented Arthropodium, the musky Caladenia, and the various species of Acacia. He said that Mr. Rimmel spoke of the flowers of the silver wattle (*Acacia dealbata*) as exhaling a similar odour to that of the French Cassie (*Acacia Farnesiana*), from which an essential oil is extracted, worth £64 per lb., the dried flowers selling at 6s. per lb. The Secretary thought that the flowers of the common honeysuckle tree (*Banksia Australis*) might be employed in perfumery also. Their abundance throughout the greater part of the island afforded ample opportunity of testing their qualities in a variety of ways. Under the leaf series he spoke of Gunn's Boronia, and the lemon-scented Boronia, as possessing "a delicious smell of lemons," to use Mr. Gunn's words. The leaves of many myrtaceous plants abounded with essential oil, more or less aromatic. He mentioned the musk tree also, and spoke of some of the genera of the mint tribe as possessing an essential oil of agreeable quality. Under the wood series, he alluded to the native box, and the box-leaved Alyxia, the latter of which has the same odour as the Tonka bean, and the bark of the sassafras, which yields an essential oil similar to that of the laurel. Under the root series he spoke of the shepherd's wreath (*Comesperma volubilis*), the roots of which, when freshly taken up, diffuse an agreeable though fleeting smell, of a very peculiar character. Under the grass series he mentioned the fragrant holy-grass which is found in alpine or sub-alpine situations. Of the substances named he thought that the following might be obtained in sufficient quantities to constitute them articles of commerce; viz., the flowers of the sassafras, different species of acacia, the honeysuckle tree, the native lily, and the fragrant houndstongue; the leaves of rutaceous shrubs, of plants of the myrtle tribe, of the musk tree (*Eurybia argophylla*), and of several plants of the mint tribe; the wood of the native box, and of the box-leaved Alyxia, and the bark of the sassafras. He thought that, when the Society was fortunate enough to obtain a new museum, a case might be with great advantage appropriated to perfumery, and concluded his paper with the remark that he should rejoice to perceive a commencement made in the disclosure of all the hidden treasures of natural history in the colony, which the want of a larger population, and therefore of a sufficient amount of labour, had hitherto left undiscovered.

A conversation ensued on the subject of the paper read by the Secretary, in which the meeting appeared to be much interested; and Dr. Agnew suggested that a few pounds of the silver wattle flowers, still in bloom about Oatlands, should be forwarded to Mr. Rimmel for the purpose of experiment, and with a view to obtain his opinion as to their value. Dr. Butler said that the flowers of the silver wattle were highly prized in Paris, where it was grown in the winter gardens. It was unanimously agreed that it would be highly desirable to send specimens of our perfume-bearing plants to the Exhibition of 1862.

Dr. Agnew remarked that cajeput oil of a superior kind had been obtained by Dr. Officer from different kinds of Eucalyptus—chiefly, he believed, from the leaves and capsules of the blue gum (*E. piperita*).

Scarcity of Fibrous Substances.

Mr. Archer then read a letter from the Colonial Secretary enclosing a despatch from Sir G. C. Lewis, Secretary of State for the Home Department, on "the extreme want felt by the manufacturing interest of Great Britain, of raw material for the production of textile fabrics, which has induced an application to the Committee of the General Association for the Australian Colonies, for the purpose of discovering the existence (if any) of some fibrous product in the Australian Continent which might tend to remove the difficulty, and at the same time prove a sufficiently valuable article of commerce to insure its being successfully and profitably cultivated."

The Secretary said that he hoped to receive communications on this subject, especially from the Fellows of the Royal Society, so that he might be in a position to make a full report to the governor before the departure of the December mail.

Scarcity of Oak Timber.

The Secretary also read the following extract from a letter addressed to him by Sir W. J. Hooker, Director of the Royal Gardens, Kew, under date Sept. 18, 1860:—

"The scarcity of good oak for naval timber is almost alarming, and the cost of it beyond all bounds. The Admiralty are satisfied that they must go elsewhere for timber, and that they must be more economical with their best timber. It is the same in France and in America. And what they say is this—'We must procure a large quantity of the next best timber to oak, and only use oak where nothing else does so well.' Your blue gum has been strongly recommended to the Admiralty; and Sir William Denison and others have written to me most strongly in its favour. Now I am truly glad to hear this, as I believe that, if once extensively introduced into the country, there would be a great and continued demand. But I should not like the Admiralty to estimate the value of the blue gum beyond its real merits. I believe it has great merits, without having some of the rare qualities of the oak. Is it not so?

"So great is the demand for timber that the Admiralty are now, at considerable expense, making search by means of competent persons. 1. In North China and Japan. 2. On the West Coast of Africa, and in Fernando Po. 3. In British Guiana, and far up the rivers there."

INSECT MEDICINES—CANTHARIDES.

From insects we derive articles of commerce of no mean importance, especially the products of the silk-worm, the honey-bee, the lac insect, and the cochineal insect. Wax and Lac have already been noticed in the pages of the TECHNOLOGIST, and we shall now advert to some other products. Insects once formed a class of medicines which were considered highly effective in certain cases; and there was a time when three gnats were taken as a dose just as three grains of calomel might be taken now; while three drops of ladybird milk were formerly prescribed as seriously as a small dose of some fashionable medicine of the present day. Wood lice and ants were used, and many beetles prescribed, for relieving toothache. It is alleged that the little insect, known as the golden cetonia, found in considerable numbers on rose trees, when pounded to a powder and administered internally, produces in the person a sound sleep, which lasts sometimes thirty-six hours, and which has the effect in many cases of nullifying the hydrophobia affection. The oil beetle (*Meloe proscarabeus*) exudes a deep yellow oil from the joints of the legs, which is esteemed diuretic, and is used in rheumatic complaints. It has also been recommended in hydrophobia. A sour liquor which ants eject when irritated, termed formic acid, was formerly obtained by bruising the red ants and distilling them mixed with water; a peculiar volatile acid passed over. This acid decomposes the salts of a few metals. Silver is readily thrown out in the state of bright metal on glass surfaces by means of formic acid. An analogous acid is artificially obtained by distilling tartaric and sulphuric acid with peroxide of manganese and water.

The Deekamalli resin (*Canarese*), Teekamullya (*Tamil*) of India, is said to be formed like lac by the punctures of insects on the branches of *Gardenia lucida*, Roxburgh, a tree found in the Coorg jungles and other places. It has a most disagreeable odour. Powdered, or made into an ointment, with country calomel and ghee (butter), it is extensively used as a dressing for slight wounds or putrid sores, either in man or beast. Capt. W. F. W. Owen, R.N., in his "Narrative of Voyages" on the Eastern coast of Africa, relates that a kind of paste made from the cockroach (*Blatta orientalis*), administered internally, was found one of the most powerful anti-spasmodics known, and particularly useful when diluted with water in the case of lock-jaw (vol. 2, p. 238). *Blaps sulcata* is eaten by the Turkish women cooked with butter, in order to make themselves fat. It is also believed to act as an antidote against the ear-ache and the sting of the scorpion. The food uses of insects we shall not touch in this article. The only important medicinal insect of the present day is the vesicatory beetle, of which several species are employed externally for blistering purposes, and occasionally internal, although highly dangerous. The *Cantharis vesicatoria* belongs to the class Coleoptera or beetle tribe, and is obtained largely from Spain (whence its popular name of Spanish fly) and the southern parts of Europe. They are mostly found upon the ash-trees, the leaves of which are their favourite food. The poplar and the rose are also frequented by them. When touched, all the cantharides have the peculiarity of feigning death, so that they are called by children "pretenders." A great variety of species possess the blistering property, and we receive commercially supplies from the Mediterranean ports, from Germany, the South of France, and from China. These insects are so light that fifty of them will scarcely weigh a drachm, and yet in some years twelve tons of them have been shipped from the island of Sicily alone. The average exports thence in the three years ending 1857 were 185 cwts. annually. Swarms of cantharides, like bees, sometimes darken the air. Their disagreeable smell may be perceived even before they are seen, and this serves as a guide to those who catch them. They are collected in Sicily, mostly in the southern part of the island. The quantity produced each year is very uncertain. Some years they are found in abundance, and in others scarcely any are to be collected.

Cantharides are collected in May, June, and July, in consequence of their wings being then wet with dew: the tree is shaken, and the deadlike insects are carefully gathered up, killed by the fumes of vinegar, and dried in the sun. But this is not the only insect that possesses the active principle cantharidin: there is the genus *Mylabris*, which consists of fifty-one species, of which twenty-eight are found in Africa. There is a large occasional importation of cantharides from Russia. The Russian insects are larger than those of other countries. Cantharidin is obtained from an alcoholic tincture of the powdered insect, and possesses in an intense degree the blistering properties of the powdered cantharides. The amount of cantharidin in 500 parts of each of the undermentioned insects is as follows:—

Cantharis vesicatoria	2·03
Cantharis vittata	1·99
Mylabris cichorii	2·13

The remedial as well as the poisonous qualities of the cantharides were well known to the ancients. Hippocrates prescribed them internally in dropsy, jaundice, and amenorrhœa; and Galen held the opinion that the virus existed only in the body of the insect, and that the head, feet, and wings contained its antidote. The ancient physicians attributed to the *Carabi* qualities scarcely inferior to those of the cantharides.

The late Dr. Duncan, in speaking of the adulteration of cantharides, says: "The *Melolontha vitis* is sometimes found mixed in considerable numbers with the cantharides. They are easily distinguished by their almost square body and black feet; and, as they do not stimulate the skin, should be picked out before the cantharides are powdered." Emmel detected fifteen per cent. of *Chrysomela fatuosa* in cantharides obtained from a commercial house on the Continent, and he had no doubt that the admixture was intentional. In Germany the golden beetle, *Cetonia aurata*, of Fabricius, or *Scarabœus auratus*, of Linnæus, is sometimes mixed with it; but this insect may be known by its greater proportional breadth and flat belly. An instance of adulteration with glass beads came under the notice of Mr. John Mackay, chemist, of Edinburgh, in 1842, but whether accidental or intentional (to add to the weight) was not clear.

The blistering flies of India are chiefly the Meloe (*Mylabris cichorii*), the *Cantharis gigas*, and the *Cantharis violacea*, but others are also used. The *Mylabris cichorii* is common in the neighbourhood of Dacca, in the Hydrabad country, and numerous other localities. Dr. Hunter has published a good account of it in the fifth volume of the "Transactions of the Asiatic Society," p. 216. The insect is about an inch long and a third broad. The colour of the body and head is dark brown; the elytra or wing coverts are marked with six cross stripes of deep blue and russet brown. Parcels of it frequently come now into the commercial sales of London. The *Buprestis* of ancient writers is met with in the Indian bazaars, under the name of the golden fly (*Sunamuki*). The *Cantharis violacea* is often mixed with specimens of Meloe in the bazaars. The *Mylabris cichorii*, if procured before the mites have commenced its destruction, yields, according to Dr. O'Shaughnessy (Bengal Dispensatory), one-third more of cantharidin than the Spanish fly of the European shops. The blue fly is of uncertain strength; the *Buprestis* he found quite inert. A species of Meloe, called the *M. trianthema*, from its being usually found on the plant named *Trianthema decandra*, is described by Dr. Fleming.

Specimens of the Indian blistering beetles, *Mylabris pustulata* and *M. punctum*, a smaller species, were shown at the Madras Exhibition in 1855 by Dr. Collas, of Pondicherry, accompanied by a full and interesting report on their blistering properties and careful researches into their natural history, which he published in the "Moniteur Official," at Pondicherry, on the 2nd March, 1854. Both insects are found in large quantities at certain seasons all over Southern India. In various parts of the world other blistering insects are used—as *C. vittata* and *Lytta cinerea*, in the United States; *C. atamoria*, in Brazil; and *C. syriaca*, in China.

At a meeting of the Medical Society of Graham's Town, Cape of Good Hope, Dr. Armstrong produced species of *Cantharis* which he had found in the neighbourhood, and which, he observed, was one of the most destructive little insects the gardener has to contend with. He had seen potato fields completely destroyed by them; but their favourite food appeared to be the blossoms of leguminous plants, and every variety of the rose. His attention was attracted to them by a friend in the district of Cradock, about three years ago, who lamented the ravages that the insect had committed on his crops; and who also mentioned, as a curious fact, that he had bruised one on his leg, which caused a blister. This induced him to examine the insect, which he found to belong to the family Cantharides. He collected a quantity of them, on which he poured boiling vinegar, and, after twenty-four hours, used the vesicatory with complete success; in fact, it was much better and stronger than the common Spanish fly. He imagined it would pay the gardeners to collect them for sale, by doing which they would get rid of one of their worst enemies. It has been remarked that they are more abundant some years than others; and it is presumed they are in larger numbers in the districts of Cradock, Colesberg, and Graaff-Reinet than in Albany.

It has often been observed by medical men, that some samples of cantharides have been almost useless, and this has been usually attributed to their being too old. Dr. Paris states, however, that flies do not lose their virtue by being kept; and from observations which Dr. Armstrong made with regard to the insect under notice, he supposes that their usefulness depends in a great measure upon the food they eat. For instance, those he had in Cradock were procured from the potato and beans; those subsequently shown were collected from roses; and the acetate (a bottle of which was produced) was of a deep rose colour, and had not been found so active.

The imports of cantharides into the United Kingdom in the last few years have been as follows:—1855, 21,513 lbs.; 1856, 35,922 lbs.; 1857, 23,670 lbs.; 1859, 37,578 lbs.—valued at £5,409.

P. L. S.

JAPAN VARNISH.

The well-known lacquered ware of the East owes its lustrous colouring to a composition of lamp-black, and the clarified sap obtained from a species of sumach called *Rhus vernix*, or *vernicia*. Wood oils are obtained from other plants of the same family, and the different qualities of lacquered ware are owing to the use of these inferior ingredients. The real varnish tree is described by De Guignes as resembling the ash in its foliage and bark; it is about fifteen feet in height, and furnishes the sap when seven years old, which is carefully collected from incisions in the trunk, opened in the summer nights. The body of the ware is wood partially smoothed, or pasteboard upon which two or three coats of a composition of lime, paper, and gum are first laid, and thoroughly dried and rubbed. The surface of the wood is also hardened by rubbing coarse clay upon it, and afterwards scraping it off when dry. Two coatings of lamp-black and wood oil, or in the finer articles of lamp-black and varnish, are laid upon the prepared wood, and, after drying, the clear varnish is brushed on, one coating after another, with the utmost care in close and darkened rooms, allowing it to dry well between the several coats. The articles are then laid by to be painted and gilded according to the fancy of the customers, after which a last coating is given them. The varnish is brought to market in brownish cakes, and reduced to its proper fluidity by boiling; it is applied to many purposes of both a varnish and paint, when it is commonly mixed with a red or brown colour.

A beautiful fabric of lacquered ware is made by inlaying the nacre of fresh and salt water shells in a rough mosaic of flowers, minerals, &c., into the composition, and then varnishing it. Another kind highly prized by the Chinese is made by covering the wood with a coating of red varnish three or four lines in thickness, and then carving figures upon it in relief. The great labour necessary to produce this ware renders it expensive. A common substitute for the true varnish is the oil of the Dryandria, Jatropha, Croton, and other members of the Euphorbiaceous family, expressed from their seeds by a variety of simple machines, consisting for the most part of different applications of power to cylinders and pestles by which the seeds are pressed or pounded. The oil, after pressing, according to De Guignes, is boiled with Spanish white, in the proportion of one ounce to half a pound of oil; as it begins to thicken, it is taken off and poured into close vessels. It dissolves in turpentine, and is used as a varnish, either clear, or mixed with different colours; it defends woodwork from injury for a long time, and forms a good painter's oil. Boiled with iron rust, it forms a reddish brown varnish.*

The lacquered or japanned ware of China is formed of a succession of as many as fifty coats of varnish, formed of an extremely poisonous vegetable gum, which exude from the plant, and differs as well in its mode of being produced, as in the character of its subsequent ornamentation.

The Indian lacquered work is formed of a thin coating of shell lac, laid upon the surface of the article to be ornamented, and upon this the native artist proceeds to fashion and colour those exquisite designs which are to be seen in the works from Lahore and Cashmere.

Mr. W. Lockhart, in his recent work "The Medical Missionary in China," thus speaks of the varnish and the japanning process:—"The juice, at first, is of a yellowish-gray colour, which turns black on exposure to the air. It is very irritating to the skin, producing troublesome sores on the hands of those who gather it, if they allow it to come in contact with them. It retains this quality even after the paint is dry, and has been for a long

* Williams's "Middle Kingdom."

time exposed to the air. Some foreigners are very susceptible to the action of the varnish poison. A visit to the lacquer-shop, or the varnishing of some article of furniture in the house, has been followed by an attack of severe nettle-rash, or even of erysipelas of the face. A patient suffering an attack of this kind once sent for me. He had frequently experienced the effect of the varnish before, but I could not account for the present attack. He said he had not bought or used any lacquer-ware; no new furniture had been brought in; but at last it was remembered that a carpenter had been repairing a door which had slightly warped, and it was found that on finishing his work he had rubbed a little varnish over the new surface caused by his plane. This was quite sufficient to affect the susceptible patient. Several of these varnish trees grow in the gardens of the London Mission at Shanghai, and it was found that the varnish flowed readily from slight wounds in the bark, and dried in black stains on the stem. The chief districts where the article is produced are in the province of Nganhwui, which are also the green tea districts. Hence it is generally found in the warehouses of the native wholesale tea-brokers. The varnish is gathered in the heat of summer; it is scraped from the trees and carried home in bamboo cups, and emptied from them into wooden tubs lined with a stiff paper, and is then sent to market. All the articles used in the storing of the varnish acquire a beautifully hard, black, and polished surface, which even resists the action of boiling water. The articles to be lacquered are of wood or pasteboard. When a large surface has to be covered, it is daubed with a combination of the pig's blood and lime, with some tow and hemp; at other times the surface is covered with moist clay, which is rubbed into the grain of the wood and then scraped off, the wood being allowed to dry. After this a mixture is laid on of Tung-yew, or wood-oil (the oil of the Tung tree, a species of Dryandria), and lamp-black for coarser articles; but for those which are more delicate, a mixture of lamp black and varnish. The surface is again allowed to dry; the varnish is applied with a hard brush in a thin layer, which, after drying, is rubbed smooth with Dutch rush and tutty powder. Another thin layer of varnish follows, care being taken that each layer successively is rubbed properly smooth. For the finer tables and cabinets, this process of rubbing down and laying on the varnish is repeated ten or a dozen times, as the object is to produce a surface very hard and clear, which retains its polish for a long time. Various colours are added to the varnish, according to the use made of the article. Cups formed of very thin wooden strips are carefully lacquered, and serve for tea-cups or rice-bowls without shrinking from boiling water, or being liable to fracture like porcelain. These are often of beautiful pattern, and finished with much artistic skill. One kind of lacquered ware, of the reign of Keen-hung, who gave the fashion for it, in boxes, vases, cabinets, pictures, &c., is made by covering wood or cardboard with coatings of red lacquer to the thickness of a third or half of an inch. Upon this various figures, or fruits, or landscapes are beautifully carved in high relief, when the whole is finished by the application of a very thin layer of varnish over the whole surface. Many of these articles are perfect gems of art and finished carving, and are much prized by the Chinese. The better specimens are often copied by ordinary workmen, but they have a coarse appearance, and are far from equal to the superior productions of the reign of the Emperor above named, who had so great a fancy for this branch of workmanship. The varnish which is generally used in house-work is a mixture of the pure juice and the Tung-yew boiled together. It is laid on with a stiff brush, giving a hard polished surface of a bright coffee colour, which is very ornamental. When it is wished to show the vein of hard wood, as in rosewood, Chinese mahogany, or elm, the pure juice or varnish is used; it is rubbed into the wood and allowed to dry. After looking very dull and heavy for some months, it becomes bright, and, when wholly absorbed by the wood, presents a hard and transparent surface. The polish will retain its brilliancy for many years, and, whenever it may become dull, may be restored by means of warm water. The Tung-yew, besides being mixed with varnish for an ornamental paint, is also used alone or with linseed and other oils as a varnish for outside wood-work, where it resists the action of the weather very effectually. Mixed with linseed oil, it is largely used on board ship; rubbed over the masts after they have been scraped clean, and on all the wood-work inside and out, the oil sets off the vein, and gives an enduring surface. It is applied with a handful of hemp well saturated, which conveys the mixture to all cracks and crevices, and the work is finished with a hard brush. This varnish will mix with any colour; the finer pigments are used for lacquer, and the coarser are mixed with the oil. The most common colour used with the latter is black, or a dull red colour consisting of levigated iron rust. When the Tung-yew is not intended to sink into the wood, the surface is prepared with blood and lime-paste, as in the preparation for lacquering."

THE SPONGE FISHERY OF THE BAHAMAS.

BY P. L. SIMMONDS.

In our first number, at page 17, we gave an account of the sponge fishery of the Ottoman Archipelago, from which the finer descriptions of sponge are obtained. The coarser descriptions entering into commerce are procured about the Bahama banks and the coast of Florida. From 1,000 to 1,500 bales of sponge of 300 lbs. are shipped from Nassau, New Providence, annually.

Sponge fishing is said to have become a very profitable business in the neighbourhood of Key West, Florida. About 100,000 lbs. are reported to have been gathered during last year, and the sales amounted to 25,000 dols. The article is mostly procured by the natives of the Bahamas. This is a new branch of business for Key West, and was formerly confined to the Mediterranean. The finer quality of sponge is not found on the American coasts, although the coarse description is abundant all about the coast of Florida and the Bahama banks.

The principal supply of West India sponge comes from the Bahama Islands. The rapid strides made in sponging within this group since 1847 appears almost incredible. Although the trade has been carried on for years, a Mr. Hayman was, I am informed, the first who gave it an impetus. About the streets and outskirts of Nassau, New Providence, vast quantities of sponge may be seen covering fences, yards, and house-tops, where it is left to dry, after having been previously buried (in order to kill the zoophyte which inhabits it) and washed. It is afterwards divested of the fragments of rock which adhere to it, pressed, and packed in bales, averaging 300 lbs. weight each, for the London market, where it is manufactured into cloth, hats, &c., and converted to many useful purposes. The value of sponge in surgery and for domestic uses is well known. Spongiopiline has recently become the medium for applying poultices to wounds, instead of cloth.

To show the importance of the sponge trade in the Bahamas I may add the following statistics, with which I have been favoured by a gentleman engaged in shipping large quantities. "From Jan. 1 to June 30, 1850, there were exported from Nassau nearly 1,000 bales of sponge, of the value of at least £5 per bale = £5,000. On Jan. 1 a very small stock of sponge was on hand, while on June 30 every dealer in this article had a large stock; therefore, as it is a cash article, there must have been paid to the crews employed in this trade at least £8,000." The value of the sponge exported from the Bahamas in 1852 was about £12,000.

The sponge trade of the Bahamas is in a very flourishing condition. The total value exported in 1849 was but £2,217; in 1850, £5,700; in 1851, £14,000; in 1852, £11,257. In later years the quantity of sponge exported from the Bahamas has been:—

	Cwts.	Value.
1855	2,399	9,615
1856	1,800	6,723
1857	2,657	11,025
1858	3,357	17,254

A great deal of this goes to the United States.

The Andros Islands and the Cays are the great sponging districts. The sponge is usually found in grassy and rocky patches near the shores of this group. Crawls for cleaning these may be seen from Joulters to Jonas Cays, constructed with stakes about two inches thick, driven into the mud, and forming a square of twelve feet, sufficiently high to prevent the sponge washing out. In these the sponge is soaked and washed frequently, after having been buried in sand about a week or ten days, when it loses the black animal matter, which has an offensive smell. When first gathered the pieces are wrenched from the rocks with a strong two-pronged fork fixed to a long pole. The sponges are of four kinds—yellow, glove, velvet, and mop. The first is the most valuable kind, selling at about 1s. the lb.; the second at 9d.; the velvet is the toughest, and much used in stables for its softness; the last kind is very inferior, and only used for mops. At the foregoing prices it scarcely repays the outfit, but 1s. 3d. a pound about remunerates the fishermen.

The imports of sponge from the Bahamas and United States during the past seven years have been as follows, in pounds:—

	Bahamas.	United States.
1853	91,736	23,774
1854	115,213	33,159
1855	120,013	14,936
1856	79,893	3,271
1857	167,051	——
1858	226,094	7,693
1859	207,450	7,234

CULTURE OF BROOM-CORN IN THE UNITED STATES, AND THE MANUFACTURE OF BROOMS.

The production of broom-corn, the *Sorghum dora*, is rapidly extending in many parts of North America, and corn brooms are driving broom sedge, as an article for sweeping floors, out of every humble dwelling in the Union. It is cultivated for its "brush," the dried panicles cleared of the seed. The grain of the panicles forms excellent food for poultry. The annual produce of the plant in the State of New York alone is valued at over one million sterling. Large quantities of this broom-corn "brush" are now imported into this country, chiefly for making carpet-brooms and clothes-brushes.

Perhaps there is not a branch of American manufactures that has within a few years increased so rapidly in extent, attended at the same time with a large increase in prices, as the manufacture of brooms. The acquisition of California, and the settlement there of a large population depending upon importation for a supply of necessary articles, and the increased population of cities and villages, have of course given an impetus to the trade of New York in brooms, as in almost everything else. But the demand for export to European and Australian markets has been the leading cause of the large increase in this particular business. In the year 1856, brooms to the value of £10,000 were exported from the United States.

The following information as to the rise and progress of the manufacture may be interesting, and also furnish a hint or two to some of our Australian and other colonists as to the profits that may be made in this line.

About 1750, Benjamin Atkinson commenced the broom business in By-berry township, Bradford county, Pennsylvania, raising the corn and manufacturing the broom. After a few years he took Bezaliel Croasdale into partnership, and they jointly had the trade altogether in their hands, until 1815 or 1816, making the brooms, and entirely supplying the markets of Philadelphia, Baltimore, Lancaster, Trenton, and sometimes New York. A broom made in those days would be a curiosity to a modern broom-maker. Invariably round, with horn on the neck instead of twine, confined to its place by a wooden peg and handle of oak, rough shaved with a drawing knife. The brooms thus made commanded a high price, particularly during the war, when they sold for $4\frac{1}{4}$ dollars per dozen wholesale. Since that time the business has gradually increased, employing a great number of hands, and a large capital to carry it on in its various stages.

Some idea of the present extent of the trade in the Philadelphia district may be formed from the fact, that in one manufactory in the town of Bensalem, about 300,000 handles were made last season, and this number is probably not more than a fourth of the whole number made and used in that district. These handles are sold at 1 dol. 30 cents to 1 dol. 40 cents per hundred. The value of the twine used on very broom is estimated at half a cent, and the labour for making two cents.

The dealers in New York are principally supplied from Schenectady, in that State; although the towns of Headley and Hatfield, in Massachusetts, furnish a considerable number yearly. It may afford some idea of the extent of the business to mention, that one firm in New York sell annually about 70,000 dozen brooms, manufactured in Schenectady, and 10,000 dozen manufactured in Massachusetts. Most of the brooms manufactured in Massachusetts find a market in Boston. There are half a dozen houses in the city of New York dealing largely in brooms; they are principally in Fulton-street.

The ordinary brooms have sold recently as high as 17 dols. per hundred. This is the Schenectady manufacture. In the Massachusetts manufacture, the corn is fastened upon the handle with a small wire, instead of stout twine, and the article, consequently, is not considered so valuable. A few years since, brooms which now bring the above price, could be bought at from 8 to 12 dols. per hundred. Latterly brooms have been sold by weight, at from 8 to 11 cents per pound. The average weight is a pound and a half.

The broom-corn used in this manufacture is raised principally in the valleys of the Mohawk and the Connecticut. The soil of the bottoms along those rivers possess certain characteristics highly favourable to the growth of this agricultural product. Although the labour attending its cultivation is great, it is considered a valuable crop, being more hardy than maize, and less liable to injury from frost. It was a good deal cultivated in the Genesee Valley a few years ago, and is now to some extent; but the product goes to supply western and local markets. Large quantities of brooms are made in the lower parts of Bucks and Montgomery counties, and the upper townships of Philadelphia county, Pennsylvania. Many are also made in Saucon, Lehigh county, in Delaware and Lancaster counties, and in Salem county, New Jersey. The crop is becoming one of the most decided importance, and it will no doubt attract the attention of farmers more generally than it has done; while to its manufacture mechanical ingenuity and capital will be turned. 2,585 tons of broom-corn, worth 85 dollars a ton, were sent away from Chicago in 1860.

A machine has, however, been invented in New Jersey which threatens to exterminate broom-corn. It takes a billet of white ash, and in a trice cuts it fine like the Mexican grass, as used for brushes. The brooms can be made for two cents each, and are said to look quite as well as corn-brooms, and to be much more enduring.

In Saratoga county sixty acres of broom-corn yielded from six to seven hundred pounds of brush per acre, and on two acres as much as eight hundred pounds per acre were obtained. The expense of cultivating and securing the crop is about ten or twelve dollars per acre.

In Montgomery county the raising of this crop is on the increase along the valley, more than 1,000 or 1,500 acres being planted. It brings from twenty to thirty dollars per acre on the field, when ready to cut. About one-fourth of the brush is made up in the county, and the remainder out of it.

In Ohio broom-corn has been introduced in some of the rich vales, and has produced in favourable situations about one-third of a ton of cleaned brush ready for market per acre, worth from thirty-three to forty-three dollars. The cost of cultivation of the corn is considered to be one-fourth greater than that of Indian corn. The yield varies with the season. Sometimes as many as six hundred brooms per acre are produced, with twenty bushels of seed, worth as much as oats for horse feed.

Analyses of the Parts belonging to Broom-Corn.

1. Analysis of the stalks:

		Removed from the soil in a ton of Stalks. lbs.
Silex	6.24	1.828
Earthy phosphates	16.66	4.881
Lime	6.25	1.831
Magnesia	3.74	1.095
Potash	30.40	8.907
Soda	15.46	4.529
Sulphuric acid	9.07	2.657
Chlorine	2.14	0,627
Peroxide of iron	2.61	0.764
Organic matter and magnesia	6.24	1.828
	98.81	28.947

2. Analysis of the sheaths of the broom-corn:

		Removed in a ton. lbs.
Silica	40.20	28.903
Earthy phosphates	15.00	10.785
Lime	3.00	2.157
Magnesia	3.24	2.329
Potash	26.56	19.096
Soda	7.33	5.270
Sulphuric acid	3.57	2.566
Chlorine	1.72	1.236
	100.62	72.342

3. Analysis of the ripe broom-corn brush, with the seeds:

		Removed from the soil in a ton of Brush and Seeds. lbs.
Silex	32.50	11.960
Earthy phosphates	36.15	13.303
Lime	0.40	0.147
Magnesia	0.10	0.036
Potash	27.32	10.053
Soda	2.37	0.870
Chlorine	2.50	0.846
Sulphuric acid	undetermined	
	101.14	37.215

4. Composition of the ash of broom-corn seed:

Carbonic acid	not determined
Silicic acid	41.975
Sulphuric acid	not determined
Phosphoric acid	28,760
Phosphate of peroxide of iron	0.525
Lime	0.845
Magnesia	3.010
Potash	3.920
Soda	7,247
Chlorine	0.245
Organic acids	4.200
	90,727

Proportions.

Water	12.22
Dry matter	87.78
Ash	3.00
Per-centage of ash calculated on the dry matter	3.417

Messrs. Van Eppes are among the largest manufacturers at Schenectady, and have been engaged in the business about twenty years. They have a farm of about three hundred acres, two hundred of which are Mohawk flats, under culture with broom-corn. A large portion of these flats were formerly of little value, in consequence of being kept wet by a shallow stream which ran through it, and which, together with several springs that issue from the sandy bluff on the south side of the flats, kept the ground marshy and unfit for cultivation. By deepening the channel of the stream, and conducting most of the springs into it, many acres which were formerly almost worthless have been made worth £25 per acre. They have also, by deepening the channels, saving the waters of the springs, and securing all the fall, made a water privilege, on which they have erected an excellent well with several run of stones, leaving besides sufficient power to carry saws for cutting out the handles of brooms, &c.

The cultivation of broom-corn by them has within a few years been simplified to almost as great a degree as its manufacture. The seed is sown with a seed-barrow or drill, as early in spring as the state of the ground will admit, in rows 3½ feet apart. As soon as the corn is above ground, it is hoed, and soon after thinned, so as to leave the stalks two or three inches apart. It is only hoed in the row, in order to get out the weeds that are close to the plants, the remaining space being left for the harrow and cultivator, which are run so frequently as to keep down the weeds. The cultivation is finished by running a small, double mould-board plough, rather shallow, between the rows.

The broom-corn here is not left to ripen, as formerly, but is cut while it is quite green, and the seed not much past the milk. It was formerly the practice to lop down the tops of the corn, and let it hang some time, that the brush might become straightened in one direction. Now, the tops are not lopped till the brush is ready to cut, which, as before stated, is while the corn is green. A set of hands goes forward, and lops or bends the tops to one side, and another set follows immediately, and cuts off the tops at the place at which they are bent, and a third set gathers the cut tops into carts or wagons which take them to the factory. Here they are first sorted over, and parcelled out into small bunches, each bunch being made up into brush of equal length. The seed is then taken off by an apparatus with teeth, like a hatchel. The machine is worked by six horses, and cleans the brush very rapidly. It is then spread thin to dry, on racks put up in buildings designed for the purpose. In about a week, with ordinary weather, it becomes so dry that it will bear to be packed closely.

The stalks of the corn, after the tops have been cut off, are five or six feet high, and they are left on the ground, and ploughed in the next spring. It is found that this keeps up the fertility of the soil, so that the crop is continued for several years without apparent diminution. It should be observed, however, that the ground is overflowed every winter or spring, and a considerable deposit left on the surface, which is undoubtedly equivalent to a dressing of manure.

In case of need, the stalks would furnish a large amount of good food for cattle. They are full of leaves which are very nutritive, and whether cut and dried for winter, or eaten green by stock turned on the ground where they grow, would be very valuable in case of deficiency of grass.

Messrs. Van Eppes employ twenty or thirty hands during the summer; and in autumn, when the brush is being gathered and prepared, they have about a hundred, male and female. They are mostly Germans, who come with their families during the broom-corn harvest, and leave when this is over. The manufacture of brooms is carried on mostly in the winter season. The quantity usually turned out by Messrs. Van Eppes is 200,000 dozen per annum.

THE EARTH OR ROCK OILS OF AMERICA.

BY THE EDITOR.

Attention has recently been very prominently directed to the natural wells of crude petroleum, or rock oil, which have been found to yield so abundantly a valuable commercial product in several of the States of North America. The supply of animal and vegetable oil, large as it has become, is yet inadequate to the increasing demand for manufacturing and domestic uses; hence, attention has been lately turned to coal and other mineral oils. This new discovery promises to exercise a most important influence in adding to the wealth of America, and also in improving the traffic of the several lines of railway over which it has to be transported. The only question regarding the worth of the discoveries seems now to relate to the probable permanence of the yield. If the experience in this respect should be satisfactory, the annual money value of the article is likely to rival that of some of the richest branches of existing industry. The railway lines which seem at present to be most interested in the matter are—first, the Atlantic and Great Western, a new road which connects with the New York and Erie; and, secondly, the Great Western of Canada, several wells having been found on the flats of the Thames, about a mile from Bothwell station on that line. The springs or wells from which earth oils may be obtained are more generally diffused in the United States than is, perhaps, supposed. Commercially it is now procured in New York, Kentucky, Virginia, Ohio, and Pennsylvania. In Texas, Canada, Nova Scotia, New Brunswick, and Newfoundland, and even on the banks of the Mackenzie river, springs of naphtha have been found. It was long collected for sale from the Seneca lake, in New York, by the Indians, and sold under the name of Genesee or Seneca oil.

In the town of Lodi, Seneca county, bitumen escapes with the water out of the shale. This mineral also arises from the vegetable matter or coal in the shale being destroyed. The decay is a process analogous to what heat produces on coal in a gas retort—it separates the coal into an inflammable gas (carburetted hydrogen), and an inflammable liquid (tar). On the slate it is decomposed into marsh gas and bitumen, or Seneca oil, as it is sometimes called, from its being gathered off the lake. On the surface of Seneca lake a large quantity of naphtha or rock oil floats at different periods of the year. This Seneca rock oil is derived from the bitumen escaping out of the shales, which are very carbonaceous in the middle counties of Western New York. The shale beds dip south and a little west under the waters of the lake, and where the opening of the seams meets the water at the bottom of the lake, the bitumen oozes out and rises to the surface. There are many other localities on the American continent where native naphtha or bitumen is found. It is met with abundantly in Kentucky. Any highly fossiliferous shale, which is dark coloured, from the large quantity of vegetable matter contained in it, and which also contains pyrites disseminated throughout, generally affords naphtha. Native naphtha boils at 201° Fahr.

Mr. Horace Wilkins, of Cleveland, Ohio, thus speaks of this oil:—In November, 1859, in the State of Pennsylvania, wells were sunk for the purpose of pumping petroleum, or rock oil, and have been vigorously continued up to this time, many of the wells producing from ten to fifty barrels of oil a day, and some even more. In July, 1860, in the State of Ohio, fifty miles from this city, oil was discovered, and, in the short time that elapsed, more than fifty wells have been put in successful operation, yielding from ten to sixty barrels, and at this time hundreds of wells are being put down. This oil is being refined for illuminating purposes, for which it is excellent, surpassing in brilliancy the best sperm oil, or any other article for light known on this continent, at the same time being half the price of sperm. The oil, in its crude state, is an excellent lubricator, and many of our railroads use it, as well as other departments requiring a friction oil. The product bids fair to be very great, but the demand exceeds the supply, and the amount of money invested is now large, and is being increased daily.

The *Philadelphia Inquirer* states that the number of oil wells bored on Oil Creek, Pennsylvania, is 345, that the average production daily of twenty-nine wells is fifteen barrels, and that the oil has been sold as low as ten cents per gallon on the spot. No less than 145 wells have been bored to a considerable depth without obtaining oil. Persons are cautioned against being too enthusiastic about the profitable character of such wells.

At a place called Union Mills some working men a year or two back observed a quantity of dark oily matter floating on pools abounding in that district. Subsequent experiments led to the discovery that the oil is highly adapted for illuminating purposes; and that, by sinking wells to the depth of from 70 to 500 feet, it can readily be obtained throughout a very extensive area. The proportion of oil in the liquid pumped up is about one-third, and the process of separation is very simple. Land in the locality has become exceedingly valuable, and the business is rapidly increasing.

About 1,200 to 1,500 barrels, containing 40 gallons each, are now, it is said, being raised daily, and sent to New York, where, when refined, it sells in any quantity at a price equal to 3s. sterling per gallon. There is a residuum, also, which is described as being used for the manufacture of superior candles. Many shipments of the oil have been made to Australia.

The enclosed extract is from a letter recently received from Mr. W. J. Palmer, of Philadelphia:—"I have seen in several local papers for some weeks past accounts of the products of these extraordinary oil springs. One statement said that as many as 2,800 barrels (forty gallons each) had been put into the wagons at a railway station near these springs in a single month, and that the quantity was constantly increasing. The oil is sent to New York, Philadelphia, and other eastern markets. I have recently made a visit to the oil region of North-Western Pennsylvania. The supply of natural oil found there in such quantities is really a wonder. There are now some 1,000 borings, which have penetrated to all depths in the rocky strata, and probably fifty or a hundred of them have actually produced oil. Some have reached oil at a depth of from ten to fifty feet, others at 300 and 400 feet, while some go 500 feet and do not get it. The phenomenon occurs in one of the wildest and most sterile portions of Pennsylvania. Where one year ago land rarely brought over 5 dollars per acre, it has since sold at the rate of over 1,000 dols. per acre for sites to bore upon. The oil is of a most excellent quality for illumination, but has not yet been satisfactorily demonstrated to be adapted to other purposes. The geological position in which it occurs in North-Western Pennsylvania is in the Hamilton and Chemung groups, underlying the old red sandstone, which is here missing. The nearest oil has been discovered at a depth of about 450 feet below the lowest bed of coal, and does not seem to be of vegetable origin, but to have been formed from the extensive animal remains found in the Silurian rocks. The crude oil is now sold in New York for 25 cents per gallon. It is refined and sold at a much higher price. The wells produce from five to a hundred barrels daily, of forty gallons each barrel. This mineral deposit promises to be of great commercial importance to Pennsylvania, and perhaps to Ohio and Virginia."

A correspondent in the *Times* defines more clearly the districts of its production, and furnishes some additional information. "If (he says) you have Colton's or any other large map of Western Pennsylvania, you will observe that the place called Union Mills is situated in Erie county, Pennsylvania, instead of New York State, and that Oil-creek, a branch of the Alleghany river, has its origin a few miles south of Union, and discharges its waters in the Alleghany, at the distance of about thirty miles. Ever since my earliest recollection (thirty years or more), and for 'time whereof the memory of man runneth not to the contrary,' oil has been obtained from the surface of the water of Oil-creek in eddies, by spreading a woollen blanket on the water and then wringing out the oil, and been used for medicinal purposes, by external applications, for rheumatism, &c., and sold under the name of 'Seneca oil,' from the Seneca tribe of Indians who at one time roamed over this part of the State. About eighteen months ago a Mr. Drake sunk a well at Titusville, on Oil-creek, by way of experiment, to the depth of about seventy-four feet, and had the good fortune to strike a vein of oil, the product of which has yielded him a handsome fortune. His success incited others to make experiments, and the whole country for more than a hundred miles on the Alleghany river and along Oil-creek has been carefully examined, with the result that fortunes are being rapidly realised by many. I am not correctly informed as to the number of wells on Oil-creek, but they are numerous. At Tidioute, in Warren county further up the Alleghany, seventeen wells are in operation, producing not less than 10,000 gallons per day. There are probably a hundred wells more being sunk at Tidioute, and within three miles each way. The 'Crescent Oil Company,' an incorporation having their business office at this city, own a large tract of land at Tidioute, and are producing great quantities of oil. By the 1st of April next they will have at least twenty wells in operation. At Mecca, a small town in the eastern part of the State of Ohio, is a large tract of oil country, which is now being worked, in which the Aurora Oil Company of this city are largely interested. Considerable quantities are also produced from wells on the little Kanawha river in North-Western Virginia. The supply obtained, also, from a large territory on the Thames river, in Canada West, is almost fabulous. These several oil territories are favourably situated for getting the oil to market. From Titusville and Tidioute during the season of navigation the oil can be run down the river in flat boats to Pittsburg at a very low price. Tidioute is fourteen miles from the railway; Titusville, twenty-two miles; Mecca, nine miles; and the Canada oil lands, from three to ten miles. The wells are mere holes in the ground, about six inches in diameter. They are dug by driving cast-iron pipes, four inches inside diameter, to the rock, varying in depth from ten to sixty feet. After finding a 'good show' of oil, a pump is put in the well driven by steam, and the oil and water pumped into large vats holding a hundred barrels each, the oil rising to the top while the water is drawn off at the bottom.

"The crude oil is sold readily at 1s. 2d. to 1s. 4d. sterling per gallon at the well, and the barrels paid for extra. It makes a better light when refined than any other burning fluid I have ever seen—second only to best coal gas, with no liability to explode like many illuminating fluids that have been from time to time offered to the public. The phenomena produced upon opening some of these wells are very singular. One opened at Tidioute a week ago spouted the oil and water to the height of sixty feet, forced by the gas, the generation of which seems at all times to be going on.

"This new trade is worthy the attention of your oil dealers, and I hope will receive it. The supply seems inexhaustible. Wells that commenced pumping at the rate of 160 gallons per day, are now pumping six or seven times that amount, while a few, from which at their opening the oil was forced in large quantities by the pent-up gas, have fallen off; but if the pump is stopped a few days (as has happened by the breakage of machinery) the oil commences to flow of its own accord. Most of the works are rude, and scarcely a well is worked to its capacity. Much of the oil territory is in the forest, the fuel for generating steam is green, and the whole thing is in its infancy. When a year shall have passed, and experience shall have taught owners and operators the true system to be pursued, the supply will be very much increased. The demand seems to augment with the supply. The refineries are not able to fulfil their orders, and it is scarcely used in the rural districts. I hope scientific men as well as dealers will turn their attention to it. It is understood here that large quantities of a similar product from the valley of the Irawaddy finds a market in London."

The proprietor of the land in which the Enniskillen Mineral Oil Springs are situated, on the Sydenham river, Western Canada, has erected a suitable building thereon, and is now manufacturing, by distillation, a beautiful burning oil from the raw material which abounds in that region. The article is described as of most superior quality, and its illuminating properties are so great that an ordinary sized lamp, giving a light superior to six or eight candles, can be kept burning at the rate of one-fourth of a cent. per hour, reckoning the oil at one dollar fifty cents. per gallon.

I received, a week or two ago, a sample bottle of earth oil from Boston, stated to be obtained in a neighbouring State, from a well lately discovered, and said to be equal, if not superior, to any previously met with in that part of the world, and that it could be shipped at the rate of 500 barrels a week, if a market were found for it. It was asserted to yield nearly seventy per cent. of fine limpid oil, and would probably give more if care were taken in refining : 10,000 gallons were stated to have been refined and sold by this correspondent at a low price. It answers for lubricating, burning, and other purposes, and the solid part is used for making paraffine candles. On examination this oil appears to be compounded, and very different to the ordinary petroleum oils of commerce. A large quantity of petroleum, from various sources, now comes into commerce, and Price's Candle Factory, and others, are purchasers of it.

The following report on it has been furnished me by Mr. Dugald Campbell :—

"Feb. 21, 1861.

"Sir,—I have examined the sample of the American earth oil which you left with me, and beg to report as follows :—

"The oil is of a dark, greenish-brown colour, and has somewhat of a pleasant etherial odour ; it is as near as may be free from water, and gives no sedimentary matter, even on standing for many days. Its specific gravity at 60° F. is 860°. When distilled in the ordinary way the loss is small, considering that decomposition has taken place in it to a considerable extent, and the really pleasant smell is now supplanted by an unpleasant empyreumatic one, which is noticeable throughout the whole distillate, and is not removed from it much by agitation with strong caustic soda. The loss when operating, which I did upon the small scale, was under 3 per cent.; but on a manufacturing scale it would likely be much more.

"The oil was fractionally distilled into four equal parts, and the specific gravity of each taken; they were, without giving the odd decimals, as follows:—

1st part	....	825°
2nd ,,	....	838°
3rd ,,	....	833°
4th ,,	....	846°

"The colour of these distillates vary. No. 1 is a very light sherry; No. 2 is darker; No. 3 is still darker; and No. 4 is brown. Their boiling points are high. No. 1 is 360° F., and they do not therefore in this respect resemble naphtha.

"The value in this country of such oils as the one I have operated upon greatly depends upon the quantity of burning oil, or Paraffin oil, as it is commonly, although erroneously called, which they may yield upon distillation; the heavier oil, or lubricating oil, being comparatively of little value to the burning oil, and is got rid of with difficulty in the market. Good burning oil should not much, if at all, exceed the specific gravity of 825°, which is that of the first part of the distillate, and is only one quarter of the bulk of the whole oil. This is a very small yield indeed, and surprised me, as the crude oil is superior in look, smell, and gravity; the latter being only 860°, whilst the crude oil from the distillation of the Boghead Coal, the source from which a great portion of the burning oil sold throughout this country is derived, approaches in specific gravity 900°, yet, when rectified, the product is two-thirds burning oil.

"In looking at the specific gravities of the four distillates, it will be observed that the second is of a higher gravity than that of the third, a peculiarity which I have not observed in any of the many distillations which I have hitherto made with oils the production of coals, schists, asphaltes, or peats. Some of the same oil treated with sulphuric acid and soda before distillation gave results much similar, and with the same peculiar difference between the second and third distillates.

"It is well known to manufacturers of these burning oils that, by re-distilling the heavier oils, a decomposition takes place each time, and some lighter oil is produced; but the quantity resulting therefrom does not in most cases justify the expense of re-distilling, and the loss of the material occasioned by so doing; so that the above (namely, 25 per cent.) may be taken as the practical yield of burning oil which could be obtained from this sample of oil.

"Since experimenting with the above specimen, I had another given to me very unlike it. It is dark brown, and has not nearly so much of the green tint about it; it is much heavier, its gravity being 900°. On standing, it deposits a little water and some yellowish earthy matter. The results from distilling it were less favourable even than from the first. It was only distilled into two portions; the loss was about 7½ per cent.; the specific gravity of the first half was 867°, and the second 872°.—I am, Sir, your obedient servant,

"DUGALD CAMPBELL,
"Analytical Chemist to the Brompton Hospital, &c.,
"7 Quality-place, Chancery-lane.

"To P. L. Simmonds, Esq."

I may refer those interested in this subject in America to a long paper on the various sources of naphtha, by Mr. M. C. Cooke, in the "Journal of the Society of Arts" for Aug. 19, 1859, which can, no doubt, be consulted in any of the leading institutions of the States; but I may quote that part which describes the Rangoon petroleum and naphtha wells, some 500 in number, which are said to afford 412,000 hogsheads annually:—"They are situated about two miles from the village of Yak, near Goung, where they occupy a space of about twelve square miles; they are from 200 to 300 feet deep, of small calibre, and sustained by scantling. The temperature of the oil, when first raised to the top, is 89°: men do not go down, but an earthen pot is lowered in and drawn up over a beam across the mouth, by two men running off with the rope. The pot is emptied into a little pool, where the water with which it is largely mixed subsides, and the oil is drawn off pure. It is exported in earthen jars, containing about 30 lbs. A well yields about 1,200 lbs. or 1,500 lbs. per day, and is worked by three or four men: sometimes upwards of 2,000 lbs. are obtained; the amount depends upon the quantity of water drawn up with the oil. A duty of 1-20th is paid to the Government. This earth oil is extensively used for lamps and torches, and is exported to all parts of the empire, for which there are great water facilities. It is also used for preserving wood, mat partitions, palm leaf, &c., from insects and the weather. The white ants will not attack wood which has been washed with it."

In the annual report of the Trade of Rangoon for last year, it is stated that the shipments of Rangoon earth oil to Europe are in the hands of one party; the contractor with the King of Burmah for this produce not finding any purchasers for it makes the shipments for his own account, getting advances on the bills of lading from one European house in Rangoon. Prices in the bazaar there are usually 15 rupees; but we doubt not that if any larger quantity were required, the king's contractor would agree to lower the rates.

With the increasing demand for asphalte, petroleum, and naphtha, the attention of persons in different quarters of the world should be directed to this subject, which is important both in a scientific and commercial point of view.

A mode of obtaining a lubricating oil from asphalte was patented not long ago by Dr. Simpson, of Edinburgh, and Prof. W. Thomson, of Belfast. The asphalte, according to their invention, is first distilled at a temperature a little below that of a red heat. This produces a thick liquid, which is again distilled at the same temperature. The second distillation brings over a more limpid liquid—a fine residuum of charcoal being left in the retort. This oily liquid is subjected to stirring or agitation in a wooden vessel, with about one-tenth of its bulk in sulphuric acid. Much of the impurities unite with the acid, and when allowed to settle fall to the bottom of the vessel. The clear liquid is then drawn off, and agitated with a caustic alkali, or mixture of quicklime and chalk, allowed to settle, and the clear drawn off. The resultant oil is then agitated with suphuric acid, as before, and again with the alkali or chalk, allowing time after each operation for the impurities to settle, and the oil to become a pale yellow colour. It is then put into an iron retort and distilled at a moderate heat, when about one-third of the quantity comes away as naphtha. The heat is then elevated, when the remainder comes over—leaving a small residuum of charcoal—and is an oil nearly limpid; one part of sperm oil mixed with nine parts of it making a good oil for machinery.

ECONOMIC PRODUCTS OF THE TISSO (*BUTEA FRONDOSA*).

BY M. C. COOKE, F.S.S.

One of the most common trees of India and Assam is the Pulas or Tisso (*Butea frondosa*), and, although seldom attaining a very large size, almost every part of it may be rendered subservient to the wants of man. When in flower its appearance is highly ornamental; and, whilst not so fragrant as many others of the order to which it belongs, it vies in beauty with most, and in utility with any. The wood is open, soft, and tough, but small in size, and is seldom employed except for coarse furniture. The liber, or inner series of the bark is tough, and is convertible into a kind of coarse rope. In a country yielding so many other and superior fibrous plants, it is not often thus employed. From natural fissures, or wounds in the bark, issues, during the hot season, a most beautiful red juice, which concretes into a ruby-coloured, brittle, astringent gum, analogous to gum kino, for which it has been employed under the name of Palass Goond, or Dâk gum. It soon loses its beautiful colour upon exposure to the air, when it becomes duller and blacker than the ordinary kino of commerce. "This gum, when held in the flame of a candle, swells and burns away slowly, without smell or the least flame, and is ultimately reduced to a fine, light, white ash. If placed in the mouth it soon dissolves, its taste being strongly, but simply astringent. It is not softened by heat, but rather rendered more brittle. Pure water dissolves it perfectly, and the solution is of a deep clear red colour. It is in a great measure soluble in spirits, but this solution is paler, and a little turbid. The watery solution also becomes turbid when spirit is added, and the alcoholic more clear by the addition of water. Diluted sulphuric acid renders the aqueous solution turbid, and the alcoholic more so, whilst caustic alkali changes the colour of the watery solution to a clean, deep, fiery, blood red." This solution, with sulphate of iron, constitutes an excellent and permanent writing ink.

An extract is also artificially prepared, from this and allied species, for tanning purposes in India, under the name of *Pelachy* or *Palasy*, which resembles the gum in appearance, but is generally brighter.

The flowers are large and pendulous. Their ground colour is of a beautiful deep red, shaded with orange, and clad with a soft, silvery down, which gives them a most elegant appearance. Infusions of the flowers, either fresh or dried, will dye cotton cloth, previously mordanted with an alum solution, of a beautiful bright yellow, more or less deep, according to the strength of the infusion. The addition of a little alkali changes the colour to a deep reddish orange. In this state it dyes unprepared cotton cloth of the same colour, which the least acid changes to a yellow or lemon tint. It is to be regretted, however, that these colours are not permanent. Under the name of Kessaree flowers, a parcel was imported into Liverpool a few years since, but hitherto we have not met with them in London.

The juice of the fresh flowers, diluted with alum water, and evaporated in the sun to the consistency of a soft extract, produces a pigment brighter than gamboge, which is said to retain its tint for a considerable time. Infusions of the dried flowers yield an extract little inferior to that of the fresh flowers, and from them may also be obtained a fine, durable yellow lake, in considerable quantity.

The seeds of this tree yield by expression a thick dark-coloured oil, resembling cotton grease, which is employed in India to a limited extent.

Lac insects are frequently found on the small branches, upon which they deposit their valuable secretion.

Of all the products of this tree it is singular that not one of them is known in European commerce, for even the kino is never met with now, whatever may have been the case in former years, and we doubt whether it ever occurred but as an exceptional import. The bright yellow pigment, if permanent, and the yellow lake which is affirmed to be so, are certainly worthy of a trial.

THE GUARANA OF BRAZIL.

Guarana is the manufactured product of the fruit of a tree which grows on the river Tappagos, on some headwaters of the Orinoco, and elsewhere in the great Amazon valley. It is manufactured by various Indian tribes, among which may be enumerated the Muras and the Decapitadores, or Mondrucu Indians, with whom it forms a staple article of commercial exchange among the Portuguese settlers (a cunning people) and the native

Brazilians. As is to be supposed, it requires both care and accuracy in the process of formation, and it is so highly prized in the Brazilian settlements as to obtain its weight in silver when exported thither. It commands a price ranging from 4s. to 20s. per ounce.

Guarana is prepared from the seeds of an *inga*—one of the *Mimosacœ.* Like all the mimosa species it is a low-spreading bushy tree. The fruit is gathered when it is ripe, and the seeds roasted in the legumes intact. They are then taken out, and, after being powdered between stones or mallets, are mixed into a thick paste with water, which is moulded into flat bricks or cakes, and, when dried—which process is accomplished with the heat of the sun—it is ready for use. In this form it will keep good for any length of time, and is always ready when required. In this state it is used for making a drink or beverage, which is prepared by scraping a table-spoonful of powder from the cake, and mixing it with a pint of boiling water. It is made not only for "home use," but also for wholesale consumption.

It has properties, when taken internally, analogous to tea and coffee, producing on the system a stimulating effect. It arouses the intellect, and prevents sleep. It is highly tonic and febrifuge, and is esteemed by many to have properties equal to quinine, especially in cases of intermittent fevers.

We believe it is only to be obtained in this country on very rare occasions, but it is probable that it will one day become a cheap and useful article, both of diet and medicine, in the homesteads of Britain.—*Chemist and Druggist.*

[Guarana is obtained from the seeds of *Paullinia Sorbilis.* The shape in which we have met with it is in round rolls. It contains a bitter principle, identical with theine. The Brazilians regard the Guarana bread as stomachic, febrifuge, and aphrodisiac. It is sold all over the country as a necessary for travellers, and a cure for dysentery and many diseases. This substance attracted a good deal of attention amongst the medical profession at Paris, where it is prescribed as a tonic and astringent in cases of nervous headache. According to the analyses of Dr. Stenhouse, F.R.S. (Pharm. Journ., vol. 16, p. 212), guarana is the richest known source of theine, as the following per-centages will show:—Guarana, 5·07 per cent. of theine; good black tea, 2·13; various samples of coffee beans, from 0·8 to 1 per cent.; dried coffee leaves from Sumatra, 1·26; Paraguay tea (*Ilex Paraguayensis*), 1·2 per cent. In addition to theine, guarana contains a colouring matter, apparently analogous to the tannin in cinchona bark, and also a fatty matter which, like the fat of chocolate, does not appear to become rancid by keeping].—Editor.

THE LACE BARK, OR GAUZE TREE.

[*Lagetta Lintearia.* The *Daphne Lagetta* and *D. Lintearia* of other authors.]

This is a tree thirty feet high, with a trunk about the size of a man's thigh, straight, with a rough outer bark. The wood is white and solid. The inner bark is tough, but of a fine texture, consisting of twenty or thirty layers, each of which on being soaked in water is easily separated —and, extended or drawn out diagonally, exhibits the appearance of a fine net lace, from which it derives the name of Lace Bark, or Gauze tree. The branches are round, and the bark somewhat smoother than that on the trunk. The leaves are four inches long by two and a half wide, pointed, and somewhat heart-shaped at the base, and are alternately attached to the branchlets by short footstalks; they are dark, evergreen, leathery, smooth, and shining. The spikes of flowers are placed at the ends of the branchlets, on alternate flower-stalks. There is no calyx; the corolla is a single-tailed, funnel-shaped white flower, the border divided into four oval, pointed, spreading divisions. The stamens are eight short filaments enclosed within the tube. The anthers are roundish, erect, bicolled—the style is short, with a short depressed stigma—the fruit is a roundish drupe or berry, with a roundish kernel pointed at both ends. In Jamaica it is common in the woods of the parishes of St. John, Vere, Clarendon, Manchester, and St. Elizabeth's, on the south side of the island, and generally in the mountains of the interior and north side parishes.

Long writes of the lace bark :—" The ladies of the island are extremely dexterous in making caps, ruffles, and complete suits of lace with it; in order to bleach it, after being drawn out as much as it will bear, they expose it stretched to the sunshine, and sprinkle it frequently with water. It bears washing extremely well, with common soap, or the coratoe soap, and acquires a degree of whiteness equal to the best artificial lace. There is no doubt but very fine cloths might be made with it, and perhaps paper. The negroes have made apparel with it of a very durable nature. The common use to which it is at present applied is rope making. The Spaniards are said to work it into cables, and the Indians employ it in a variety of different fabrics. It may, perhaps, be of service to Great Britain as a manufacturing nation, but the inhabitants of these colonies are very seldom disposed to improve what nature offers, or apply many productions here to the obvious uses for which they are intended. Necessity, that great spur to such improvement, is wanting to stimulate; or otherwise they would soon find out methods of turning them to account."

Swartz relates that Charles II. had a cravat made of the bark of this tree, which was presented to him by Sir Thomas Lynch.

Dr. Wright attributes some medicinal qualities to the bark of this tree, which he says has the sensible qualities of Mezereon, but in a greater degree.

There are several other species of *Daphne* to be found in the island of

Jamaica, but they are not noticed as having the same quality of bark. A very tastefully-made bonnet was recently manufactured with much ingenuity by a poor widow lady of Jamaica from the sheathing leaves or husk of the seed of the Indian corn. It was adorned with lace bark (some dyed), artificial flowers, and the seeds of the orange, and presented to her Majesty the Queen, with the hope of her acceptance.

The bark of *Daphne papyracea*, or *cannabina*, in Nepaul, and *D. chinensis* and *Indica*, in China and the Eastern Archipelago, have the same properties as the *Lagetta Lintearia*.

W. T. M.

Scientific Notes.

Curing Meat.—Mr. H. Clark, of South Carolina, points out a mode of curing meat in the hottest climates, which has been practised in most of the Southern States for fifteen or twenty years at least. The plan is to dig a hole in the earth, from four to six feet deep, and large enough for the amount of meat you have to cure; lay boards on the bottom, and on this pack your meat in salt—the usual quantity—and then cover the hole with boards and earth, keeping it in this condition till the meat is sufficiently salted. By this mode of preserving, no person need lose a pound of meat in the warmest climate. Large quantities of pyrolignous acid are manufactured in Philadelphia and sent to Cincinnatti, for the purpose of curing hams. It gives them the same flavour as those which are smoked, and it may answer just as well.

A New Stimulant.—The decoction of the leaves of the coca, or Peruvian *Erythoxylon*, recently introduced into Europe, is exciting attention as possessing a peculiar stimulating power, and favouring digestion more than any other known beverage. These leaves, chewed in moderate doses of from four to six grains, excite the nervous system, and enable those who use them to make great muscular exertion, and to resist the effect of an unhealthy climate, imparting a sense of cheerfulness and happiness. In larger doses coca would occasion fever, hallucinations, delirium. Its exciting power over the heart is twice that of coffee, four times that of tea. It has no equal in its power of stimulation, in cases of forced abstinence. Dr. Mantegazza, of Milan, states that although he has a weak constitution, he has been enabled, by the use of coca, to follow his usual studies uninterruptedly for forty hours, without taking any other aliment but two ounces of coca chewed during that time. He adds that he felt no fatigue after this experiment. The Indians of Bolivia and Peru travel four days at a time without taking food, their only provision consisting in a little bag of coca. It is regularly administered to the men who work in the silver mines, and who, without it, could not resist the hard labour and bad diet to which they are subjected.—*Scientific American.*

The Curries of the East.—The dishes in Sumatra are almost all prepared in that mode of dressing to which we have given the name of curry (from an Hindostanee word), which is now universally known in Europe. It is called in the Malay language *goolye*, and may be composed of any kind of edible, but is generally of flesh or fowl, with a variety of pulse and succulent herbage, stewed down with certain ingredients, by us termed, when mixed and ground together, curry powder. These ingredients are, among others, the cayenne, or chili pepper, turmeric, serraye, or lemon grass, cardamums, garlick, and the pulp of the cocoa-nut bruised to a milk, resembling that of almonds, which is the only liquid made use of. This differs from the curries of Madras and Bengal, which have greater variety of spices, and want the cocoa-nut. It is not a little remarkable that the common pepper, the chief produce and staple commodity of the country, is never mixed by the natives in their food. They esteem it heating to the blood, and ascribe a contrary effect to the cayenne, which I can say my own experience justifies. A great diversity of curries is usually served up at the same time, in small vessels, each flavoured to a nice discerning taste, in a different manner; and in this consists all the luxury of their tables. Let the quantity or variety of meat be what it may, the principal of their food is rice, which is eaten in a large proportion with every dish, and very frequently without any other accompaniment than salt and chili pepper. It is prepared by boiling in a manner peculiar to India; its perfection, next to cleanness and whiteness, consisting in its being, when thoroughly dressed and soft to the heart, at the same time whole and separate, so that no two grains shall adhere together. The manner of effecting this is by putting into the earthen or other vessel in which it is boiled no more water than is sufficient to cover it, letting it simmer over a slow fire, taking off the water by degrees with a flat ladle or spoon, that the grain may dry, and removing it when just short of burning. At their entertainments the guests are treated with rice, prepared also in a variety of modes, by frying it in cakes, or boiling it mixed with the kernel of the cocoa-nut and fresh oil in small joints of bamboo. This is called lemmung. Before it is served up they cut off the outer rind of the bamboo, and the soft inner coat is peeled away by the person who eats.—*Marsden's "Sumatra."*

The enduring odour of musk is astonishing. When Justinian, in 538, rebuilt what is now the Mosque of St. Sophia, the mortar was charged with musk, and to this very day the atmosphere is filled with the odour.

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The Eruption in May, 1860, of the Kollugja Volcano, Iceland. By W. Lauder Lindsay, M.D., F.L.S.
Annales de l'Agriculture des Colonies for January.
Pharmaceutical Journal for January.
The Chemist and Druggist. No. XVIII.
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THE TECHNOLOGIST.

VARIETIES OF SUGAR.

BY THE EDITOR.

The different varieties or kinds of sugar known to chemists are, cane-sugar, glucose, mannite, dulcose, milk-sugar, &c. The only plants, however, which contain sugar in quantity are the sugar-cane *(Saccharum officinarum* and its varieties), the white beet *(Beta cicla)*, the sugar-maple *(Acer saccharinum)*, and certain palm trees. Sugar is manufactured in Spain and Portugal from grapes: 100 lb. of this yields, by refining, 70 lb. of fine white sugar. The cocoa-palm and the arbutus (or strawberry tree) are sugar-yielding. A large kind of millet grass brought from Africa, the Imphee or Kafir corn, yields sugar equal to that of the cane, as do other species of *Holcus.*

The grains of wheat, and all the similar seeds which are used as food, contain at first a large quantity of sugar, which gradually disappears as they approach to a state of maturity. This is the case also with peas, beans, and all leguminous seeds, and is one reason why the flavour of young peas is so much superior to that of old ones. The manufacture of sugar from chestnuts was some time ago prosecuted in France, but the extraction of starch from them is now the chief commercial application.

1. Sugar, similar to that of grapes, may be prepared by boiling one part of the starch of potatoes or flour with from one-hundredth to one-tenth of sulphuric acid, and four parts of water, for thirty-six or forty hours, care being taken to renew the water as it evaporates. At a higher pressure and temperature the change may be effected more rapidly with a smaller quantity of acid. The excess of acid is then to be saturated with lime, the sulphate of lime separated, and the liquid concentrated by sufficient evaporation. 2. The starch of flour soon loses its gelatinous consistence when moistened with an extract of sprouted barley; it is transformed into a liquid, and if the barley is in sufficient quantity, it is changed in the course of a few hours into sugar of grapes, provided the temperature be maintained at 158 to 167 deg. Six parts of barley which has germinated produce twenty-five parts of sugar of grapes. 3. Sugar may also be procured by taking twelve parts of linen rags, or paper cut into small

pieces, mixing them intimately and gradually with seventeen parts of concentrated sulphuric acid, or with five parts of sulphuric acid, and one part of water: the temperature must be kept moderate. After twenty-four hours the mass is to be dissolved in a quantity of water, and boiled for ten hours; it is then to be neutralised with chalk, filtered and evaporated to the consistence of syrup, and crystallised. Chemists have not yet been able to obtain sugar prepared by these artificial methods in regular crystals like cane-sugar, although there is little doubt that these two species differ from each other merely in the quantity of water with which they are combined.

The plants containing sugar, far from being confined to a single species, are extremely numerous: there has been a long list published of them, and sugar may be extracted in greater or less portions from a vast number. If any form of *lignin* or woody fibre—for instance, saw-dust (cleansed from all foreign bodies, such as resin, extractive matter, &c.)—be rubbed up with a little sulphuric acid, taking care that the action of the acid does not go to the extent of charring, and if the acid be afterwards abstracted by adding to the mixture an alkali or some powdered chalk, it will be found that the *wood* has been changed into a species of *gum*. If we now boil this gum for some hours in acidulated water, it gradually becomes converted into sugar.

Hay, straw, leaves, shavings—in short, any form of ligneous fibre, may be similarly converted; and although we do this but clumsily and inconveniently in our laboratories, being as we are but Nature's journeymen, Nature herself carries on these transmutations with the most wonderful results, as we see in the ripening of fruits, where the hard woody texture gradually softens down into sweet and luscious pulp, as in the ripening of the pear, the grape, the strawberry, and, in short, almost all fruits.

Bracconot, some years since, pointed out the very remarkable fact that saw-dust and linen could be converted into grape-sugar, and that from a pound of these substances more than a pound of sugar could be produced. The process is as follows:—Wood, or linen, or paper, is left to imbibe its own weight of oil of vitriol; eventually the whole is converted into a viscid mass; care must be taken that it does not become too hot. This mass being diluted with water is boiled for some hours, the liquor is filtered, the acid removed by chalk, and the sugar formed after evaporation. One hundred pounds of saw-dust will yield, by this treatment, one hundred and fifteen pounds of sugar; the same quantity of starch may be converted, by a similar operation, into one hundred and six pounds of saccharine matter. These substances only differ chemically from each other by an addition of a small quantity of hydrogen and oxygen, the elements of water, to the latter. The quantity of carbon remains through all the same, but the proportions of the two gaseous elements are increased by the process described.

The chemical characters of different kinds of sugars are at the present day much studied, and several curious facts concerning them have been brought to light. It is well known that some kinds of sugar crystallise with ease, whilst others cannot be crystallised at all. Analysis has detected a slight difference in their atomic constitution, which would account for this singular disagreement in their crystallising power. Of the crystallisable class are the cane, maize, beet, and maple sugar. Uncrystallisable sugar is frequently termed grape-sugar, as it exists ready formed in the juice of ripe grapes: of this class are sugars made from starch, whether by the action of diastase or sulphuric acid, and sugar from linen rags or saw-dust and gluten. The formation of sugar from the action of diastase upon starch presents a curious phenomenon, but cannot be considered of practical value, although this idea has been entertained by some.

Diastase is extracted by water from malt, and possesses the remarkable property of converting starch into sugar in a few hours, and in some cases in a few minutes: 100 parts of starch, made into a paste with 39 times their weight of water, mixed with 6 parts of diastase, dissolved in 40 parts of water, and kept for one hour between 140 and 149 deg. Fahr., afford 80 parts of sugar.

That sugar might be obtained from the potato, was a discovery which before the days of chemical knowledge might justly have been considered as wonderful as the conversion of lead into gold, promised by alchymists.

The discovery, by chemical analysis, that the potato, though far different in form, taste, and all external qualities, was perfectly similar in component parts to the different kinds of grain used for the food of man, led naturally to inquiries, whether the products derived from these grains, by submitting them to different chemical operations, might not be procured also from this root. Complete success was the consequence. It was found, among other things, that a substance possessing all the properties of sugar, though differing a little from that of the sugar-cane, could be procured by a simple operation from the potato. Until 1830, however, the discovery was considered only as a matter of curiosity, and was mentioned only among men of science. In 1832, experiments were tried, on an extensive scale, in the United States of America, to ascertain whether, in districts where the potato grows abundantly, this sugar might not be made advantageously to the population of the district, and to the manufacturer himself. An account of the process and the results is interesting. The potatoes were ground by a very ingenious and simple method, by exposing them through a box or hopper to the action of a wooden cylinder, having nailed upon it long strips of iron punched full of holes, to give them a rough, grating surface. This cylinder was driven by a band of leather attached to the drum of a water-wheel. On filling the hopper with potatoes, and giving the grater the necessary motion, the potatoes were reduced with surprising rapidity to a fine pulp, from which, by the aid of a sieve and water, the starch in great purity was readily obtained. This apparatus ground 3,500 bushels of potatoes without the least repair. The starch thus obtained was then dissolved completely in water, heated by steam let into it. A certain quantity of sulphuric acid or vitriol was then mixed with it, and heat being applied, the whole of the starch was converted into syrup. This was purified from the acid by adding quicklime, and then evaporated; when the result was an excellent sugar, fit for all domestic purposes. A bushel of potatoes, weighing 60 lb., gives 8 lb. of pure dry starch; and from these 8 lb., $7\frac{1}{2}$ lb. of sugar are obtained. This sugar ferments briskly when made into beer, and yields a healthful and pleasant beverage. It will be of most use, however, for making sweetmeats, and may be used at table in place of honey, for which it is a good substitute. It has already become a great favourite with most persons who have become acquainted with it. Its taste is that of a delicious sweet, and as an article of diet it is probably more healthful and less oppressive to the stomach than any other sweet substance in use. (Silliman's Journal.) Potatoes (as I find from the account of a traveller) are used extensively in the eastern part of Russia for making treacle, which is quite as sweet and good as that which we obtain from the tropics, but having less consistence.*

In Sweden, sugar has long been extracted from the potato. A company has been formed for the purpose of bringing under the notice of the mercantile community here the important advantages of glucose, or potato sugar, which is already largely used on the Continent.

The varieties of manna have already been described (p. 225).

A correspondent of the 'Deseret News' gives the following account of the discovery of a new kind of sugar at Provo city:—"Last week, a sweet substance was discovered on the leaves of trees. A few began to gather it, by stripping off the leaves and soaking them in water; in this way Dr A. Daniels made 11 lb. of sugar in one day: it looks and tastes like maple-sugar. Many scores of men, women, and children are now engaged in gathering it. When it was first discovered, some said it was honey-dew; others said it proceeded from the cotton wood leaves; but it is found on all kinds of leaves, and on the rocks. Many of the leaves have scales of this sweet substance as thick as window-glass, and some a great deal thicker."

A Mr Hoffman some years ago took out a patent, in conjunction with a Mr E. Devay, for extracting sugar from the pumpkin. They established a small manufactory at Zandor, and made about 40 cwt. of pumpkin-sugar, part of which they refined. The yield of sugar, weight for weight, was about the same as from the beet-root; but one hectare of land (a little more than two acres) would produce three or four times greater weight of pumpkins than of beet-root, the space occupied by the Indian corn growing between the rows not being included: 8 cwt. of sugar could be raised on 1,600 square toises, from which a weight of 200 and sometimes 260 cwt. of pumpkins was obtained. Mr Hoffman obtained from between 26 and 27 cwt. of pumpkins 1 cwt. of sugar, and as much syrup. In making the sugar, the pumpkins were cut in pieces, and then with the rind were rubbed on a grater, the same as that used for beet-root. The seeds, which yield an excellent oil, were kept separate, 1 lb. of oil being obtained from 5 lb. of seed.

* M'Adam on the Potato, Quarterly Journ. Ag., vol. v., p. 335-6.

The juice was extracted from the grated pumpkins in the same manner as from beet-root.

Mr Hoffman obtained from an indifferent press 82 lb. of juice, containing a proportion of sugar of from 3 to 10. This juice is stated to be far preferable to that of the beet-root, because it does not so soon lose its virtues, but remains good for twenty-four hours. It is purified and cleared with animal matter, and the pumpkin juice is boiled down in the same manner as that of beet-root. Sheep prefer the refuse of the pumpkin to that of the beet-root, which also requires a well-cultivated soil, while the former will thrive in one that is less so.

Some successful experiments were made a few years ago in Sicily in extracting sugar from the Indian fig (*Opuntia vulgaris*, or *Cactus Opuntia*), which is known to contain much saccharine matter, capable of being crystallised. The plant is very plentiful in the southern regions of Europe, where it grows in many parts wild. The process employed was much more simple than that commonly used in the extraction of beet-root. The honey of the prickly pear is of two kinds: one is a syrup, the other is as thick as honey; both are saccharine, and said to possess all the qualities of common honey.

The first settlers of America, in order to obtain sugar, used to boil up the chips of the walnut trees which they had cut down. The Indians on their long journeys prefer sugar to any other food, because it will not corrupt, and they mix it liberally with their powdered Indian corn. The sycamore, the ash-leaved and the Norway maples, abound with a saccharine juice from which sugar might probably be prepared with advantage in certain localities. Sugar is also made from the sap of the birch tree.

Mr Edmund Spencer, in his Travels through Circassia, Krim Tartary, &c., in 1836, describes a similar process to that from the maple, pursued in obtaining Caucasian sugar. "Here," says he, "I was made acquainted with their manner of procuring sugar, which is derived from the walnut tree, that flourishes here in extraordinary perfection. During spring, just as the sap is rising, the trunk is pierced, and a spigot left in it for some time: when this is withdrawn, a clear sweet liquor flows out, which is left to coagulate, and on some occasions they refine it. For diseases of the lungs, and general debility, they consider it a most valuable medicine."

Clarified honey, bleached in the sun till it becomes quite white, is another substitute for sugar.

The Arabs in Eastern Africa make honey-sugar; the material, after being strained and cleaned, is stored for two or three weeks in a cool place till surface granulation takes place. The produce resembles in taste and appearance coarse brown sugar.

Jaggery is obtained in India from the *Cocos nucifera*, in Ceylon from the *Borassus flabelliformis* and the *Caryota urens*, and in the Moluccas from *Arenga saccharifera*—the sago palm, which is prolific in sugar, as are the plantain and banana of the West Indies.

An abundant and yet neglected source of sugar appears to be the Nipa plant, sometimes called the Nipa palm *(Nipa fruticans)*, but which belongs rather to the screw pines. The sap, obtained by simple tapping, yields by evaporation large-grained sugar.

The manufacture of date-sugar has been noticed in the TECHNOLOGIST (p. 12). Each tree yields about 180 pints of sap. Every 12 pints give, by boiling, 1 lb. of goor or syrup, and 7 lb. of sugar. The sugar-yielding variety *(Phœnix sylvestris)* is known as the wild date of Bengal; 35,000 tons of sugar were made yearly from it in 1854-58. Tapping commences about the 1st of November. The processes of manufacturing maple-sugar and maize-sugar will be found fully detailed in Simmonds's 'Commercial Products of the Vegetable Kingdom.'

Darwin speaks of a palm the (*Jubæa spectabilis*), which appears to abound in the more central provinces of Chile, that is valuable on account of a syrup called *miel de palma* (palm honey), made from the sap. The palms are, for their family, ugly trees; their stem is very large, and of a curious form, being thicker at the middle than at the base or top. On one estate near Pitorea they tried to count them, but failed after having numbered several hundred thousand. Every year, in the early spring, in August, very many are cut down; and when the trunk is lying on the ground, the crown of leaves is lopped off. The sap then immediately begins to flow from the upper end, and continues so doing for several months: it is, however, necessary that a thin slice should be shaved off from that end every morning, so as to expose a fresh surface. A good tree will give 90 gallons, and all this must have been contained in the vessels of the apparently dry trunk. It is said that the sap flows much more quickly on those days when the sun is powerful; and likewise that it is absolutely necessary to take care, in cutting down the tree, that it should fall with its head upwards on the side of the hill; for if it falls down the slope, scarcely any sap will flow, although in that case one would have thought that the action would have been aided, instead of being checked, by the force of gravity. The sap is concentrated by boiling, and is then called treacle, which it very much resembles in taste.—(Darwin's 'Journal of Researches.')

The Peruvians, as well as the Mexicans, made sugar from the green stalks of the maize plant, and sold it in their markets. Cortez, in one of his letters to the Emperor Charles V., speaks of it. At Quito these green stalks are brought to market, and the Indians suck them as the negroes do the sugar-cane. About ten years ago, the manufacture of sugar from the sap of the Indian corn attracted some attention in the United States, but was not persevered in. In America, a patent was, however, granted in 1850 for making sugar out of Indian-corn meal, which is worthy of notice. Twenty-five bushels of corn meal are mixed with 150 gallons of water at a temperature of 175 deg., and to this is added 25 lb. of vitriol, to which, after stirring well, 50 more gallons of water are added, and the whole run into a boiler (a leaden one, we presume), when the contents are boiled by high-pressure steam. The boiling is continued until, by the trial of a little iodine with a portion of the mixture in a saucer, it does not turn blue, which shows the operation to be complete. Chalk is then added to neutralise any of the free sulphuric acid, when the whole liquor above the sediment at the bottom is run off and concentrated to crystallise. This is one of the wonders of chemistry: sugar is now made of corn, by boiling it along with a most virulent acid.

THE GOLD PEN—ITS HISTORY AND MANUFACTURE.

In olden times, the man who had ventured to predict the advent of those great improvements which have so largely contributed to the comfort and luxury of the present age, would have been deemed quite beside himself through excess of knowledge. But, in all ages, progress has constantly served to banish prejudice, and to overthrow obstacles apparently insurmountable. In no one department have the evidences of vast improvement been more signally and substantially verified than in that of Calligraphy.

From the earliest period of the history of writing—the first data of the papyrus, the waxen tablets, and the style—to the attainments and facilities of the nineteenth century, is a long and eventful lapse; wherein might readily be found the material for an entertaining and instructive historic sketch, full of valuable details. These, however, we leave to the professed delver in the curious, the explorer of the hidden mysteries of inventions and inventors, and pass directly to the subject designated at the head of this article. We have thought that a complete but succinct history of the gold pen, from the earliest inception of the idea to the manifold operations of this manufacture at the present day, would possess some degree of interest, and have, therefore, gathered from a variety of sources, of undoubted authenticity, a series of statements relative to this interesting pursuit, as full and accurate as it is possible to obtain. A brief summary of the experimental operations which led to the final result comes naturally first in order.

Mr John Isaac Hawkins, an American by birth, though for nearly forty years a resident of Europe, chiefly of England, and now in the United States in a vigorous old age, claims the original invention of the project of so forming a pen from gold as to render its point or nib thoroughly indestructible. The perfection of his invention dates back to about the year 1834. Mr Hawkins at that time had been for nearly thirty years seeking the hardest material in nature which was capable of being soldered to gold, in quantities so small as to allow of a fine and smooth point, which might be cleansed with the readiness of a quill. He had during many years manufactured specimens of durable pens from various minerals and precious stones, but these all proved deficient. Some were made of rubies set in gold sockets; but here the nibs were clumsy, could not be easily freed from ink, and there was a sad want of elasticity in writing with them. Other contrivances equally failed; some in one way, some another. All these appeared to be difficulties which were not to be overcome. The next essay was with diamond-powder, coarse and fine, cemented inside the points of quill-pens; but the particles were dragged out by degrees, and a sensation of roughness caused thereby. The quill also became warped, and the whole was thus rendered useless.

In 1833, after a multitude of such experiments, the persevering inventor became aware that the celebrated philosopher Dr Wollaston had sent to a ruby-pen manufacturer in London sundry specimens of rhodium and the native alloy of iridium and osmium—minerals found in combination with platinum—with the request that a pen might be formed from each. Accordingly a few were made, but from the rhodium alone—the iridium being returned to Dr W. by the manufacturer, with the remark that it was too hard to be wrought into figure. Here, then, was exactly the thing for Mr Hawkins; the very object for which he had expended so many years' time, capital, and labour. Justly considering that if the hardness of the new mineral were really so great as represented, it was eminently calculated to meet the want which he had experienced, he was led to commence his experiments anew. Entering upon the investigation with renewed care and deliberation, he prosecuted it until he obtained that result for which the writing portion of the civilised world are now so much indebted to him. The details of Mr Hawkins's final operations at this period are full of interest; we regret that we have no room for more than an outline of his principal experiments. A great point was to be gained in determining the relative degrees of hardness of the mineral he had employed, as compared with the newly-discovered one. To ascertain this, Mr H. contrived a lathe capable of giving to the mandril 10,000 revolutions per minute, upon which was placed a lap of two inches diameter, running 5,000 feet per minute, or 833 feet every second. Diamond-dust being then placed upon this lap, the minerals were severely tested. A bit of the iridium held against it was slightly abraded in five minutes; a ruby was cut away to the same extent in about one-third of the time. This experiment was decisive, and abundantly satisfied Mr H. that the grand object of his endeavours had at last been reached. From this time, the manufacture of "durable" pens went on rapidly with iridium alone. Of course, many difficulties were encountered; but the inventor finally succeeded, to his own entire satisfaction, in so soldering the iridium and gold together, that he obtained a perfect pen—convenient and indestructible. "I was now satisfied," says Mr Hawkins, "that with fair usage I had a pen for my lifetime." Thus begins the actual history of the gold pen as such.

The progress of the manufacture has since been constant and rapid, both in England and America. We believe the first right sold in Great Britain was to Mr F. Mordan, who is yet one of the largest dealers in the article in London. Mr Levi Brown is generally acknowledged to have been the pioneer in the United States; and other manufacturers have followed him in rapid succession, until there are now in various parts of the Union some twenty establishments. Of these, New York alone (City and State) contains at least a dozen. The city counts some five or six in active operation, each transacting an amount of yearly business governed by the demand for the article they furnish. We cite one of the most extensive and celebrated—that of Messrs Bard, Brothers, and Co., William street—in illustration of the immense traffic now carried on in this single branch of competitive industry. Mr Bagley is also a large manufacturer.

To render the subject clear and comprehensive, we will briefly trace the formation of a single gold pen, through the different stages of its manufacture, as follows:

First.—The gold is melted in quantities ranging from a few to many ounces, as the requirements of the establishment may at the time demand. The Messrs Bard find it necessary to melt three times every week; other manufactories undoubtedly vary from this standard. Here Victoria sovereigns are generally used in preference to all other qualities of gold; occasionally, however, fine jewellery is employed for the purpose. Usually, the value of one day's melting is from $300 to $400. This amount suffices the wants of the workmen for about a day and a half or two days. The metal is alloyed with silver and copper for twelve, fourteen, or sixteen carats. One day, passing through the factory, we saw twenty-five ounces in the crucible, which was immediately moulded into an ingot worth $360; and we then had the curiosity to follow it, through the various processes, until it came out in the form of finished pens. The whole operation is performed with marvellous celerity, in the order which follows.

Second.—The gold is rolled into strips, through a powerful machine which thins and lengthens the ingot at each revolution.

Third.—The "blocks," or angular morsels of the gold, tapered toward one end, are cut by a separate workman and machine.

Fourth.—The tapered ends are filed half through the thickness of the block.

Fifth.—In the niche thus formed the iridium point is set. This is a very delicate operation, requiring a good eye and an experienced workmen.

Sixth.—The "diamond point" is secured by soldering together the iridium and the gold. A very small but intense heat is applied at the point, by the agency of a minute jet of flame.

Seventh.—The point is ground square.

Eighth.—The pen is rolled and hammered.

Ninth.—It is cut to the proper shape, in a small, neatly-contrived machine, in which works a steel die.

Tenth.—The pen is turned up, perfectly semicircular, as it comes to the hand of the purchaser.

Eleventh.—The point is split, having before been guarded from injury by small grooves in the different machines through which it has passed.

Twelfth.—After the nib is thus started, another workman cuts the slit the necessary length.

THIRTEENTH.—The nibs are now cut accurately.

FOURTEENTH.—The points are set together, and the pens filed into shape.

FIFTEENTH.—They pass into the grinder's hands.

SIXTEENTH.—They are stoned and polished.

SEVENTEENTH.—The nibs are finally adjusted, the point smoothed, and the pen is ready for writing.

EIGHTEENTH, AND LASTLY.—Every pen is now tried with ink. If it be defective, it returns to the operatives; if not, but writes readily and smoothly, it is transferred to the office, placed in the holder, and exposed for sale.

Such, briefly, are the various processes through which every pen is compelled to pass before it is ready for the hand of the purchaser.

Iridium, which forms the so-called "diamond-point" of the gold pen, is the hardest known mineral after the diamond, and is the only one which at all answers the purposes required in the delicate manufacture of which we are speaking. The iridium imported is from the mines of Siberia, and from South America, and is obtained through agents in England, being purchased largely expressly for the use of the gold-pen manufacturers. Its price in gross bulk ranges from $30 to $75 per ounce; no good qualities being procurable at a lower rate than $30. Indeed, some years ago, very excellent samples are known to have commanded $100 an ounce. The same quality, again, which was valued five years ago at $15 and $20 per ounce, now brings $50. As the demand has increased, the quality of the mineral has also grown poorer, it being now quite difficult to procure good qualities to any large extent—the bulk of that imported being at least seven-eighths waste. The details of the separation of this mineral from its kindred metals, which likewise enter into combination with platinum, would furnish an interesting paragraph, but we must hasten on to other topics. We will say, however, that he who shall discover some mode—chemical or otherwise—whereby the refuse of the iridium in its present unmalleable and infusible state may be rendered subservient to the uses of the manufacturer, will have accomplished an improvement which would add greatly to the rapidity and certainty of his operations.

It is not easy to make an estimate of the number of gold pens manufactured per annum in America, but it is probably not less than 1,500,000. A person who had not thought of the subject would scarcely suppose that 1,000 lb. of gold are used up every year in America in the manufacture of such a trifling article as pens. A statement of the tons of iron worked into pens in England every year would be even more startling.

The establishment of which we have spoken is conducted simultaneously in New York and Boston, giving constant employment to some thirty or forty workmen, and transacting business to a very large extent. The two factories turn out annually 104,000 gold pens, complete—or an average of 2,000 per week. To supply customers and the trade, 150,000 pen-cases, gold and silver, are also required annually. In addition to these, about 10,000 pencil-cases, without the pen, are called for; the establishment largely supplying the trade in all parts of the country, besides satisfying a very extensive retail demand. A large amount of iridium is of course consumed every year for the immense number of pens manufactured, each of which requires a selected "point," carefully chosen from the mass imported in bulk. Here occurs the great waste of this material, of which we have before spoken. We have understood that an average of 200 ounces of iridium is used up every year for the gold-pen manufacture, in the different establishments of the United States.

Multiply the business thus transacted from one year to another by the single firm whose operations we have cited, and the reader will have obtained an idea of the enormous aggregate valuation of this apparently simple, but really intricate, most interesting, and now quite indispensable branch of industry. It is a striking evidence of the ability of the New World to compete with, and even to surpass the Old, in different departments of manufacturing industry, that the American manufacturers have been enabled, by their superior facilities for obtaining competent workmen and labour-saving tools, but still more by the far greater extent of the demand in that country, and the fact that the makers there early obtained control of the market, to furnish the gold pen, for years, at rates vastly lower than those still charged in England. When first introduced in London, the ruling price for the pen alone (without any description of holder) was 1*l.*, or nearly $5. In New York the whole brings but half that price, $2 50c. (in ordinary silver cases), although additional expense is entailed upon the manufacturers by the simple circumstance of the reimportation of the iridium through English hands. A handsome and well-merited compliment has been paid by Mr Hawkins to the skill and ingenuity of the American manufacturers, in the following language, used while contrasting the progress of his invention in England and America. "I am free to confess," he says, "that the New York manufacturers have advanced much beyond me in despatch; the ingenuity of the American workmen, who delight in 'going ahead,' having been encouraged and exerted in the construction of several labour-saving tools and ready methods of working—while the sluggish and let-well-alone feeling of the English workmen in my employ formed a clog to the introductin of new tools and methods of working into my manufactory, even when plainly indicated by experience."

ON THE PROBABLE UTILITY OF PEAT-SOIL IN COMBINATION WITH SEAWEED AND OTHER SUBSTANCES AS MANURE.

BY GEORGE PARSON.

Agriculture may now, or at any rate, probably, before many years elapse, have a fair claim to be called a science. By the aid of chemistry and other branches of natural philosophy, the agriculturist has already attained a prominent position in the scientific world. What, indeed, can be of higher importance, in a social point of view, than a knowledge of the most efficient means of raising from the earth sufficient food for an ever-increasing population?

Philosophers have been wont, from time immemorial, to speculate; often with mystic and vague elements, as the bases of their speculations. What is the source of magnetism? Are light and caloric distinct forms of matter? These and many other questions have given rise to speculative theories, and to strange and conflicting hypotheses. Now, I think that people whose minds are more disposed to cleave to the dust, and who prefer tangible matter for furnishing them with ideas, may also be allowed to speculate a little; and this latter kind of speculation may turn out the more profitable of the two.

Where are farmers to obtain an abundant supply of manure, when guano becomes scarce? This question has often occurred to my mind, and, among other things, I have thought that Peat-soil might probably be used as an excellent substratum for artificial manure.

Nature has provided ample resources for the necessities of the human race; to develop these resources is the province of man. It must be evident, however, to all intelligent people, that the more numerous our race becomes, the more will man be beholden to science for the adequate development of these resources. Ignorance is opposed to science; it has shown its antagonism in anti-steam-power riots, and opposition to the introduction of machinery: but science must triumph; it will become, or rather it has become, indispensable to society.

That bogs—those stores of Nature's vegetable conserve, the peat—are destined to play a prominent part in agriculture, seems to me very probable. What extensive tracts of this substance we find scattered widely over the world!—in many parts useless—nay, in some cases worse than useless, spreading ague and fever far and wide. The use of peat as fuel is, indeed, extensive; in many parts of the Continent of Europe it is almost the only fuel used. Hundreds of people find employment in transporting it on the Elbe to Hamburg, and other markets on that river. In Jutland, in Denmark, extensive bogs exist, many of which afford excellent fuel both for domestic purposes, and for burning lime, bricks, &c. Some kinds make very hot fires: I have seen in a limekiln in Denmark, where peat was used, vitreous slags produced that indicated a high degree of heat; there is also a kind in the neighbourhood of the small town of Grenaa, called Ramten-turf (from the place where it is obtained) that produces good charcoal which is used by smiths. But large tracts of bog-land lie undisturbed, only producing rank grasses on which herds of lean cattle graze during the summer.

But, to come nearer home, the bogs in Ireland and some parts of Scotland would furnish an abundant supply of peat-soil, if it were once found how to turn it to profitable account. I am not aware that this kind of soil has ever been made much of as arable land ; I have seen oats and flax on it on the Continent, but in all cases the crops were poor. However, in the Hebrides they get, on a small scale, very fair crops of oats from it by the following mode of culture:—They first set fire to the heather, and then spread seaweed in strips of six or eight feet width on the ground ; on each side of the seaweed-covered patches they dig a trench two to three feet deep, throwing the soil from the trenches over the seaweed ; when this soil is hacked a little with a spade, it is ready for the seed.

It appears, from what I heard, that the seaweed in this case exercises a great influence in making the peat-soil productive ; yet it seemed strange that a soil of this kind, composed almost entirely of vegetable matters, should require more *vegetable matter* as manure.

Now, the principal use of manure undoubtedly is, to furnish the *minerals* required by vegetation in a *soluble* state. In the Channel Islands, where vraic (the name of seaweed in those islands) is extensively used as fuel, it is found that the ashes are more beneficial as manure than the fresh weed; and peat-ashes are considered of great value for rye-land on the Continent. We find that where water percolates the soil, it renders it unfruitful; it evidently washes away dissolved minerals, and robs the vegetation of its nutriments. Where the land is too wet, and the contained water stagnant, the dissolved minerals may be too largely diluted: besides, the water will prevent the air from acting on the soil, and thus prevent farther solution. Land in this state *therefore* requires draining. The quantity of suitable mineral substances that water ought to hold in solution to sustain vegetation may be extremely small, but one can conceive that the supply ought to be continuous.

Manure may furnish mineral matters suitable to nourish plants, in the first place, when it contains them in such a state that they are acted on directly by air, moisture, temperature, &c., so that they by degrees become soluble ; secondly, by acting chemically on the minerals composing the soil; and thirdly, by facilitating the decomposition of organic substances, setting free their contained minerals: the action of ammonia as manure is, perhaps, of this latter kind.

Now, peat-soil is evidently not prone to spontaneous decomposition ; hence its sterility *per se:* but if it were laid up in heaps, mixed with seaweed, refuse fish, &c., the action of these substances on each other might tend to produce a most valuable manure. In the case of fish, the peat-soil would probably absorb evolved ammonia, and other volatile products, the greater part of which might otherwise have gone to waste. Quicklime and many other substances might perhaps also be found useful. But it is vain to speculate in details; I have only attempted to throw out hints of a general nature, and experiments alone can test their value.

Glasgow.

THE TRADE IN SHELLS.

The commerce in shells is more extensive, and the uses to which they are applied more varied, than is generally supposed. This trade is growing year by year into greater importance, and there is ample scope yet for its extension with profit and advantage alike to the merchant and importer, the manufacturer and vendor, and to the general public, who are the purchasers and consumers.

It is somewhat difficult to arrive at any correct estimate of the value and extent of the British trade in shells, because they are scarcely mentioned in the official trade returns. Coming now under the head of those raw materials which are imported free for the use of manufacturers, the officials are very indifferent as to whether the imports are small or large, and we have no account of the snail-shells and ear-shells, the Murices and others, which are received in large quantities. Formerly, when shells were subject to an import duty varying from 5 to 20 per cent., it was necessary that the entries should be more specifically detailed.

Large quantities of shells which are used for different manufacturing purposes come in under the broad general heading of "Specimens of Natural History;" and the only specific mention of shells in the annual Parliamentary trade returns are mother-of-pearl shells, cowries, cameos unset, and pearls, the well-known and valued product of the pearl oyster.

In former years, mother-of-pearl shells were subject to a duty of 5 per cent. on the value, and cameos 20 per cent. Cowries were considered merchandise, and when the quantity of the assortment was such as to indicate they were not for manufacturing purposes, they were admitted as specimens of natural history.

Summary of the Commercial Applications and Aggregate Value of the British or Home Trade in Shells.

Principal Manufacturing and General Uses.

1. Nacreous shells, for making pearl-buttons, and other useful and ornamental articles.

2. Iridiscent and pearly shells, for ornamenting papier-maché work, making card-cases, folios, jewel-cases, &c.

3. Various small shells used for making shell-flowers and different fancy articles of grouped shells, and for ladies' bracelets, head-dresses, &c. Many of the small common shells used for covering little boxes, figures, &c., are known among dealers as "grotto-shells."

4. For carving cameos on, to form brooches, bracelets, scarf-pins, ear-rings, necklaces, coat and sleeve links, studs, &c., as articles of personal decoration.

5. For spoons, handles for knives, drinking-vessels, lamps, and other purposes in domestic economy; for snuff-boxes, pipes, and various other uses.

6. For making the purest kind of lime when calcined, and for manure when in the form of shell-marl and shell-sand.

7. For making pottery and enamel when crushed.

8. For small monetary payments in India, Africa, and North America, and for counters in games of chance.

And lastly, they serve as studies of design, form, and colour to the sculptor, painter, and art manufacturer.

There are other uses besides the foregoing, but these are the principal ones.

The average value of the imports of foreign collected shells in the last five years may be taken to be 250,000*l.*

The details of imports of shells, &c., in 1859, as far as can be ascertained, were—

Mother-of-pearl shells, 40,003 cwt.	- -	Value £67,859
Cowries 14,033 do.	- -	28,051
Cameos, not set	- - - -	9,590
Pearls	- - - - -	108,768
Miscellaneous shells for collectors, dealers, and manufacturers, about	- - - -	60,000
		£274,268

Having shown the aggregate value, we shall enter into special particulars respecting the sources of supply and trade uses of particular shells on another occasion.

HIPPOPOTAMUS TEETH OR TUSKS.

BY THOMAS D. ROCK.

One great difficulty—happily not always insurmountable—which invariably attends the path of the technological student, is that which arises from the erroneous application of proper names. Thus, the article now proposed for consideration, is treated by different authors under the terms sea-horse teeth, morse teeth, and hippopotamus teeth—the first two names being applied, indiscriminately, both to the walrus and hippopotamus; although I believe that, *commercially*, the term sea-horse, is restricted solely to the teeth of the latter animal.

The word hippopotamus is compounded of two Greek nouns, ἵππος and ποταμὸς, and literally signifies "the river-horse," a name bestowed upon this singular animal by the ancients, to whom it was very probably suggested by the amphibious nature of the creature, and the striking resemblance which its profile bears to that of the equine family; more especially when seen just emerging from the surface of the water, with ears erect, the unwieldy body, at the same moment, being hidden from view.

Visitors to the Regent's-park Gardens, where two hippopotami are to be seen constantly enjoying the pleasures of the bath, may, by careful observation, verify for themselves the appropriateness of the name thus bestowed upon this interesting mammalian.

The Dutch Boers of South Africa, distinguish this animal by the rather curious appellative of "zee-coe," or sea-cow.

Hippopotami form by themselves a distinct genus of the pachydermatous, or thick-skinned animals ; and even of this distinct genus, there is but one living species—"*Hippopotamus amphibius*"—found exclusively in certain parts of the African continent.*

The interest attaching to this animal from an economic point of view, is rather limited, being confined to a local use of its skin and flesh by the African natives and colonists, and the more general application of its powerful teeth, or tusks, as a substitute for true ivory.

However interesting it might be to consider the general anatomical, and physiological, features of this gigantic creature ; or to trace out the resemblance thought to exist between it and the "Behemoth," described in the Book of Job, I propose to confine my remarks exclusively to its singular dental apparatus, and such other matters as relate immediately thereto.

The mouth of the hippopotamus, is one of the most capacious in the animal world, and is armed with a set of teeth of the most powerful description, adapted solely for cutting and bruising its food, which is of the coarsest and rankest kind, and such as is found lining the banks of the tropical rivers of Central and South Africa.

The dental formula is as follows—

$$\text{Incisors - -}\left\{\frac{\text{upper jaw - 4}}{\text{lower jaw - 4}}\right. \qquad \text{Canines - - -}\left\{\frac{1—1}{1—1}\right.$$

$$\text{Molars - -}\left\{\frac{7—7}{6—6}\right. = \text{38 teeth in all.}$$

The molars evidently play but a secondary part in the economy of this animal ; and a portion of them are described as "strictly false molars ;" that is, the three molars of both jaws that succeed the canines, and which are conical in form, having only one point. The posterior molars are armed with two rows of points, which gradually wear down to a trefoil surface. To man, the molars of the hippopotamus are perfectly useless.

Incisor teeth, as the name imports, are the cutting instruments of the jaw : and of these teeth, which are situated in the fore front of the mouth, the hippopotamus possesses eight ; four in the upper jaw, which are short, conical, cylindrical, and curved slightly inwards ; and four in the lower jaw, cylindrical, straight, pointed and projecting forwards, the two centre ones especially, termed lateral incisors, which are both longer, and larger, than those next the canines. These incisor teeth are of some value in the arts for their ivory.

It so happens, that the teeth most highly prized by man, are those that occupy the most prominent place in the dental economy of the hippopotamus : these are the canines, which may be described as "enormous tusks," sharpened at their points, by mutual attrition of those in the upper and lower jaw, into oblique "chisel-like edges." They are four in number, two in each jaw ; the upper ones being short, slightly curved, rounded on

* Some Naturalists distinguish between the hippopotami of South and West Africa, making two species—*H. Capensis* and *H. Senegalensis*—but the difference is so small, that this division is for the most part rejected.

the outer side, deeply furrowed in the centre on the inner side, and ridged longitudinally, more especially on that portion of the tusk which is coated with the enamel. The canines of the lower jaw are considerably larger, are very much curved, like the tusks of a boar, and in shape somewhat elliptical; they are also ridged after the same fashion as those in the upper jaw.

Both the incisors and canines of this animal, although popularly called teeth, are virtually tusks; for they are uninterrupted in their growth, are formed on cores, and consequently hollow for a considerable portion of their length.

The canine teeth, or tusks, of the hippopotamus, are primarily composed of the two substances known as *dentine*, and *enamel;* the first-named forming the principal body of the tusk, whilst the enamel is merely an external shield, or tooth armour, of a denser and more durable material; and described as sufficiently hard to strike fire when contused with steel.

The enamel is not continuous throughout the entire circumference of these tusks, but only to the extent of from one-half to two-thirds of the whole, and occurs on such portions, as appear to be the most exposed to injury: lengthwise, the enamel extends from end to end, and is formed anew, in conjunction with the dentine, as the tusk grows. In thickness, the enamel varies from 1-32nd to 1-16th part of an inch, according to the size of the tusk. River-horse, or hippopotamus teeth, contain less organic matter (33·00) than either elephant ivory, or the tusk of the walrus, in which substances, the organic elements amount to about 44·00 and 38·00 per cent. respectively. The chemical composition of these teeth, as well as the essential difference between their dentine and enamel, is advantageously illustrated in the following analyses by Thomson.

Hippopotamus Teeth.

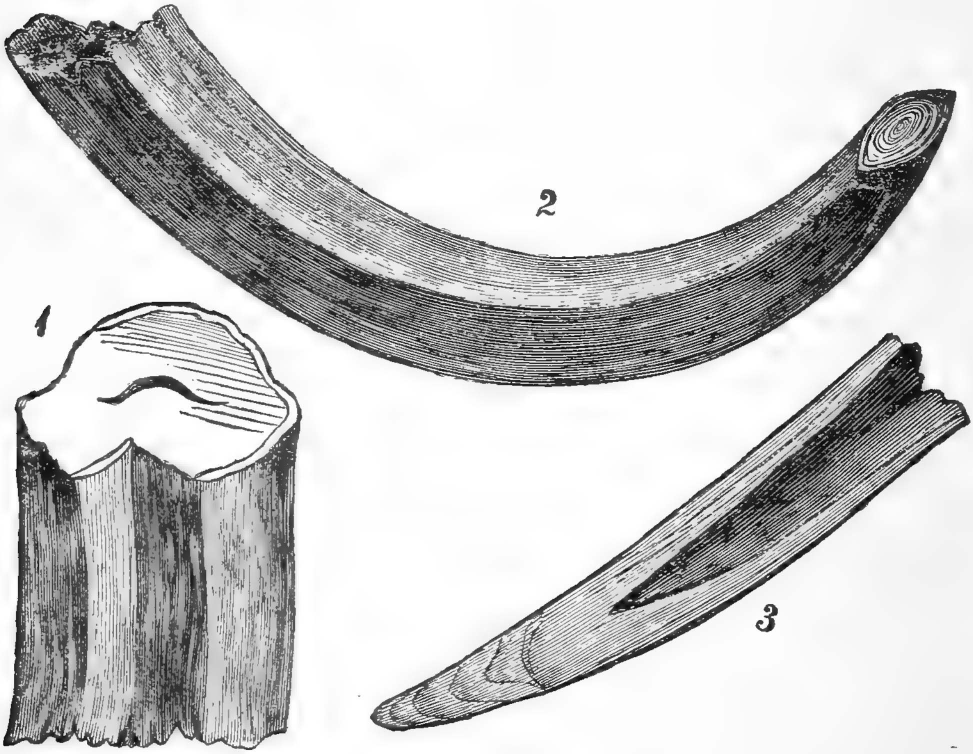
Constituents.	Enamel.	Dentine.
Organic Matter	4·102	33·41
Phosphate of Lime	83·630	55·90
Fluoride of Calcium	0·850	
Phosphate of Magnesia		1·19
Carbonate of Lime	10·620	9·14
Chloride of Sodium, Chloride of Potassium	0·800	0·36
Total	100·002	100·00

Sp. gr. of the dentine, 1·866.

A mere glance at the foregoing table, is sufficient to discover the more prominent qualities of the teeth now under consideration. The larger proportion of mineral matter in this dentine, coupled with great density of formation, renders it both harder, and less liable to receive stains, than other bone substances; whilst, to the smaller amount of organic matter, and the almost entire absence of oily particles, the delicate and superior whiteness of these tusks is to be attributed. It is the combination of these especial qualities, density and whiteness, that makes the hippopotamus teeth, so invaluable to the dentist.

On the other hand, the absence of oily matter, and the comparatively smaller amount of animal substance in this bone, induces brittleness, and causes it to be more easily affected by the acids of the food, and saliva.

The enamel is still harder and whiter than the dentine, by reason of its being composed almost exclusively of phosphate of lime, with only about 4 per cent. of organic matter. Dentists are the principal consumers of the canines of the hippopotamus; for no bony substance has hitherto been found that possesses, to so great an extent, the properties requisite to the successful performance of their art. Mineral teeth are, for the moment, in great favour; but, after all, it is very questionable if any artificial substance can be made so appropriate, as the precise material which an Infinitely Wise Being has selected, and supplied, both to man and the lower animals, for the purpose of mastication.



1. Lower end section of canine tusk of the upper jaw.
2. Canine tusk of the lower jaw.
3. Lateral incisor tusk of lower jaw, showing the extent of the hollow portion.

When these tusks are employed for the manufacture of front teeth, the enamel on the surface is valued, and retained, for the sake of its delicate whiteness and density, as before described; and the tusk is so manipulated that this enamel forms the outer or visible surface of the teeth. But when used in the production of artificial gum, or back teeth (molars), the enamel is removed by the aid of a chisel and grindstone, or, more frequently, by steeping the tusks or sections thereof, in a solution of muriatic acid, sufficiently long to destroy the enamel, without affecting the dentine; the softer parts, at the same time, being coated or painted over with some fatty substance, to preserve them from injury during the operation. Sometimes the blowpipe is resorted to as a means for removing the enamel, and a fine file is afterwards used in either case, for imparting the final surface to the bone. The points of the canines are generally defective, and in the process of working are first removed, the tusks being afterwards sawn into transverse sections, of varying thickness, according to the destined application, and as required by the operator.

Although the teeth of the hippopotamus are all but monopolised by dentists, yet the very excellent quality of their dentine is more widely appreciated, and likewise adopted for a few other purposes in the arts. When great delicacy is required, this bone is found more suitable for carvings, than the ivory of the elephant, and is much used in France for this purpose, especially in the manufacture of fine brooches.

The handles of surgical instruments are sometimes formed of this material, for which purpose it is admirably adapted, because of its being less liable to receive stains than other sorts of ivory.

Vases made of hippopotamus tusks were displayed in the Great Exhibition of 1851; and in the Irish Exhibition, a Mr R. Barter, of Dublin, exhibited some elegant intaglio brooches, consisting of figures carved in the same substance, and mounted on a groundwork or surface of cornelian. The enduring nature of the hippopotamus ivory appears to have been known, and valued, as early as the first century; for, according to a writer named Pausanias, a certain Greek statue of "Dindymene" had its face "formed of these teeth, instead of elephant ivory."

A few words on the incisor teeth of the hippopotamus received into commerce, will suffice. They are not so generally imported as the canines, with the exception of the two lower, lateral, and projecting incisors, commonly called tusks in the market, as distinguished from the canines, which are usually termed teeth. These projecting incisor teeth, as already described, are long, straight, and hollow for a portion of their length, like the canines; but differing vastly in quality from the latter, being considerably softer, and more easily affected by the fluids of the mouth, so that they are seldom used by dentists. Yet these long, straight teeth have their especial application, being employed in the manufacture of the long knitting needles, and netting meshes, used by ladies, as well as for other more general purposes. The enamel on these lateral teeth appears to be confined to the projecting point, and does not extend into the jaw.

The smaller and curved incisors of the upper jaw are comparatively valueless, except for common turnery work.

I may here mention, that unless the teeth of the hippopotamus are employed by the dentist, the enamel is always removed; and generally by means of an acid bath, as no ordinary tool produces any effect upon it.

As the Board of Trade returns furnish no separate account of the imports of hippopotamus teeth, I cannot give any statistical table of the extent of our trade in this article, but should roughly estimate the quantity imported, at from 7 to 10 tons annually; which, considering the limited source of supply, is far from being small. The importation of these teeth into Liverpool in the year 1850, was $2\frac{1}{2}$ tons; and as by far the larger quantity received enters the port of London, I think my estimate of the total is not overdrawn. The value of hippopotamus teeth depends both upon size and quality—those being the most esteemed, that are large, and free from flaws. In years that are past, as much as 30s. per lb. has been paid for fine tusks; but the price may now be said to range from 1s. per lb. to 17s. or 18s. per lb. At a recent sale, some very small teeth realised only $7\frac{1}{2}$d. per lb.; but the following table, compiled from a sale at the end of last year, will perhaps convey to the reader a better idea of the comparative value of these tusks.

Teeth	averaging each	6 lb.	realised	17s.	per lb.
"	"	$5\frac{1}{4}$	"	13s.	"
"	"	$5\frac{1}{5}$	"	8s. 9d.	"
"	"	5	"	11s.	"
"	"	$4\frac{1}{2}$	"	11s. 6d.	"
"	"	$4\frac{1}{5}$	"	14s. 3d.	"
"	"	4	"	10s.	"
"	"	$3\frac{3}{4}$	"	8s. 6d.	"
"	"	$3\frac{1}{4}$	"	6s. 6d.	"
"	"	3	"	3s. 7d.	"
"	"	$2\frac{3}{4}$	"	4s. 9d.	"
"	"	2	"	2s. 2d.	"
"	"	2	"	1s.	"
"	"	$1\frac{1}{2}$	"	1s. 1d.	"
"	"	$1\frac{1}{3}$	"	2s. 4d.	"

Allowing 20 lb. on an average, for every set of hippopotamus teeth imported, and presuming our total imports are 10 tons, no less a number than eleven hundred of these giant creatures must be slaughtered, every year, to supply our markets.

At the present time, the demand for hippopotamus teeth is small, and no scarcity is felt; but as civilisation advances in West and South Africa, and the animals become gradually exterminated, it is probable that the time may come when this comparatively insignificant, though useful and valuable article of commerce, will be sought after in vain.

ON POISONOUS FISHES AND FISH-POISONS.

BY RICHARD HILL.

Dr Burroughs has given a long list of the fishes of the West Indian seas, either known or reputed to be poisonous, with the scientific names by which he recognised themas given in the first column. It would be difficult to certify the fishes by the names he gives, unaided by the trivial or popular specification of them. I have run over the list, and set down the genera and species assigned to them by Cuvier, giving you such remarks by the way as seem necessary to be added to them.

Balistes monoceros	Old wife	*Balistes ringens*
Ostracion globellum	Smooth bottle-fish	
Tetraodon sceleratus	Tunny	
Tetraodon oculatus	Blower or blazer	

The fishes here intended cannot be specifically determined. All Ostracions, Diodons, and Tetraodons are deleterious fishes. We have several under these *three* denominations, and it is not necessary to do more than say that *all* are to be treated as objectionable, if not absolutely dangerous fishes.

Muræna major	Conger eel	*Gymnothorax rostratus*
Coryphæna splendens	Dolphin	*Coryphæna dorado*
Sparus chrysops	Porgee	*Pagellus calamus*
Coracinus fuscus major	Grey snapper	*Serranus arara*
Coracinus minor	Hyrie	*Serranus nigriculus*
Perca major	Barracouta	*Sphyræna barracuda*
Perca venenosa	Grouper	*Scorpæna grandicornis*
Perca venerata	Rock-fish	*Serranus catus*
Scomber thynnus	Bonito	*Thynnus Coretta*
Scomber maximus	King-fish	*Cybium Solandri*
Scomber cæruleo or *Genteus nudus*	Spanish mackerel	*Cybium regale*
Mormyrus	Blue parrot-fish	*Scarus cæruleus*
Clupea thryssa	Yellow-tailed sprat	*Alosa Bishopi*

Fortunately, however, of all the above, the *Clupea thryssa*, or yellow-tailed sprat, is the only one at all times dangerous. In the other species of fish, poison may be said to be only incidental or accidental; but in this it is inherent. The effects of this poison on the human frame are violent to a terrific degree—death occurring immediately in many cases, and in some instances on record so quickly that the sprats were not even swallowed.

Many have been the learned disquisitions, why fish should at one period prove nutritious, and at another detrimental. The old and popular notion that the fish becomes poisonous by having its feeding-grounds near copper banks, or in places where copper had been deposited, though long since deemed improbable by naturalists, still finds supporters, and every once in a while we find the theory advanced in public as completely accounting for the poisonous nature of our fishes.

We believe the present opinion is, that some morbid change takes place in the system of the fish, under peculiar circumstances which make it poisonous ; but in what that change consists, or what are the circumstances which induce this change, is not known.

It appears to us, however, that the opinion of Dr Ferguson, read before the Royal Society of Edinburgh, is as rational as any. His theory is, that the larger fishes of prey (among them he enumerates the barracouta) became affected with the poisonous qualities of the yellow-tailed sprat when it swallowed it, and thus the poison of the latter became incorporated or assimilated with the substance of the former.

With respect to the tests to be used to determine whether a fish is noxious or innoxious, not one appears to be determined, so as to be thoroughly relied on: all have proved fallacious. The only sure method is that of giving the offal of the fish to some inferior animal, such as a duck, fowl, &c., and observing its effects. The early and immediate cleansing of the fish after its capture, and sprinkling it with salt, is considered the best precaution.

For the remedies to be used in case of fish-poisoning, Dr Ferguson recommends "sugar," as the only antidote established as deserving of credit! A good practice, however, is at *once* to give an emetic: sulphate of zinc (or blue vitriol) is the best; but rather, however, than lose any time, the nearest emetic at hand should be given. Cathartics should also be administered freely. Should, however, the vomiting and purging be very violent from the effects of the poison, the treatment must not be pursued—but, on the contrary, anodynes must be administered.

The effects of fish-poison are, extreme sickness at the stomach, gripings, cold sweats, cutaneous eruptions, sometimes cholera morbus, leaving behind a degree of paralysis. When the poison does not prove fatal, the patient is, notwithstanding, long in recovering. The effects of fish-poison are frequently obviated by taking freely of brandy, or any other ardent spirit; but where symptoms of empoisonment have already come on after the contents of the stomach have been brought off by an emetic, recourse may be had to strong cordials,—ginger-tea, brandy, with laudanum, Cayenne pepper made into pills, &c.

The Scorpænas do not occur in Dr Burroughs' list among the fishes reputed poisonous,—unless we consider his "grouper," to which he gives the name of *Perca venenosa*, to be intended for the Scorpæna, which our fishermen call the "poison-grouper."

I doubt if any of the Scorpænas be really poisonous. They may be adventitiously injurious, from being out of condition; but when we inquire into the reason of their evil repute, we find that we are equally directed to the puncture of their spines as the quality of their flesh. The particular Scorpæna known as the "crapaud de mer" in Martinique, as "rascacio" in Havana, and as "rascasse vingt-quatre heures" in St Domingo, has an especially bad reputation. Valenciennes, in his associated labours with Cuvier, says of one species, in volume iv. of the History of Fishes, "on redoute beaucoup les pigures des ses aiguillons;" and of another, "les pigures de leurs épines les rendent redoutables;" the prick of their spines is much dreaded;—and then he adds, that a prejudice prevails against the flesh as poisonous, mentioning, that because death is supposed to ensue in the course of a day, one has received the name of "rascasse vingt-quatre heures." As the rascacio of the Spaniards means nothing more than prickly fish, it may only import that those who handle it may reckon on a prickling sensation from the fish for a whole day, and not that the flesh is a poison within twenty-four hours. The most distinct fact of the danger of wounds from its spines is related by Sir Robert Schomburgk, in his History of Barbados. "It lurks," he says, "amongst the stones in shallow water, and inflicts a wound with its spines which causes the most violent pain. A fisherman who had been struck by one, told Mr. Bishop that he was not able to reach his home without assistance."—(P. 667.)

The Scorpænas, of which we have three—the *bufo*, *Brasiliensis*, and *grandicornis*—are a part of that family of *Loricati*, or "Acanthopterygiens à joues cuirassées," distinguished by Cuvier as fishes by their general form, standing close to the "perches," but from their singular aspect, with the head armed and bristled, having a special classification. The Scorpæna is the Skophaina of the ancient Greeks. The barbillous and fleshy shreds *(lambeaux charnus)* about the head, and the strong and unequal spines of the fins, give the several species a dangerous look. Their Mediterranean name is from *raschia*, the itch. It is only the *Scorpæna grandicornis* that has a bad reputation in our seas. The *S. bufo*, Parra says, is a fish of very savoury flesh, excellent for soups ; and Plée expresses himself precisely in the same way with regard to the fish of Martinique. It attains a large size, individuals being got sometimes eighteen inches in length. (C. & V., Hist. Natur. des Poissons, liv. iv., ch. ix., vol. iv.)

The *Pagellus calamus* (pagel à plume) and the *Pagellus penna* (pagel à tuyau) are the fishes known among us by the name of Porgee, and have proved at times deleterious. They are readily distinguishable at table by the quill-like process by which the spine of the anal fin is inserted into the abdominal muscle. It is from this organisation they receive the names of calamus and penna. Porgee is a name they have in common with *Mesoprion pagrus*, and pargo of Porto Rico. In both instances the appellation is derived from the *Pagrus vulgaris* of the Mediterranean, to which the Pagellus is closely allied. Both Pagrus and Pagellus are *sparoid* fishes, of which the sparus of Artedi is the type. *Mesoprion pagrus*, however, ranks among the perches. The mesoprions are the fishes known in our market as snappers. (C. & V., Hist. Natur. des Poissons, liv. vi., ch. iii. & iv., vol. ii.)

Valenciennes, who wrote portions conjointly with Cuvier of the Natural History, and was the author of that portion in which is described the "*Serrans*," assigns to two of these fishes, under the names of *Serranus nigriculus* and *arara*, the injurious character of fishes producing the disease called by the Spaniards *siguatera*. The first intimation we have of this prejudical fact is conveyed in these words : "Ce poisson," speaking of *S. nigriculus*, "comme *beaucoup d'autres des Antilles*, est dangereux à manger dans certaines saisons" (liv. iii., ch. xi.) ; and referring to *S. arara* on Parra's authority, "ce poisson mange avec quelque danger, parcequ'il est *du nombre des ceux* qui donne cette indisposition appelée la siguatera." The serrans are perches, distinguished from the true perch by the continued serration of the preoperculum, from whence they have their name serranus.

This, with some trifling differences in the dentition, forms their class character. (C. & V., Hist. Natur. des Poissons, vol. ii.)

The *Lachnolaimus caninus*, the hog-fish, called the dog-toothed hog-fish, is set down among the number of those that are casually poisonous. Speaking of Parra's figure of this fish, Cuvier says, "L'auteur assure que sa chair est suspecte." It is more uniformly of a deep roseate red than the other species of Lachnolaimus, the *suillus*, *dux*, and *aigula*, being devoid of any blackened mark upon the flank, and without any brown upon the dorsal fin, or any purple on the nape. The hog-fish, properly so called, the *Lachnolaimus suillus*, is one of the most delicious of market fishes; but as, in common with all its alliances of the *Labroides*, it feeds on small shell-fish, on sea-eggs and crabs, for which sort of food it is well organised, by having the throat coated with a perfect nap of teeth like velvet, with elongated front prongs, for *prising off* the living prey from the rocks, a species may subsist on things deteriorating the flesh, while the genus may be not so characterised. (C. & V., vol. xiii., liv. xvi., ch. vi.)

I have no means of ascertaining why the Spaniards of Cuba give the name of siguatera to the disorder in the system which follows the eating of fishes reputed poisonous. Cuvier, however, in his description of the *Sphyræna barracuda*, has extracted from the MS. papers of M. Plée, who minutely examined into the history of the fishes of these seas, all that has been distinctly ascertained on the subject of this adventitious quality of that particular species of Sphyræna distinguished by naturalists as barracouta; a quality, however, common to the *S. becuna* of Lacépède, and the *S. pecuda* of Parra. We will quote M. Plée's statement:

"Many persons are afraid to eat the barracouta, because there are frequent proofs of its causing sickness and death. The *venenose* quality of it is most certainly the result of a particular condition of the fish, occurring at different seasons of the year.

"I have consulted many persons with regard to the poison of the becune; all have assured me that there is an unfailing means of being certain whether it is or is not venenose, when fishing for it. For the purpose of testing the one or other condition, it is only necessary to observe in cutting it up whether there flows from it a kind of white water, or rather a sort of *sanie* or matter, which in any case is a sure sign that the becune is in a state of disease. Don Arthur O'Neill, the Marquis del Norte, has told me that he had seen experiments with the flesh in this condition made upon dogs, and that they all confirmed the exactness of the means of being secure against injury.

"The signs of being poisoned by the flesh of the becune," (the becune, it must be remarked is our barracouta of the market; the smaller of the two species; that properly known as barracouta being from six to nine feet long, and slimmer in form,) are a general trembling, nausea, vomiting, acute pains, particularly in the joints of the arms, and the hands.

"Sometimes these symptoms succeed each other with such rapidity, that it is difficult to fix with anything like precision the periods of the morbid affection. When the sickness does not end in death—and, happily, this is not the most ordinary issue of it—one sees oftentimes the virus causing pathological phenomena altogether singular. The pains in the articulations of the limbs become very acute; the nails of the feet and the hands fall off without any feeling; the hair, whose constituent character we know is absolutely the same as that of the nails, finally falls also. These effects in many individual cases are to be seen continuing for a great many years, and an instance has been mentioned to me of a person suffering in this way for five-and-twenty years. I myself," M. Plée proceeds to say, "have not been a witness to any accident of poisoning by the becune, and I write only what I have heard others relate, who are well acquainted with such occurrences, and who are worthy of credit." (Vol. iii., liv. iii., ch. xxxi.)

The very young fish, six inches long, are without teeth in the lower jaw. M. Poey, who has published a highly-embellished work on the Natural History of Cuba, in which especial attention is devoted to the ichthyology of its seas, says that "the means of recognising barracoutas that are in a condition to produce mischief (état mal-faisant) is that the *root of their teeth will be found of a blackened colour;* and that wanting this mark, the fish may be eat without fear." (C. & V., Hist. Natur. des Poissons, vol. iii.)

I can say for this test, that seeing one day a fine-looking barracouta in a tray for sale, nearly if not quite three feet in length, and apparently well-conditioned, I examined the teeth, and finding them faintly purple at the root, I remarked that the fine look of the fish would induce purchasers without doubt, but we must be prepared to hear of injurious consequences to those who should eat of it; and it happened next morning that complaint was common in the town (Spanish Town) that many had suffered the well-known sickness from eating poisonous barracouta.

I should have added to the extract from the manuscripts of M. Plée, that "it is a remarkable fact that the barracouta being salted, causes no injury;" that "at Santa Cruz, it is the usage never to eat the fish till next day, and then not till after salting it;" and that "we may ask the question whether salt should not be esteemed an antidote for barracouta poison;" because not only is the salted just as poisonous as the unsalted fish, but our newspapers, at this very time, record an instance in which four persons are suffering from fish-poison—and that fish-poison, corned or salted barracouta.

All the fishes we have been considering and treating of as adventitiously poisonous, belong to the great division ACANTHOPTERYGIAN or hard-spined fishes:—we proceed to consider now some of the soft-spined or MALACOPTERYGIANS. One species is at all times to be found dangerous eating. It has certain specific marks. The sprat of the Caribbean Sea, the fish referred to, is not properly a *Clupea*, but one of the allied family *Alosa* or Shad. The opinion that this is the only fish to be considered permanently poisonous, and that the larger fishes become deleterious in flesh by feeding on these shoals, is altogether gratuitous as an explanation of the fatal and harmless influences among them at different seasons. It was

Father Labat who first started this notion; but, as Oliver Goldsmith well observes, "it only removes our wonder a little further back, for it may be asked with as just a cause for curiosity, how comes the permanently poisonous fish to procure its noxious qualities?" (Animated Nature, book iii., ch. ii., History of Fishes.)

There is a harmless as well as a hurtful sprat. The noxious is distinguished from the harmless by the presence of a spot at the operculum. The fish that may be safely eaten has the same spot, but golden yellow. Are they different species, or are they one and the same, only indicating different conditions? The question has never been answered. Sir Robert Schomburgk submitted some specimens of sprat from Barbados to the examination of the eminent naturalists Müller and Troschell, of Berlin, and all we learn is that the species seemed new. One was named *Alosa Bishopi.* "It agreed in some points with *Alosa apicalis*, known as the red-eared pilchard: it had, however, a black spot behind the operculum, not to be observed in the *Alosa apicalis.*" Its length was that of our market sprat, four and a half inches. He adds that the "sprats are much esteemed in the West Indian Islands, but that a species called the yellow-tailed sprat proves unfortunately poisonous at certain periods of the year among the Leeward and Virgin Islands." (Hist. of Barbados, ch. iv., p. 675-6.)

Goldsmith, speaking on Dr Grainger's authority,—the author of the poem the 'Sugar Cane'—"his poor worthy friend," as he calls him,—"mentioned that of the fish caught at one end of the island of St Christopher, some were the best and most wholesome in the world, while others taken at a different end were always dangerous and most uncommonly fatal." He was speaking of fish in general, and of sprats in particular. Our own experience of sprats is very similar. The sprats taken on the south side of Jamaica are only occasionally to be suspected, but those on the north side always. How far the distinctive black and yellow spot prevails at those times and in those places, I have not learnt; but in the Kingston market they consider the distinction not specific, but adventitious in one and in the same species,—so that our wonder at this quality goes even still further back than Goldsmith thought it did in his time, if the poison of the other fishes depended on their feeding on sprats.

Among the fishes enumerated as poisonous in the division Malacopterygii, are the *Balistes* and *Ostraciones*, both genera of the family *Sclerodermi.* We have some eight different Ostraciones, all known by the name of Trunk-fishes, and some four or five Balistes, receiving ordinarily the appellation of Old wives. Though differing much from each other in external appearance, there is much similarity in their internal organisation.

The Balistes, beside having an air-bladder near the back, are provided with a ventral cavity into which they can introduce, when they will, air to lighten themselves in swimming,—for they move through the water with toil and difficulty. They are not, like the Trunk-fishes, boxed in around and about the body; yet in the place of scales they are covered over with hard tubercles, set in groups, or dispersed in compartments more or less regular, and stoutly rooted in a thick skin. They receive the name of Balistes from the serrated spine on their back, which they can suddenly elevate for defence, just as the ancient Balista was forced up with a spring for the discharge of arrows. They have powerful teeth; in the anterior two, compared to incisors, which enable them to break crustaceous and testaceous animals readily; and their flesh is said to become dangerous during the season in which they feed on the coral polypi: nothing but sea-weed was found, however, in those that Cuvier examined. Though possibly deleterious from their description of food, it is probable their most hurtful quality is to be found in the spines, furnished them by nature for their defence. These spines are invested with a viscous fluid, producing inflammation in the wounds which they cause, and may have much to do with the poisonous reputation of the flesh.

The Ostraciones, or Trunk-fishes, in lieu of scales, have an envelope made up of regular compartments, set one into the other, and forming an inflexible coat of mail. It so invests the head and body, that they have nothing soft or moveable but the tail, the fins, the mouth, and the coriaceous edging of the gill-slits. All their swimming appendages are passed through holes in their cuirass. The greater number of their vertebræ are cemented together, and their ten or a dozen conical teeth can break shells and crustacea with ease. It will be seen that the Ostraciones have a close relation in external character with the 'Balistes. To what extent we are to place reliance on the assertion that the flexible portions of the fish are poisonous, especially the tail, I know not; but inasmuch as their flesh is but small in quantity, and their liver large, yielding oil considerably, and their stomach membranous and voluminous, they have not been suspected without reason of being poisonous. They are, with the Balistes, all tropical fishes.

The Diodons and Tetraodons are fishes of the family *Gymnodontidæ*. They both live on crustacea and fuci. Their flesh is mucous or slimy. They have a peculiar organisation,—a detached outer skin, a sort of crop, which they can inflate, swimming upside down. Their air-bladders are very large. The stomach of the Diodon is thin, furnished with many appendages, which, like so many small cæcal pouches, contribute to the necessary completion of digestion, by retarding the aliment till it be acted upon by an augmented quantity of gastric juice. Their liver, thick and trilobate, extends almost to the anus.

The flesh of both Diodon and Tetraodon is regarded as dangerous food. "Pison assures us that the gall is poisonous, and that if it be not removed, it causes death to those who are so imprudent as to eat of the animal thus prepared. Their sensibility becomes blunted, the tongue immoveable, the limbs grow stiff, and life is extinguished, while a cold and a colliquative sweat inundates the entire body. The wound inflicted by the prickles or spines is considered dangerous. Serious accidents are experienced, if care be not taken to withdraw from the viscera of these animals, when they are prepared for the table, the remains of the aliments which they may be found to contain." (Supplem. Cuvier's Animal Kingdom: Malacopterygii—Griffiths' edition.)

We have to consider the Conger eels among the Malacopterygians. The flesh of the conger eel is a common article of the market, both fresh and salted, in Mediterranean ports.

Cuvier has withdrawn the *Muræna Conger* from the genus *Anguilla*, and made it the foundation of a subgenus under the name of Conger. "It is found in the seas of Europe, of Northern Asia, and in those of America, as far as the Antilles. It is very abundant on the coasts of England and France, in the Mediterranean Sea (where it was much sought after by the ancients), and in the Propontis, where it was not long ago in considerable estimation. Those of Sicyon were more especially esteemed." "The flesh of this fish is white and well flavoured; but, as it is very fat, it does not agree with all stomachs." "In many places the conger eels are dried for exportation. For this purpose, they are cut open in their under part through their entire length; the intestines are removed; deep scarifications are made upon the back; the parts are kept separate by means of small sticks, and they are suspended by the tail to poles or the branches of trees. When they are perfectly dry, they are collected in packets, each weighing about two hundred pounds." "Redi has found, in several congers which he has dissected, some species of hydatids, nine or ten inches in length, situated on the coats of the stomach, the liver, the muscles, the ovaries, and other parts." "The Murænæ proper were carefully reared in vivaria by the Romans. As early as the time of Cæsar, the multiplication of these domestic Murænæ was so great, that on the occasion of one of his triumphs, that great general presented six thousand of them to his friends. Licinius Crassus reared them so as to be obedient to his voice, and to come and receive their food from his hands; while the celebrated orator Quintus Hortensius wept over the loss of those of which death had deprived him." In all cases the bite of these fishes is severe, and often dangerous.

Such is the testimony to the quality and estimation of the conger eel which Griffiths has collected in his Supplement to *Malacopterygii apodes*, in Cuvier's 'Animal Kingdom.' We see that its flesh does not agree with all stomachs; but what renders it so frequently deadly? The late Dr William Gordon, than whom there was not a more careful or more erudite investigator into physiological and pathological facts, assured me that in a case which had terminated in death, after long lingering, from eating the conger of our coasts, not the common *Muræna*, but the *Gymnothorax* in all probability, the injury suffered had resulted from eating the liver; the rest of the fish had no part in the deleterious consequences that ensued. The case he referred me to was that of a man poisoned at Unity Hall, from the fish he had taken at the mouth of Great River. We shall find, in the course of our ensuing remarks, that the liver in most cases has a great deal to do with danger attending fish-poisons.

(To be continued.)

ON LIGHTHOUSE ILLUMINATION—THE ELECTRIC LIGHT.

BY PROFESSOR FARADAY, D.C.L., F.R.S.

The use of light to guide the mariner as he approaches land, or passes through intricate channels, has, with the advance of society and its ever-increasing interests, caused such a necessity for means more and more perfect, as to tax to the utmost the powers both of the philosopher and the practical man, in the development of the principles concerned, and their efficient application. Formerly the means were simple enough; and if the light of a lanthorn or torch was not sufficient to point out a position, a fire had to be made in their place. As the system became developed, it soon appeared that power could be obtained, not merely by increasing the light, but by directing the issuing rays: and this was in many cases a more powerful and useful means than enlarging the combustion; leading to the diminution of the volume of the former with, at the same time, an increase in its intensity. Direction was obtained, either by the use of lenses dependent altogether upon refraction, or of refractors dependent upon metallic reflection; and some ancient specimens of both were shown. In modern times the principle of total reflection has also been employed, which involves the use of glass, and depends both upon refraction and reflection. In all these appliances much light is lost: if metal be used for reflection, a certain proportion is absorbed by the face of the metal; if glass be used for refraction, light is lost at all the surfaces where the ray passes between the air and the glass; and also in some degree by absorption in the body of the glass itself. There is, of course, no power of actually increasing the whole amount of light, by any optical arrangement associated with it.

The light which issues forth into space must have a certain amount of divergence. The divergence in the vertical direction must be enough to cover the sea from the horizon, to within a certain moderate distance from the shore, so that all ships within that distance may have a view of their luminous guide. If it have less, it may escape observation where it ought to be seen; if it have more, light is thrown away which ought to be directed within the useful degree of divergence: or if the horizontal divergence be considered, it may be necessary so to construct the optical apparatus, that the light within an angle of 60 or 45 deg. shall be compressed into a beam diverging only 15 deg., that it may give in the distance a bright flash having a certain duration instead of a continuous light,—or into one diverging only 5 or 6 deg., which, though of far shorter duration, has greatly increased intensity and penetrating power in hazy weather. The amount of divergence depends in a large degree upon the bulk of the source of light, and cannot be made less than a certain amount, with a flame of a given size. If the flame of an Argand lamp $\frac{7}{8}$th of an inch wide, and $1\frac{1}{2}$ inches high, be placed in the focus of an ordinary Trinity-house parabolic reflector, it will supply a beam having about 15 deg.

divergence. If we wish to increase the effect of brightness, we cannot properly do it by enlarging the lamp flame; for though lamps are made for the dioptric arrangement of Fresnel, which have as many as four wicks, flames $3\frac{1}{2}$ inches wide, and burn like intense furnaces, yet if one be put into the lamp place of the reflector referred to, its effect would chiefly be to give a beam of wider divergence; and if to correct this, the reflector were made with a greater focal distance, then it must be altogether of a much larger size. The same general result occurs with the dioptric apparatus; and here, where the four-wicked lamps are used, they are placed at times nearly 40 inches distant from the lens, occasioning the necessity of a very large, though very fine, glass apparatus.

On the other hand, if the light could be compressed, the necessity for such large apparatus would cease, and it might be reduced from the size of a room to the size of a hat: and here it is that we seek in the electric spark, and such-like concentrated sources of light, for aid in illumination. It is very true, that by adding lamp to lamp, each with its reflector, upon one face or direction, power can be gained; and in some of the revolving lights, ten lamps and reflectors unite to give the required flash. But then not more than three of these faces can be placed in the whole circle; and if a fixed light be required in all directions round the lighthouse, nothing better has been yet established than the four-wicked Fresnel lamp in the centre of its dioptric and catadioptric apparatus. Now the electric light can be raised up easily to an equality with the oil lamp, and if then substituted for it, will give all the effect of the latter; or by expenditure of money it can be raised to a five or tenfold power, or more, and will then give five or tenfold effect. This can be done, not merely without increase of the volume of the light, but whilst the light shall have a volume scarcely the 2000th part of that of the oil flame. Hence the extraordinary assistance we may expect to obtain of diminishing the size of the optical apparatus and perfecting that part of the apparatus.

Many compressed intense lights have been submitted to the Trinity-house; and that corporation has shown its great desire to advance all such objects and improve the lighting of the coast, by spending, upon various occasions, much money and much time for this end. It is manifest that the use of a lighthouse must be never-failing, its service ever sure; and that the latter cannot be interfered with by the introduction of any plan, or proposition, or apparatus, which has not been developed to the fullest possible extent, as to the amount of light produced,—the expense of such light,—the wear and tear of the apparatus employed,—the steadiness of the light for 16 hours,—its liability to extinction,—the amount of necessary night care,—the number of attendants,—the nature of probable accidents,—its fitness for secluded places, and other contingent circumstances, which can as well be ascertained out of a lighthouse as in it. The electric spark which has been placed in the South Foreland High Light, by Professor Holmes, to do duty for the six winter months, had to go through all this preparatory education before it could be allowed this practical trial. It is not obtained from frictional electricity, or from voltaic electricity, but from magnetic action. The first spark (and even magnetic electricity as a whole) was obtained 28 years ago. (Faraday, 'Philosophical Transactions,' 1832, p. 32.) If an iron core be surrounded by wire, and then moved in the right direction near the poles of a magnet, a current of electricity passes, or tends to pass, through it. Many powerful magnets are therefore arranged on a wheel, that they may be associated very near to another wheel, on which are fixed many helices with their cores, like that described. Again, a third wheel consists of magnets arranged like the first; next to this is another wheel of the helices, and next to this again a fifth wheel, carrying magnets. All the magnet-wheels are fixed to one axle, and all the helix-wheels are held immoveable in their place. The wires of the helices are conjoined and connected with a commutator, which, as the magnet-wheels are moved round, gathers the various electric currents produced in the helices, and sends them up through two insulated wires in one common stream of electricity into the lighthouse lanthorn. So it will be seen that nothing more is required to produce the electricity than to revolve the magnet-wheels. There are two magneto-electric machines at the South Foreland, each being put in motion by a two-horse-power steam-engine; and, excepting wear and tear, the whole consumption of material to produce the light is the coke and water required to raise steam for the engines, and carbon points for the lamp in the lanthorn.

The lamp is a delicate arrangement of machinery, holding the two carbons between which the electric light exists, and regulating their adjustment; so that whilst they gradually consume away, the place of the light shall not be altered. The electric wires end in the two bars of a small railway, and upon these the lamp stands. When the carbons of a lamp are nearly gone, that lamp is lifted off and another instantly pushed into its place. The machines and lamp have done their duty during the past six months in a real and practical manner. The light has never gone out, through any deficiency or cause in the engine and machine house: and when it has become extinguished in the lanthorn, a single touch of the keeper's hand has set it shining as bright as ever. The light shone up and down the Channel, and across into France, with a power far surpassing that of any other fixed light within sight, or anywhere existent. The experiment has been a good one. There is still the matter of expense and some other circumstance to be considered; but it is the hope and desire of the Trinity-house, and all interested in the subject, that it should ultimately justify its full adoption.

COMMERCIAL PRODUCTS OF THE ASPHODEL.

BY SIR W. J. HOOKER, K.H., F.R.S.

Every one is familiar with the pretty, lovely-looking white-flowered Asphodel of our gardens. In the South of Europe, and apparently on both sides of the basin of the Mediterranean, the plant (*Asphodelus ramosus*) is extremely abundant; though it has never, so far as I know, been turned to any account, except that in times of scarcity its acrid fasciculated roots, after much boiling, have been eaten by the poor. In the Paris Exhibition of 1855, there were shown bottles of alcohol extracted from the Asphodel; specimens of the residuum of the roots after being twice distilled; paper-stuff from the stalks and leaves of Asphodel—card-paper, cards, paper and writing-papers, of various qualities, manufactured from the same, and mixed in various proportions with rags and common paper-stuff. M. de la Bertoche, in a pamphlet, asserts that Asphodel roots contain upwards of 27 per cent. of alcoholic principle, or more than double the quantity which resides in the root of Beet. The stalks and leaves contain a remarkably tenacious fibre, fine, strong, and flexible. The distillation of Asphodel root has been already pursued, and with considerable success, in Algeria; but the immense abundance of the plant in Tuscany, where it has hitherto been considered only a pernicious and most ineradicable weed, points to the advantage of endeavouring to turn it to account. The fasciculated roots, after cleansing and crushing, are mixed with water, and the fluid is exposed to heat, so as to facilitate fermentation. The alcohol which it yields is pure and colourless, perfectly transparent, and has the colour of alcohol itself. It contains neither acid, salt, nor oily matter: it burns without leaving any residue, and the flame is remarkably bright. But at the present time, when material for paper seems likely to fail, a most important succedaneum is afforded by the remains of Asphodel. It is undeniable that the residuum of the roots after distillation, together with the other parts of the plant, are eminently adapted to this object.

The expense of adding the foliage and stalks is no more than that of mowing them. Three processes are necessary: the separation of the useful portions,—the bleaching,—and the reducing the substances into a homogeneous and tenacious pulp. The first is better effected by crushing than by grinding, as the latter mode is apt to destroy the fibre. The second operation involves most difficulty, as the root is covered with a skin which contains a tanning principle; and it is necessary, unless the expensive mode of hand-picking the root be adopted, to expose the substance to air and light, aided by immersion in diluted chlorine, which brings the substance to a very pale brown tint, which is not objectionable for many sorts of paper. For the third process, that of inducing the whole mass to a smooth and tenacious paste, the paper manufacturers must supply the details.

THE TECHNOLOGIST.

NOTES ON TANNING SUBSTANCES.

BY WALTER G. FRY.

In Statute 1st James I., cap. 22 (A. D. 1603), entitled "An Act concerning Tanners, Curriers, &c.," is the following:—"Section 11. And be it further enacted, by authority aforesaid, that after the Feast of St Bartholemew next coming, no person or persons whatsoever which shall after the said feast occupy or use, by him or themselves, or by any other person or persons, the craft or mystery of tanning leather, shall suffer any hide or skin to lie in the limes till the same be overlimed; nor shall put any hides or skins into any tan-fats before the lime be well and perfectly soakened and wrought out of them, and every of them; nor shall use, employ, occupy, or put, by themselves, or by any other person or persons, any thing or stuff in or about the workmanship or tanning of leather, but only ash bark, oak bark, tapwort, malt, meal, lime, culver dung, or hen dung." All the leather tanned in any way contrary to the Act (which is a very long and curious one) was to be forfeited.

By sections 18 and 19 of the same Act, it is enacted that no person shall buy "any oaken bark, before it be stripped or after, to the intent to sell the same again." This was to prevent speculation.

By Statute 12th George III., c. 50 (A. D. 1772), it is enacted "that at all times hereby when the price of oak bark shall be under ten pounds for the load of hatch bark containing forty-five hundredweight, delivered at the buyers' warehouses in the City of London, or within the weekly bills of mortality, no oak bark whatsoever shall be allowed to be imported into Great Britain." Another section of the same Act provides for the importation of oak bark when the price exceeds ten pounds as aforesaid. Such restrictions as these would not suit the requirements of the present day, the necessity for and the production of leather having so greatly increased since the year when the last-named Act was passed.

No two substances will produce the same description of leather. Whether this is owing to any difference in the variety of tannin, or owing to the presence of a greater or less degree of gallic acid, is not understood. "Proust has supposed, in his paper on Tannin, that there exist different species of tanning principle, possessed of different properties and different powers of acting upon reagents, but all precipitable by gelatine. This opinion is sufficiently conformable to the facts generally known concerning the nature of the substances which are produced in organised matter; but it cannot be considered as proved till the tannin in different vegetables has been examined in its pure or insulated state. In all the vegetable infusions which have been subjected to experiment, it exists in a state of union with other principles, and its properties must necessarily be modified by the peculiar circumstances of its combination."—(Davy on Tanning.)

An experienced judge can tell from the colour of his raw tanning material very nearly what the colour of the leather tanned with it will be. Thus, for instance, take a first-rate sample of carefully-dried English oak bark; observe the colour of the interior cortical layer, and compare it with a sample of the best pure English oak-bark tanned leather, and it will be seen that they are comparatively of the same colour: the leather will be the darkest, owing to the red colour of the epidermis. Also compare a piece of the best Sardinian cork-tree bark with the leather tanned with it: the leather will be of a reddish hue, very similar in colour to the bark itself. The same thing may be observed in hemlock, alder, and mimosa barks, and in almost every other kind of tanning material. Pure valonea-tanned leather is very similar in colour to the valonea itself. The way to find out what the colour of the "bloom" of any tanning material is, is to make a decoction and allow it to stand a few days, when the "bloom," if any, will deposit.

Some materials simply tan leather, but will not "fill up" the pores of the hide, and only make a porous and poor leather; while others "fill up" the hide, and make good and firm leather. The cause of this would form a very interesting and profitable subject for investigation.

"The CONIFERÆ are natives of various parts of the world, from the perpetual snows and inclement climate of Arctic America to the hottest regions of the Indian Archipelago. The principal part of the order is found in temperate countries, in Europe, Siberia, China, and the temperate parts of North America. The species are exceedingly abundant, and have an aspect very different from that of the Southern hemisphere. In the former we have various species of pines, the larch, the cedar, spruce and juniper, the place of which is supplied in the latter by araucarias, podocarps, dammars, and dacryds."—(Lindley.)

HEMLOCK SPRUCE *(Abies Canadensis)*.—"This tree is natural to the coldest regions of America, and constitutes three-fourths of the evergreen woods in Nova Scotia, New Brunswick, Maine, Vermont, and part of New Hampshire. It is also very common in Canada. It is less common further south, but is found in the Middle and Southern States. On the Alleghanies it grows to a height of 70 to 80 feet, with a uniform circumference for two-thirds of its length of 6 or 9 feet. The bark is of a grey colour when young, but grows lighter when old, and is generally covered with moss; the leaves are 6 or 8 lines long, flat, irregularly disposed in two ranks, and downy at their unfolding; its flowers, which appear in May, are preceded by cones of a dark ash colour. The bark is taken from the tree in June, and half of the epidermis is shaved off before it is ground. It imparts its red colour to leather made with it, which is said to be inferior to that tanned with oak bark."—(Morfit.)

The 'Montreal Commercial Advertiser' for April 1859 states "that a company is about to be formed in Upper Canada to work a patent granted to Mr Abraham Steers for extracting the tanning principle from hemlock bark, with a view to its exportation for the use of foreign tanneries. By this process, the astringent properties of a cord and a half are to be concentrated into a forty-gallon cask of extract." Hemlock bark is one of the staple tanning substances used in North America.

Larch Bark *(Larix Europæus)*.—The bark of the common larch is much used for tanning basils, hog and other skins, leather for bookbinding, &c., principally in Scotland, where the tree is abundant: it is also used in England, but only to a small extent, as the supply of bark is limited. The trees of this tribe are common in North America, where the bark is used for tanning.

Betulaceæ, or Birchworts, are "inhabitants of the woods of Europe, Northern Asia, the Himalayas and North America, and even making their appearance on the mountains of Peru and Columbia, and the Antarctic regions. They appear capable of existing up to the last limits between land and eternal snow."

Birch Bark *(Betula alba)*.—This bark is used in Scotland (and elsewhere) for tanning basils and other light skins, though not to any great extent. The empyreumatic oil extracted from this bark is employed in dressing Russia leather, and is said to give it its well-known smell. Birch bark is used by the Laplanders for tanning: they extract the tannin by boiling the bark, but usually allow the liquor to cool before immersing the hides.

Alder Bark *(Alnus glutinosa)*.—This tree grows in wet, marshy places, often by rivers. The bark is used for tanning sheep-skins for rugs, &c., but it cannot be considered as one of the staple tanning materials of this country: it is used for dyeing black by country people.

Corylaceæ, or Mastworts, are "inhabitants of the forests of all the temperate parts of the continents both of the Old and New World; extremely common in Europe, Asia, and North America; more rare in Barbary, Chile, and the southern parts of South America, and wanting at the Cape. The species which are found within the tropics of either hemisphere are chiefly oaks and chestnuts, which abound in the high lands, but are unknown in the valleys of equatorial regions. The most southern genus is the beech, of which many species occur in the lower parts of

South America, and in Van Diemen's Land and New Zealand. Of the former, *Fagus procera* is said to be a larger tree than the *Araucaria* itself, in whose country it grows wild."

English Oak Bark (*Quercus pedunculata* and *Q. sessiliflora*) is preferred before all other materials for tanning; the best and highest-priced leather being tanned with it. The quality of the oak bark grown in this country is considered superior to that of any other part of Europe, being supposed to contain a larger proportion of tannin.

The bark season in England is usually from the middle of April to the end of May; but much depends on the weather, a few warm sunshiny days being desirable before stripping, as it is essential the sap should run well, for the bark contains more tannin when the sap begins to circulate. The tree is generally thrown before stripping, but sometimes the bark is stripped from the standing tree: in both cases the method pursued is the same. The operation of barking is performed by cutting the bark round the tree, and then cutting it lengthwise, peeling it off with a tool similar in shape to a small oyster-shell fitted to a handle. The bark is then piled in stacks about two feet high and two feet wide, each stack consisting of the bark of one tree, or those felled near together. It is left thus until dry; but care should be taken to cover the tops of the stacks with large pieces of bark, to preserve them from the rain.

Besides our home supplies of oak bark, estimated at from 200,000 to 300,000 tons a year, 20,000 to 30,000 tons more of bark are imported from the Continent, &c.

Coppice Oak Bark.—This bark is very similar to the timber bark, but lighter and thinner, and contains more tannin in proportion to its weight, as it has less epidermis. It is preferred for tanning dressing leather.

Antwerp Oak Bark.—This bark is imported "hatched" (that is, chopped into pieces four or five inches long, with most of the epidermis scraped off), but does not sell for quite so high a price as the English, as it is supposed not to contain so much tannin.

American Oak Barks.—The following is from the 'Shoe and Leather Reporter' of the United States:—"There are four species of oak barks chiefly used in tanning. The first is the Spanish oak, which thrives in Maryland, Delaware, and Virginia, and in all the States south of 41 deg. N. In the Atlantic States this species is most abundant, and in Georgia and the Carolinas it is known by the name of red oak; its bark, which is thick, black, and deeply furrowed, is preferred for coarse leather, which it makes more pliable and of a better colour. Hemlock bark is often with advantage mixed with it. In the Southern States, the Spanish oak grows to the height of 80 feet, having a trunk 4 or 5 feet in diameter; while in some of the Northern States it does not exceed 30 feet in height, with a diameter of 5 or 6 inches. The common red oak grows abundantly in Canada and in the Northern States, especially in the southern half of New York, in New Jersey, in Northern Pennsylvania, and along the range of the Alleghanies. Its bark is very generally employed, though inferior in several respects to some other kinds. This tree grows to the height of 70 or 80 feet, and has a diameter of 3 or 4 feet. The rock chestnut oak is seldom found in the Southern States, but abounds in elevated districts having a broken rocky surface. On some of the Alleghany mountains it constitutes nine-tenths of the forest growth; hence the name rock oak by which it is known on the banks of the Hudson and the shores of Lake Champlin. It has received in Pennsylvania, Maryland, and Virginia, the name of chestnut oak. Its bark is thick, hard and deeply furrowed, and differs from other barks in that the epidermis or outer layer contains a large proportion of tannin, which is usually in other kinds confined chiefly to the under layers. In Pennsylvania and New York it abounds, but only the bark of the small branches and young trees is used in tanning.

"The Quercitron or black oak grows throughout the States below the latitude of 43 deg. N., and in the more elevated sections of Georgia and the Carolinas. Its bark is not very thick, but is bitter, deeply furrowed, and of a deep brown or black colour. It also imparts a yellow colour to the liquor, and leather tanned with it is apt to give a yellow tinge to the stockings: this inconvenience, however, may be obviated by an inexpensive chemical process. Quercitron bark is much used, as it is abundant and cheap, and rich in tannin. This tree often attains a height of 90 feet, and a diameter of 4 or 5 feet. (Quercitron bark is used in England for a dye, where it is much valued on account of the various shades of colour that can be produced with it; it is imported ground very fine.)

"Besides these four kinds are others less known. The white oak chiefly grows in Florida, and to the south of 46 deg. N. Its bark is preferred for leather, for saddles, and similar purposes. The scarlet oak is found as far north as latitude 43 deg. N.—its bark is very thick; the grey oak, in Maine, New Hampshire, and Vermont; and the live oak is never found more than 20 miles inland, its bark being black, hard, thick, and replete with tannin. Other kinds of oak bark are occasionally used, but not to any great extent, in the United States."

Cork Tree Bark (*Quercus Suber*).—The cork tree grows in the South of Italy, the Isle of Sardinia, Spain, and the more temperate parts of Europe and Africa.

The exterior bark of this tree is the substance usually known as *cork*, and the bark used by tanners is the inner bark, the cork containing no tannin. Cork bark is imported to this country from the Isle of Sardinia, Tuscany, and Barbary; the largest quantity is obtained from the Island of Sardinia.

The Sardinian cork-tree bark may easily be distinguished by its colour and weight, being of a pinkish hue throughout and weighing heavier than the other two varieties; it is considered the best imported to this country. The Tuscan is the next best; it is considerably lighter than the Sardinian, and of a whiter colour. The African is more like the Tuscan, though not quite so good.

But very little is imported from other places; though after a while it is possible we may get it from Algeria, the cork tree growing there very fine. The bark is usually dried in the sun; but if it should become wetted when drying, the operation is finished by means of artificial heat.

The kiln-dried may be distinguished by being of a somewhat browner hue than the reddish tint of the sun-dried: it also weighs less, and is not so valuable. Cork-tree bark contains a great deal of tannin, but deposits little or no "bloom:" it is therefore generally mixed with other materials, such as English bark or valonea. The tannin it contains is more quickly extracted than from English oak bark.

"Cork trees are very numerous in Algeria, which country is peculiarly favourable to the development of its precious bark; for Algeria unites a uniformly high temperature with profuse nightly dews, and the dry, warm, open hill-sides are covered with a sufficiency of light soil. Under these circumstances, cork becomes finer in substance, more elastic, less porous, and freer from earthy particles, than even in Spain, where the best European cork is found."

"Valonea is the commercial name for the acorn cups of the *Quercus Ægilops*, a valuable tree which grows in abundance in the Morea and adjacent countries. Several thousand tons of these acorn cups are annually imported into this country from Smyrna and the Morea, and sold almost wholly to tanners and dyers. As soon as the cups are gathered, they are partially dried, and then conveyed by mules to Smyrna, or some other port, from which they are to be shipped, where they are stored in warehouses for several months, being disposed in layers from 3 to 5 feet in thickness. During this time the cups undergo an incipient fermentation; and as they dry, the long spreading scales which at first completely confined the acorn become contracted, and allow the acorn to fall out of the cup. When dry, the whole is picked over, to separate the damaged black cups, and all the acorns which contain no tannin.

"The cups on the surface of the stratum always become damaged during desiccation. The average diameter of the cups of common valonea, including the scales, is a little less than two inches. The quality of valonea may be ascertained by an experienced eye from the appearance of the cup, which when good is thick, full-grown, and of a bright colour. After the cups are gathered, they are frequently exposed to heavy rain, whereby they become deprived of a great portion of their tannin and darkened in colour: they are also frequently injured in preparation for shipment."

Valonea contains a great quantity of tannin, and deposits a considerable amount of "bloom," which gives to the leather a fine buff colour.

Valonea is usually mixed with bark or other material for tanning sole leather, since if used by itself the leather would be too hard to suit most markets. It is used with gambir for tanning kips and dressing leather. Valonea is an excellent tanning material when used in proper proportions with bark of some sort. In 1856, 22,733 tons of valonea were imported. The average of the three years' imports 1858-60 was 22,000 tons.

Knoppern is the name given to a peculiar kind of gall which affects the acorn of the oak in Hungary, and forms large, crest-like, thick and spongy excrescences. This gall has been figured and fully described in the TECHNOLOGIST, page 183. They are stated to be largely purchased in Britain for tanning leather, but this is not the fact. The common globose galls formed by *Cynips Quercus* are of no value. It would be very desirable to determine the insect which causes the knoppern. It is generally attributed to the *Cynips quercus calycis.* Specimens of the oaks on which this acorn are produced show the trees to be the *Quercus pedunculata* and *Q. pubescens.*

ANACARDIACEÆ.—"Trees or shrubs with a resinous, gummy, caustic, or even milky juice. Leaves alternate, simple or ternate, or unequally pinnate, without pellucid dots. Chiefly natives of tropical America, Africa, and India; a few are found beyond the tropics, both to the north and south. Pistacias and some species of *Rhus* inhabit the South of Europe; many of the latter genus occupy stations in North America and Northern India, and also at the Cape of Good Hope; and *Schinus* inhabits exclusively Chile and the adjacent districts. The order is unknown in New Holland."

The SUMAC of commerce is the crushed or ground leaves and stems of *Rhus Coriaria,* and is imported from Sicily and Malaga, though most comes from Sicily. "It rises to the height of four to eight, and in some cases to twelve feet. Its stem is crooked, and covered with a reddish grey bark: the leaves present a green on the upper, and a whitish colour on the under, surface during spring and summer; but they assume a reddish hue in autumn."

"Spanish sumac is variable in quality, being less carefully prepared, and consequently more or less mixed with woody matter; the best sort comes from Priego, and is grown in the neighbourhood of Malaga. It is like the Sicilian, and affords a colour of equal or greater brightness. With water it gives a darker and more red solution than the former. The other sorts, the Molina and Valladolid sumac, are next in quality to the foregoing."

In making the ground sumac of commerce, the larger branches or sticks are taken out by hand; the smaller do not pulverise, and are taken out by sifting; the stems of the leaves are put under the mill a second time. In grinding, the calculation is that 333 lb. of leaves turn out 280 lb. of fine ground sumac. There is naturally, or at least unavoidably, from three to four per cent. of sand or dirt in the leaves that come from the country, even in the absence of any fraud. This can only be taken out before grinding; and as the operation makes the sumac cost, if done thoroughly, 1s. 6d. per cwt. extra, the trade will not pay the difference, except in some exceptional cases. Sumac is chiefly used for currying and tanning kips for upper leather, and it is also used for dyeing. The average imports of sumac are 13,000 to 14,000 tons.

Schinus Molle.—The leaves and bark of this shrub are used in South America for tanning.

Pistacia Terebinthus, Atlantica, and *Lentiscus; Rhus pentaphylla, &c.*—In 1859, Enos Welsford, of Bona, Algeria, took out a patent for tanning with the leaves of these shrubs and trees.

FABACEÆ.—"Leguminous plants are found more or less in every part of the known world, with perhaps the exception of the Islands of Tristan d'Acunha and St Helena, neither of which do they inhabit; but they are distributed in extremely unequal proportions. In general, they diminish sensibly in approaching the pole.

"The Leguminous order is not only among the most extensive that are known, but also one of the most important to man, whether we consider the beauty of the numerous species, which are among the gayest-coloured and most graceful plants of every region, or their applicability to a thousand useful purposes."

KINO is an astringent exudation, which hardens into a brilliant resin-like substance which is much esteemed for tanning, but, from the small supply, is usually too dear. The tree *(Pterocarpus Marsupium)* yielding the best kind of kino has been found on the eastern coast of the Bay of Bengal, and in some of the forests of Central India, though at one time thought to be confined to the Malabar coast. In India, kino is used for dyeing cotton a nankin colour, and is also employed in medicine. African kino is the product of *Pterocarpus erinaceus*, but is now unknown in commerce.

DIVI-DIVI, or Libi-dibi, the wrinkled seed-pods of *Cæsalpinia Coriaria*, is one of the most astringent of known substances. It is indigenous to South America, but is cultivated in India, where plantations are thriving in the Madras Presidency, having been introduced from South America. The three principal places whence Divi-divi is obtained are Maracaibo, Rio Hache, and Savanilla. Divi-divi is not used to any great extent in this country for tanning; the leather made with it absorbing moisture too freely, and the colour of the leather is not liked, being of a dark-brown hue. It should be purchased and stored away in the summer, as in wet weather it absorbs moisture and is liable to injure.

Divi-divi is also used as a dye-stuff.

TEREE.—The pods of another *Cæsalpinia* are used in India for tanning under this name. The tree grows in Chittagong.

BAUHINIA VARIEGATA.—The bark of this tree is also used by the natives in India for tanning, dyeing, and as a medicine.

TURWAR.—This bark (*Cassia auriculata*) is used for tanning at Vizagapatam, Mysore, and other places in the East Indies. Dr Cleghorn reports it to be the best of the native tanning astringents.

ACACIA BARKS.—The barks of the following acacias growing in the East Indies are either used or stated to be suitable for tanning:—*Acacia Arabica*, Babool bark of the natives, largely used; *Acacia Catechu;* and *Acacia Farnesiana.* The pods of *Acacia nilotica*, called neb-neb, are used in Nubia for tanning. *Acacia horrida* bark (Doornboom, or Thorn Tree) is used at the Cape of Good Hope for tanning.

Acacia dealbata (Silver Wattle) bark is used in Tasmania, where the tree abounds from the level of the sea to nearly 2,000 feet, growing vigorously in great extremes of temperature, even where the mercury indicates 21 deg. at sunrise. It is evergreen, and would probably succeed well in the South of England. It grows from 80 to 120 feet high, and measures from 5 to 9 feet in circumference at four feet from the ground.

Acacia melanoxylon (Blackwood).—The bark of this tree is used for tanning; it is an abundant timber tree in Tasmania, about 150 feet high.

The bark of *Acacia mollissima* (Black Wattle) is also used for tanning there. These trees were first called wattles from being used in the early days of the colony for forming a network or wattling of the supple twigs, for the reception of the plaster in the partitions of houses.

MIMOSA BARK.—A considerable quantity of acacia bark, known in the trade as mimosa bark, is imported for tanning. It is brought chiefly from Tasmania and Australia. It is very hard, and difficult to grind fine. The tannin is not so easily extracted as from other barks. It also deposits no "bloom," and, generally speaking, is not much liked by English tanners, it being chiefly used where a red leather is required.

GAMBIER.—The astringent substance known as gambier (or terra japonica—so called from being at one time supposed to be an earth) is produced by boiling and evaporating the bark and wood of *Uncaria Gambir*. When the evaporated juice has acquired a proper consistency, the liquor is strained, and soon coagulates into a mass. It is then dried in the sun, and packed in bales or cakes of different sizes. It is frequently mixed with sand or other impurities; has little smell, but a sweet astringent taste in the mouth, and is gritty. If it is perfectly pure, it will totally dissolve in water; otherwise the impurities will remain behind. It is sometimes met with of a pale reddish brown, of a dark blackish brown, or a black like bitumen.

There are different varieties, called catechu, cutch, and kassu, from India. Dr Hooker, in his Himalayan Journal, states—"This province (Soan Valley) is famous for the quantity of catechu its dry forests yield; the plant *(Acacia Catechu)* is a little thorny tree, erect, and bearing a rounded head of well-remembered prickly branches. Its wood is yellow, with a dark brick-red heart, most profitable in January and useless in June for yielding the extract."

Gambier is chiefly used in England, mixed with bark and valonea, for tanning kips for upper leather; but it is not a good material for tanning sole leather, merely tanning the hide, without filling up the pores or making a firm leather. Gambier is also used by dyers and curriers. The Indians chew catechu with the betel-nut. In 1856 the imports of gambier amounted to 6,847 tons. In the past three years the imports into the United Kingdom averaged 9,200 tons, and of catechu nearly 3,000 tons.

ALGAROBILLA.—The seed-pods of this tree *(Prosopis pallida)*, which grows in South America, contain a very large percentage of tannin, and are used in Valparaiso and other places for tanning. A few years ago, about

300 tons were imported into this country; but since then nothing more has been heard of them in England.

Algaroba bark is used for tanning in South America. There is a tannery in Cordova where it is said to be used.

COMBRETACEÆ *(Myrobolans)*.—"All natives of the tropics of Asia, Africa, and America; no species is extra-tropical; mostly astringents."

MYROBOLANS, the dead fruit of *Terminalia Chebula* and *Bellerica*, contain a large percentage of tannin, and are used to a considerable extent for tanning, particularly in India (whence they are imported). They deposit a large quantity of "bloom" of a yellowish hue, and make a firm leather. Myrobolans should be gathered when green, and whilst the sap is in the tree (for then they contain most tannin), and dried; those that drop off when over-ripe are not so good in quality, and are of a darker hue.

RHIZOPHORACEÆ, or Mangroves, are "natives of the shores of the tropics, where they root in the mud, and form a close thicket down to the verge of the ocean. Such thickets are so dense, that they entirely intercept the rays of the sun, and, preventing the exhalation of putrid miasmata, become the most unhealthy places in a tropical climate."

MANGROVE BARK AND LEAVES are used for tanning in the Brazils, where the tree grows very abundant. It has never been used in this country, but would form a very valuable addition to the list of English tanning substances. Almost every part of the mangrove—the bark, root, and fruit more particularly—abounds in an astringent principle which is successfully applied to the purposes of tanning.

For external application in arresting hæmorrhage and disposing malignant ulcers to assume a healthy action, a decoction of the bark has been found most effectual by Dr Barham, who informs us, in his work, that he had a son "extraordinarily full of the confluent small-pox, the soles of whose feet separated and came off like the sole of a shoe, and left his feet raw, and so tender that he could not set them upon the ground; upon which he sent for some of the tan-fat or liquor of the bark, such as they tan the leather with, and added a little alum and boiled it up very strong, with which he bathed his feet every day, and in about a week's time his feet were as hard and as firm as ever, and he was able to walk about without shoes on." For tanning, the mangrove is said to be infinitely superior to oak bark, completing in six weeks an operation which with the latter occupies at least six months, and the sole leather so tanned is said to be more durable than any other.

In addition to the foregoing classified list of tanning substances, there are many which are either used or stated to be suitable for tanning purposes, amongst which may be enumerated the following, some of which were exhibited in the Exhibition at Paris in 1855.

EAST INDIAN PRODUCTS.—Palachy extract (*Butea superba*), from Cochin. Asacum extract (*Terminalia tomentosa*). Mochrus (*Bombax Malabarica*). Subanjuna (*Moringa pterygosperma*), N. W. India. Saul-tree bark (*Shorea robusta*). Pomegranate rind (*Punica granatum*). *Calotropis gigantea*.

Diospyros glutinosa: the fruit is used for tanning, under the name of gaub. The ashes of *Musa sapientum*, *Justicia Adhatoda*, *Chenopodium*, and *Arum* are all employed in tanning, on account of the carbonate of soda they contain. Sogah bark is used for tanning in Singapore ; Samak bark is also used in the same place. The bark of *Careya arborea* is used for tanning in Ceylon.

British Guiana.—Mora bark (*Mora excelsa*) is suitable for tanning. The barks of the mangrove, hog plum (*Spondias lutea*), karakalli (*Lecythis ollaria*), and siruaballi (*Nectandra* sp.) are all recommended for tanning. Also the following barks, of which the scientific names are not known ; consequently the trees which produce them are undefined :—Baramalli, or pump-wood bark ; marsiballi, hurahee, arumata, konaballi, cuyama, kulaballi, haiawaballi.

Bucida Buceras of French Guiana, the French oak of the Antilles, is used for tanning. Holm-tree bark is used in Tuscany for tanning. The barks used for tanning in Spain are those of the alder ; of the Aleppo, Spanish, Corsican, Bordeaux, and stone pines ; of the ilex, cork, and four other oaks, and three kinds of willow. Rhatany root (*Krameria triandra*) is said to be used in South America for tanning ; Cascara and Timbo colorado barks, in the city of Parana ; Curupay bark, in Corrientes ; Algaroba and Cevil barks, in Cordova (South America) ; Courida bark (*Avicennia nitida*), on the east coast of Demerara.

There can be little doubt that some of the Indian and Colonial barks mentioned in these notes might advantageously be imported into this country. The introduction of a really good tanning substance would be of great service, as it would cause a reduction in the price of oak bark and valonea, which are at present the staple tanning materials used in England.

Bristol.

ON POISONOUS FISHES AND FISH-POISONS.

BY THE HON. RICHARD HILL.

(Concluded from page 284.)

Mr Samuel Barton, pilot of Port Royal, supplies me with a remark that carries us over a great deal of ground in accounting for the fishes of our coast so frequently manifesting poisonous qualities. Midway between Cuba, Haïti, and Jamaica, lie the extensive reefs and shoals of the Formigas. They are several miles in extent, and have barely more depth of water on them than for a moderate-sized vessel to pass in a smooth sea. This shoal presents a concentration of all the incidents to be found in our fringing shore reefs. Arborescent corals and spreading millepores stretch on walls and ledges, interspersed with huge meandrinas and brain stones, among which lodge a profusion of holothurias, echinuses, star-fishes, and a variety of sponges. This great mass of reefs, called from their clustering swarm, the Ant's Nest, or the Formigas, is a great warren or *vivarium* for all sorts of fishes. As you approach the great submarine plateau, the odour of the slime, and of the spermatic substances that find a nestling-place in the crevices and shallow pools spread through it, is very remarkable. You approach it from the east, and find the cheering blandness of the sea-breeze suddenly changing to the nauseating smell of a fish-market. Those who have waded on to our shore-reefs, know not only the strong scent given out by the polyps that build there, but feel how sensibly the hands are affected, and the skin of the thighs are susceptible of a stinging influence from the slightest contact with the slime of corals. (*Vide* Gosse's 'Naturalist's Sojourn in Jamaica,' page 54.) It has been found by invariable experience that all the fishes taken on the Formigas are pernicious; that the barracoutas especially are always poisonous, at least in those months when the Formigas may be sailed over in unbroken water. Similar stretches of shoals among the Bahamas produce fishes similarly deleterious as food. The low-spreading ledges and banks of the Virgin Islands, called the *Anegadas*, or the Drowned Islands, afford a similar unfavourable ground for fishing. In this way we may account for the remark of Dr Grainger, that fishes are poisonous at one end of St Christopher's, while they are harmless at another. The deep water shoals are not the resort of the star-fish, nor of any of the Echinodermata. They are, therefore, exempt from their evil influences. I do not know whether it be a fact consistent with experience, but fishes of the deep water fish-pot ought always to be safe eating.

We get over, by these several incidents of our fishing-grounds, the adventitious occurrence of poisonous among wholesome fishes. Some have a natural pernicious character, but others become deleterious from the food on which they subsist at certain seasons on certain banks and coasts. Our ensuing observations will be directed to the *sanies* indicating disorder in the living tissues of some fishes, and to the poisonous putrefaction or chemical process known to take place in others after they have been a few hours out of water.

There may be such a change effected by mere condition of the living tissues in animals, at certain times, as that indicated by the conversion of flesh into *adipocere.* After lying in water, meat begins to undergo the adipocerous putrefaction, or the conversion of flesh into a substance resembling the waxen fat of spermaceti. In the course of these changes a poisonous principle develops itself.* If over-driven cattle, killed before they are allowed to recover from fatigue, will produce malignant dysentery, what difficulty can there be in accounting for conditions of life which may become poisonous to those who eat of what is not ordinarily deleterious? No chemical analysis can disclose a state in which there is nothing new or extraneous superadded—only a peculiar condition, and relation of the ordinary constituents, superinduced. *Kreatine,* which is found in the flesh of fishes, is a crystalline substance. It never occurs in organised bodies, but as the result of some abnormal process. The minutest particles of matter

* Christison on Poisons, in the London Medical Repository, ed. 1835.

in organisation, whether saline or earthy, animal or vegetable, are combinations always so arranged by the powers of life as to be diffused. They are never so concentrated as to assume the crystalline form, except when in a state of excretion. As a general principle, crystallisation determines the incompatibility of the matter with the life of the structure in which it occurs.*

The liver of fishes, in performing its function of separating impurities from the blood, and of secreting fluids necessary to digestion, must do all the increased depuratory work attendant on the absence of lungs. Exhalations from animals living in aëriform fluids are properly excretions. From animals living in aqueous fluids, excretory action must be much modified, and in fishes it exists only by that energy of "reduction" in which the albuminous matters of the chyle evolve gases by the "processes of completion."† (Prout's Bridgwater Treatise.) In reptiles the liver is large, in consequence of the low degree of respiration of that class of vertebrate animals; for the same reason it is large in fishes, and very large among the invertebrata. In fishes the gall-bladder is observed for the first time in the animal series, as we ascend from the invertebrate to the vertebrate classes, but it is not constant in its existence among them. It is absent in many genera, and it is then substituted by a peculiar economy of efferent tubes. The compensatory energy of the liver in this class of organic beings must render it vastly congestive. We know that fish-liver contains an enormous quantity of oil, that fish-oil is an important article of commerce, and fish-liver oil is a valuable medicine; but we know, beside, that these oils in a corrupt state are active poisons. Hence we may infer that the liver is a great operator in the injury done by deleterious fishes; and if we but knew all the genera in which the gall-bladder is wanting, we might arrive at some rule for estimating the possible development of those prejudicial fluids that mingle from the liver with fish-flesh in cooking.

Before adverting to the circumstances under which tunny fish, when becoming unwholesome, is condemned by the police in the market of Venice, it is necessary to remark some peculiarities in the organisation of the

* I have no experience of the manifestation of kreatine or flesh-crystals in fishes either occasionally or permanently poisonous; but the ordinary chemical property of living structures as laid down by Dr Prout, in the Bridgwater Treatise, book iii., ch. i. on the "Chemistry of Organisation," is, that "the essential elements *are hindered* from assuming a regular crystallised form. The incidental matters entering into the composition of a living body apparently furnish to the organic agent new powers—which powers the organic agent has been endowed with the ability to control and direct, in any manner that, from the exigencies of the living organised being, may become requisite." Raspail, in his 'Chimie Organique,' section 1578, says, "Jamais je n'ai aperçu de crystaux dans le sein d'une *cellule vivante*, et *d'accroissement*."

† Il y a des poissons," says M. Ehrmann, illustrating excretory modification in nutrition, "qui avalent l'air atmosphérique et en convertissent l'oxigène en acide carbonique, en la faisant passer au travers de leur intestins. Tel est le COBITIS,—il se fait à la peau et sous les écailles une transmutation semblable." (Cuvier, Hist. Natur. des Poissons, vol. i., liv. ii., ch. vii.)

mackerel tribe, the family of fishes to which the tunny belongs. We have enumerated some of the instances of scomberoid fishes that are pernicious. We have mentioned the bonito, and naming some of the caranxes and jacks, we have included the Coryphæna dolphin, the king-fish, and the Spanish mackerel among them.

Every one has remarked the lateral line that extends along the scaling of fishes from the gills to the tail, either interrupting or dividing the dormal imbrication. This line has a relation with the mucus that lubricates the skin,—" quelque appareil secrétoire qui en suit la longueur." This lateral line is especially distinct in the tunny fish. Along it there occurs a peculiar reddening of the flesh, deeper than in any other part of the body. A number of little tubes forming pores start off from it ; each of these little tubes has a bundle of nerves. There is something very similar to this in the carp.

In addition to this peculiarity of red flesh in the lateral line of the tunny, one of the most distinguished of the mackerels, we have to consider the non-existence of that reservoir for air known as the swimming-bladder, placed beneath the spine. The gas in this bladder, whether it be nitrogen or oxygen, is a product of secretion. "The air-sac is most developed in species which frequent or feed at the surface of the water, and is least developed or wanting in those which lie at the bottom, or burrow in mud ; its secretion contains a larger proportion of oxygen in the powerful predaceous fishes of deep seas, and nitrogen predominates in the feebler species which frequent shores and shallow waters. Being developed, like the lungs of higher animals, from the alimentary canal, the air-sac of fishes generally communicates with the œsophagus or stomach, by means of a short trachea or *ductus pneumaticus:* in some, however, this tracheal communication becomes completely obliterated, and the sac remains an isolated, closed cavity, filled with its gaseous secretion." (Outlines of Comparative Anatomy, by Robert E. Grant, M.D., chap. iv., 5th sec.)

Cuvier very justly observes that whatever opinion may be entertained relative to the use of the air-bladder, it is difficult to explain how so considerable an organ has been denied to so many fishes as occur in our researches ; not only to those which ordinarily remain quiet at the bottom of the water, as rays and flat-fishes, but to many others that apparently yield to none in the rapidity or facility of their movements. The presence or the absence of the swimming-bladder has, however, no accordance with conformation, or no relationship with it. A species nearly approaching the common mackerel, the *Scomber pneumatophorus,* is provided with this organ, and bears a name from having it, as a distinction: the *Thynnus vulgaris* is without it, while the *Thynnus brachiopterus* has it, though small. It is wanting in the *Pelamys sarda,* one of the bonitos, and in the *Auxis vulgaris,* another, and occurs in the remoter scomberoid, the *Trichiurus lepturus,* the cutlass-fish. It does not exist in the Coryphæna dolphin, but is largely found in the caranxes or jacks. It is difficult to trace the effects of these differences in fishes of the mackerel family. Though the air-bladder may be no auxiliary in respiration, it must yet influence the circulation in some respect, for "it has been ascertained that when a fish that has it, has been deprived of it, the evolution of carbonic acid gas by the gills is nearly reduced to nothing." * (C. & V., Hist. Nat. des Pois., vol. i., liv. ii.)

We now turn to Cuvier's account of the wholesomeness or unwholesomeness of the flesh of the tunny fish, to which our king-fish is nearly allied, while the bonito *is* of the genus Thynnus or Tunny.

"It is befitting that we remark," Cuvier says, "how the tunny is as wholesome and agreeable when it is used fresh or salted, as it becomes hurtful when it at all approaches putridity. If the bones and the edges of the fish are *reddened*, the flesh immediately near this redness takes on a sharp and acrid taste, as if it had been peppered ; and it causes inflammation in the throat, pains in the stomach, diarrhœa, and even death, if one has eaten much of it. The police of Venice examine carefully the boats that bring in the fish, especially when the sirocco has delayed their arrival—and if ever so little touched they throw it in the sea. The freshest tunny ought to be sold within twenty-four hours." (C. & V., Hist. Nat. des Poissons, vol. viii., liv. ix., ch. ii.)

What occurs with the tunny when decomposition commences on the dead fish, is in reality the representation of the state of the living tissues when the cognate fishes assume the poisonous character. We say nothing of the oily fishes, such as the salmon, herring, &c., which are known when kept too long to give rise to symptoms of irritant poison.

I think that the facts and inferences set out in this paper are a much nearer solution of the mystery of fish-poison than the crude guesses we see published as explanations. I do not know how far the following vital economy in respect of the keeping quality of fishes may be applied to the subject we have been endeavouring to illustrate, but I give it as making some weight in the tendency of fish-flesh to become prejudicial as food. "Physiologists have shown that the quantity of respiration is inversely as the degree of muscular irritability. It may be considered as a law, that those fish which swim near the surface of the water have a high standard of respiration, a low degree of muscular irritability, great necessity for oxygen, die soon—almost immediately when taken out of the water, and have flesh prone to rapid decomposition. Mackerel, salmon, trout, and herrings are examples. On the contrary, those fish that live near the bottom of the water ('or feed on the ground') have a low standard of respiration, a high degree of muscular irritability, and less necessity for oxygen,—they sustain life long after they are taken out of water, and their flesh remains good for several days. Carp, tench, eels, the different

* Cuvier cites the experiments of Humboldt and Provençal for this fact : he says, "On a pensé que la vessie natatoire pouvait être aussi un auxiliare des organes de la respiration, et il *est certain que lorsqu'on en prive un poisson, la production de l'acide carbonique par ses branchies est presque réduite à rien.*" (V. pp. 522, 526, 528—Nutrition.)

sorts of skate, and all the flat-fish, may be quoted as instances of this character." (Yarrell's 'Introduction to History of British Fishes.') All our surface-swimmers die and decompose soon, while our ground-fish have the power of endurance more manifested as a quality of their organisation.

It should be remarked that the mullets being vegetable feeders, or fishes taking animal food in a state of maceration or solution in the unctuous ooze of river-beds, are at all times wholesome fishes. Their sensitive lips, with ciliary fringes, hardly fit them for taking aliment of any substance harder than pulp ; hence it is that in England they bait for them with the pith of cabbage boiled in fat, and we entice them with avocada pear and the soft portions of wild fig.

The mud-fishes, whether described under the name of Gobius, Eliotris, or Philyprius, are all fishes of the most esteemed character for the table. "Ce sont, en général," says Mons. Valenciennes, in describing the Eliotris, "un groupe des Gobioides à ventrales séparées," the true gobies, as in our sand-fishes, having the ventral fins united like a cup,—" ce sont, en général, des poissons paresseux, qui se tiennent tranquillement dans la vase ou dans des trous de rochers. La plupart fournissent un *aliment agréable et de facile digestion.*" Speaking of the *gyrinus* and *guarina* specially, two of the gobies, he says of the first, "l'espèce est très-estimée à St Domingue, *sourtout pour les malades* ;" and of the second, "répandue dans toutes les rivières de l'île de Cube, elle atteint dix-huit à vingt deux pouces de longueur, et on *l'estime beaucoup comme aliment.*" (C. & V., Hist. des Poissons, vol. xii., liv. xiv., ch. xiv.) The flesh of all is truly savoury, and nourishing, and very digestible.

If your readers from time to time would give notices of any peculiarity in the qualities of fish generally brought into the markets, they would contribute much important information to the public and naturalist.

I must not omit to remark, it has sometimes happened that fishes have contracted a prejudicial quality, by being covered over in the baskets, in which they are carried for sale, with the leaves of poisonous shrubs. Instances of many such occurrences could be readily quoted. On these occasions, fishes get qualities assigned them which do not belong to them.

Jamaica.

PINE-WOOL.

BY M. C. COOKE, F.S.S.

A new manufacture has recently sprung into existence on the continent of Europe which promises to become one of importance. It consists of the utilisation of the acicular leaves or "needles" of coniferous trees, hitherto a waste substance. It was long ago known that pine-leaves consisted of a bundle of tough fibrous material, agglutinated together, and bound into long rigid leaves by means of a resinous integument; but the practical development of this knowledge is but of recent date. Near Breslau, in Silesia, there are two establishments, both of which are worthy of notice. One of these is a factory where pine-leaves are converted into a kind of cotton or wool; and the other, an establishment for invalids, in which the waters used in the manufacture of the pine-wool are employed as curative agents. These establishments have both been erected, as we are informed, by M. Pannewitz, the discoverer of the process employed for obtaining the fibrous material from pine-leaves. This material he calls "woody wool." It can be curled, felted, or woven. We are not acquainted with the precise method employed by M. Pannewitz, but we have succeeded in obtaining a coarse brownish-yellow fibre by boiling pine-leaves in a solution of caustic alkali for a few hours; and after rinsing and boiling them again in alkaline liquor, and saturating them in a solution of chloride of lime, a whiter and finer substance, much resembling the pine-wool wadding now being imported from the Thuringerwald. It is stated that by the mode of preparation employed by M. Pannewitz, the woolly substance acquires a quality more or less fine, or remains in its coarse state. In the former case it is employed as wadding, and in the latter as a stuffing for mattresses. The leaves may be stripped from the trees when quite young without injury, and a man may gather 200 lb. per day.

The first application of this fibrous material consisted in its substitution for cotton with wool in the manufacture of blankets. Five hundred of these were sold to a hospital at Vienna, and after a trial of several years they are now exclusively used. Amongst the enumerated advantages, it has been stated that no kind of insect will lodge in the beds, and that the odour has been found agreeable and beneficial. Since this period, the same kind of blankets have been adopted at the Penitentiary and some other institutions in Vienna, as well as in the barracks at Breslau. Its application for stuffing purposes has been no less successful; the cost being one-third that of horsehair, and its resemblance so great, that it has been affirmed that when employed in furniture, the most experienced upholsterer could not tell the difference. When spun and woven, the thread resembles that of hemp, is very strong, and may be advantageously employed for many of the purposes for which hemp is used. From this "Forest-wool yarn" are now manufactured jackets, spencers, drawers, and stockings of every description; flannel and twill for shirts, coverlids, body and chest warmers, and knitting yarn. These manufactures are recommended for keeping the body warm without heating, and are very durable.

In the preparation of the wool, an ethereal oil is produced, which is at first green, but on exposure to sunlight becomes of an orange yellow tint, and when distilled colourless. It has been successfully employed as a curative agent. It burns in lamps like olive oil, and completely dissolves caoutchouc. The perfumers of Paris are stated to be employing it in considerable quantities. The liquid left by the decoction of pine-leaves is employed in the medicinal bath. The membranous substance and refuse are compressed into blocks and used as fuel: from the resinous matter they contain, they produce sufficient gas for the lighting of the factory in which the production of these useful articles is carried on. The result of one hundred quintals of wool in combustible material is equal in value to six cubic metres of pine-wood.

The Forest-wool ware manufactory at Remda in the Thuringer-wald advertises Forest-wool, oil, spirits, wadding, and the other articles already enumerated. Whether these deserve or not all the high encomiums that have been passed upon them, it is nevertheless an important fact that a material before considered useless is now converted into articles of domestic utility and commercial importance.

THE COPAL OF EASTERN AFRICA.

BY CAPT. RICHARD F. BURTON.

The copal tree is called by the Arabs Shajar el sandarús, from the Hindostani chhandarus; by the Wasawahili, msandaruse; and by the Wazaramo, and other maritime races, mnángú. The tree still lingers on the island and the mainland of Zanzibar. It was observed at Morubasah, Saadani, Muhonyera, and Mzegera of Uzaramo; and was heard of at Bagamoyo, Mbuamaji, and Kilwa. It is by no means, as some have supposed, a shrubby thorn; its towering bole has formed canoes sixty feet long, and a single tree has sufficed for the kelson of a brig. The average size, however, is about half that height, with from five to six feet girth near the ground; the bark is smooth; the lower branches are often within reach of a man's hand, and the tree frequently emerges from a natural ring-fence of dense vegetation. The trunk is of a yellow-whitish tinge, rendering the tree conspicuous amid the dark African jungle-growths: it is dotted with exudations of raw gum, which is found scattered in bits about the base; and it is infested by ants, especially by a long ginger-coloured and semi-transparent variety, called by the people maj-m'oto, or "boiling waters," from its fiery bite. The copal wood is yellow-tinted, and the saw collects from it large flakes; when dried and polished, it darkens to a honey-brown, and being well veined, it is used for the panels of doors. The small and pliable branches, freshly cut, form favourite "bakur," the kurbaj or bastinadoing instrument of these regions; after long keeping they become brittle. The modern habitat of the tree is the alluvial sea-plain and the anciently-raised beach. Though extending over the crest of the latter formation, it ceases to be found at any distance beyond the landward country slopes, and it is unknown in the interior.

The resin or gum copal is called by the Arabs and Hindus sandarus, by the

Wasawahili sandarusi, and by the Wanyamwezi—who employ it, like the people of Mexico and Yucatan, as incense, in incantations and medicinings—sirokko and mámnángu. This semi-fossil is not "washed out by streams and torrents," but "crowed" or dug up by the coast clans and the barbarians of the maritime regions. In places it is found when sinking piles for huts, and at times it is picked up in spots overflowed by the high tides. The East African seaboard from Ras Gomani, in S. lat. 3 deg., to Ras Delgado, in 10 deg. 41 min., with a medium depth of thirty miles, may be called the Copal coast; every part supplies more or less the resin of commerce. Even a section of this line, from the mouth of the Pangani River to Ngao (Monghou), would, if properly exploited, suffice to supply all our present wants.

The Arabs and Africans divide the resin into two different kinds. The raw copal (copal vert of the French market) is called sandarusi za miti, "tree copal," or chakázi, corrupted by the Zanzibar merchant to "jackass," copal. This chakazi is either picked from the tree, or is found, as in the island of Zanzibar, shallowly embedded in the loose soil, where it has not remained long enough to attain the phase of bitumenisation. To the eye it is smoky or cloudy inside; it feels soft, becomes like putty when exposed to the action of alcohol, and viscidises in the solution used for washing the true copal. Little valued in European technology, it is exported to Bombay, where it is converted into an inferior varnish for carriages and palanquins, and to China, where the people have discovered, it is said, a process for utilising it, which, like the manufacture of rice-paper and of Indian ink, they keep secret. The price of chakazi varies from four to nine dollars per frasilah (of 35 lb.) The true or ripe copal, properly called sandarusi, is the produce of vast extinct forests, overthrown in former ages, either by some violent action of the elements, or exuded from the roots of the tree by an abnormal action which exhausted and destroyed it.

The gum, buried at depths beyond atmospheric influence, has, like amber and similar gum-resins, been bitumenised in all its purity, the volatile principles being fixed by moisture and by the exclusion of external air. That it is the produce of a tree, is proved by the discovery of pieces of resin embedded in a touchwood which crumbles under the fingers; the "goose-skin," which is the impress of sand or gravel, shows that it was buried in a soft state; and the bees, flies, gnats, and other insects, which are sometimes found in it delicately preserved, seem to disprove a remote geologic antiquity. At the end of the rains, it is usually carried ungarbled to Zanzibar. When garbled upon the coast, it acquires an additional value of one dollar per frasilah. The Banyan embarks it on board his own boat, or pays a freight varying from two to four annas (3d. to 6d.); and the ushur or government tax is six annas per frasilah, with half an anna for charity. About eight annas per frasilah are deducted for "tare and tret." At Zanzibar, after being sifted and freed from heterogeneous matter, it is sent by the Banyan retailers to the India market, or sold to the foreign merchant. It is then washed in solutions of various strengths: the lye is supposed to be composed of soda and other agents for softening the water; its proportions, however, are kept a profound secret. European technologists have, it is said, vainly proposed theoretical methods for the delicate part of the operation, which is to clear the goose-skin of dirt. The Americans exported the resin uncleaned, because the operation is better performed at Salem. Of late years they have began to prepare it at Zanzibar, like the Hamburg traders. When taken from the solution, in which from twenty to thirty-seven per cent. is lost, the resin is washed, sun-dried for some honrs, and cleaned with a hard brush, which must not, however, injure the goose-skin : the dark "eyes," where the dirt has sunk deep, are also picked out with an iron tool. It is then carefully garbled, with due regard to colour and size. There are many tints and peculiarities, known only to those whose interests compel them to study and to observe copal, which, like cotton and Cashmere shawls, require years of experience. As a rule, the clear and semi-transparent are the best; then follow the numerous and almost imperceptible varieties of dull white, lemon colour, amber yellow, rhubarb yellow, bright red and dull red. Some specimens of this vegetable fossil appear, by their dirty and blackened hue, to have been subjected to the influence of fire; others, again, are remarkable for a tender grass-green colour. According to some authorities, the resin, when long kept, has been observed to change its tinge. The sizes are fine, medium, and large, with many subdivisions: the pieces vary from the dimensions of small pebbles to two or three ounces; they have been known to weigh 5 lb., and, it is said, at Salem a piece of 35 lb. is shown. Lastly, the resin is thrown broadcast into boxes and exported from the island. The Hamburg merchants keep European coopers, who put together the cases, the material of which is sent out to them. It is almost impossible to average the export of copal from Zanzibar. According to the late Lieut.-Col. Hamerton, it varies from 800,000 to 1,000,000 lb. per annum, of which Hamburg absorbs 150,000 lb., and Bombay two lacs' worth.

The refuse copal used formerly to reach India as "packing," being deemed of no value in commerce; of late years the scarcity of the supply has rendered merchants more careful. The price also is subject to incessant fluctuations, and during the last few years it has increased from four and a half dollars to a maximum of twelve dollars per frasilah. According to the Arabs, the redder the soil, the better is the copal. The superficies of the copal country is generally a thin coat of white sand, covering a dark and fertilising humus, the vestiges of decayed vegetation, which varies from a few inches to a foot and a half in depth. In the island of Zanzibar, which produces only the chakazi or raw copal, the subsoil is a stiff blue clay, the raised sea-beach, and the ancient habitat of the coco. It becomes greasy and adhesive, clogging the hoe in its lower bed; where it is dotted with blood-coloured fragments of ochreish earth, proving the presence of oxidising and chalybeate efficients, and with a fibrous light-red matter, apparently decayed coco-roots. At a depth of from two to three feet, water oozes from the greasy walls of the pit. When digging through these formations, the copal resin occurs in the vegetable soil overlying the clayey subsoil.

A visit to the little port of Saadani afforded different results. After crossing three miles of alluvial and maritime plain, covered with a rank vegetation of spear-grass and low thorns, with occasional mimosas and tall hyphænas, which have supplanted the coco, the traveller finds a few scattered specimens of the living tree, and pits dotting the ground. The diggers, however, generally advance another mile to a distinctly-formed sea-beach marked with lateral bands of quartzose and water-rolled pebbles, and swelling gradually to 150 feet from the alluvial plain. The thin but rich vegetable covering supports a luxuriant thicket; the subsoil is red and sandy, and the colour darkens as the excavation deepens. After three feet, fibrous matter appears; and below this, copal, dusty and comminuted, is blended with the red ochreish earth. The guides assert that they have never hit upon the subsoil of blue clay; but they do not dig lower than a man's waist, and the pits are seldom more than two feet in depth. Though the soil is red, the copal of Saadani is not highly prized, being of a dull-white colour; it is usually designated as "chakazi." On the line inland from Bagamoyo and Kaole, the copal tree was observed at rare intervals in the forests, and the pits extended as far as Muhonyera, about forty miles in direct distance from the coast. The produce of this country, though not first-rate, is considered far superior to that about Saadani. Good copal is dug in the vicinity of Mbuamaji, and the diggings are said to extend to six marches inland. The Wadenkereko, a wild tribe mixed with and stretching southwards of the Wazaramo, at a distance of two days' journey from the sea, supply a mixed quality, more often white than red. The best resin is procured from Hunda and its adjacent districts. Frequent feuds with the citizens deter the wild people from venturing out of their jungles, and thus the Banyans of Mbuamaji find two small dows sufficient for the carriage of their stores. At that port the price of copal varies from two and a half to three dollars per frasilah.

The banks of the Rufiji River, especially the northern district of Wánde, supply the finest and best copal; it is dug by the Wawande tribe, who either carry it to Kokunya and other ports, or sell it to travelling hucksters. The price *in loco* is from one and a half to two dollars per frasilah; on the coast it rises to three and a half dollars. At all these places the tariff varies with the Bombay market; and in 1858 little was exported, owing to the enlistment of "free labourers."

In the vicinity of Kilwa, for four marches inland, copal is dug up by the Mandandu and other tribes: owing to the facility of carriage and the comparative safety of the country, it is somewhat dearer than that purchased on the banks of the Rufiji. The copal of Ngao (Monghou) and the Lindi Creek is much cheaper than at Kilwa: the produce, however, is variable in quality, being mostly a dull-white chakazi.

Like that of East African produce generally, the exploitation of copal is careless and desultory. The diggers are of the lowest classes, and hands are much wanted. Near the seaboard it is worked by the fringe of Moslem negroids called the Wamrima, or Coast clans; each gang has its own mtumku or akida'ao (mucaddum—headman), who, by distributing the stock, contrives to gain more and to labour less than the others. In the interior it is exploited by the Washenzi, or heathen, who work independently of one another. When there is no blood-feud, they carry it down to the coast; otherwise they must await the visits of petty retail dealers from the ports, who enter the country with ventures of ten or twelve dollars, and barter for it cloth, beads, and wire. The kosi—south-west or rainy monsoon—is the only period of work; the kaskazi, or dry season, is a dead time. The hardness of the ground is too much for the energies of the people: moreover, "kaskazi copal" gives trouble in washing, on account of the sand adhering to its surface, and the flakes are liable to break. As a rule, the apathetic Moslem and the futile heathen will not work whilst a pound of grain remains in their huts. The more civilised use a little jembe or hoe, an implement about as efficient as the wooden spades with which an English child makes dirt-pies. The people of the interior "crow" a hole about six inches in diameter with a pointed stick, and scrape out the loosened earth with the hand as far as the arm will reach. They desert the digging before it is exhausted; and although the labourers could each, it is calculated, easily collect from ten to twelve pounds per diem, they prefer sleeping through the hours of heat, and content themselves with as many ounces. Whenever upon the coast there is a blood-feud—and these are uncommonly frequent—a drought, a famine, or a pestilence, workmen strike work, and cloth and beads are offered in vain. It is evident that the copal-mine can never be regularly and efficiently worked as long as it continues in the hands of such unworthy miners. The energy of Europeans, men of capital and purpose, settled on the seaboard with gangs of foreign workmen, would soon remedy existing evils; but they would require not only the special permission, but also the protection, of the local government. And although the intensity of the competition principle amongst the Arabs has not yet emulated the ferocious rivalry of civilisation, the new settlers must expect considerable opposition from those in possession. Though the copal diggings are mostly situated beyond the jurisdiction of Zanzibar, the tract labours under all the disadvantages of a monopoly: the diwans, the heavy merchants, and the petty traders of the coast derive from it, it is supposed, profits varying from 80 to 100 per cent. Like other African produce, though almost dirt-cheap, it becomes dear by passing through many hands, and the frasilah, worth from one to three dollars in the interior, acquires a value of from eight to nine dollars at Zanzibar.

DUGONG OIL.

BY THE EDITOR.

There are many substances of the animal kingdom used in pharmacy of considerable importance, and others possessed of valuable curative properties are from time to time being discovered.

Dr T. Thompson has pointed out the medicinal value of various animal oils besides cod-liver oil, such as sperm and seal oil, and the result of his observations was a conviction that fish oils generally resembled one another in their remedial properties, although differing in their apitude for digestive assimilation in the human stomach. He tried neat's-foot oil, an animal oil obtained from a soft, solid fat found between the parchment and the leather skin of animals, also an oil obtained from a species of fish abounding on the Malabar coast; and these trials were frequently attended with encouraging results.

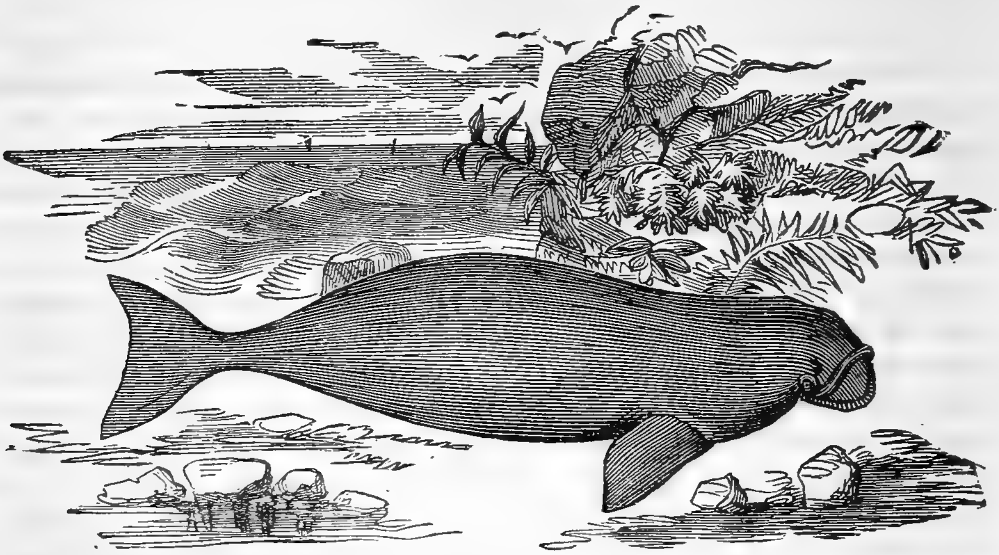
The practice of daily inunction is common in many warm countries, and serves to soften the skin and keep the body in health. In tropical regions, vegetable oils are chiefly used; but the New Zealanders and some others use shark oil. The Esquimaux and Greenlanders imbibe large quantities of train, seal, and various fish oils; whilst the natives about the large rivers and coasts of Brazil use turtle oil, and fat obtained from the alligator and crocodile.

Those who are employed in the woollen trade, soap, candle and other factories, where oils and fats are largely used, enjoy a comparative immunity from scrofula and phthisis. Sailors believe a whaling voyage to be a cure for consumption; and probably the quantity of oil drunk and taken into the skin may have its beneficial effect upon the system.

Another animal oil having medicinal properties has of late years been added to the list of commercial products: it is obtained from the Dugong of Australia. The Dugongs and Manatees were formerly classed with the Cetacea; but, being herbivorous animals, Professor Owen well remarks that they must either form a group apart, or be joined, as in the classification of M. de Blainville, with the Pachyderms, with which they have the nearest affinities. The name has been corrupted from the duyong of the Malays.

There appear to be two recognised species of the dugong: 1. *Halicore Dugong* (the Indian dugong—the *Trichechus Dugong* of Gmelin, *Dugungus Indicus* of Hamilton); and, 2. *H. Australis*. *H. Tabernaculi* is, however, considered by Ruppel a distinct species.

The first species is met with about the shores of the Indian Ocean, Ceylon, and the islands of the Eastern Archipelago. Round Ceylon they are frequently seen in considerable numbers, especially along the northern shore of the island among the inlets from the Bay of Calpentyn to Adam's Bridge, where the water is still and shallow, and abounds with algæ and fuci: length from 7 to 8 feet. They are also caught about the Straits settlements 8 or 9 feet long. Leguat, about 125 years ago, says they were met with in flocks of 300 or 400 around the Isle of France (Mauritius), and they were 20 feet long.



HALICORE DUGONG.

2nd. The Australian dugong is a native of the north-west coast of Australia. It is the manate of Dampier, the whale-tailed manate of Pennant. It is unnecessary here to enter into details of the specific anatomical distinctions of these species, which have been pointed out by Dr Gray and others, and can be referred to by those specially interested, under the article "Cetacea," in the 'English Cyclopedia,' or any other work on Natural History. These remarks have reference exclusively to its oil.

About Moreton Bay the aborigines give the dugong the name of the yungan, and are immoderately fond of its flesh. It is their greatest delicacy; and when one is speared on the coast, a general invitation is sent to the neighbouring tribes to come and eat, and the party never leave the carcase till it is all gone. The colonists are, however, now taking the capture into their own hands, for I see occasional shipments of about 50 gallons of dugong oil from Moreton Bay, valued at 40s. a gallon, and many cwt. of dugong ivory (incisors), valued at 60s. a cwt. The animal frequently weighs there from 12 to 14 cwt., and the skeleton of one forwarded a few years ago to Europe measured 11 feet in length.

Dugong oil was a few years ago brought into notice by medical men in Australia as a therapeutic agent possessing all the advantages of cod-liver oil, without its nauseous taste and smell. It has also been successfully used in diseases of the ear, and has further been recommended as a depilatory. Dr Hobbs, a practitioner of Moreton Bay, and Health-Officer of Brisbane, in the new Northern Australian colony of Queensland, was the first to draw attention to its virtues in Australia. He received a prize medal for it at the Sydney Exhibition in 1854, and has now continued the use of it for upwards of six years as a substitute for cod-liver oil; it has proved eminently beneficial in the treatment of debility, atrophy or wasting of children, dyspepsia, chronic dysentery, consumption, chronic bronchitis, &c. &c. It has found its way, through Dr Hobbs' agency, into the medical stores of Sydney, Hobart Town, and other Australian cities.

Dr M'Grigor Croft, of St John's Wood, Physician, late Staff-Surgeon to H.M.F., and Medical Officer to the Ceylon Rifles, has the credit of having introduced and tested its merits in this country in extensive private practice, and at the Hospital for Consumption, Brompton. Dr Croft is worthy of all praise for the trouble he is now taking in endeavouring to make the oil cheap and accessible to the British public, as he is highly successful in his treatment of consumption and other cases with it.

The animals of the allied genus, the Manatus, would, we should suppose, prove equally useful for their oil. Three or four species are recognised. The best known is the *Manatus Americanus*, Cuvier, which frequents the mouths of rivers, and quiet, secluded bays and inlets among the islands of the West Indies and the coasts of Guiana and Brazil. It is said to attain nearly 20 feet in length, and differs from the dugong in having no canines or incisors. An old author, R. Brookes, M.D. (Nat. Hist.), speaking of it, says, "The fat which lies between the cuticle and the skin, when exposed to the sun, has a fine smell and taste, and far exceeds the fat of any sea animal. It has this peculiar property, that the heat of the sun will not spoil it, nor make it grow rancid. The taste is like the oil of sweet almonds, and it will serve very well in all cases instead of butter. Any quantity may be taken inwardly with safety, for it has no other effect than keeping the body open. The fat of the tail is of a harder consistence, and when boiled is more delicate than the other." The flesh of the manatus is highly esteemed as food in all those countries the shores of which it frequents. In my work 'On the Curiosities of Food,' I have cited opinions regarding it. In Brazil the natives call the manatus the "peixe boi." It is particularly abundant in the lakes of the Amazon. Wallace, in his Travels up that river, describes their capture. "Beneath the skin," he says, "is a layer of fat of a greater or less thickness, generally about an inch, which is boiled down to make an oil used for lighting and cooking. Each yields from five to twenty-five gallons of oil." Edwards, in his 'Voyage up the River Amazon,' speaks of them, and says, not unfrequently they are taken 8 feet in length. It is said to be a distinct species from the manatus of the Gulf of Mexico.

MUREXIDE.

BY F. CRACE CALVERT.

Prout was the first chemist to remark, that if the fæces of serpents were heated with nitric acid and a little ammonia added, a beautiful purple colour was produced. He named it purpurate of ammonia. This substance, when dry, has the appearance of a dark-red powder, soluble in water, to which it communicates a magnificent red colour. This solution not only gives a precipitate with metallic salts, but, when evaporated, yields beautiful crystals, having the iridescent appearance of the wings of cantharides. This discovery has also been useful to medical men, by enabling them to distinguish the uric acid calculi.

Messrs Liebig and Wohler had also investigated the subject, and succeeded in obtaining from the uric acid contained in the fæces of serpents this substance, which they called murexide, and a new class of organic substances, the knowledge of which has much facilitated the application of murexide to dyeing and printing. M. Saac was the first to apply the products of uric acid to the dyeing of fabrics: his process consisted in dipping woollen fabrics prepared with a salt of tin into a weak solution of alloxan, a product discovered by Liebig and Wohler in heating uric with nitric acid. The fabric so prepared was dried, and when submitted to heat a fine crimson was generated, the intensity of which increased by the fumes of ammonia: but, owing to the difficulty of obtaining a colour of uniform shade, M. Saac's process required improvements, and these have been effected by M. Schlumberger.

The process followed by Messrs Saac and Schlumberger could not be applied to silk or cotton fabrics. The method of dyeing silk with murexide was discovered by M. de Pouilly, who adopted the following process—viz., dipping the silk in a concentrated solution of bichloride of mercury mixed with murexide, squeezing the silk well and hanging it in the air, when a magnificent crimson insoluble compound was fixed on the silk. This effect is produced from the fact that when solutions of bichloride of mercury and murexide are mixed together, an insoluble compound is only formed after the lapse of an hour or two.

The process for dyeing cotton is due to Messrs Lauth and Schlumberger, and consists in producing on cotton a purpurate of lead by mordanting with nitrate of lead, passing into an alkali, and then dyeing in a solution of murexide. In order to give a full brilliancy to the colour, it is lastly passed through a weak solution of bichloride of mercury. This process was further improved by Messrs Dolfus, Meig, & Co., in France, and Mr Lightfoot, in Lancashire, by printing murexide with an excess of nitrate of lead, and subjecting the cloth so printed to the action of ammoniacal fumes, or passing it through a solution of caustic soda mixed with sal ammoniac. In order to render this substance more generally useful, it remained to find a method for obtaining fast colours with it on mixed fabrics, such as mousseline de laine; and this has also been effected by M. Schlumberger. The cloth is first prepared by uniting binoxide of tin with the wool. This object is attained by using a salt known to calico-printers as pink salt, the double chloride of ammonium and tin, and then printing on the prepared fabric the following mixture:

1 part of murexide.
6 parts of nitrate of lead.
2 parts of nitrate of soda.

The pieces are then allowed to age for two or three days, when, to fix the purpurate of lead on the cotton, and the purpurate of ammonia on the wool, it is necessary to pass the cloth into a bath of bichloride of mercury composed as follows:

Water	100 gallons.
Bichloride of mercury	6 lbs.
Acetate of soda	12 lbs.
Acetic acid	2 quarts.

SILK COTTONS.

BY THE EDITOR.

We have received applications from time to time from brokers, importers, and others, as to the identification and probable uses of various silk cottons; and it may be well to throw together, for convenient reference, the few facts known with regard to them. That some of these may yet be made economically useful on a commercial scale is not at all improbable, seeing that of many of them the material is abundant and to be had cheap. The silky substance found in the capsules of the silk cottons has been tried by European spinners and hatters for their respective purposes, but, from wanting tenacity of fibre, was found generally unfit for the manufacture of any durable material.

At a recent fair held in Liberia, on the West Coast of Africa, a pair of stockings was exhibited, manufactured from the silky floss of the Bombax. These stockings were the result of African skill in spinning and manufacturing. Our mechanism has never yet been capable of utilising this fibre.

Captain Burton (Lake Region of Central Africa) tells us that in Zanzibar, where the musufi or bombax abounds, its fibrous substance is a favourite substitute for cotton, and costs about half the price. In Unyamwezi it fetches fancy prices; it is sold in handfuls for salt, beads, and similar articles. About one maund may be purchased for a shukkah, and from one to two ounces of rough home-spun yarn for a fundo (a knot of ten strings) of beads. At Ujiji the people bring it daily to the bazar, and spend their waste time in spinning yarn of it with the rude implements they have at their command.

Mr Williams, of Jubbulpore, India, has succeeded in spinning and weaving some of the Bombax down so as to form a very good coverlet, and we have specimens of the fabric. The late Dr Royle suggested that it might be easily made use of for stuffing muffs, for wadding, or for conversion into half-stuff for papermakers—perhaps for making gun-cotton.

In the 'Transactions of the Agri-Horticultural Society of India,' iii., p. 274, there is a report from the Society of Arts upon two pieces of cloth made from it; and it is observed that, from the shortness of the staple of the down and its elasticity, it could not be spun by cotton-spinning machinery.

In the Jury Reports of the Exhibition of 1851 occurs the following:—"Mention may here be made of the very beautiful fibre of the silk cotton tree (*Bombax heptaphyllum*), which, owing to the shortness and want of strength of the fibre, combined with its peculiar elasticity, is incapable of being spun like ordinary cotton. It is occasionally in India, more especially in Assam, spun into a very loose and large thread, which is then woven into cloth with a warp of some other fibre, and forms a soft, warm, and very light fabric. The silk cotton being a very tender fibre, cannot be used with advantage as a stuffing material alone; but it is highly probable that it might be very advantageously used in combination with other substances, not merely for the purposes of upholstery, but even in the manufacture of mixed fabrics for various other uses in the arts. It was suggested by Dr Percival in 1787, and by Buchanan in 1793, that this fibre might be advantageously employed as a substitute for beaver fur in hat-making; and Le Breton states that its importation into some countries was forbidden, for fear that it should be used to adulterate beaver's hair. Practical obstacles were, however, found to interfere with this application, and it appears that they have only recently been overcome."

Silk cotton from *Bombax ceiba* has been sent from British Guiana to the United States for the manufacture of hats.

James Bruce Niel, Esq., in a letter to the Manchester Chamber of Commerce, dated March 10th, 1860, calls attention to the transference of the silk cotton tree from Persia to the East Indies; but what tree he alludes to is not clear, for the Bombax is a native of both Indies:—

"Now that we have an accredited Minister at the Court of Teheran, in Persia, I would respectfully recommend the Chamber of Commerce to direct his attention to the properties and value of the silk cotton tree, which is used in the manufacture of clothing in that country. The same would thrive well in India, in the West Indies, or in parallel latitudes. Seeds of the same, ready for planting, might be remitted to those countries by attending to the following instructions.

"Fill an old cask half full of earth, put the seeds as near as possible to the middle of the cask, then fill the latter entirely with moist earth, pressing it down, and finally closing in the cask against air and water. Keep it from contact with sea-water by means of a coating of glue boiled in linseed oil. In this manner, seeds may be brought from Persia or India in a state of preservation, and fit to vegetate."

The short, brownish, cottony substance which is found inside the capsules of *Bombax ceiba* and *malaribicum* is used, by the poor inhabitants of the countries where it grows, for making hats and bonnets, and stuffing chairs and pillows. It is not made into beds, being too warm for those climates. Next to eider down, it is the softest material for stuffing. The beautiful purple down of *B. villosum* is spun and woven into a cloth of which garments are made and worn by the inhabitants of Mexico, and it retains its purple colour without being dyed. *B. septenatum* or *heptaphyllum* is said to furnish the same kind of material.

The *Ochroma Lagopus* of Jamaica contains in its capsules a fine, soft, mucous down, which enwraps the seeds, and which is said to be employed in the manufacture of English beavers.

Another West Indian silk cotton, the *Eriodendron Caribæum* (*E. anfractuosum*, Dec.; *Bombax pentandrum*, Lin.), furnishes the silky down known in the East under the name of capock. The woolly coat of the seeds of most of the species is used in different countries for stuffing cushions and similar purposes.

Edwards ('Voyage up the River Amazon') makes mention of "the sumaumeira tree, which yields a long-stapled silky white cotton, grows upon the banks of the Rio Negro in great abundance, and could probably be made of service, were it once known to the cotton-weaving communities. It is excessively light, flying like down; but the Indians make beautiful fabrics of it." This is, no doubt, the *Eriodendron Samauna.*

The wool of various Sterculiaceæ—as of the balsa (*Ochroma Lagopus*, Swartz), ceiba (*Eriodendron Caribæum*, Don), and barrigon (*Pachira Barrigon*, Seeman)—is employed in Central America for stuffing pillows, cushions, &c.

The seeds of the Syrian swallow-wort (*Asclepias Syriaca*) are covered with a thistle-like down an inch or two in length, which it was at one time proposed to spin into textures for wearing apparel. Articles of dress have, we learn, been manufactured with it both in France and Russia. It is well adapted for stuffing mattresses and pillows. It is very common in the United States, where it is called silk-weed; and the silky down is there used for making hats, as well as for stuffing bedding. Specimens of it from Canada were shown at the Exhibition of London in 1851, and at Paris in 1855. The down of the Asclepiads, Dr Royle observes, may no doubt be turned to some useful purposes, and therefore makes the plants abounding in fibre more valuable, as yielding a double product.

Dr A. Hunter, of Madras, has drawn attention to the value of the fibre of the yercum (*Calotropis gigantea*) silk cotton. The plant thrives best in the neighbourhood of neglected rubbish-heaps, whence it derives an abundant supply of nitrogen, which seems essential to its perfection. The difficulty of spinning its hairs, which do not contract in the same way as cotton, has been overcome by new machinery. A variety of fabrics of a light, soft texture were lately exhibited in Madras by Messrs Thresher and Glenny, made from the yercum silk cotton mixed with other fibres. The cloth is well suited as a substitute for flannel. Several large bales of the fibres have been sent to London. It is expected that, with aloe and plantain fibre, they will be fit for the finest descriptions of note-paper. The whole plant is of commercial value. In Madras the silk cotton of the pod is collected, in Bombay the fibre of the bark is used as a substitute for flax, and in Bengal the natives collect the milky juice as a substitute for shellac and gutta-percha.

"Mr Moncton, C. S., has proposed making use of the downy substance contained in the follicles of the mudar or yercum, and, indeed, has had paper made of it, as well pure as when mixed with two-fifths of the pulp of the sunne hemp, such as the natives use for making paper. As the glossy and silky, but comparatively short fibre, is difficult to spin, a mixture of one-fifth of cotton was made in order to enable it to be worked. A good wearing cloth, which stands washing and takes a dye, was produced. It is, however, well suited for stuffing pillows or coverlets. Mr Moncton calculated that its cost would be one rupee a maund. The silky down of the pods is used by the natives on the Madras side in making a soft, cotton-like thread."—(Dr Royle on Fibrous Plants of India.)

Wild cotton, with a fine glossy fibre like silk, grows abundantly in the valley of the Amazon, and is used at Guayaquil to stuff cushions and mattresses. Some silk manufacturers in France, to whom specimens of this cotton were sent by Mr Clay, the United States *chargé d'affaires* at Lima, thought that, mixed with silk, a cheap and pretty fabric might be wove from it.

The cotton which is found on the seeds of *Chorisia speciosa* is used to stuff bolsters and pillows in Brazil, where it is called by the inhabitants 'Arvore de Paina.' It has been imported into Liverpool under the name of vegetable silk.

In the Prussian department of the London Exhibition of 1851, a fibrous silky substance was shown, obtained from plants growing in Prussia and several other countries. It is applied to silk buttons and fringes, and available also for spinning and weaving. A curious vegetable substance, the pulu fibre, or vegetable silk, obtained from the rhizomes and lower portion of the stipes of several species of *Cibotium*, has been fully described by our contributor, Mr M. C. Cooke, in the 'Pharmaceutical Journal,' 2nd series, vol. i., p. 501.

A considerable export trade in this pulu fibre, as it is termed, is now carried on from the Sandwich Islands. Its only use, we believe, is for stuffing mattresses; and to this purpose it has long been applied in Madeira and the Azores.

RIMMEL'S PERFUME VAPORIZER.

Much as has been done for the comfort, convenience, and pleasure of the public of late years, much still remains to be accomplished as scientific knowledge, skill, and enterprise progress. The luxury of the Turkish bath is only now beginning to take general hold on the public, and even in our dwellings there are many cheap conveniences and skilful appliances that have scarcely yet been adopted to any extent. We are wont to reproach the Chinese with having made no improvement in their manufactures for the last thousand years, and yet there are some things—minor matters, it is true—in which we, who boast of our constant progress, have made no advance or improvement whatever. For instance, the art of perfuming the atmosphere of our rooms is in the same state now, in Europe generally, as it was in the time of the Egyptians, the Jews, and other nations of remote antiquity.

The modern West-end lady who burns a pastille in her boudoir is not, perhaps, aware that she is using the same ingredients that the Egyptian priest placed in his censer to burn as incense, or that Moses was commanded to offer to the Most High. But so it is, nevertheless. It seems strange that, in this age of wealth and refinement, no one should have thought of replacing the heavy empyreumatic odour and smoke of aromatic woods and resins by a more refreshing and genial fragrance, until the ingenious perfumer, Mr Rimmel, has brought into use a process which throws into the shade all such antiquated practices.

"The Perfume Vaporizer," as he terms it, is a simple and elegant apparatus, supported on a pedestal and heated by a spirit-lamp, as is shown in the annexed engraving. It is composed of a lower chamber or water-bath, and of an upper basin fitting into the other, and communicating with it by means of a tube or worm pierced with holes. Perfumed water is placed in the lower chamber, and a semi-alcoholic perfume in the upper. As soon as the water in the bath reaches ebullition, the steam is carried into the upper basin by means of the worm, and volatilises all the fragrant molecules, which become diffused through the atmosphere with astonishing rapidity. From ten to fifteen minutes suffice to perfume a whole theatre, and an apartment naturally requires much less time.

The pleasant vapours thus generated can be varied *ad infinitum*, and embrace all perfumes that have as yet been extracted from flowers or plants, such as the rose, violet, sweet-briar, &c., which are given out in all their freshness and purity—in fact, the effect produced may be compared to the exhalations from a blooming parterre on a fine May morning. Although delicate in the extreme, the odour thus obtained is so powerful as to diffuse itself thoroughly, and overcome immediately all obnoxious smells: even the strong and penetrating fumes of tobacco are completely destroyed by its influence, probably owing to the aqueous nature of the perfumed vapour.

We understand that Mr Rimmel has experimentalised with his process in large theatres and ball-rooms with complete success, and that it has also been found exceedingly beneficial in sick-rooms and hospital-wards. We expect next to hear of his services being called into requisition to neutralise the after-dinner fumes at the Mansion House, London Tavern, City Companies' banquets, and other festive occasions, and to impart a soothing fragrance to the atmosphere, which will cause his name to live in the memory of many a civic and public celebrity. We are fully convinced that this simple but ingenious contrivance will be most extensively adopted and patronised so soon as it becomes more generally known, for it combines useful with agreeable properties, and hence may truly be termed *utile dulci.*

Review.

DIAGNOSTICS OF AURAL DISEASE. By S. E. SMITH, M.R.C.S. Baillière.

This work, in its general detail, cannot be said to lie within our province. The discussion of the anatomical, physiological, and curative portions we will leave to those more competent than ourselves to decide. But there is one feature in the work which, amid much that is interesting chiefly to the medical man, makes it also of interest to the technologist. This consists in the announcement of the successful treatment of certain phases of aural disease by means of the vapour of Bromine. Of so much importance does the Author think this agent—for the suggestion of which, by the way, he acknowledges himself to be indebted to one of our contributors—that he has invented an apparatus for its application. We have no doubt that this treatise will receive due attention from the Faculty. It is written in a pleasing style, apart from the necessary technicalities to be found in all scientific works, and cannot fail to be duly appreciated in all medical circles.

Twickenham Economic Museum.—We are glad to learn the appointment of M. C. Cooke, Esq., F.S.S., as Lecturer on Botany and Technology, and to develop more fully this Museum. A more suitable person could scarcely have been found for the office, and we doubt not that under his supervision it will speedily progress towards greater completeness, and become one of the most interesting and valuable institutions in the vicinity of the Metropolis.

THE TECHNOLOGIST.

ON VEGETABLE WAXES.

BY M. C. COOKE, F.S.S.

These natural products, obtained from different orders of plants and widely-dissevered regions, have of late years increased in commercial importance. Vegetable wax, and that prepared by bees, must be regarded as a concrete fixed oil. Both kinds are indifferent to the action of acids, and contain a large proportion of oxygen. *Myrica* wax before it is bleached has a greenish hue : its specific gravity exceeds that of animal wax ; it is harder, more brittle, easily powdered, and melts more readily. It contains, besides, a good deal of a peculiar substance which is analogous to stearine or stearic acid, and which for that reason is called *myricine.* Beeswax contains a smaller quantity of this ingredient, but a much larger proportion of *cerine,* another constituent of wax. Vegetable wax dissolves in boiling turpentine, and combines with alkalis, forming a compound possessing the properties of soap.

Vegetable wax is obtained from two species of palm, from several species of *Myrica* which are *par excellence* the wax-producing plants, from one species of fig, from at least one species of gourd, from two species of sumach, and from other plants at present unknown.

Wax obtained from plants of the *Myrica* tribe exudes from the surface of the fruits, chiefly towards the time of their maturity. It is exhaled in a liquid state, but soon hardens when exposed to the atmosphere, and forms a white powder which under the microscope displays the shape of minute scales. In most instances vegetable wax is secreted upon the fruit, in others upon the stem or leaves ; but in all instances the essential properties of the secretion appear to be nearly identical.

CARNAUBA WAX *(Copernicia cerifera,* Mart. ; *Corypha cerifera,* Camara). —The leaves of this palm produce a kind of wax, obtained by shaking the young leaves after they have been detached from the tree ; when each leaf yields about 50 grains of a whitish, scaly powder, which is melted in pots over a fire. This wax is sometimes employed by the Brazilians to adulterate beeswax, and it has been several times imported into Great Britain for the purposes of candlemaking ; but the lemon-coloured tint has hitherto baffled all attempts at bleaching. The palm which yields this wax is found chiefly in the northern districts of Brazil, either isolated or in immense numbers.

Humboldt's Palm Wax (*Iriartea Andicola*, Spr.; *Ceroxylon Andicola*, H. & B.)—This palm was found by Humboldt in the Cordillera at the Pass of Quindin, between Ibague and Cartago, not lower than 7,930, and not higher than 9,700 feet. The lofty, noble trunks are covered with a coating of resin-like wax,—according to Vauquelin, one-third wax and two-thirds resin. This coating gives them a white and marble-like appearance, imparting a lively feature to the scenery. To obtain the wax, the tree must be felled, each tree giving about 25 lb. A man will cut down and scrape two trees a day. The wax is used, mixed with tallow, for making candles; it is said to burn too rapidly alone. After scraping, it is merely melted and run into calabashes for the use of the villagers. It is sold in the town of Ibague, at the foot of the Quindin, at 3d. per lb., and is in considerable demand; but it is abundant and easily obtained. Hitherto it has not been met with in European commerce.

Bahamas Candleberry Wax (*Myrica cerifera*).—This is the common candleberry myrtle of North America: it grows in the woods all over the United States, and abounds in the Bahamas. At the Great Exhibition, specimens both of the wax and candles made therefrom were exhibited from New Brunswick. The method employed in America for procuring this wax is by boiling the berries in a copper or brass vessel for some time. Iron pots are found to darken and cloud the wax. The vessel after a sufficient time is taken from the fire, and, when cool, the hardened wax floating on the top of the water is skimmed off. Most of the myrtle wax imported into London during the past few years has been received from Nassau.

Carolina Candleberry (*Myrica Carolinensis*).—This appears to be a humbler but a more valuable plant than the candleberry of the Bahamas. It flourishes in light sub-humid soils, and has even been found to thrive upon the sands of Prussia, where it was cultivated successfully by M. Sutzer at about half a league from Berlin. From the berries M. Sutzer separated the wax, which retained its fragrance so powerfully after its manufacture into candles, that a single candle, on being lighted, not only diffused a delightful odour through the room while burning, but even for a considerable period after its extinction. In America a fertile plant is said to yield annually 7 lb. of berries, from every 4 lb. of which a pound of wax may be obtained. This wax is of a greenish yellow colour, and of a firmer consistence than beeswax. "The process by which the wax is separated from the berries is one of extreme simplicity, and consists in throwing them, when collected in sufficient quantity, into a kettle, and water is poured in to the depth of six inches over them; the whole is then placed over the fire and boiled, stirring the berries during the ebullition, to facilitate the separation of the wax, which forms a pellicle on the surface, when it is skimmed off and strained through a coarse cloth to free it from impurities. When the wax ceases to rise to the surface, the berries are removed and their place supplied by a fresh quantity, adding to the original water a quantity sufficient to replace the waste by boiling. The same process is pursued; and after this second batch has been removed, the whole of the water is renewed, and fresh parcels of berries subjected to the same operation, until a sufficiency of wax shall have been obtained. When a sufficient mass to form a cake has been thus separated, it is spread upon a cloth to drain, after which it is dried, melted a second time to purify it, and then formed into cakes of a convenient size for the market."* This species of candleberry myrtle is found chiefly in the swampy districts of North Carolina.

Cape Myrtle Wax.—There are five species and two varieties of the candle myrtles (*Myrica*) indigenous to South Africa, all of which yield more or less the myrtle wax, now to a certain extent an article of commerce. For more minute details, the reader is referred to an elaborate paper on 'Vegetable Wax from the Candleberry Myrtle,' by P. L. Simmonds, Esq., in the 'Journal of the Pharmaceutical Society,' vol. xiii., p. 418.

Myrica cordifolia.—This species has leaves somewhat heart-shaped, sessile, closely produced so as to be somewhat imbricate, and with serrated margins in one variety, and entire in the other. It affects a moister soil than the other Cape species; and though they appear to flourish in the pure sands of the Cape flats, they are rooted in a better sub-soil over which the sand has drifted and accumulated.

Myrica Æthiopica.—The leaves in this species are elliptic in form, with the margin entire at the base, and serrated towards the point or apex. It is met with both on stiff and light soils, and, more frequently than the others, in rocky situations.

Myrica serrata.—The leaves of this species are lanceolate, attenuated towards the point, sharply serrate, and hairy. The catkins are bisexual, with egg-shaped scales. It is common on all soils in the Cape District, generally on level ground.

Myrica quercifolia.—The leaves are oblong, with bluntly-waved margins; the young branches are downy, so as to have a velvety appearance. There are two supposed varieties in cultivation in the gardens of the English residents, the one only distinguished from the other by the leaves being slightly hairy at the base. This species is often found in company with *M. serrata.*

Myrica laciniata.—The leaves are oblong, linearly divided from the margin towards the midrib in a feather-like manner. The younger branches are covered with resinous punctures. Catkins androgynous and solitary; scales blunt. It is found principally in the George District, more commonly on sandy loam or clay soil.

* 'On the Cultivation, &c., of *Myrica Carolinensis,* or Wax-tree of Carolina,' by W. Hamilton, M.B.

Other species have been described in the districts of Swellendam and George, but the above only have been identified during recent years.

From an Appendix to Dr Pappe's 'Silva Capensis' we extract the following particulars of collecting the berries, and extracting and preparing the wax:

"Anything hollow, from the size of a plate to that of a schepel measure, placed under the branch with one hand, while the other is employed in rubbing off the berries, will be found the most useful in collecting them from the branches: besides which, every person gathering berries should have a cloth the size of a small handkerchief about his person; that, where a bush whose vines are partly buried in the sand is met with, the vine may be lifted gently, the cloth placed under, and when the berries are rubbed off, the vine may be replaced without the slightest injury: a muid bag to be kept at hand to receive such small quantities in the mean time. Where berries are found large and abundant, one man can gather two muids a day with ease in this manner: such berries, from being large, would realise 14lb. of white wax to the muid.

"With respect to extracting and preparing the wax, although I have had defecators made since the last Agricultural Show, by the use of which the process of extracting the wax is simplified, yet, for the benefit of parties who may not wish to incur the expense of such articles, I will here explain the process by which the best specimen of wax then exhibited was got up.

"A small quantity of berries at a time was put into a pot of boiling water, so proportioned to its size as to admit each berry to have cast its wax to the surface. This small quantity was not in the water more than two minutes when skimming commenced, the berries being stirred gently with a ladle during that time. The wax was then skimmed off rapidly, to avoid the colour from the pulp. To receive the skimmings, a small keg, with one end out, was prepared; over this end two flannel strainers were fastened, through which the wax was strained, and when the keg was full, the wax being yet a liquid, was again strained through flannel into a mould that gave it shape. After each skimming, the boiler, being too large for removal with facility, was baled of its contents, water and all, cleaned with mops and hot water, refilled with water either cold or otherwise, and the fire applied with all despatch.

"This having been performed in the open air, an hour was often consumed between each process in getting the water up to boiling heat, while the process itself did not occupy more than five minutes from the time the berries were put into the boiler until the skimming ceased. To save so much time and labour, the necessity for something with which to enclose the berries in the boiler became apparent; hence the construction of the defecators alluded to.

"There are two of them. The brass defecator is adapted to the berries towards the close of the winter, when the pulp is dry. The pulp being then brittle, will break into small particles in the water, and float to the top with the wax. It was found more difficult to sever such particles by straining, than it was to avoid the colour by despatch ; the decayed pulp conveying a darkish, and the juice of it a greenish colour to the wax. The other defecator is adapted to the berries in their season. It is of iron wire, and has a dash. The berries, when sound, well winnowed and picked, will admit of their being tossed about a little, either before or when full ripe. The vanes of the dash are so shaped as, when set in motion, to hitch the berries in succession towards the surface of the water, thus affording additional facility for each berry being rid of its wax. The application of either of these instruments with a brass strainer and cock fitted to a mould (that will be produced at the same time), will save four-fifths of the labour and time lost in preparing water, gathering fuel, baling, mopping, and straining, as described in the former process. In working either, one minute and a half will suffice for its immersion with the berries in the boiler; more time than this will extract the juice and discolour both the wax and the water. The dregs and other substances that may have escaped in cleansing being retained by the defecator, some warm water should be at hand in which to rinse it after every second or third immersion. By attending to this particular, and to the time above specified, the same water will answer all day, replacing that, of course, which was taken out with the wax in skimming.

"The wax being the produce of the pulp, it is to be observed that the latter will retain more or less of the former until the berries are quite ripe. To ascertain this, let the berries remain in the water some time after skimming; and should any wax appear, it will be of the colour of the juice, and will show at once that the berries are not ripe. However, as wax so made is objectionable only from its colour, and is valuable to the farmers and their servants, it may be procured by a second skimming until the berries are seasoned,—care being taken that such skimmings are put into a separate vessel from that in which the first skimmings are deposited. These remarks are applicable to parties who, having commenced making wax at a distance from their homes, may not find it convenient to return and wait for the proper season.

"I will conclude with remarking, that I have not found all the bushes in any locality bearing berries the same year, and the coarsest kind have not borne at all during the last five years, while others have borne yearly. This would indicate sexual properties: yet, whilst admitting the possibility of such qualities, I am aware that a large portion of bushes are barren both from age and from an unfavourable position—having had berries at Deep River in 1850 from bushes that have not borne since ; and having found the berries in my own neighbourhood drop from the bushes before attaining half the usual size, year after year, some of them not even appearing larger than pin-heads.

"I have not found the plant bear under the fourth year in any situation."

Azores Candleberry (*Myrica Faya*).—This *Myrica* is a native of the Azores, or Western Islands, and Madeira. The berries are affirmed to be ceriferous, like those of the other species; but whether the wax is collected and employed to any extent, we are not at present informed.

Colombia Wax (*Myrica macrocarpa*).—This species yields an excellent wax, of which specimens only have as yet been seen in this country, but which does not appear to differ from the myrtle wax of the Bahamas. It is employed, as we are informed, for making candles in the country in which it is produced.

SCOTCH MYRTLE (*Myrica gale*).—The berries of this indigenous little shrub will yield a small quantity of a hard, greenish wax, upon being thrown into boiling water. But the quantity yielded is so small, and the expense of collecting so great, that there is no probability of its being met with as an article of commerce. This wax has a slight aromatic odour, similar to that which the plant possesses in a greater degree.

ST DOMINGO WAX.—At the Great Exhibition of 1851, Sir R. Schomburgk sent specimens of a peculiar vegetable wax, and candles made therefrom, from the Island of St Domingo. This wax is of a yellowish colour, with a greenish tint, hard and brittle, but otherwise much resembling the candleberry waxes. No information was given of the source from whence it was procured, but it was doubtless derived from a species of *Myrica*. The plant is stated to be abundant in the northern portions of the island.

JAPAN WAX (*Rhus succedanea*, L.)—This hard white wax is now a considerable article of export from Japan. It was formerly generally seen in round cakes of from 4 to 4½ inches in diameter, and 1 inch thick; but since the opening of the ports of Japan the importation has so largely increased, that it is now commonly received in large square blocks or cases, each of an average weight of 133 lb. The fusing point of this wax is from 125 to 130 deg. Candles are commonly made of this substance in Japan. Dr Macgowan states that the Japanese are cultivating these little plants in all corners of their gardens, and in every spare nook of ground, for the sake of the wax, which is now becoming such an important article of export from the empire. Japan wax is softer, more brittle and fatty than beeswax, and is easily kneaded. It contains twice as much oxygen, and has a different composition, consisting of palmitic acid united with oxide of glyceryle.

VEGETABLE WAX (*Rhus vernicifera*, D. C).—It is affirmed that the seeds of this plant, which is indigenous to Japan, contain also a tallow-like oil which is employed in the manufacture of candles. Some of the Japan wax met with in commerce may consist either entirely or in part of wax produced by this plant.

PEETHA WAX (*Benincasa cerifera*).—The fruit of this cucurbitaceous plant secretes upon its surface a waxy substance which resembles the bloom found on plums and cucumbers. In this instance it is produced in sufficient quantities to be collected and made into candles.

BIRCH WAX (*Betula nana*).—Dr Royle states that this birch yields a wax very similar to that afforded by the different species of *Myrica*.

GETAH LAHOE (*Ficus cerifera*).—This species of fig, which is found in the Island of Sumatra, yields a kind of waxy secretion, which is known there under the above name, and is made into candles.

GETAH PODAH.—A kind of green wax from Biliton (a small island in the Eastern Archipelago, lying to the east of Sumatra) was exhibited at the Great Exhibition of 1851. It may have been the same as that obtained in the neighbouring island of Sumatra from *Ficus cerifera,* and already alluded to under its native name of Getah Lahoe.

GOINGAMADON.—A trial has been recently made in the nursery-gardens established by the French Government in Algeria to cultivate a tree new to Europe, which is called the *Goingamadon,* or wax-tree of Cayenne. This tree furnishes a kind of wax exactly similar to that in common use, and possessing all the useful properties of beeswax. The tree grows freely, and costs little; and it has been calculated that each full-grown stem will yield from 45 to 50 lb. of wax annually. A quantity are about to be planted on the Government lands.

MAFURRA.—A kind of vegetable wax may be obtained at Mozambique, on the eastern coast of Africa, which would be available for the manufacture of candles. It was recently analysed at the International Exhibition of Paris: the estimated quantity obtained annually is 32,000 lb. The native name of the tree which secretes this substance is *Mutianâ.* It is obtained in the largest quantities at Juhamban. A communication on this wax was made to the Institute of France by MM. Oleveira Pimentel and J. Borus. In 1857, 746 cwt. of vegetable wax, valued at 3,170*l.*, were imported; in 1858, 2,081 cwt., of the value of 8,823*l.*; and in 1859, 31,547 cwt., of the value of 110,406*l.*

MAUVE AND MAGENTA.

BY ROBERT HUNT, F.R.S.

The ancients prided themselves upon the possession of the *Tyrian Purple,* obtained by a peculiar process from one of the Mollusca of the Ægean Sea. The moderns may, with far more reason, be proud of their *Perkins's Purple,* derived, by the refinements of chemical science, from refuse matter of our gasworks.

To the story of the modern colour we invite attention, premising that under the generic term given above, originating in the name of the inventor, Mr W. H. Perkins, we include Mauve, Magenta, Solferina, Azaleine, Roseine, Violine, Fuchsiacine, and those other beautiful varieties of colour which are produced by our dyers in silk, wool, or cotton.

When a lady arrays herself in a fine example of our silk manufacture in either of these colours, she cannot but feel she is indebted for a new pleasure to the science that produced it. We never possessed any tint in which there was so much depth, or intensity, with so little of that glare which becomes offensively obtrusive. The colours, too, are absolutely new; they are neither the rose, the violet, the peach, nor the blossom, in which our mothers prided, but they are those, with something superadded. The dyed surface has a power peculiarly its own, of separating two or more rays from the source of all colour, LIGHT, and of sending them off in most harmonious combination. The *philosophy of colour* may eventually engage our attention, when the causes producing the much-admired tones of the Mauve and Magenta can be elucidated more satisfactorily than we can do now; at present, we are limited to a clear but concise description of the processes by which we have obtained the dyes whose names are taken for the heading of our article.

A piece of wood and a lump of coal have no particular resemblance to each other, but they belong to the same family; they are very near relations. The coal we burn, and which is dug from a thousand feet below the present surface of the earth, with most laborious toil and under circumstances of peculiar hazard to the miner, was once a forest growing in luxuriant beauty, in the splendour of a tropical sun. Myriads of ages have elapsed, mountains have been worn down, and their *dêbris* strown over the buried forests. Hundreds of yards in thickness of sandstone and shale have to be pierced ere we reach our buried treasure, more valuable far than the "hoarded gold" of the enchanter Merlyn. In the deeps, and in the darkness of these rock formations, chemical changes have gone on, resulting in the production of that coal which gives to our country her commercial supremacy, and to our ladies—Mauve and Magenta.

We have to take our coal to the gasworks, and there we subject this natural product to a destructive distillation—as the process is termed; we obtain the gas with which we illuminate our towns and our houses, and the coal yields by the process, at the same time, many other things.

The simplest illustration of gas-making may be obtained by taking a common tobacco-pipe, filling the bowl thereof with powdered coal, and covering it with a piece of clay. If we place the bowl of the pipe inverted in the fire, we shall find, as it becomes red-hot, that, first, a liquid will distil over through the stem—this is the fluid product—and as the heat is increased we have a gaseous body, which will take fire, and burn steadily, on the application of flame. Precisely the same process goes on in our tobacco-pipe as occurs in the open fire, with one very important exception—the products are not allowed to combine with the oxygen of the air. By heat we decompose the coal: the elements thus separated re-combine among themselves; and thus it has been proved that we can obtain—

Seven solid products; nine gaseous compounds; six acid substances; eleven bases, or compounds capable of uniting with acids; and no less than fourteen neutral bodies, many of them of a very remarkable character.

Coal is, chemically, a compound of carbon with hydrogen, oxygen, and nitrogen; and it is by the interchange of these four elementary bodies, in varying proportions, that the forty-seven bodies are obtained.

Among the eleven bases is a substance named *Aniline;* and as from this body all the colours of which we have to speak are procured, it merits an especial description.

Formerly, at our gasworks, everything was regarded as a waste product except the illuminating gas—CARBURETTED HYDROGEN. The coal tar was, it is true, collected and used; but it was regarded, from its disagreeable smell, as a very unpleasant neighbour. The chemist has, however, taken this coal tar, so offensive to our sense of smell, and he has extracted from it several essences remarkable for their fragrance; and again, from the same black tar—to touch which was to be defiled—by a process of transmutation, the chemist has evoked a colour which has carried joy to the hearts of the Cardinals of Rome, and administered much pleasure to the Fashion rulers of our own and other lands.

Aniline, we have said, is one of the products obtained from coal tar. This substance derives its name from *Anil*, the name of one of the plants producing Indigo, as from this colouring matter Aniline was first separated. From Indigo-blue this Aniline can be obtained by treating it with potash, and then distilling the mass; but Hofmann discovered a far more abundant source of it in the oil of gas tar. It would be tedious, and after all not very intelligible, to describe the processes, but the result of many careful distillations is a brown oil; this, by purification, becomes a colourless liquid, possessing a peculiar aromatic odour. This is the important *Aniline*, a chemical compound, consisting of twelve proportions of carbon, seven of hydrogen, and one of nitrogen.

This interesting substance combines with acids to form crystalline salts; its combination with oil of vitriol (sulphuric acid) forms sulphate of Aniline, which is the most important. These crystals, which are beautiful colourless plates of a silvery lustre, become *red* by exposure to the air; and here is developed the secret of its producing the exquisite reds and purples of which we write.

By adding oxygen to, that is, by oxidising this salt of Aniline, the red or purple colour is obtained; and as we vary the agent imparting the oxygen, so we have the means of varying the dye, and may secure any of the shades, between the blues and the reds, which are met with in the shops.

As we have stated, Mr Perkins was the discoverer of the original Mauve. He was a student of Dr Hofmann's, and employed by that chemist to assist him in his investigations of the products from coal. The preparation of Aniline was described by Dr Hofmann, and he first showed that its presence could be detected by the violet colour it gave when treated with chlorine. This was the key to everything that has since been done, and it is not a little curious to see how the changes have been rung by the chemists on oxidising agents. A few examples will suffice:

Salt of Aniline, with	Bichromate of Potash ...	*Mauve*, and Perkins' Purple.
Ditto	Bichloride of Mercury ...	*Magenta*, and other Reds.
Ditto	Bibromide of Tin	*Fuchsiacine*, &c.
Ditto	Nitric Acid	*Azaleine*, *Solferina*, &c.
Ditto	Arsenic Acid	Reds and Purples.
Ditto	Peroxide of Lead	*Roseine*.
Ditto	Manganese Salts	Pink, Red, and Purple, *Solferina*, &c.

This list might be considerably extended if there were any reason for so doing. Our purpose is answered if we have sufficiently explained the sources from which are now procured this class of charming colours, before which the boasted Tyrian, or Imperial Purple, must pale. The colour obtained from the shell-fish does not appear to have been a permanent colour; though costly, it was evanescent. The Mauve and Magenta are permanent colours. Light does not bleach them; the weaker acids do not stain them; the colour is dependent on the oxidation of the base of it, whereas, in nearly all other colours, the action of oxygen is to destroy the colour.

The power of chemistry is exemplified in this discovery, and through it physical science teaches us a remarkable truth.

Aniline is formed in the *Indigofera Anil*, or Indigo Plant, in the process of vegetation; and we find Aniline existing in the coal that has been buried myriads of ages, deep in our solid rock formations.

Every organised form is the result of the action of the solar rays. The woody structure of a plant is only formed under the influence of Light, and for every equivalent of sunshine an equivalent of wood is formed. So of the vegetable juices, and so of vegetable colours. In Nature's arcana the Great Alchemist changes Light into Colour, and from the Imponderable Powers, material forms are created, the quantity being always in exact proportion to the amount of solar influence brought into action on matter.

We may perhaps be able to render this intelligible to the unscientific reader, by taking an example from another department of science. Electricity is always developed during chemical change. The galvanic battery is merely an arrangement for taking advantage of this. A plate of zinc, when placed in water, rusts, or oxidises—taking its oxygen, to form Oxide of Zinc, from the water. For every grain of this oxide formed, an *equivalent* (an exact quantity) of water is decomposed—and an equally exact proportion of electricity is liberated. If near this zinc plate a piece of copper is placed, it collects this subtile Power; and provided we attach to each piece of metal a wire, and carry those wires into another vessel of water, holding a metal in solution—say copper—a remarkable action takes place. The electricity obtained by the oxidation of the metal, zinc, in one vessel, passes over by the wires into the other, and there it precipitates precisely the same proportion of copper as was required of zinc to develop the electricity in the first vessel.

The Sun is represented by the galvanic arrangement. In that orb matter is continually changing its form to produce Light, Heat, and other Physical forces; the connecting wires are the sun-beams, and our earth is the second vessel—or the recipient—upon which a corresponding change of matter is effected—the agencies being absorbed in producing the material effect. That "every dust is weighed in the balance," we are told by the inspired poet; and this beautiful truth is proved to the satisfaction of the human intellect by the labours of the philosopher.

By the sun-light the face of early Nature was covered with vegetable forms, and the Powers emanating from the sun were used (*expended*) in their production. The tree grew in size, and the leaves and the flowers were abundant, or otherwise, and palely or intensely coloured, according to the degree of sunshine poured upon them. Decay comes over the living forests, and they gradually change into the form which we name COAL. We dig this from the earth, and we submit it to the destructive chemistry of the gasworks. Gas is obtained; we employ it for all purposes of illumination, and there are other products left behind. The quantity of light we obtain from the gas produced by a given weight of coal is exactly the quantity of Light which was necessary to complete the growth of the plants from which the coal was formed; so that we are actually in our library, writing this brief essay, warmed by the Heat, and illuminated by the Light, which was flooded upon this earth long before it was fitted to be the abode of man. Again, the Mauve and Magenta, with their allied colours, are due to those mysterious forces which—we scarcely yet know how—give colour to Nature. They were produced in the very youth of the world, and have been stored until now in the earth's recesses.

The lady clad in Mauve or Magenta, modern though these colours be, walks abroad, into the sunshine of to-day, in tints produced by that same orb, ages before Eve, the mother of mankind, had been taught to clothe herself in the vegetable beauties of the Garden of Eden.*

THE POTATO AND ITS COMMERCIAL PRODUCTS.

BY THE EDITOR.

The potato products, and their economic uses, and the industries they evoke, are more extensive than may be generally supposed by those who have considered this tuber only as it appears in its edible form at our dinner-tables; and the preparation and application of many of its subsidiary products are not so generally known as might be desirable. Of all our root crops, none is more valuable than the potato: it furnishes nutritive food to man and beast, and is one of the most important contributions to the Old World which the discovery of the New gave.

It is considered by political economists, next to wheat, of the greatest importance as human food; leaving out of view the circumstance that, in times of scarcity, it affords food fully three months earlier than the cereal grains. As compared with wheat, its nutritive properties are comparatively low; yet one acre of potatoes gives more food for man than two acres of oats. The potash and the soda present in the potato are considered to form important elements in its adaptation to nutrition, as a source of supply of those substances to the animal economy. Approaching as it does somewhat closely in its composition to rice and the plantain, which constitute the food of large masses of the human race, the potato is yet superior to these in nutriment.

* From the 'St James's Magazine.'

In 1664, one John Forster, gentleman, of Harslop in Buckinghamshire, "invented and published (as he styles it) for the good of the poorer sorts," a pamphlet, the first devoted to the culture of the potato, and bearing this wordy title: "England's Happiness increased, or a sure and easy Remedy against all succeeding Dear Years, by a Plantation of the Roots called Potatoes, whereof (with the addition of wheat flour) excellent, good, and wholesome bread may be made every year, eight or nine months together, for half the charges as formerly. Also, by the planting of these roots, 10,000 men in England and Wales who know not how to live, or what to do to get a maintenance for their families, may of one acre of ground make 30*l.* per annum." In this treatise, besides rules for the cultivation, he gives directions for making potato bread, potato biscuits, potato pudding, potato custards, and potato cheese-cakes.

Among the anecdotes told of Sir Walter Raleigh, it is said that when his gardener at Youghal, in the county of Cork, had raised to the full maturity of "apples"—the potatoes which he had received from the Knight as a fine fruit from America,—the man brought to his master one of the apples, and asked if that were the fine fruit. Sir Walter having examined it, was, or feigned to be, so dissatisfied, that he ordered the weed to be rooted out. The gardener obeyed, and in clearng out the weeds found a bushel of potatoes.

The potato, which is an annual, represents in the tubers developed from the stem the perennial part of a plant. Like all annuals, the potato exerts its chief efforts in developing flowers and fruit, and it has the power of limiting the period of development when the extent and power of the roots are increased. The potato differs from all those plants which are cultivated for economical purposes in Europe, and can only be compared to those orchideous plants which yield salep, and are not yet cultivated among us. The tubers, both of the potato and of the salep plants, are nutritious, and agree in this, that in the cells of the tubers, grains of starch, with more or less azotised mucilage, are collected, while the cell-walls possess the remarkable property of swelling up into a jelly, and thus becoming easily digestible, when boiled with water. But, while the tuber of salep contains only one bud or germ, the potato usually develops several, often many germs. The potato plant continues to form tubers until the flowers appear, after which it is employed in ripening those already formed.

Not a portion of the potato but is subservient to the welfare and convenience of man. Its green tops are good boiled as spinach, and from its leaves and flowers Dr Latham extracted an anodyne medicine. The blossoms yield a very beautiful yellow dye. From the stems is obtained, in Austria, a soft and useful flax; and if burned, they yield a good deal of potash. The haulm or stems have often been patented as a paper-making material, and so has the fibrous pulp of the root.

In one of Evelyn's works, he remarks that the small green fruit or apples of the potato make an excellent salad. This assertion has not, however, since been verified by experience. When ripe and fermented, a good spirit and vinegar have been obtained from them. Fresh varieties of potatoes are sometimes raised from seed.

Previous to the general use of the common potato, considerable quantities of the batata, or sweet potato, were imported into England from Spain and the Canary Islands ; and this is the potato alluded to by Shakspeare and other contemporary writers. Its use is now entirely superseded here by its more hardy and palatable rival. In tropical countries, however, it is still esteemed a wholesome and pleasant vegetable. The roots, when roasted or boiled, have a sweetish mucilaginous taste, more watery and more insipid than the common potato, but wholesome and nourishing.

In Gerarde's time (1597), Virginian potatoes, as they were then called, were just beginning to be known. The sweet potato had been previously used as a kind of confection at the tables of the rich. Of these, Gerarde says, "They are used to be eaten rosted in the ashes ; some, when they be so rosted, infuse them, and sop them in wine ; and others, to give them the greater grace in eating, do boile them with prunes and so eat them ; and likewise others dress them (being first rosted) with oile, vineger, and salt, every man according to his own taste and liking ; notwithstanding, however they be dressed, they strengthen, nourish, and comfort the bodie," &c. These were sold by women, who stood about the Exchange with baskets.

The same writer says of the common potato, which for a considerable time after its introduction was a rarity, that "it was likewise a foode, as also a meate for pleasure, equall in goodnesse and wholesomenesse unto the same, being either rosted in the embers, or boiled and eaten with oile and vineger, or dressed any other way, by the hand of some cunning in cookerie." They were originally but the size of walnuts.

The kissing comfits of Falstaff were principally made of sweet potatoes and eringo roots. Potatoes were at first cultivated by very few, and were looked upon as a great delicacy. In a MS. account of the household expenses of Queen Anne, wife of James I., who died in 1618, and which is supposed to have been written in 1613, the purchase of a small quantity of potatoes is mentioned, at the price of 2s. a pound. Previously, however, to 1684, they were raised only in the gardens of the nobility and gentry ; but in that year they were planted, for the first time, in the open fields in Lancashire, a county in which they have long been very extensively grown.

Sweet potatoes are largely cultivated in some of the Southern States of America, as well as in the Bermudas and West India Islands. The principal American markets for them are the cities of New York, Philadelphia, Boston, Wilmington, Delaware, and Baltimore. There are several varieties. The State of Georgia alone raises about 8,000,000 bushels yearly. Sweet potatoes are not very popular in England ; indeed, the sweet taste given by frost to our own potatoes is not generally relished. The flavour of the sweet potato has been likened by some to beeswax and brown sugar intimately mixed.* Sweet potatoes cannot be kept through the winter in

America, unless in an atmosphere where the thermometer does not sink below 40°. If it falls below that, they chill and rot; and if the temperature rises above 60°, they will grow.

The extension of potato cultivation has been particularly rapid during the present century, not only in Great Britain and Ireland, but in Europe and North America. Potatoes are now very largely grown in France, Italy, and Germany ; and, with the exception of the Irish, the Swiss have become their greatest consumers. They were introduced into India at the close of the last century, and are now successfully cultivated in Bengal and Madras, Java, the Philippines, and China. But the potato does not thrive within the tropics, unless it be raised at an elevation of 3,000 or 4,000 feet above the level of the sea ; so that it can never come into very general use in those regions. The Swiss early grew potatoes among their mountains, and had learnt the art of drying and grinding them into flour, and making them into bread. A traveller, in 1730, relates that the miller of Untersen had scarcely anything to grind but potatoes.

The New Zealander owes his potatoes to England, and his koo-mur-ra, or sweet potato, probably also to other foreigners ; although, as Capt. Cook noticed plantations of the latter, they may have been indigenous. Potatoes are not so much used for food in the United States as in Europe ; yet the crops raised over the whole country appear to be very great, probably 150,000,000 bushels yearly. The crop there varies from 50 to 250 bushels per acre.

So rapid an extension of the taste for and the cultivation of an exotic has no parallel in the history of industry ; it has had, and will continue to have, the most powerful influence on the condition of mankind. It can be cultivated on a small as well as a large scale, is under every system of agriculture a beneficial object, and produces more nutriment, upon the same extent of ground, than any other plant cultivated in the temperate regions. It may thus be regarded as the plantain of the temperate zone. The potato now forms a great part of the food of the inhabitants of Europe, and its introduction as a supplementary crop has greatly lessened the hazards of famine.

It would not be very far wrong to estimate the consumption of potatoes in the Metropolis at 1lb. for each adult per day, which, for an adult population of 2,000,000, would give 326,000 tons used up in London yearly. There are about two millions and a half of acres under culture with potatoes in the United Kingdom. If these averaged as much as 5 tons to the acre, this would give 12,500,000 tons of potatoes as the entire annual produce. Taking the value at 3*l.* per ton, this would amount to 37,500,000*l.*; rather a large item, it must be admitted, for one root-crop. In October 1860, a Mr Wallace, of North Berwick Mains, sold all the potatoes on his farm (73 Scotch acres) at the high price of 57*l.* 10s. per acre ; so that he realised 4,197*l.* for his potato crop alone.

The comparative yield of potatoes, of course, depends much on soil, season, care in cultivation, and other points. Mr Knight, when President of the Horticultural Society, obtained, by careful experimental culture, 34 tons to the acre. In many parts of Scotland, 24 tons per acre have been raised. An American author of repute affirms, on good authority, that 4,000 bushels of potatoes have been grown in Germany on five acres of land. In the State of New York, 250 to 460 bushels of potatoes have been grown to the acre. The bushel being taken at about 64 lb., this is over 13 tons to the acre. When we find that the *average* produce in Ireland is about $7\frac{1}{4}$ tons per acre, it is evident that, under careful management, with choice selected seed, 9 tons per acre at least might be generally raised, affording a very remunerative return. Nearly 300 varieties of the potato are now grown in this country, besides many peculiar to America and the Continent.

A new variety, called the peach-blow potato, has recently been brought into notice in the United States, which combines great productiveness with excellent quality. The average yield of this variety is said to be 250 to 300 bushels per acre.

I have occasionally seen mention made of potatoes which have been grown of the gross weight of 4 lb. and upwards. No doubt, such large potatoes would gladden the sight of many an agriculturist, who prefers to convert his potatoes into flesh before he seeks a market for his industry; but they would not be readily saleable for table use. It is a mistake to seek to grow monster potatoes for such a purpose. The potato, like the turnip, the carrot, the cabbage, and the beet, to be fit for human food must be of moderate size. In form, the nearer the potato approaches the shape of the egg, and the less the number of eyes or tendencies to irregular contour, the better. It should not exceed a pound in weight, and be of a dry, mealy flavour and quality.

Instead of potatoes being lifted from the soil by the fork and hand-labour, they have now potato-digging machines in use in Scotland, which effectually scatter the potatoes above the soil, and separate the tubers from the shaws or stems. But our American brethren have been long before us in this, as in other labour-saving machines. By the year 2000, it is probable that manual labour will have utterly ceased under the sun, and the occupation of the adjective "hard-fisted" will have gone for ever. They have now, in New Hampshire, a potato-digging machine which, drawn by horses down the rows, digs the potatoes, separates them from the dirt, and loads them up into the cart, while the farmer walks alongside, whistling "Hail, Columbia," with his hands in his pockets.

The composition of the potato has often been made the subject of chemical investigation. The existence of starch in the tuber was discovered about the middle of last century. The different varieties of potatoes contain the same ingredients, but the proportions vary considerably. The proportion of water ranges from 73 to 81 per cent; of starchy fibrin, from 6 to 8 per cent.; of pure starch, from 9 to 15 per cent.; and of gum, from 3 to 4 per cent;—while small proportions of vegetable albumen, acids, and salts make up the remainder of the bulk.

Different varieties of potatoes yield, as the following table shows, very different quantities of starch.

	Starch.	Fibrous Parenchyma.	Vegetable Albumen.	Gum, Sugar, and Salts.	Water.
Red potato - - - - - -	15·0	7·0	1·4	2·2	75·0
Germinating potatoes - -	15·2	6·8	1·3	3·7	73·0
Kidney potatoes - - - -	9·1	8·8	0·8	—	81·3
Large red potatoes - - -	12·9	6·0	0·7	—	78·0
Sweet potatoes - - - -	15·1	8·2	0·8	—	74·3
Peruvian potatoes - - -	15·0	5·2	1·9	1·9	76·0
English potatoes - - - -	12·9	6·8	1·1	1·7	77·5
Parisian potatoes - - -	13·3	6·8	0·9	4·7	73·1

The following is an analysis of the potato, given by Mr Calvert :—

Water - - - - - - - -		74·00
Starch - - - - - - - -		20·00
Epidermis, cellular tissue, pectose, pectine; pectates of lime, soda, and potash - -		1·65
Albumen - - - - - - - -	1·50	
Asparagin - - - - - - -	0·12	
Fatty matter - - - - - - -	0·10	
Sugar, resin, essential oil - - - - - -	1·07	4·35
Citrate of potash; phosphates of potash, lime, magnesia, silica, and alumina; oxides of iron and manganese - - - - - - -	1·56	
		100·00

Besides its ordinary use as human food, the potato is employed in rearing live stock, and in distillation. Its fecula wanting gluten, does not undergo the panary fermentation; but it may be so mixed with wheat flour as to produce good bread, and it is applicable to other purposes of domestic economy, while the use of its starch is extending in various forms.

The results of examination on the comparative yield of starch in the potato show that, while it abounds towards the latter part of the season, it decreases when the tubers begin to germinate in the spring. It was found by M. Pfaff that 240lb. of potatoes left in the ground contained of starch,

	lb.		lb.					
In August - - -	23	to	25	or	9·6	to	10·4	per cent.
„ September -	32	„	38	„	13·3	„	16·0	„
„ October - - -	32	„	40	„	13·3	„	16·6	„
„ Nov. to March -	38	„	45	„	16·0	„	18·7	„
„ April - - -	38	„	28	„	16·0	„	11·6	„
„ May - - - -	28	„	20	„	11·6	„	8·3	„

The quantity of starch remained the same during the dormant state of winter, but decreased whenever the plant began to grow and to require a supply of nourishment.

The manufacture of starch from potatoes is carried on to a very large extent in France, not less than 27,000,000 lb. being produced there annually: from 50,000 to 60,000 tons of potatoes are used for this purpose in the neighbourhood of Paris. In this country also potato-starch has of late been manufactured in considerable quantity, and sold for food under a variety of imposing names. Some of the starch sold as Indian corn starch is usually potato-starch, with various slight additions to impart a flavour. The potato flour and English arrowroot met with in many Italian warehouses in London are the same substance.

The operations for extracting the starch from the potato are as follows:

1st. Washing the tubers.
2nd. Reducing them to a pulp, by rasping.
3rd. Pressing the pulp.
4th. Washing the rough starch.
5th. Draining and drying the produce.
6th. Bolting and storing.

1st. The washing of the tubers requires particular attention, any dirt left on them being injurious to the purity of the starch. The water itself ought to be perfectly pure and clear. An open cylinder, working in a trough into which a stream of water can be constantly pouring, is the best method of effecting it.

2nd. The rasping is accomplished by cylinders made of sheet-iron, roughed by having holes thickly punched in it from the inside, so as to form a grater. Or, if a more expensive and durable machine is required, the cylinder is furnished with iron cutters set in wood. This is placed under a hopper similar to that of a corn-mill. The cutting cylinder is made to turn rapidly—say from 600 to 900 times per minute; but the quicker this is done, the more effectual will be the separation of the starch, &c. in the tubers. The cylinder should be about 16 inches long, and 20 inches in diameter; and such a one, revolving by means of multiplying wheels 800 times per minute, will reduce 50 bushels of potatoes per hour to a perfect pulp. It may be worked either by water, steam, horse, or hand power.

3rd. The pulping being effected, it is passed through a wire sieve; and the cellular tissues, which constitute the coarser parts, are separated, and must be pressed, to extract from it what starch still remains.

4th. Water is poured on the pulp whilst passing through the sieve. This is run into vats, in which it is allowed to settle. When quite clear, the water is poured off, and a fresh supply put on.

5th. When the starch is perfectly clean, the water is finally poured off, and the starch taken out, and laid on a clean floor, where it soon becomes hardened and consolidated into a firm cake or mass.

The sixth process finishes the operation, by breaking up the mass into flour, and passing it through a bolting machine like those in a flour-mill, which prepares it for sale.

Any machinist is competent to fit up the necessary apparatus, either upon a large or small, cheap or expensive scale. No grower of potatoes to any considerable extent ought to be without this addition to his agricultural implements or machinery, especially in those parts of the country where it is difficult to dispose of a crop of unsound potatoes, and it may not be convenient to consume them by cattle or pigs. In such cases, the diseased tubers are scarcely worth the raising. The money produce of manufacturing the potatoes may be stated as follows :

	£	s.	d.
One ton of potatoes, or 2,240lb., produces, at 17 per cent., 3 cwt. 1 qr. 16lb. of starch, at 22*l.* per ton - - -	3	15	0
One cwt. of residue - - - - - - - - -	0	11	0
	£4	6	0

Against this must be charged the expense of manufacture, and the wear and tear of machinery, neither of which is at all costly, as they do not require skilled labour or complicated machines.

Were it not for the excise, the starch, when extracted, might easily be converted into sugar by a chemical process, every cwt. of starch (112lb.) producing 140lb. of sugar. This process, however, is both complicated and expensive, and would only be remunerative upon a large scale, which is not the case with the manufacture of starch, which may be performed by women in even a less expensive mode (on a small scale) than the one I have described.

The proportion of starch contained in the tubers varies from 12 to 23 or 24 per cent. ; and the average may be about 16 or 17 per cent. At the latter rate, a ton will produce 380lb. of starch. The price also varies according to the proportion between demand and supply. It is sometimes as high as 30*l.* per ton ; and in 1847, when so much was manufactured from the diseased potatoes, especially in Ireland, the price fell as low as 12*l.*: but it is seldom lower than 20*l.*, and probably from 22*l.* to 24*l.* may be reckoned as the average. It is extensively used by the cotton manufacturers in the North of England and Scotland ; and a great deal of it is sold by the grocers as arrowroot, to which it has a great resemblance.

The residue, of which about 5 per cent. remains, after being pressed and dried will keep any length of time ; but, if suffered to lie in a damp state, it very soon becomes putrid and worthless. If properly economised, it is a valuable food for cattle and pigs. When dried, the pulp is worth from 10*l.* to 12*l.* per ton. The water in which the pulp is washed contains the soluble constituents of the potato, and is used in France as liquid manure with considerable advantage, especially in the neighbourhood of Paris, where large quantities of starch are made.

Thus every particle of the healthy or even diseased potato, if properly economised, may be turned to the profit of the grower.

Mr John Towers states that—

1st. From 8lb. of *un*peeled potatoes he obtained—	lb.	oz.
Amylum, or starch - - - - - - -	1	6
Pulp, pressed by the hand - - - - -	1	11
The loss in watery or soluble matter - -	4	15

2nd. From 8lb. of peeled tubers—

Amylum, or starch	1	3
Peelings	1	5
Pulp, pressed	1	14
Loss	3	10

Thus the yield of starch was decreased by peeling; whence he inferred that potatoes should be cleaned by brushing under water, and then boiled *un*peeled—or, as we say, "in their jackets."

Pure starch of the potato, in common with Indian arrowroot, is nearly allied to sugar; and by not containing azote, or *nitrogen*, cannot nourish and support animal muscular tissue. Hence, however starch and sugar may tend to produce fat, and to sustain the respiratory processes, we cannot consider either of them calculated to build up and support the human frame.

The shoots of germinating potatoes contain a small quantity of *solanine*, an extremely poisonous substance, which constitutes the active ingredient of the deadly nightshade, another of the Solanums. The germs developed in the spring contain a very sensible quantity of this poisonous principle. The tuber itself sometimes contains a small quantity, which it readily yields to water. If germinated potatoes (with the germs remaining) are employed in the preparation of potato spirit, the residue contains so large a quantity of solanine, that cattle fed with it become paralysed in their posterior extremities. This is by no means a rare instance of the contiguity of an active poison and an amylaceous substance. In the tuber of *Arum maculatum*, for instance, from which Portland arrowroot is made, starch is associated with an acrid principle which gives it a purgative property; and in the root of the bitter cassava (*Janipha Manihot*), from which the Brazilian tapioca and cassava meal are prepared, the starch is accompanied by hydrocyanic acid. But, fortunately, the poisonous matters may always be removed by extremely simple means. They are invariably soluble with facility in water; hence the process of washing in cold water suffices for their removal.

In the West Indies and Demerara, the cassava starch is exposed to a moderate heat, when the prussic acid, which is extremely volatile, is entirely dissipated in vapour, and the concentrated watery extract, previously poisonous under the name of "cassareep," forms a condiment and seasoning of the flavour of soy, which, from its antiseptic properties, is the basis of the well-known negro mess termed "pepper-pot."

Potato starch may be known from true arrowroot by rubbing a little of it between the finger and the thumb, when it will be observed that the potato starch is softer to the *touch* and more shining to the *sight* than arrowroot. The microscope is, however, the most important agent in distinguishing the different starches from each other, and by it we can readily detect potato starch. We recognise it by the size, shape, and structure of its grains, and the numerous concentric rings visible on its surface. Though the size varies somewhat, yet on the average it exceeds that of other commercial starches, always excepting *tous les mois*, whose grains are usually rather larger. The actual size of the grains varies from $\frac{1}{800}$ to $\frac{1}{30}$ of a line in diameter. The shape of the larger particles is ovate.

The quantity of starch obtained from potatoes, as we have already shown, is subject to considerable variation. The proportion in

100 parts of the kidney potato is	28 to 32,	Dr Pearson.
" " potato, various shaws	18 " 8,	Vauquelin.
" " Champion	15 " 9	
" " Chair rouge	12 " 2	
" " L'Orpheline	24 " 2	

All starch in potatoes is confined very near the surface; the heart contains but very little nutriment. Ignorance of this fact may form a very plausible excuse for those who cut off thick parings in preparing potatoes for cooking, but none to those who know better. Circulate the injunction, "Pare thin the potato skin."

In manufactories, the maximum quantity of starch obtained rarely exceeds 18 per cent; and it deserves especial notice that frosted potatoes yield as much fecula as those which are unfrosted.

The potato may be preserved in a dry state by washing the tubers well in water, then subjecting them to the temporary action of steam, by which the skins are readily detached, and finally slicing them into thin pieces, drying them, and grinding the whole into a powder. Of this, bread may be made by an admixture of wheaten flour or oatmeal.

Three qualities of potato meal are obtained in grinding,—fine, middle, and black: 1 lb. of bran or refuse is obtained from 12 of meal.

The manufacturers of potato starch in Germany use a very simple process for determining the qualities of their potatoes. They prepare a solution of salt of a certain density, into which they throw the potatoes; all those which float are considered too watery to be profitably used in the manufacture of starch, and are rejected. By taking a number of vessels and partially filling them with solutions of salt of different densities, and then successively introducing the roots into one vessel after another, until a solution is found in which they nearly float, we can ascertain in a rough way its relative quality when compared with another root.

The potato starch, when separated from the pulp and dried, has still a peculiar rank taste, which renders it disagreeable for food. To remove this nauseous odour and taste, it is washed with a weak solution of carbonate of soda, which renders it perfectly sweet. Besides its application in the manufacture of artificial tapioca, sago, vermicelli, &c., it is also used in large quantities in print-works for thickening colours and finishing goods, and also as a substitute for wheaten starch in laundry purposes. The Glenfield Company were the first to introduce a preparation of potato farina having the advantage, when boiled with water, of forming a clear fluid which gives to net and other fine fabrics a transparent appearance, instead of an opaque one. This the Company effects by mixing with the starch a trace of sulphuric acid, which is sufficient to convert the insoluble starch into the soluble substance dextrine.

(To be continued.)

THE BEAD-TRADE OF EASTERN AFRICA.

The lucrative bead-trade of Zanzibar is now almost entirely in the hands of the Banyan capitalists, who, by buying up ships' cargoes, establish their own prices, and produce all the inconveniences of a monopoly. In laying in a stock, the traveller must not trust himself to these men, who seize the opportunity of palming off the waste and refuse of their warehouses: he is advised to ascertain, from respectable Arab merchants on their return from the interior, the varieties requisite on the line of march. Any neglect in choosing beads, besides causing daily inconvenience, might arrest an expedition on the very threshold of success: towards the end of these long African journeys, when the real work of exploration commences, want of outfit tells fatally. The bead monopolisers of Zanzibar supplied the East African Expedition with no less than nine men's loads of the cheapest white and black beads, some of which were thrown away, as no man would accept them at a gift. Finally, the utmost economy must be exercised in beads: apparently exhaustless, a large store goes but a little way; the minor purchases of a European would average ten strings or necklaces per diem, and thus a man's load rarely outlasts the fifth week. Beads, called by the Arabs kharaz, and by the Wasawahili ushanga, are yearly imported into East Africa by the ton—in quantities which excite the traveller's surprise that so little is seen of them. For centuries there has been a regular supply of these ornaments; load after load has been absorbed; but although they are by no means the most perishable of substances, and though the people, like the Indians, carry their wealth upon their persons, not a third of the population wears any considerable quantity. There are about four hundred current varieties, of which each has its peculiar name, value, and place of preference; yet, being fabricated at a distance from the spot, they lack the perpetual change necessary to render them thoroughly attractive. In Urori and Ubena, antiquated marts, now nearly neglected, there are varieties highly prized by the people. These might be imitated with advantage.

For trading purposes, a number of different kinds must be laid in: for travellers, the coral or scarlet, the pink porcelain, and the large blue glass bead, are more useful than other colours; yet, in places, even the expensive coral bead has been refused. Beads are sold in Zanzibar Island by the following weights:

16 Wakiyyah (ounces, each = 1 dollar in weight) = 1 Ratil or pound (in the plural, Artál).
3 Ratil, or 48 Wakiyyah = 1 Man (Maund).
12 Amnan (Maunds) = 1 Frasilah (35 to 36 pounds).
60 Artál (pounds) = 1 Frasilah.
20 to 22 Frasilah (according to the article purchased) = 1 Kandi (Candy).

The following are the terms known throughout the interior, but generally unintelligible at Zanzibar, where this merchandise is sold by weight:

4 Bitil (each a single length, from index tip to wrist) = 1 Khete.
10 Kete (each a double length round the throat, or round the thumb to the elbow-bone) = 1 Fundo (*i.e.* a "knot").
10 Fundo (in the plural Mafundo) = 1 Ugoyye or Ugoe.
10 Ugoyye, or 60 Fundo = 1 Miranga or Gana.

Of these measures there are local complications. In the central regions, for instance, the khete is of half size, and the fundo consists of five, not of ten khete.

Beads are purchased for the monopolisers of Zanzibar unstrung; and before visiting the country, it is necessary to measure and prepare the lengths for barter. The string, called "ut'hembwe" (in the plural "t'hembwe"), is generally made of palm-fibre, and much depends for successful selling, especially in the larger kinds of beads, upon the regularity and attractiveness of the line. It will be remembered that beads in East Africa represent the copper and smaller silver coins of European countries. It is, however, impossible to reduce the khete, the length most used in purchases, to any average; it varies from a halfpenny to threepence. The average value of the khete in Zanzibar coin is three pice, and about 100 khete are included in the man or maund. The traveller will find the bitil used as our farthing; the khete is the penny, the shukkah kaniti is the sixpence and shilling, the shukkah merkani and the fundo represent the half-crown and crown; whilst the Barsati cloth, the kitindi or coil bracelet, and the larger measures of beads, form the gold money. The following varieties are imported in extensive outfits: Nos. 1, 2, and 3 are the expensive kinds; Nos. 4, 5, and 6 are in local demand, cheap in the maritime, and valuable in the central regions; and the rest are the more ordinary sorts. All those that are round and pierced are called indifferently by the Arabs madruji, or the "drilled."

1. Sam sam (Ar.), sáme sáme (Kis.), kimara-p'hamba (food-furnishers), joho (scarlet cloth), and kifungá-mgi (town-breakers, because the women are mad for them), are the various names for the small coral bead, a scarlet enamelled upon a white ground. They are known at Zanzibar as kharaz-kartasi (paper beads), because they are sent into the country ready strung and packed in paper parcels, which ought to weigh 4 pounds each, but are generally found to vary from 8 to 10 fundo or knots. Of this bead there are fifteen several sizes, and the value of the frasilah is from 13 to 16 dollars at Zanzibar. In Unyamwezi, where the sáme sáme is in greatest demand, 1 fundo is equivalent to 1 shukkah merkani, and 6 khete to the shukkah kaniki.

2. Next in demand to the sáme sáme throughout the country, except at Ujiji, where they lose half their value, are the pink porcelain, called gulabi (the rosy), or máguru lá nzige (locust's fat). The price in Zanzibar varies from 12 to 15 dollars per frasilah.

3. The blue porcelain, called in Venice ajeriro, and in East Africa langiyo or murtuto (blue vitriol), is of three several sizes, and the best is of the lightest colour. The larger variety, called langyio mkuba, fetches at Zanzibar from 6 to 12 dollars per frasilah ; and the p'peke, or smaller, from 7 to 9 dollars. In Usagara and Unyamwezi, where from 3 to 4 fundo are equivalent to the shukkah merkani, and 1 to 2 to the shukkah kaniki, it is used for minor purchases, where the sáme sáme would be too valuable. It is little prized in other parts, and between Unyamwezi and Ujiji it falls to the low level of the white porcelain.

4. A local variety current from Msene to the Tanganyika Lake—where, in the heavier dealings, as the purchase of slaves and ivory, a few strings are always required to cap the bargain—is called mzizima, mutunda, falghami, and jelabi, the ringed perle of Germany. It is a large flat bead of glass ; the khete contains about 150, and each item acts as a copper coin. The mzizima is of two varieties ; the more common is a dark blue, the other is of a whitish and opaline tint. At Zanzibar the frasilah costs from 7 to 9 dollars. In Unyamwezi 3 fundo are equivalent to 1 shukkah merkani, and 1 fundo to 1 shukkah kaniki.

5. Another local variety is the balghami mkuba, popularly called sungomaji, a bead made at Nuremberg. It is a porcelain, about the size of a pigeon's egg, and of two colours, white and light blue. The sungomaji, attached to a thin cord or twine, is worn, singly or in numbers, as an ornament round the neck, and the people complain that the polish soon wears off. At Zanzibar, the price per 1,000 is from 15 to 20 dollars ; but it is expected to decline to 10 dollars. This bead is useful in purchasing ivory in Ugogo and Unyamwezi, and in hiring boats at Ujiji. Its relative value to cloth is 19 per shukkah merkani, and 15 per shukkah kaniki.

6. The sofi, called in Italian cannettore, resembles bits of broken pipe-stems, about two-thirds of an inch in length. It is of various colours—white, brick-red, and black. Each bead is termed masan, and is used like pice in India : of these, the khete (string) contains from 55 to 60. The price varies at Zanzibar from 2 to 3 dollars per frasilah : in the interior, however, the value greatly increases, on account of insufficient importation. This bead, in 1858, was in great demand throughout Usagara, Unyamwezi, and the western region, where it was as valuable as the sáme sáme. Having neglected to lay in a store at Zanzibar, the East African Expedition was compelled to exchange cloth for it at Msene and Ujiji, giving 1 shukkah merkani for 30 to 35 khete, and 1 shukkah kaniki for 15 to 25. In Ujiji, however, many of the purchases were rejected, because the bits had become small by wear, or had been chipped off by use.

7. The staple of commerce is a porcelain bead, of various colours, known in Zanzibar by the generic name of Láfizi. There are three principal kinds. The khanyera or ushanga wampa (white beads) are common throughout the country. The average value at Zanzibar is 6 dollars per frasilah : in Unyamwezi, 4 fundo were equivalent to the shukkah merkani, and 2 to 3 to the kaniti ; but the people, glutted with this bead (as many as 20,000

strings were supplied to the East African Expedition by the Banyans of Zanzibar), preferred 1 khete of sáme sáme to 3 of khanyera. The kidunduguru is a dull brick-red bead, worth at Zanzibar from 5 to 7 dollars per frasilah, but little prized in the interior, where it is derisively termed khanyera ya mk'hundu. Another red variety of Láfizi is called merkani ; it is finely made to resemble the sáme sáme, and costs from 7 to 11 dollars per frasilah. Of this bead there are four several subdivisions. The uzanzawirá or samuli (glue-coloured) is a bright yellow porcelain, worth at Zanzibar from 7 to 9 dollars per frasilah. It is in demand throughout Chhaga and the Masai country, but is rarely seen on the central line.

8. The sukoli, an orange-coloured or rhubarb-tinted porcelain, which average at Zanzibar from 7 to 9 dollars. They are prized in Usagara and Ugogo, but are little worn in other places.

9. The nili (green) or ukiti wa muazi coco-leaves are little beads of transparent green glass ; they are of three sizes, the smallest of which is called kikiti. The Zanzibar price is from 6 to 11 dollars. In Ujiji they are highly valued, and are readily taken in small quantities throughout the central line.

11. The lungenya or lak'hio is a coarse red porcelain, valued at 5 to 6 dollars in Zanzibar, and now principally exported to Uruwwa and the innermost regions of Central Africa.

12. The bubu (ububu ?), also called ukumwi and usthanga ya vipande, are black Venetians, dull dark porcelain, ranging at Zanzibar from 5 to 7 dollars. They are of fourteen sizes—large, medium, and small ; the latter are the most valued. These beads are taken by the Wazaramo. In East Usazara and Unyamwezi they are are called khuni, or firewood; nor will they be received in barter, except when they excite a temporary caprice.

The other beads, occasionally met with, are the sanketi, ovals of white or garnet-red, prized in Khutu ; choroko or mágiyo, dull-green porcelains ; undriyo maupe (?), mauve-coloured, round or oval ; undriyo mausi (?), dark lavender ; asinani, sky-coloured glass ; and pusange, blue Bohemian glass beads, cut into facets. The people of the coast also patronise a variety of large fancy articles, flowered, shelled, and otherwise ornamented : these, however, rarely find their way into the interior.—(' Burton's Lake Regions of Central Africa.')

THE ORDEAL ROOT OF GOUMBI.

BY PAUL B. DU CHAILLU.

The *mboundou* is an intoxicating poison, which is believed by the people of Goumbi, Gaboon river, to confer on the drinker, if it do not kill him, the power of divination. It is much used in all this part of the country to try persons accused of witchcraft. A poor fellow is supposed to have bewitched his neighbour or the king, and he is forced to drink mboundou to establish his innocence. If the man dies, he is declared a witch ; if he survives, he is innocent. This ordeal is much dreaded by the negroes, who often run away from home, and stay away all their lives, rather than submit to it. The doctors have the reputation of being unharmed by the mboundou (and I am bound to admit that Olanga drank it without serious consequences). Nevertheless, it is a deadly and speedy poison. I have seen it administered, and have seen the poor drinker fall down dead, with blood gushing from his mouth, eyes, and nose, in five minutes after taking the dose. I was told by a native friend that, sometimes, when the mboundou-drinker is really hated, the dose is strengthened secretly ; and this was the case, I suppose, in those instances where I saw it prove fatal. I have also been assured by negroes that sometimes the veins of the person who drinks it burst open.

This time I overlooked the whole operation. Several of the natives took the root and scraped it into a bowl : to this a pint of water was poured. In about a minute, fermentation took place. The ebullition looked very much like that of champagne when poured into a glass. The water then took the reddish colour of the cuticle of the mboundou root. When the fermentation subsided, the victim was called by his friends. The drinker is not permitted to be present at the preparation of the mboundou, but he may send two friends to see that all is fair.

When he came, he emptied the bowl at a draught. In about five minutes the poison took effect. He began to stagger about ; his eyes became bloodshot ; his limbs twitched convulsively ; his speech grew thick ; and other important symptoms showed themselves, which are considered as a sign that the poison will not be fatal. A frequent and involuntary discharge of the urine is the surest indication that the mboundou will have no fatal effect, as it proved in this case ; otherwise it is generally followed by death. The very words employed by the men when any one drinks the poison, seem to imply what are its usual consequences. This man's whole behaviour was that of a drunken man. He began to babble wildly, and now it was supposed that the inspiration was upon him. Immediately they began to ask him whether any man was trying to bewitch Quengueza. This question was repeated several times ; at last he said, "Yes, some one was trying to bewitch the king." Then came the query, "Who ?" But by this time the poor fellow was fortunately hopelessly tipsy, and incapable of reasonable speech. He babbled some unintelligible jargon, and presently the palaver was declared over.

While he was being questioned, about one hundred people sat around with sticks in their hands. These they beat regularly upon the ground, and sung in a monotone,

"If he is a witch, let the mboundou kill him :
If he is not, let the mboundou go out."

The whole ceremony lasted about half an hour ; and when it was over, the people dispersed, and the person who had drunk the potion, by that time partially recovered, lay down to sleep.

I gave to Professor Torrey, of New York, some of the leaves and root of this remarkable plant for chemical analysis, and insert here the note in which he communicates his opinion as to its properties and chemical affinities :

96 St Mark's Place, New York, Nov. 27, 1860.

MY DEAR SIR,—The leaf and root of the mboundou which you placed in my hands for examination are insufficient materials for determining with certainty the plant to which they belong. From the intensely poisonous quality of the root, and the symptoms which result from its administration, there can be little doubt that the active principle is a vegeto-alkali belonging to the Strychnine group. Under a powerful glass I have not been able to detect any crystalline salt in the bark. The taste of the infusion is extremely bitter. The ligneous portion of the bark (?) is much less active, is very hard, and from the numerous annual rings, it must be of very slow growth.

The mboundou certainly belongs to a natural order that contains many venomous plants—viz., the *Loganiaceæ ;* and from the peculiar veining of the leaves, it is probably a species of *Strychnos,* belonging to that section of the genus which includes *S. nux vomica.*

Yours truly, JOHN TORREY.

MONKEY BREAD NUTS, OR FRUIT OF THE BAOBAB.

BY THOMAS D. ROCK.

Those hardy and self-denying pioneers of African civilisation, who, by their writings, have furnished us with such rich stores of information concerning the countries and customs of the Negro, have likewise enlarged our knowledge of many natural productions of great technological interest and importance.

The Monkey Bread Nut is not by any means a novelty amongst scientific men ; but I apprehend that to the general public a particular account of this fruit will prove both acceptable and useful, more especially as I am induced to believe that, sooner or later, it will become a regular article of British commerce.

Drs Barth, Baikie, and Livingstone, of African notoriety, as well as Dr Bennett in his Australian 'Gatherings,' have supplied me with such copious details respecting this singular product of African and (as it now appears) Australian vegetation, that my work is rather an affair of compilation than composition ; although I hope to include some observations of my own, on nuts in my collection of natural products, which may perhaps add to the completeness of this paper.

The trees producing these nuts are distinguished by a variety of popular names, all, more or less, indicative of some of their striking peculiarities; as,

Baobab Tree,
Ethiopian Sour Gourd,
Cream of Tartar Tree,
Corn Tree (Hughes),
Monkey Bread Tree,
African or Monkey Tamarind Tree, &c. &c.

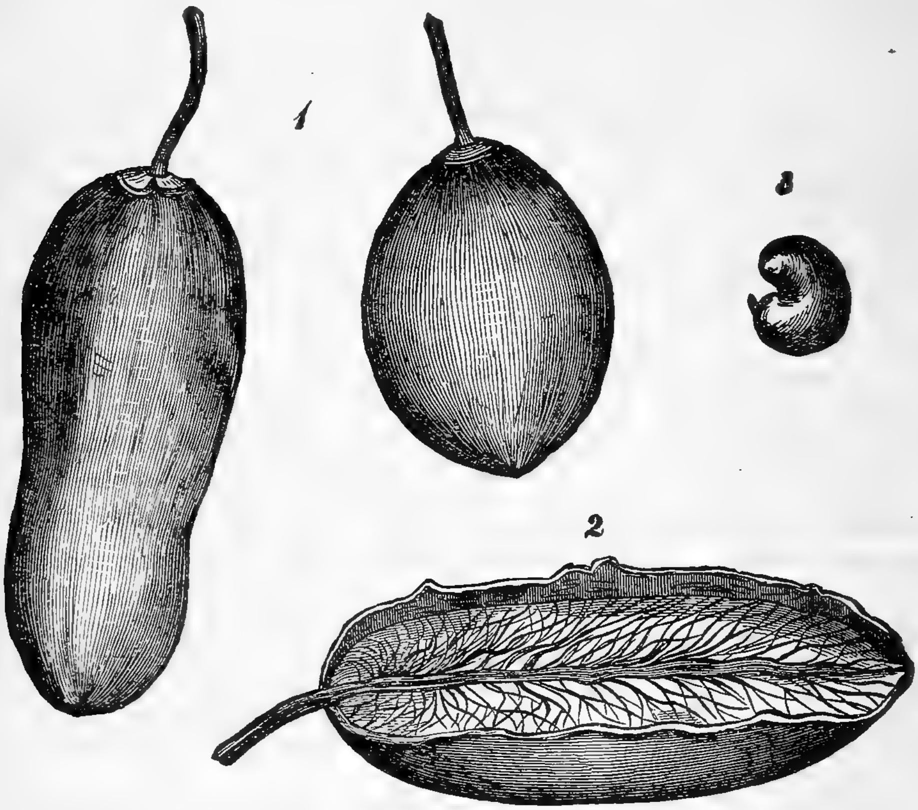
They belong to the Natural Order Sterculiaceæ, and to Class Monadelphia, Order Polyandria, of the Linnæan system, and only two distinct species are known to exist,—*Adansonia digitata*, indigenous to Africa and the West Indies, and *Adansonia Gregorii*, indigenous to Australia.

The chief external feature of the Baobab trees is their great size; a fact strongly noticed by all travellers and botanists, and embodied in their descriptive accounts; as, "Vegetable monster" (Bennett)—"Behemoth of the forest" (Gilpin)—"A tree of large dimensions" (Adanson)—"Largest tree in the world" (Paxton)—"Gigantic Baobab" (Baikie)—&c. &c. They are not tall and towering trees, but short and spreading like the oak, and throw out branches at heights varying from ten to twenty feet, or thereabouts. In girth they are enormous; to illustrate which I have arranged the following table of some notable specimens.

Name of Traveller, &c.	Height from Ground.	Circumference.
Baikie	3 feet	30 feet
"	18 "	80 "
Livingstone	3 "	85 "
Paxton		90 "
Bennett	2 "	85 "
	26 feet	370 feet
Average, say	6 feet	74 feet

Livingstone mentions spending a night near one of these trees, which was hollow, and capable of accommodating twenty men, and had formerly been used as a habitation.

Baobab trees appear to be not the less remarkable in their internal characteristics; for Livingstone asserts that nothing short of boiling the tree in sea-water could possibly destroy its vitality. Constantly barked by the natives of Africa, the tree nevertheless retains its full vigour, and a removal of the very core or centre of the stem would not, according to that traveller, affect the existence of the tree; and "the reason is," to quote his own words, "that each of the laminæ possesses its own independent vitality; in fact, the Baobab is rather a gigantic bulb run up to seed than a tree." Unlike most of the vegetation which adorns the warm regions of the earth, these trees are deciduous in habit, being sometimes quite bare of foliage, and in Australia, at least, serve to remind the colonist of those wintry scenes in the old country which it may never be his lot again to behold. Some trees discovered by Adanson were supposed by that traveller to have existed coeval with the Flood ; a rather improbable story, even for a tree so tenacious of life as the Baobab.



1.—Nuts of *Adansonia digitata* (about $\frac{1}{16}$th of real size).
2.—Half Section of Nut.
3.—Seed, full size.

It is difficult to fix the precise localities in Africa where the Monkey Bread trees are principally found, but they are perhaps most profusely distributed in the western and central parts of that continent. The West Indies, Cape de Verde, and possibly other islands in the Atlantic, also possess the Baobab trees; whilst North-West Australia has an abundant store. Dr Baikie remarks that these trees are found mainly in the neighbourhood of towns and villages; an observation which he had confirmed by the experience of Dr Crowther in the Yoruba country.

I have now to notice the nut which is produced by these giant trees, and to which I desire more especially to direct the attention of readers of the TECHNOLOGIST. This fruit is borne in greater or less profusion, according to the nature of the soil on which the trees are found. A moist situation appears most favourable for the production of large nuts, whilst a dry soil increases the quantity, but greatly diminishes the size and affects the quality of the fruit. The nuts vary both in shape and dimensions ; some are nearly globular, or like a cocoa nut; the majority, however, being of an oblong form, from nine to twelve inches in length, and about four inches in diameter. They are pendulous, the penduncle in the African species being long, in some cases no less than twelve or eighteen inches, whilst in the Australian variety it is very short, this variation in the length of the peduncle constituting the sole difference between the fruit of the two species.

The shell of the nut is brittle, but moderately hard, and about $\frac{3}{16}$ or a quarter of an inch thick, covered externally with a soft rind or epidermis of a dingy green colour. It contains a number of pulpy carpella, or compartments, separated from each other by partitions of reticulated fibre, and arranged round an imaginary axis, similar to the fruit of the orange. In these pulpy layers, small kidney-shaped seeds are imbedded, two or more in each compartment. The pulp is of a pale cream colour, and of a porous nature; it is both farinaceous and mucilaginous in quality, and possesses a delicate acid flavour somewhat resembling cream of tartar, which is very pleasant to the palate. It is highly appreciated by the natives of Africa for its grateful and cooling properties, and is esteemed by them even as a luxury, the wealthier natives eating it in combination with sugar. The Australian aborigines likewise use the pulp as an article of food. The mucilaginous and acetous qualities of this fruit are found to be very serviceable in treating the putrid fevers so common to Africa; a cooling drink, formed from the expressed juice of the pulp, and sweetened with sugar, being the form in which it is administered. In Jamaica both the pulp and rind or shell of the fruit are employed medicinally, though in what form I am unable to say. An excellent soap is made in Africa from the ashes of the shell mixed with palm oil.

A moderate traffic in Monkey Bread nuts has existed amongst the Africans probably for many centuries, but I can find no account of their value in any of the travels recently published. Dr Baikie purchased forty or fifty good nuts for about the value of a shilling; but even this apparently low price was most likely far beyond their legitimate value. The pulp dried and powdered is to be found, I understand, in the markets of Egypt, and more particularly at Cairo, where it is sold under the title of Lemnian earth. (?) In the island of Jamaica, where the Baobab trees are not very abundant, the nuts are occasionally exposed for sale in the markets at Kingston and elsewhere, the usual price being 1½d. for each nut.

The practical observations I have to offer, as suggested by the foregoing account of the Monkey Bread fruit, will be necessarily brief. If once fairly introduced into the English market, I feel persuaded the nut would soon become a favourite table fruit with all classes. So delicate and pleasant is the flavour of the pulp, that even little children once tasting it apply for more, as I have tested on more than one occasion. The nut is also well worthy of attention for its medicinal properties. Most of us know the value of a mucilaginous and acid drink in fevers of all kinds, and barley-water flavoured with lemon-juice is an old specific that might fairly be set aside for the introduction of its African rival, in which great virtue must undoubtedly reside, if it really acts as a remedy and alleviant in the putrid fevers of that unhealthy climate. The subject is at least worthy of receiving some notice from our eminent pharmaceutical chemists. It is also quite possible that the mucilaginous and acid properties of this fruit might be found useful in the flavouring of soups, sauces, and other culinary preparations. When required for the table, the nuts would naturally be imported just as gathered from the tree; but for other economical purposes, it might be well to have the juice expressed from the fresh fruit on the spot, or the pulp dried and pulverised, as experience would dictate to those engaged in the traffic.

Other parts of the Baobab tree have economic uses; but I have purposely avoided any allusion to them in this paper, to avoid confusion.

NOTICE OF ECONOMIC PRODUCTS EXHIBITED AT IRONMONGERS' HALL.

BY T. D. ROCK.

Public feasting, like public fasting, is decidedly on the wane, and men of intelligence are beginning to discover the many sources of pleasure and profit which are far more really enjoyable than the gross indulgences of a dinner-table. Even our public corporations, always famous for their hospitable cheer, are awaking to a manly sense of shame that so much valuable time and money should be squandered over a meal; and the admirable example recently afforded by the Ancient and Honourable Ironmongers' Company is so well deserving of praise and worthy of imitation, that we most sincerely hope the other corporate bodies of this vast city will follow suit, and spend some portion at least of their inexhaustible wealth in a similar manner, so as to earn the thanks and intelligent approval of their fellow-citizens.

Many of the readers of the Technologist, doubtless, had an opportunity afforded them, by the liberal courtesy of the Ironmongers' Company, of inspecting the rich, varied, and *recherché* collection of Antiquities collected in the early part of last month at the Hall of the Company in Fenchurch street, on the occasion of a grand Conversazione, and which was afterwards thrown open to public admission by members' tickets for three consecutive days. So rare a concentration of antique valuables was, perhaps, never before seen under one roof. Contributors from all parts of the country lent their treasures for the occasion, amongst whom the members of the Company themselves figured prominently, including Sir C. Price, Messrs. Slade, Howard, Penn, Baily, S. W. Silver, Tatham, Pellatt, &c.; whilst even our Gracious Sovereign and her Royal Consort helped to swell this triumph of mind over matter: and so numerous were the articles exhibited, that a mere descriptive enumeration would alone fill a moderate-sized volume.

As we wandered from room to room, glancing hastily at the dazzling splendours of the olden time, in the shape of gold and silver plate, ivory carvings, weapons of warfare, jewels, &c., our eyes, now and then, alighted upon certain articles, or series of articles, having decided attractions for the Technologist; and a few of these specimens we think it desirable to notice.

The mineral kingdom was represented by some of the rarer metals, as platinum, aluminum, Titanic iron, &c. A case of aluminum, exhibited by Messrs. Bell, Bros., was notable in the extreme; it included aluminum in the ore (cryolite), also in the form of bars, wire and sheets, and likewise in conjunction with copper as an alloy; but the more remarkable feature of the case was a splendid helmet in aluminum of an antique pattern.

Platinum in all its stages, native and manufactured, and neatly arranged, was shown by the eminent assayists, Messrs Johnston and Matthey; and the visitors were thus enabled at one view to comprehend the great chemical and electrical value of this metal.

Messrs Mosely and Son contributed samples of Taranaki (New Zealand) sand, or Titanic iron ore, with specimens of the steel and splendid cutlery produced therefrom. Swedish iron in its various qualities, and the process of copper urn-making in all its stages, from the round flat plate of copper to the finished article, must complete our brief category of the mineral specimens.

Vegetable substances were very sparingly represented, with the exception of a large table full of articles made from ebonite, the prepared india-rubber of Messrs Silver. Submarine and other insulated telegraph cables, batteries, baths, pencil-cases, knife-handles, bracelets, and a host of other manufactures, all bore their silent yet significant testimony to the suitability of this excellent material for an infinite variety of purposes in the arts. We must also mention one large and solid slab of ebonite, 8 feet × 3 feet × $\frac{1}{4}$ inch in thickness.

The animal products included a magnificent display of corals (corallium rubrum), and a variety of horns, ivory carvings, &c. The corals were especially deserving of attention, so rich was the display, and so chaste and elegant were the ornaments manufactured therefrom. Red, pink, and white coral were to be seen in most agreeable contrast.

Not less remarkable and attractive to the Technologist, were two splendid vases of rhinoceros horn, elegantly and elaborately carved; their pleasing and yellow translucency contrasting favourably with the black buffalo horn stands on which they were mounted. Neither must we omit to mention a singular and rather formidable collar of monkeys' teeth, as worn by the Peruvian Indians in time of war; and, as far as we can judge, a very apt emblem of strife. To show the teeth, or gnash with the teeth, are common emblematical expressions of rage; and in selecting the teeth of the chattering monkeys, the natives of Pizarro's Conquest have chosen those of an animal which, above all other bipeds or quadrupeds, exhibits its teeth to its enemies, and sometimes to its friends. If the exhibition of this collar was intended to convey a moral to the friends of the Ironmongers' Company, we should suppose that, having decided to abolish the habit of high feeding, these teeth were prominently brought forward to prove that, for the future, the masticatory organs of the members would

> "Hang
> Quite out of fashion, like a rusty mail,
> In monumental mockery."—*Troilus and Cressida.*

SCIENTIFIC NOTES.

New Use of Bark—Cheap Blasting-Powder.—A patent has been taken out in Belgium for a simple method of making blasting-powder from spent tan bark. It is said that while the price of this powder is less than that of gunpowder, it takes but one-seventeenth part as much to produce the same effect. It is composed of $52\frac{1}{2}$ lb. of waste tan bark, and 20 lb. of pulverised sulphur. The nitrate of soda is dissolved in a sufficient quantity of boiling water, and the tan bark added in a manner to completely impregnate it with the solution, after which the sulphur is added in the same way. The mixture is taken from the fire and thoroughly dried, when it is ready for use. If it is wet, it does not permanently injure it, but on being dried again is as good as ever. If fired in the open air, it causes no explosion, but is very efficient for blasting when confined in the usual manner. It is not suitable for use in guns or cannon.

A New Canadian Dye.—Professor Lawson exhibited specimens of a dye of great richness, prepared in the laboratory of Queen's College, Kingston (Canada), from an insect, a species of *Coccus*, found for the first time last summer on a tree of the common black spruce (*Abies nigra*, Poir.) in the neighbourhood of Kingston. This new dye closely resembles true cochineal, a most expensive colouring matter, capable of being produced in warm countries only, and which is used to give a fine and permanent dye, in red, crimson, and scarlets, to wool and silk. Unlike cochineal, the new dye discovered at Kingston is a native Canadian product, capable of being produced in temperate countries, having been but recently observed. A sufficient quantity has not yet been obtained for a complete series of experiments as to its nature and uses; but the habits of the insect, as well as the properties of the dye, seem to indicate that it may become of practical importance. In colour it closely resembles ordinary cochineal, having rather more the scarlet hue of the flowers of *Adonis autumnalis*; and, no doubt, other shades will be obtained. The true Mexican cochineal is now being cultivated in Teneriffe, and other vine-growing countries of Europe and Africa, with such success as to displace the culture of the grape-vine; yet the Directors of the East India Company offered in vain 2,000*l.* for its introduction into India.—*Proceedings of Botanical Society of Canada.*

THE TECHNOLOGIST.

THE TUSSEH SILK-MOTH.

ANTHERÆA PAPHIA, *Hübner*.
ANTHERÆA MYLITTA, *Hübner*.
ATTACUS MYLITTA, *Blanchard*.
SATURNIA MYLITTA, *Westwood*.

One of the earliest notices of the insect which produces the *Tusseh* silk of India was given by Rumphius. Later it is noticed by Dr Roxburgh, who states that it is the *Bughy* of the natives of the Burbhoom hills, where the silk which the same people call *Tusseh* is manufactured. The Tusseh moth is said to be a native of Bengal, Bahar, Assam, &c., and feeds upon the leaves of the Byer (*Rhamnus jujuba*) and the Asseen (*Terminalia alata glabra*, Roxb.). "They are found in such abundance over many parts of Bengal and the adjoining provinces, as to have afforded to the natives, from time immemorial, an abundant supply of a most durable, coarse, dark-coloured silk, commonly called Tusseh silk, which is woven into a kind of cloth called Tusseh dhooties, much worn by Brahmins and other sects of Hindoos." Atkinson states that this species cannot be domesticated. The hill-people say that they go into the jungles, and under the Byer and Asseen trees they find the excrement of the insect; on which they examine the tree, and, on discovering the small worms, they cut off branches of the tree sufficient for their purpose, with the young brood upon them: these they carry to convenient situations near their houses, and distribute the branches on the Asseen tree in proportion to the size thereof; but they put none on the Byer tree. The Pariahs, or hill-people, guard the insects night and day, while in the worm state, to preserve them from crows and other birds by day, and from bats by night. It is very abundant in the Bhaugulpore district, where the cocoons in their proper seasons are collected by cartloads for the manufacture of the *Bhaugulpore* or *Tusseh silk*. Col. Sykes is of opinion that this is the *Kolisurra* silkworm of the Deccan. The cocoons are extensively used by matchlock-men, cut into thongs, as ligatures for binding the matchlock barrel to the stock. The thongs are more durable than those of leather.

According to Lady Isabella Gilbert, "Tusseh moths are hatched twice in the year, in May and August. The larvæ go into the chrysalis state in

September, remaining so till the May following; whilst those that enter the chrysalis state in July, come out in three weeks. Many of the females lay eggs in eight or ten hours after quitting the chrysalis; others, again, do not until the following night, or longer. In ten days the young larvæ make their appearance, and feed on the Asseen and Saul trees. In about three weeks from the time of their exclusion from the egg, they attain their full size, and in eight or ten days more prepare for their transformation into the chrysalis. The caterpillar commences its operations by drawing a few leaves slightly together, as if to screen it from observation. It then spins a strong cord composed of many threads, altogether about the thickness of a crow-quill, at the end of which it weaves the cocoon. This is so transparent for the first six-and-thirty hours, that the larva may be distinctly perceived at work in the interior. After that time, the cocoon gradually acquires consistence by the continued industry of the caterpillar, and becomes quite opaque from the addition of a glutinous liquid with which it moistens the whole. When that dries, the cocoon appears as if covered with white powder, and in the course of a couple of days becomes perfectly hard. The moth generally deposits its eggs within a few yards of the cocoon: these the villagers collect and keep in their houses till the young caterpillars come forth, when they are placed on the Asseen trees in the jungles, the proprietors remaining to protect them from the birds, and to bring home the cocoons when perfect. The people who rear these silkworms are of the Sontal and Bhouree castes, and practise many superstitious ceremonies while tending them in the jungles.

From the experiments of M. Perottet of Pondicherry, it would appear that the statement that this moth cannot be domesticated is fabulous, as he succeeded in inducing it to breed in a state of captivity, and obtained sound and productive eggs. He managed, during a year of abundant rain, and when there was a continued damp atmosphere, to obtain four generations of these worms during the year. M. Perottet forwarded to France living cocoons of this species, and several generations were reared there, being fed on the leaves of the common oak, which were greedily eaten by them. During the early part of 1859 he sent five different despatches of living cocoons of this worm to France, which arrived safely and were doing well.

The cocoons found upon the *Terminalia* are always considered stoutest and strongest, while those on the *Jujube* are the weakest. Fifty cocoons obtained from the former tree will weigh one French pound. These cocoons are exceedingly rich in silk; they reel by means of an alkali or any other solvent with great facility, and to the very end. The silk they produce is very elastic and of singular brilliancy, but dark in colour.

There has been some discussion as to the distribution of this species of moth in India; the difficulties having arisen mainly from the existence of other and allied species in Darjeeling and other remote localities. A true species of Tusseh moth has been found sparingly in the Deyrah Doon, and named *Antheræa Sivalensis.*

The Darjeeling species are *Antheræa Frithi*, Moore; *Antheræa Helferi*, Moore; and *Antheræa Roylei*, Moore. These new species were exhibited at the Exposition Universelle at Paris, in 1855.

The larva and cocoon figured on the plate are from the drawings of Lady Isabella Gilbert. The moth is figured from specimens in the South Kensington Museum.

M. C. C.

THE VEGETABLE PRODUCTS OF SIAM.

BY SIR ROBERT H. SCHOMBURGK, K.C.H., BRITISH CONSUL-GENERAL OF SIAM.

The vegetable productions of a country of such vast extent as Siam, lying under the tropics and favoured by periodical rains, are very numerous. Rice, sugar, and pepper are, however, the staple articles; the first serving not only for home consumption, but a large quantity is exported to China. Several varieties of rice are raised; some account as many as forty, but four species are principally cultivated: namely, the common rice, of a white colour, much resembling the rice of Carolina; the mountain-rice; the glutinous, and the red rice. The first kind is mostly exported.

Rice has hitherto been the principal export from Siam: in 1858 not less than 100,000 tons were exported, principally to China. It is grown over the whole plain of Siam. About the end of June, when the water is rising up the country, the ground is prepared and planted. Na-muang rice is sown broadcast in the paddy-fields, and not transplanted, and is much superior to the Na-suen, having a longer and better grain, and being less liable to get broken. The white rice is prepared by pounding it, in the same manner as in China. A small quantity of Pulat rice is also grown, and is occasionally shipped to Singapore.

Next to rice, sugar is the largest article of export from Siam. Nachonyhaisi and Petrio are the principal sugar districts; but it is also produced at Paklat, Bangpasoi, Chantibon, and Petchaburi, in considerable quantities. The owners of the mills seldom cultivate the canes themselves, but purchase it standing in the fields from the growers, who have usually money advanced to them by the mill-owners at the commencement of the season, to enable them to plant on their ground; they in return being bound to sell all their cane at a fixed price to the person lending the money, besides paying interest at the usual rate.

The cultivation of the sugar-cane has greatly increased. It is mostly in the hands of the Chinese. The extraction of the juice of the cane and its manufacture into sugar are carried on in a very primitive manner, without any of the modern improvements, to obtain from the cane the largest possible quantity of a superior quality of sugar. I have seen samples of sugar from Nakhon-Yaisi which left nothing to desire, either as regarded grain or appearance; but this is only an instance, while other districts produce a quality very inferior. The greatest quantity of sugar is made in the neighbourhood of Bangkok and the adjacent provinces, to where the tidal waters extend. Here irrigation, in cases of drought, may be carried on, with the greatest convenience; and, were there sufficient labouring hands to attend to its cultivation, ten times the quantity of sugar now produced might be raised in those localities to which the tidal waters extend, setting aside other places appropriate for its cultivation.*

With better machinery, the manufacture of sugar in Siam might be greatly improved. White or clayed sugar, red unclayed, and yellow, are the three descriptions brought to market. The yellow sugar is always deficient in grain; most of it comes from up the country, and from Chantibon: it seems to be a peculiar description of sugar, and the Chinese manufacturers say they are unable to grain it; it is usually pretty dry.

Palm-sugar is manufactured to a considerable amount at Pitchaburé; but it is all consumed in the country. This is not the same as the date-sugar known in Europe.

The best sugar is procurable in March and April; that which is made in the two following months is mostly from the second boiling, and is much lower in quality. The quantity produced during each of the two seasons 1857 and 1858 is supposed to have been about 100,000 piculs (of $133\frac{1}{3}$ lb.) of white, and the same quantity of red and yellow together. The yellow sugar generally costs a little more than the red.

Amongst the woods which are used for architecture or the construction of ships, the teak-wood stands prominently forward. The tree is known to botanists under the name of *Tectona grandis*, and is confined to only a few localities. It is considered the strongest and most durable timber of India, or perhaps even in the world, the greenheart of Guiana only vieing with it. In Siam it has not been found in large quantities south of latitude 16° North. The greatest supply to the Bangkok market arrives from the province of Sangkalock, the capital of which, bearing the same name, is placed in Sir John Bowring's map in latitude 18° 30′ North.

Large forests of teak exist on the Burmese boundaries. The logs, when dry enough to float, are made into rafts and floated down the rivers to Bangkok, where they are usually sawn up. The most suitable form for exportation is planks five inches in thickness. The supply has almost entirely ceased, owing to the high prices and scarceness of wood. The tree is now fully 50 per cent. higher than it was in former years.

A number of woods, the produce of the forests in the interior of Siam, might become of importance, were their qualities for naval or civil

* As far as I have been able to judge, from what I have hitherto seen of the coast regions of Siam, they strongly resemble those of British Guiana, one of the greatest sugar-producing colonies of the British possessions in the New World.

architecture, or as woods proper for ornamental purposes, sufficiently known. I would mention, amongst others, the Takieng, which, as far as regards size and quality, might become a rival to the teakwood, possessing, moreover, the great advantage that it may be easily bent by artificial means. Very little is known of the tree which produces the Takieng, and I think it deserves a closer examination, how far it might be profitably employed for naval architecture. I have seen, at the building sheds of the first king, a log of that wood, which was being prepared for the construction of a war-canoe, measuring 135 feet, perfectly sound and without a flaw. This wood is brought from the south-eastern provinces, and generally used for planking the bottoms of ships. It ought likewise to be stated, that trees belonging to the Pine genus are not uncommon, principally on the eastern coast of the Gulf of Siam, which might furnish liquid bitumen for the preparation of pitch or tar.

Of ornamental woods, useful for cabinet-makers and joiners, the following form already articles of export: namely, rosewood, ebony, satin-wood, krachi, and a number of others. The spontaneous produce of the forests are entirely unknown to cabinet-makers, although their colour and suitableness to receive a high polish would render them valuable additions to the articles of export.*

Rosewood is brought from the west coast of the Gulf of Siam: the grain is not so close as South American wood generally. A large quantity is exported yearly to Shanghai and other Chinese ports. The quality of the Siamese ebony is said to be not very superior: a little is exported every year by the junks. A small quantity of satin-wood is shipped to China. None of a large size can be obtained. It is brought from the east coast of the Gulf.

The bamboo furnishes an excellent material, in its outer bark, for the manufacture of furniture. The first king, in his saloon near the aviary, has a set of chairs made of it, very nice in appearance.

Amongst dye-woods, the principal is the sapan (*Cæsalpinia Sappan*), of which large quantities are exported. It is the spontaneous produce of the forests of the northern provinces of Siam and the frontier hills dividing that country from Tenasserim. It has been asserted that the roots of this tree afford the dyeing matter in a much larger quantity than either the trunk or the branches.

There are enormous forests of this wood in the upper parts of the country, and down the west coast of the Gulf of Siam. The greater part of the supplies brought to Bangkok comes from Soupan and Bang Chang, also from the west coast of the Gulf. From various places up the country a considerable quantity of block sapan-wood has been floated down the river. It has, however, only had the bark and a small portion of the

* A collection of walking-sticks made of indigenous woods of Siam was given to me as a present. The native names of these woods are—samchsan, krapi kao, quai khanrad, praduket, marit, chin-chun (or rosewood), phra-ya-ya, mun kun, lamut kao, dam (black dam), and maprao (cocoa-nut wood).

outer wood chipped off, and requires to be re-chipped in order to remove all the outside white wood, and leave it a uniform bright colour.

A beautiful dye of a brilliant yellow is procured from the heart of the jack-tree (*Artocarpus integrifolia*). This wood deserves a closer examination, whether it might not become of importance to commerce, not only as a dye, but likewise to the cabinet-maker. It must, however, be understood that it is only the heart of the tree which can be employed for such purposes : its outer part (and this is likewise the case with the tree which furnishes the beautiful letter-wood of Guiana, which belongs, according to botanical classification, to the same family as the jack-tree) is soft and useless.

The natives obtain a fine red dye from the roots of the *Morinda citrifolia ;* and I have seen silk cloth, manufactured here, of a *green* colour, which, I was given to understand, was extracted from a vegetable substance procured in the forests of the interior. This green dye had much more lustre than sap-green ; and if it be really a vegetable production, it deserves further inquiries.

The wood of a species of mangrove yields a red colour ; and the bark of the common kind (*Rhizophora Mangle*) is used in tanning, and a small quantity of it is exported.

Several species of plants furnishing indigo grow spontaneously in the interior. An attempt has recently been made by a British subject to manufacture the dye from these plants ; but he has not succeeded in rendering it profitable, in consequence of which he has given up the speculation. Safflower (*Carthamus tinctorius*), cultivated in Spain, Egypt, &c., is likewise produced in Siam, and sold for its colouring matter. This refers equally to saffron (*Crocus sativus*), and to turmeric, the root of *Curcuma longa*, which is used in dyeing yellow, and as an ingredient in the preparation of curry-powder : however, only sufficient for home consumption is cultivated.

Gamboge is the gum-resin of a tree belonging, according to botanical classification, to the natural family of *Clusiaceæ.* It is employed as a pigment, and as an active medicine. The best quality is brought to Siam from Cambodia, and is considered to be the produce of *Garcinia Cochinchinensis.* An incision having been made into the tree, the gum is collected into hollow bamboos, which, after the secretion has become dry, are broken : hence the drug receives a cylindrical appearance. An inferior quality is brought down from the Laos country, which is in lumps.

The rich red-coloured resin called dragon's blood is obtained from a species of rattan (*Calamus Draco*), which is gathered within the forests of Siam. It is well known that this substance is principally used to tinge varnishes and lacquers.

Bishop Pallegoix speaks of a varnish being obtained from a species of banana tree by incision. Neither the sun nor the rain has influence upon this substance ; hence it is employed for securing the gilding of Siamese idols. It might be employed, with great advantage, in Europe, for such monuments and ornaments as are gilded, and exposed to the influence of the atmosphere.

I do not believe that this varnish is obtained from a plant which belongs to the *Musa* tribe; it is much more probable that it is procured from the theet-tsee or kheu, a plant called by Wallich *Melanorrhœa usitatissima.* The milk from which the varnish is prepared, flows from the tree after an incision has been made into the trunk, and is very caustic, causing pustules where it comes in contact with the skin. This very circumstance does not render it likely that the vegetable production which yields the varnish belongs to the tribe of plants which the Bishop designates.*

Wood-oils, which more properly ought to be called resinous balsams, are yielded by *Dipterocarpus trinervis,* and allied species. They give to teakwood a fine polish, and are substituted in house decorations for the coloured paints for verandahs, window-sashes, doors, &c.

Mr Edward O'Riley, when speaking of the vegetable products of the Tenasserim provinces, says that it is not generally known that the oil of the *Dipteraceæ* possesses the same quality as the balsam of copaiba.† This had been stated previously by Dr Blume, and it has been recommended lately in England.

These balsamic resins, which are yielded by numerous trees of the forests of Siam, deserve much more attention than they have hitherto received.

The damar, or dammer, is the resinous produce of trees belonging to the same kind which yield the wood-oil, namely, *Shorea* and *Tumbugaia.* The damar is found at the foot of the trees, much like the gum anime of South America, and is frequently fished up (just like the latter), floating on the surface of rivers, carried there by floods of rain. No care is taken in collecting it; hence it is frequently mixed with extraneous substances, which greatly lessen its value. It is used as a substitute for pitch or tar, and forms an article of export to Singapore.

Gum benzoin, or benjamin (probably the produce of *Styrax Benzoin*), is brought to Bangkok from the Laos country, and a kind of camphor, perhaps the balsamic resin of *Dryobalanops camphora,* from the Malay Peninsula. The tree is destroyed to produce the gum benjamin. The bark is chipped all over; and after the gum has exuded and hardened, it is found between the stem and bark, which is then stripped off. The tree is called kanyan by the Siamese. The gum which exudes naturally, has a much stronger perfume than that procured by cutting; but, from dropping on the ground, it is a good deal mixed with earth and other impurities. It is not white, but of a clear brownish colour. From the manner in which it is brought down the country, it is much destroyed, being broken into dust, often from the knocking about which it receives before arriving at the navigable parts of the Menam. The common way of bringing it to the river, is in small baskets, strapped in pairs, across bullocks' backs, which are never taken off till arriving at the boats.

* I have every reason to believe that the varnish alluded to by the Bishop is prepared from the milk of a species of *Ficus,* called tomsie by the Siamese.

† 'Journal of the Indian Archipelago,' vol. iv., p. 62.

The eagle or aquila wood, or lign-aloes, a fragrant substance, is yielded by *Aloexylon Agallochum.* Another kind, which is considered less valuable, comes from *Aquilaria Agallochum.* The fragrant resinous substance which it contains is highly prized by the Chinese, to which country it is only exported. This refers likewise to krachi-wood and angrai bark; the former being used for incense, the latter for medicinal purposes.

Amongst plants which are employed for medicinal purposes, must be mentioned the beyche nut, or nux vomica, obtained from the Laos country, which forms an article of export to China.

Til-seed, the produce of *Sesamum indicum,* containing an abundance of an oil which, when fresh, can scarcely be distinguished from olive-oil, forms an important article of export.

Pangtarai seeds, the produce of *Arachis hypogæa,* or "ground nuts," are cultivated by the natives for expressing a bland oil, which is mostly used for home consumption: some of the nuts are, however, exported. The name in Siamese is tueh-esong.

A great deal of oil is obtained from the cocoa-nut, which is mostly used for burning in lamps by the inhabitants, very little being exported.

Areca Catechu, a slender graceful palm, is extensively cultivated for its fruits, known under the name of betel-nuts, so largely employed in chewing by the Siamese and other Eastern nations, as affording a stimulant. It has been observed that the Asiatic nations would rather forego meat and drink than their favourite betel-nuts. A small quantity are exported to China. May and June are the months when the largest quantity can be procured; but, though an article of very large comsumption in the country, it is not grown to any extent for exportation. What is exported is mostly grown about Petrio, and down the west coast of the Gulf.

The leaf of the betel pepper (*Piper betle*) is inseparable from the use of the betel-nut, the kernel of which is wrapt in a leaf of that plant, over which a small quantity of quicklime is spread, to which a fine pink colour is given by mixing with it the root of the *Curcuma longa,* or turmeric. This root, as already observed, forms one of the chief ingredients of the curry powders of India.*

Returning to the useful productions of the Palm tribe, I have to mention the sago, and a species of palm-sugar or jaggery, the latter of which is prepared from the juice, procured by incision, from the spathe or flowering spike of the *Borassus gomutus,* before it is fully expanded. The juice goes quickly over into fermentation; but, by evaporation, the palm-sugar is obtained, and is sold in earthen pots at the bazaars of Bangkok.

Amongst the spices cultivated in Siam, pepper deserves principally to be mentioned. The greater part is cultivated in the province of Chantibon,

* The proper colour of the turmeric, under which name it is generally known, is yellow; hence it is employed to give a yellow colour to the skin of women and children, a custom which is much practised by the highest and lowest of the Siamese.

where, likewise, a small quantity of white pepper is manufactured, which, however, has not as yet become an important article of export.

I have already mentioned the betel, and the use which is made of its leaves, and may likewise observe that another species, the sirih (*Chavica betle* or *Siriboa*), is equally cultivated for a similar purpose. Two kinds of cardamoms are produced in Siam, and are exported. The best are obtained from several species of the genus *Elettaria* or *Alpinia;* an inferior kind is called bastard cardamoms, which are brought here from the country of the Laos. They are described as the seed of a tree (or plant ?) of about a man's height, at the end of the branches of which grow clusters of flowers, which produce the bastard cardamoms. Ginger is cultivated with the greatest facility, but only a small quantity is exported, the root being mostly used for home consumption.

Amongst the fibres of plants growing in Siam useful for textile fabrics, a species of hemp has been exported which is said to be prepared from a plant resembling a nettle in appearance. This has probably been obtained from the *Urtica tenacissima*, the fibres of which have been pronounced identical with the celebrated China grass. The real hemp is likewise cultivated, not so much for its fibres, as for extracting its intoxicating and narcotic qualities, for the preparation of the haschish of the Arabs or guncha of the Siamese, which is used for the same purposes as the opium, producing, when being smoked, exhilarating effects, with subsequent prostration and sleep.* The cultivation of cotton has not received that attention which it deserves. Small quantities are produced in the Laos country, samples of which I have transmitted to Her Majesty's Government. The great distance of the country where it is at present cultivated, and the difficulty of transport to Bangkok from the interior, have no doubt injuriously operated in preventing the development of the trade. Judging from the countries that produce cotton which I have visited—namely, the United States, the West Indies, and Guiana—I see no reason why the alluvial districts of Siam should not produce as fine a cotton as the countries previously stated. A want is seriously felt to effect an extensive cultivation,—namely, the scarcity of labourers. The distance of the country where cotton is cultivated from Bangkok is very great; and as the article is so bulky for transport in canoes down the river, this is one of the circumstances which has operated against a greater development of this trade. To obviate this difficulty in some regard, Her Majesty's Government has included amongst the presents forwarded to the sovereigns of Siam a hydraulic press, to compress the cotton into bales.

A substance called silk or tree cotton is much employed by the Siamese

* A somewhat similar effect is produced by the seeds of the *Datura Stramonium* and *Datura fatuosa,* which, it is asserted, the talpoins, or priests, make frequent use of to procure fantastic dreams and ravings. They assert that they take it to sharpen their memory. It is stated that the priests of the Delphic Temple used the seeds of the *Datura Stramonium* to cause that state, bordering on raving, during which their words were considered prophetic.

for stuffing beds, cushions, &c. This is the produce of different species of *Bombax* and *Eriodendron*, very large trees, the seeds of which are enveloped in long hairs, but, as they do not spin like cotton, in consequence of no adhesion existing between the hairs, the substance loses its importance, except as employed for the purposes mentioned.

The coffee of Siam is of a superior description, resembling the Mocha bean: its cultivation is, however, but sparingly attended to, being even insufficient for home consumption. If there were more attention paid to the cultivation, it might form one of the principal articles of export. The tree grows luxuriantly, and is covered with berries. The tobacco of Siam is of a very good quality: scarcely sufficient, however, for home consumption is produced.

The list of fruits indigenous or cultivated in Siam includes those of tropical countries in general. This country is, however, especially distinguished for the excellence of its mangosteens and durians. There are a large number of different species and varieties of the orange, besides pine-apples, mangoes, guavas, and various fruits the produce of the forests, vieing in delicacy with those cultivated in gardens.

THE MINERAL OILS OF AMERICA.

The petroleum oil springs of America are exciting so much interest at the present time, that importance naturally attaches to all reliable accounts concerning them. The whole subject was very carefully surveyed in a recent number of the TECHNOLOGIST (p. 244), and we may now summarize the further information furnished by practical journals in America. The numerous reports from the petroleum regions of Pennsylvania and Ohio, a few years ago, respecting the immense oil discoveries, received at that time but little more attention from the business and manufacturing world than to elicit a passing remark, or to be merely the subject of mention as an interesting circumstance. The information regarding the yield of the wells, and the vast number of springs discovered, was of so marvellous a character, and the reputed amount of oil pumped from single wells was so incredibly large, that doubts were cast upon the whole enterprise, and those who left the chief cities to engage in the prospecting for oil in those regions were regarded as rather visionary in their ideas, and were deemed to be pursuing a phantom which would soon lead them into an unenviable plight. Time, however, has demonstrated the value of the production of the petroleum regions; and instead of the supply failing, as was at first predicted, the reports of still larger yields, and of still newer resources, are being circulated, and the fruits of the enterprise amply verify the statements regarding the increased supply of oil. The local papers of Western Pennsylvania, Ohio, Kentucky, and other States are laden with items announcing fresh and valuable discoveries ; and these openings seem to inspire explorers with still greater zeal, and many new sources will doubtless be inaugurated. It is not strange that, amid all the authenticated accounts of valuable openings, numerous exaggerated and untrue statements should likewise appear, and frauds be perpetrated by unscrupulous landowners, desirous of realising by swindling inexperienced operators. Of course, many of the reports of enormous yields are bare falsehoods, issued by designing speculators to deceive the unwary: but, notwithstanding this, we may regard the petroleum basins as sources of great wealth, and which promise to be productive of large revenue.

Thus far the demand for the oil has been far in excess of the supply, and the rapidity with which it is forwarded is indicative of the energy of those engaged in raising it. A very large portion of it is shipped to France and Germany, where it is extensively employed in the manufacture of aniline, fuschine, and other brilliant colours for dyeing. It is principally used in America as an illuminating agent, and as a lubricator; for both of which purposes it is, after a slight rectification, admirably adapted. Already the greatly-increased supply of this fluid is having a damaging effect upon other articles which have been relied on as artificial illuminating agents, and it is proper to suppose that it will eventually become the main reliance of all who desire a cheap, pleasant, and safe light, where gas is not used. The popularity of petroleum and coal oils as illuminators has seriously interfered with the whaling trade, and the statistics of that traffic show a remarkable falling off in the supply of whale-oil, and a diminution in the number of the vessels employed. In the year 1844, the total number of vessels engaged in whaling in the United States was 635, the aggregate tonnage being 200,485. In 1857 the number of vesssels was 655, aggregate tonnage 204,209. In 1861 the number of vessels has decreased to 514, aggregate tonnage 158,746. In 1858, 200 ships went into the North Pacific for whale-oil, whereas in 1861 less than 100 are expected to go. These figures exhibit a large decrease within the past four years, and this will probably continue. The diminution in the number of vessels is attributable in some measure to difficulties experienced by the whalers, owing to a decrease in "catch." The whales, it is said, have grown wild, and are constantly changing their position. This, together with severe weather experienced in their usual latitudes, has contributed to the disastrous result. But the most important cause of the falling off is undoubtedly the largely-increased consumption of petroleum and coal oils, and the inauguration of gas-works in towns where whale-oil was previously used as an illuminating agent. If the statistics of the petroleum business could be accurately compiled, they would present a long array of figures, representing the amount raised and forwarded to market, and would afford an evidence of its importance as an article of trade. Already it has diffused a spirit of life and energy into a before comparatively quiet region ; it has swelled the population of villages and projected new towns. The industrial arts have been largely stimulated, and the increased demand for steam-engines, pumps, barrels, and other implements required for raising the crude oil from the wells, and preparing it for market, has opened new fields for inventive genius, the consequence of which has been that many improved methods have been adopted for producing the oils, effecting an economy both in time and labour. A truly reliable account of the geology of the petroleum regions is much needed. The *rationale* of the formation of the oil is not yet accurately defined to the unanimous satisfaction of scientific men; different theories being held in regard to this subject, as is the case with many others. The most natural supposition would be, that it is a distillation of coals conducted in Nature's laboratory, under modified conditions of heat and pressure. This is doubtless correct to some extent, as certain petroleums display such characteristics as to prove their production from bituminised plants; while at the same time other samples indicate their probable origin from animal tissue by certain unmistakeable evidence. Many of the more recent discoveries of oil-wells have occurred in places hundreds of miles from any known coal-fields, and where it is not possible for coal to exist, owing to the peculiar geological character of the country. Thus, oil has been discovered in many parts of Canada, far from the coal formations, and veins have been struck there which yield a most abundant supply.

With respect to the history of Coal Oils, it is likewise remarked that the production of oil from coal and petroleum, or rock-oil, having passed through its experimental stages and become an article of commerce, and having assumed a form of utility which commends its use in all localities where gas is not attainable, as well from its illuminating properties as its economy, it bids fair to compete successfully with the production of burning fluid and camphine, and finally to, perhaps, exterminate their manufacture. The first attempt to introduce coal-oil practically to the people of the United States was made by the Kerosene Oil Company, in 1857; and their efforts in this direction were quickly seconded by those of the Carbon Oil Company, in December of the same year, by the first introduction of oil made from petroleum, for burning in the coal-oil lamps. The beginning thus made has been steadily followed up through some trying fluctuations and depressions, growing partly out of the inferior quality produced, and partly from the fact that the demand speedily outran the supply, and the public discontinued its use in the fall and winter of 1859, from its scarcity, poor quality, and high price. American coals are not well adapted to the production of coal-oil, as the yield of oil is not sufficient to make manufacturing from them profitable, as compared with the greater yield and superior quality of foreign coal—especially that obtained from Scotland and New Brunswick. But this defect Nature has abundantly made up in the great deposit of natural oil. The yields of crude oil per ton—of native and foreign coal—is given below; and in addition to the greater quantity obtained, the imported coal has the advantage of producing an oil much lighter in specific gravity, hence much superior for illuminating purposes:—

England—Derbyshire	82	gallons per ton.
Scotland—Boghead	120	„ „
„ Lesmahagow	96	„ „
New Brunswick—Albert Coal	110	„ „
American—Pittsburg	49	„ „
„ Kanawha	71	„ „
„ Falling Rock	80	„ „
„ Cashtown	74	„ „
„ Breckenridge	100	„ „
„ Petroleum Springs	—	„ „

Alabama, Tennessee, Pennsylvania, Virginia, Ohio, Kentucky, Texas, Canada, and California produce from 60 to 95 per cent. of the illuminating oil. The Breckenridge shows the most favourable among American coals; yet the most satisfactory results are obtained from the Scotch Boghead coal. These coals also yield oils of heavy gravity, and by some it is claimed that they possess superior lubricating properties; but this is a point not yet satisfactorily established. Doubtless they are useful to some extent as lubricators, mixed with animal oils ; but for such purposes their value is but small. The heavy oils also contain a large percentage of paraffine, which is used extensively and successfully in the manufacture of so-called paraffine candles, of fair quality, very little inferior to sperm. The discovery of the great oil deposit of Pennsylvania has given a great impetus to the production of these oils; and the certainty that these deposits are of vast extent causes the prospective business in this class of oils to loom up very largely. The first petroleum oil, known as "carbon oil," was introduced into New York in 1857, and was obtained from a salt-well at Tarentum, on the Alleghany River, Pennsylvania: it was introduced to the public by a gentleman now connected with the Carbon Oil Company.

The great demand which immediately followed its introduction, and the remunerative prices obtained, stimulated further search for these oils, and led to the development of the great oil deposit, of which almost fabulous accounts have from time to time appeared in the newspapers of the day. The deposit is of great extent, and reaches in a direction nearly north and south from Lake Erie, through the States of New York, Pennsylvania, Ohio, Virginia, Kentucky, Tennessee, Alabama, and Florida, and also exists in abundance in Canada West. Its principal development in Canada is in the township of Enniskillen, about twenty miles from Port Sarnia. But, although existing in very great abundance in Canada, its commercial value from that section is small, owing to the unconquerable and offensive odour with which it is impregnated. We give below the number of square miles of the great oil deposit, as far as yet determined, although it doubtless extends over a much greater area :—

	Sq. miles.
Alabama	1,300
Tennessee	1,000
Kentucky	2,000
Virginia	1,800
Ohio	1,500
Pennsylvania	2,500
Florida	500=10,600

This petroleum also exists abundantly in Texas, although entirely undeveloped in that State; and on the Pacific coast, in California, there are immense deposits of oil and bitumen, which have as yet attracted but little attention. A belt of this oil deposit, of great extent, also exists west of the Mississippi, but how extensive is yet undefined. It is also found in Illinois, and doubtless will yet be discovered in many other localities in the United States. We are thus particular in giving some idea of the extent of the deposits of this material, as we think it is ere long destined to form a very important article of commerce, both for domestic use and for export.

This rock-oil is peculiar in its chemical combinations and bases, and will doubtless yet be applied to a great variety of important uses; but our purpose is to give an idea of its present or immediate importance as an article of trade and manufacture. As to the origin of this oil, opinions differ: the popular idea is that it oozes from coal, or has been expelled from it by heat or pressure; but many facts bear against this theory, and the probable truth is that it is an independent or original deposit, having no connection with coal, but closely allied to it—although sometimes found in geological formations which absolutely forbid the existence of coal, as in Canada West. But our purpose is not to discuss this, but to give its present dimension and probable expansion, with the prices it is likely to command in the future. The production of petroleum, which occurs at the present time mainly along Oil Creek and its tributaries in Pennsylvania, in the vicinity of Mecca, Ohio, and Parkersburg, Virginia, may be stated as follows:—

January, 1860 - - - - -	30	barrels per day.
July - - - - - - - -	500	„ „
December - - - - - -	1,600	„ „

This oil has commanded an average price in its crude state at the wells of 18 cents per gallon. At the present time it is selling for about 23 cents, although it has been sold during the past summer as low as 10 cents per gallon. But as the yield for July, 1861, is estimated at 5,000 barrels, of 40 gallons each, per day, it is probable that the price will decline to a lower point than it has yet reached. The manufacture and sale of oil refined from coal and petroleum, which has already had a marked effect on the whaling interest and the production of fluid, may be stated as follows:— In 1858, 100 barrels per day, at an average price of 80 cents per gallon; in 1859, 300 barrels per day, at an average price of 100 cents per gallon; in 1860, 1,500 barrels per day, at an average price of 70 cents per gallon. Its production before the close of 1861 will, doubtless, reach 5,000 barrels, or 200,000 gallons per day, or upwards, at an average price below rather than above 50 cents per gallon. As it is an oil perfectly free from danger of explosion, gives a light fully equal to gas, and is more than three times as lasting as fluid, it is very probable that when these low prices are reached, whales may have some rest, and the camphine operators turn their attention to the manufacture of rock-oil. Much capital has been invested in the manufacture of coal-oil; but as the rock-oil can be pumped so much more cheaply than the oil can be extracted from coal by the agency of heat, coal-oil manufacturers will have eventually to give over the field to the rock-oil.

We give a brief description of the oil-wells:—These are borings through the solid rock from 3 to 6 inches in diameter, and of various depths, from 50 to 500 feet, the drill being kept in operation till a vein of oil is "struck," or the attempt abandoned. If successful, the hole is tubed, and a pump, worked by hand or the feet, or steam, put in operation, and rude tanks erected to contain and separate the oil and water which flow from the pump. The wells in successful operation number about 200, principally in Pennsylvania, Virginia, and Ohio; and the total number in operation and in course of construction at the present time is about 2,500. The average cost of boring and fitting up is about $ 1,200, and the average production of oil from the successful wells is about 8 barrels, or 320 gallons, per day each.

It appears that within the past year (1860), over half a million of dollars have been expended at Pittsburg for steam-engines, boilers, tubing, &c., for the oil district: 17,000 barrels of crude oil have been received, and $ 219,500 worth of purified oil disposed of; $ 176,976 were received for steam-engines and boilers, and $ 178,002 for tubing and drills. The cost of an engine has averaged less than $ 300, but never above that sum. The amount of oil sold during the year, 8,700 barrels. Amount realised, at $ 25 per barrel, $ 219,506. Total cost of steam-engines, boilers, machinery, tools, ropes, &c., purchased here for oil operations during the last twelve months, $ 527,720. Value of refined oil sold by the refiners, $ 219,500. Value of oil received by railway and river, $ 203,208. This is exclusive of business done in Pittsburg in coal-oil.

ESTIMATION OF TANNIN IN SOME BARKS FROM BRITISH GUIANA.

BY JOHN MULLIGAN,

Student in the Evening Class for Practical Chemistry, Museum of Irish Industry.

As Mr Fry, in his valuable "Notes on Tanning Substances," which appeared in the May number of the TECHNOLOGIST, at p. 299, has alluded to the barks of British Guiana, perhaps the following determination of tannin in some barks from that colony may be of interest, and form a kind of supplement to Mr Fry's paper. The quantity of tannin in the barks was estimated for the purpose of ascertaining whether these barks could be profitably used as tanning materials. The method employed in determining the quantity of tannin in the barks was similar to that used by Mr Dowling and myself on a former occasion.*

* Estimation of Tannin in some Tanning Materials, by Messrs Mulligan and Dowling. Vide 'Chemical Gazette,' Nov. 15, 1859.

Wild Cashew Bark.—Infused 100 grs. in cold water for 24 hours, and made up the infusion to measure exactly 8,000 grs.: 2,000 grs. of the infusion required 180 grs. of a standard solution of gelatine (1,425 grs. gelatine solution = 5 grs. of tannin) to precipitate the tannin = ·630 gr. of tannin = 2·52 per cent. of tannin.

Po-Ca-De Bark.—Infused 100 grs. in cold water for 24 hours, and made up the infusion as before to 8,000 grs.: 2,000 grs. of the infusion required 405 grs. of a standard solution of gelatine (1,388 grs. of gelatine solution = 5 grs. of tannin) to precipitate the tannin = 1·455 grs. of tannin = 5·82 per cent. of tannin.

Sirada Bark.—Infused 100 grs. in cold water for 24 hours, and made up the infusion as before to 8,000 grs.: 3,000 grs. of the infusion required 325 grs. of gelatine solution (1,388 grs. of gelatine solution = 5 grs. of tannin) to precipitate the tannin = 1·170 grs. of tannin = 3·12 per cent. of tannin.

Hetchia Bark.—Infused 100 grs. in cold water for 24 hours, and made up the infusion as before to 8,000 grs. : 3,000 grs. of the infusion required 250 grs. gelatine solution (1,388 grs. gelatine solution = 5 grs. tannin) to precipitate the tannin = ·81 gr. of tannin = 2·16 per cent. of tannin.

Horahe Bark.—Infused 100 grs. in cold water for 24 hours, and made up the infusion as before to 8,000 grs.: 3,000 grs. of the infusion required 500 grs. of a standard solution of gelatine (1,447 grs. of gelatine solution = 5 grs. tannin) to precipitate the tannin = 1·727 grs. tannin =4·6 per cent. of tannin.

Waramcah Bark.—Infused 100 grs. in cold water for 24 hours, and made up the infusion as before to 8,000 grs. : 3,000 grs. of the infusion required 400 grs. of a standard solution of gelatine (1,447 grs. gelatine solution = 5 grs. tannin) to precipitate the tannin = 1·38 grs. tannin = 3·68 per cent. tannin.

Mora Bark (*Mora excelsa*).—Infused 100 grs. in cold water for 24 hours, and made up the infusion as before to 6,000 grs.: 3,000 grs. of the infusion required 290 grs. of a standard solution of gelatine (1,399 grs. gelatine solution = 5 grs. tannin) to precipitate the tannin = 1·037 grs. tannin = 2·074 per cent. tannin.

The following is a summary statement of the per-centages of tannin in the barks examined :—

Wild Cashew	2·52 per cent.
Po-Ca-De	5·82 ,,
Sirada	3·12 ,,
Hetchia	2·16 ,,
Horahe	4·60 ,,
Waramcah	3·68 ,,
Mora	2·13 ,,

The quantity of tannin contained in the specimens examined is far too small to admit of the barks being successfully used as tanning materials, unless the tannin in the specimens examined had been diminished by preventable causes, such as the trees from which they were stripped being too old; not stripping them at the proper season, that is, when the sap is running freely in the tree; and then the bark should be taken off when the tree is about to be or has been felled; and also the manner in which it was saved or dried, for some barks are neglected by allowing them to get wet and then heated.

In conclusion, I may add that the trees most suited to the climate and latitude of British Guiana, and which would yield a sufficient amount of tannin to render them useful as tanning materials, would seem to be some of the Acacia genus, or the Divi-divi (*Cæsalpina coriaria.*)*

The following Table contains the average amount per cent. of tannin found by different chemists in the tanning materials examined, with the authority for the same :—

Oak bark formation, 100 years old - -	8·45	C. Müller.
„ young - - -	13·87	„
„ British, 50 years old - -	8·90	Mulligan & Dowling.
„ „ age about 50 years -	9·76	„ „
„ „ „ 70 „ - -	6·12	„ „
„ Southampton, age about 50 years	8·80	„ „
„ Coppice, picked sample - -	12·35	„ „
„ Irish, picked sample, age 45 years	9·50	„ „
Oak, old, white inner bark - - -	21·00	Cadet de Gassincourt.
„ „ „ „ „ - -	14·20	Davy.
„ young „ „ - - -	15·20	„
„ „ coloured or middle bark -	4·00	„
„ „ entire bark - - -	6·00	Davy & Geiger.
„ „ spring-cut bark - -	22·00	Davy.
Oak bark, Belgian, Popering or Plantzen -	8·33	Mulligan & Dowling.
„ „ „ heavy Coppice, picked sample - -	10·74	„ „
„ „ „ light - - -	8·52	„ „
„ „ Eschurg - - -	19·35	G. Müller.
Mimosa bark - - - -	17·97	Mulligan & Dowling.
„ „ - - -	31·16	G. Müller.
Willow bark - - - -	3·95	Mulligan & Dowling.
Willow, Leicester, white inner bark -	16·00	Davy.
„ „ coloured or middle bark	3·10	„
„ „ entire bark - -	6·80	„
„ Weeping - - - -	16·40	Cadet de Gassincourt.
Larch bark - - - - -	3·51	Mulligan & Dowling.
„ „ - - - -	1·60	Davy.

* The barks examined by my student, Mr Mulligan, were given to me in Demerara by a gentleman who was attempting to establish a tannery in that country: the barks were collected by his agents, and, so far as he was aware, with great care. He informed me that he had tried the barks Hog-plum (*Spondias lutea*) and Courida (*Avicennia nitida,* Jac.), which are stated in the 'Official Catalogue' of the Great Exhibition of 1851 to be commonly used in British Guiana for tanning, and he found, from his practical experiments, that they did not contain sufficient tannin to render them useful as tanning materials: he also informed me that no tannery had been attempted to be established in Demerara until he started one about two years ago.—R. GALLOWAY.

Cork-tree bark	12·16	Mulligan & Dowling.
Hemlock bark	13·92	" "
Divi-divi	29·80	" "
" "	49·25	G. Müller.
Valonia, Smyrna	34·78	Mulligan & Dowling.
Myrobaloms	20·91	" "
Shumac	19·35	G. Müller.
" Palermo	24·37	Mulligan & Dowling.
" "	16·20	Davy.
" Malaga	10·40	Frank.
" Carolina	5·0	Cadet de Gassincourt.
" Virginian	10·00	" "
Catechu, Bombay, light colour	26·32	Mulligan & Dowling.
" " " "	55·00	Davy.
" Pegu, dark brown colour	46·88	Mulligan & Dowling.
" Bengal	44·00	Davy.

THE TINCAL OF ASIA, AND ITS APPLICATIONS.

BY ARTHUR ROBOTTOM.

The question has often been put to the writer, "What is tincal? where does it come from? and what are its uses?"—and probably not one person in a hundred knows what the product so extensively sold under this trade-name really is. Articles of commerce are frequently advertised for sale in the 'Public Ledger,' 'Commercial Daily List,' or other special class publications, which are, no doubt, puzzling to many, unless they have at their elbow Mr Simmonds's 'Dictionary of Trade Products and Trade Terms.' Many a timber-merchant, wool-spinner, wholesale grocer, or other dealer or manufacturer, into whose hands these trade prices-current pass, naturally would inquire, "What is tincal?" They can scarcely be expected to be so well informed on this matter as the Mincing-lane brokers, the brokers and merchants of the Liverpool Exchange, or the pottery manufacturers, and others, who deal in and use this substance. With the view of diffusing a little more information on the subject, I shall condense and arrange such information as may convey a correct idea of this important natural product of the East.

Tincal is crude or rough borax, which is imported from Calcutta in crystalline masses, which contain borax, combined with soda and a fatty acid. The salt is never termed borax until refined or purified. It was very early known to the Arabians; but they applied the term "baurach" indifferently to carbonate of soda, the *nitrum* and *natron* of the ancients, also found as an efflorescence on the soil.

Baurach is among the many chemical preparations noticed by the Arabian, Geber, who lived in the eighth century. It was employed by him for one of the same purposes for which it is used at present; namely, to assist in reducing the oxides of certain metals to the metallic state.

Tincal is a saline compound or combination of soda with boracic acid. This acid is a compound of oxygen with an elementary substance, to which the name of boron is applied.

This mineral salt is met with in most extensive districts in Thibet, the Thibetians carrying on a considerable trade in this article; quantities are dug out of the earth and crystallised, and a great many of the shepherds of Thibet are engaged a large part of the day in collecting this substance. The earth in some districts of Thibet, particularly in the neighbourhood of Tasso Lumbo, is so impregnated with it, that as the dew falls it becomes saturated with it, and the stunted vegetation is soon covered with this crystalline salt. Large masses of it are obtained from Lake Pelta, a sheet of water near to the small village of D——. The natives report a lake, 100 miles from this spot, where still larger masses are found, which, when broken, detach themselves in six-sided prisms of a very large size. This lake is said to be surrounded by precipitous rocks, no rivulet having access to it, and being supplied only by springs containing the tincal in solution. The constant evaporation of the water causes the deposition of the tincal in the bed of the lake, whence it is removed by the natives; and not the least curious fact connected with it is, that although thousands of tons have been removed there is no apparent decrease in the quantity, so that we have an almost unlimited supply. Rock-salt is also found in large quantity in the bed of the lake: this is collected by the natives, and exported to Nepaul, and thence to Bengal.

Thibet exports very few articles of commerce to India; tincal, musk, rock-salt, gold-dust, and a little wool, being the most important. Many of the natives are anxious to ascertain what such very large quantities of tincal are used for: some of them know that the greater portion finds its way ultimately to England, and some time back, when a few scientific gentlemen were travelling in Thibet, a native inquired of one of them what such large quantities of tincal were used for in England. Of course, the traveller was one of those who had never heard of tincal, and was at a loss for a reply. One of his companions, however, suggesting to him that it was borax in its crude state, he sagely told the man that it was used for rubbing the mouths of babies. The Thibetian, very much astonished, said that he had heard England was a most extraordinary country, but he had no idea it was so productive of babies!

Huc, in his 'Travels in Tartary,' gives the following account of the district:

"On the 15th of November we quitted the magnificent plains of the Kokou-Noor, and entered upon the territories of the Mongols of Tsaidam. Immediately after crossing the river of that name, we found the aspect of the country totally changed. Nature becomes all of a sudden savage and sad; the soil, arid and stony, produces with difficulty a few dry saltpetrous bushes. The morose and melancholy tinge of these dismal regions seems to have had its full influence upon the character of its inhabitants, who are all evidently a prey to the spleen. They say very little, and their language is so rude and guttural that other Mongols can scarcely understand them. Mineral salt and tincal abound on this arid and almost wholly pastureless soil. You dig holes two or three feet deep, and the salt collects therein, and crystallises and purifies itself without your having any trouble in the matter. The tincal is collected from small reservoirs, which become completely full of it. The Thibetians carry quantities of it to their own country, where they sell it to the goldsmiths, who apply it to facilitate the fusion of metals. We stayed two days in the land of Tsaidam, feasting upon tsamba and some goats which the shepherds gave in exchange for some bricks of tea. The long-tailed oxen and camels regaled themselves with the nitrate and salt, which they had everywhere for the picking up."

The mode in which tincal is forwarded from the place of production shows the very primitive means of transit in those regions. Large quantities of sheep are kept by the poorer inhabitants, who dispose of them to factors or traders, and they bring them to a station where stocks of tincal are kept. A bargain is made with the owners of this salt, and about eight or ten pounds of tincal are packed upon each sheep's back; the flock is then driven across the mountains, which are so rugged and inaccessible that no conveyance could pass over.

The manner in which tincal is sent to England and disposed of to the manufacturer may not be without interest to a few. It is first collected, as we have seen, by the shepherds, and bartered for various articles; it is then brought through Nepaul, and nearly all finds its way to Calcutta, where, if prices are moderately high, the native traders dispose of it to the native merchants. The European houses in Calcutta employ Banians to go round to the bazaars and see what is on offer; and if no limits are sent out by the English merchant, very high prices are frequently paid for it.

Tincal is brought to the Calcutta market principally from Thibet and Nepaul, and generally shipped by English houses to Great Britain to order. Bombay and Madras take off a quantity occasionally, which is shipped by native merchants. As a rule, they never ship from Calcutta to England on their own account. It is usually packed in double gunny-bags, containing 2 maunds (of 82 lb. to the maund), sometimes in empty beer-hogsheads. Before packing, the tincal is bulked, and mixed with mustard (rape), oil, and curd of milk, which prevents evaporation during the long sea-voyage; else it is supposed it would heat and crumble into powder. The average freight to England may be quoted at about 4*l.* per ton. Some ships object to carrying it, for fear of waste by evaporation, and consequent loss in weight, which would diminish the freight payable on the quantity delivered.

The following is one of the modern processes for refining tincal:—The crude salt, being placed in proper pans, is covered with cold water to a height of two or three inches above its surface, and allowed to stand for some hours. Recently-slacked lime is then added to the amount of one part to four hundred parts of tincal; the mixture is thoroughly stirred, allowed to stand for twelve hours, again strongly agitated, and the troubled supernatant liquid decanted. The liquor is not thrown away, but preserved to wash the impure borax; the solid matters held in suspension being first separated by settlement and decantation. The washing is continued with the same liquid, clarified by subsidence as often as applied, until it is no longer rendered turbid. In this way a great portion of the fatty matter may be washed away as an insoluble soap of lime. The salt thus purified is dissolved in two and a half pints of boiling water, and mixed with a solution of chloride of calcium, containing two parts of that salt to one hundred parts of tincal. A precipitate is thereby produced, consisting chiefly of the insoluble soap of lime; the liquor is separated from the precipitate by filtration, and evaporated down to the density of 1·14 or 1·16. It is then run off in crystallising vessels, and cooled very gradually, in order to obtain large crystals.—The preceding process has received various modifications. There are several works in England and on the Continent where they purify and crystallise tincal, producing from it the finest borax. Some manufacturers, however, prefer tincal to borax, as the latter frequently contains large quantities of soda and moisture. Very fine borax, such as should contain 85 per cent. of pure borax, is scarcely to be met with; whereas very fine purified tincal will refract 98 to 99 per cent. of pure borax.

The most considerable consumption of borax at present is at the potteries, chiefly in the formation of a porcelain and earthenware glaze—an application dependent on the vitreous character of most combinations of this salt with metallic oxides and earthy bases. The particular composition of the borax glaze is varied at different potteries; but the essential constituents, besides borax, are felspar and soda. Nitre is sometimes added in small quantity, and a mixture of powdered flint-glass and flints is occasionally substituted for felspar.

The following information has been supplied me by a manufacturing chemist in the Potteries district:—

The use of tincal or borax in the manufacture of earthenware is to give increased fusibility to the glass or glaze, which is composed of silica or felspar, lime, and soda: lead is also added to the above, when run down, to increase its fusibility and density. The finer the quality of the glaze required, the greater the quantity of borax must be used. After it is run down into a glass, it is called by the potters "frett," and the operation is called "fretting."

This frett is ground in water until it is very fine and smooth, and about the consistence of cream, when it is ready for use. The calcined or biscuit porous ware is then dipped into it, and absorbs a portion of it; the ware is then dried, and again fired, when the glaze on the surfaee fuses and covers the ware with a thin coating of glass.

It is also used in preparing the colours of the earthenware manufacturer, to increase their fusibility, and to make them a little softer than the glaze with which the ware is covered.

Borax is also used for domestic purposes, by the laundress, who finds that, when put into starch, it improves the colour, and renders the muslin incombustible; also instead of soda, for softening the water, and giving increased whiteness to the linen, without injuring the texture of the fabric. It is very useful as a hair-wash, for cleansing the hair, and removing scurf, &c.; and is an excellent dentifrice, not injuring the enamel of the teeth, and being very clean in its use. It is frequently used in the teapot, to soften the water, and assist in extracting the flavour of the tea; and when taken in combination with carbonate of soda and tartaric acid, forms a cooling beverage.

Good borax, refined from tincal, contains in 100 parts, soda 16, boracic acid 40, water 44, being rather less water and more boracic acid than the ordinary borax.

Borax also enters into the composition of some varieties of glass. A glass suited for optical purposes is made with seven parts of red lead, two parts of calcined borax, and three parts of ground quartz. The addition of a little borax to the materials for plate glass and crown glass has been recommended; but a large quantity seems to communicate an exfoliating property to the glass. The vitreous body of artificial gems called *strass* (from the name of its German inventor) is a kind of flint-glass, in most receipts for which borax is mentioned as an essential constituent. According to Dr Shaw ('Chemical Lectures'), by fusing together four parts of borax and one part of fine white sand, a pure glass is formed, sufficiently hard to cut common glass like the diamond.

Borax is used to a large extent in assaying metallic ores, to dissolve the mineral and facilitate the reduction of the oxide by carbonaceous matters. It is eminently adapted for this purpose, as it forms fusible combinations, not only with bases, but also with silica. On this property of dissolving metallic oxides is founded the use of borax to braziers, silversmiths, jewellers, electro-platers, and others, in the soldering of metals; for which purpose merely, several tons of borax are consumed in Birmingham and its neighbourhood weekly. An aqueous solution of borax has the remarkable property of dissolving shellac, affording a solution which may be employed as a sort of varnish. The proper proportions of the materials are five parts of borax and one of shellac.—(Parnell's 'Applied Chemistry.')

Borax is sometimes sophisticated with common salt, and occasionally with alum. The presence of the former is easily detected by adding a few drops of a solution of nitrate of silver, which would afford a white curdy precipitate of chloride of silver, insoluble in nitric acid if the smallest quantity of common salt is present. The presence of alum in the borax may be detected by ammonia, which gives, with that salt, a white frothy precipitate of alumina, but nothing of the kind with borax. The amount of soda in borax may be estimated by observing how much free sulphuric acid must be added to the solution of borax to give it an acid reaction, precisely after the manner of the common alkalimetrical process for determining the value of a specimen of carbonate of soda.

The imports of borax and tincal into the United Kingdom since 1853 have been as follows, in cwts. :—

	Tincal.	Refined Borax.	Boracic Acid.
1853	10,803	2,262	20,793
1854	14,456	2,164	24,839
1855	16,765	704	27,808
1856	13,984	4,651	26,827
1857	13,390	6,674	25,687
1858	2,800	2,111	26,263
1859	4,136	1,707	35,927

The tincal and refined borax all come from India, and the boracic acid chiefly from Tuscany. The boracic acid crystals are far from pure, containing a small quantity of numerous sulphates mechanically mixed. Those interested in the manufacture and supply of boracic acid from Tuscany, where it is all made by Count Lardarel, who chiefly supplies the English market, and M. Durval, who exports to France, will find some descriptive details of the lagoons from which it is obtained, and the mode of manufacture, in the 8th vol. of the 'Journal of the Society of Arts,' p. 542 (No. for May 25, 1860).

THE TORTOISESHELL OF COMMERCE.

BY THE EDITOR.

The term tortoise is applied in science to those land and water animals which form the first order of reptiles, and are characterised by an external bony envelope, covered with a horny or leathery sheathing, and enclosing, as in a box, the internal organs and other portions of the osseous framework. The common name of turtle is often given, but not commercially, to the marine tortoises; and it is these with which we have at present to deal.

The broad, horny plates which cover the dorsal buckler or carapace of the sea-tortoise are in some species so fine and of such beautiful colours as to be employed for various purposes of art. There are usually thirteen of these epidermal plates on the carapace or back, and twenty-five marginal pieces, or those round the edges. The tortoiseshell of the hawk's-bill turtle (*Chelonia imbricata* of some authors), and of the Caret of the French (*Chelonia Caretta*), is that most esteemed, the plates being stronger, thicker, and clearer than in any other species. Of the thirteen largest plates, called in trade the "head," there are four on each side, and five on the back, the last bent in the centre. Of the side plates, the two middle are the most valuable, being largest and thickest; those on the back, and on the margin, denominated *hoofs* or *claws*, are comparatively of less value. The lamellæ or plates vary in thickness from one-eighth to one-quarter of an inch, according to the age and size of the animal, and weigh from four to six pounds or upwards. The larger the animal, the better is the shell.

The hawk's-bill turtle has the carapace large, depressed, somewhat heart-shaped, and covered with broad scales, overlapping each other, whence the specific name. The scales are thick and firm, and are of a yellowish colour, variously stained and marbled with brown: the vertebral row are keeled, and have a raised central line. It is for the sake of the plates of its carapace that this species is in request; for the flesh is disagreeable, and perhaps even unwholesome.

The hawk's-bill turtle is not only an inhabitant of the warmer latitudes of the seas and coasts of the New World, but is found also in the seas of Asia; and it was from the latter regions that the ancients derived the tortoiseshell which they used in the arts, and for ornamental work, as is now practised in modern Europe and India.

The vertebral and costal scales of the carapace of this animal are thirteen in number; and these, instead of being united edge to edge, are imbricated,—that is, the anterior scales largely overlie the next in succession, like tiles on a house-top; but the part of each that overlies the next is thinner than the part adherent to the osseous framework of the carapace, and terminates in a rather sharp edge, so that the general surface of the whole is smooth. These are the valued parts of the animal, and it is said that the shell procured from the creature while alive is the finest. The mode in which the shell is separated from the bone of the carapace, is by presenting its convex surface to a glowing fire, which causes the scales to rise and separate from the bone to such a degree that their complete detachment is easily effected. It appears that in Easter Island, and other places in the Pacific where the fishing of this species is carried on, the animal is subject while alive to this barbarous operation, and that, after being stripped, it is set at liberty. This is confirmed by Mr Darwin, who, in his 'Voyage of a Naturalist,' states that he was informed by Captain Moresby, that in the Chagos Archipelago the natives take the shell from the back of the living tortoise. It is covered with burning charcoal, which causes the outer shell to curl upwards; it is then forced off with a knife, and, before it becomes cold, flattened between boards. After this barbarous process, the animal is suffered to regain its native element, where after a certain time a new shell is formed: it is, however, too thin to be of any service, and the animal always appears languishing and sickly.

The coast of Darien and several adjacent islets are celebrated for the fishery of this tortoise. At San Blas, a colony of Indians is established for the sole purpose of taking these animals; and formerly as much as 1,500 pounds weight of shell was collected on the average annually.

Tortoises are found in all the seas of the Malay and Philippine Archipelagos; but the imbricated kind, which yields the finest shell, is most abundant in those of Celebes, Sulu, and the Spice Islands, as far as the coasts of New Guinea. The parties chiefly engaged in their capture are the Bajaus, or sea-nomadic hunters, of whom the turtle is the principal game.

These people distinguish four species of sea-turtle, to which they give the names of kulitan, akung, ratu, and boko. The last is the pânu of the

Malays, and the green esculent turtle, of which the carapace is of no use, the animal being valued only for its flesh to sell to the Chinese and Europeans, for among the Mahometans it is unlawful food. The three first-named species all yield a marketable shell. The ratu, which signifies king or royal turtle, is said to be of great size, measuring from five to six feet in length, but is not often taken, and the shell is of inferior value. All the finest shell is afforded by the first, the kulitan—the name, in fact, signifying "shell-turtle."

A very interesting account of the turtle fishery of Celebes, contained in the 16th vol. of the 'Transactions of the Batavian Society of Arts and Sciences,' describes the reptile as follows :

"The first-named (the kulitan) is the kind which, on account of its costly shell, is the most prized. It is the so-named Caret tortoise. The shell or back of this creature is covered with thirteen shields or plates, which lie regularly on each other in the manner of scales—five in the centre of the back, and four on each side. These are the plates which furnish such costly tortoiseshell to the arts. The edges of the scales of the back are further covered with twenty-five thin pieces, joined one to another, which in commerce are known under the appellation of 'feet' or 'noses' of the tortoise. The value of the tortoiseshell depends on the weight of each 'head ;' by which expression is understood the collective shell belonging to one and the same animal.

"Such is the article of commerce so much in request both for the Chinese and European markets. Shells which have white and dark spots that touch each other, and are as much as possible similar on both sides of the blade, are in the eyes of the Chinese much finer, and on that account more greedily bought by them than those which want this peculiarity. On the contrary, shells which are reddish rather than black in their dark spots, which possess little white, which are more damasked than spotted—in a word, of which the colours, according to the Chinese taste, are badly distributed—are less valued. The caprice of the Chinese makes them sometimes value single 'heads at unheard-of prices—such, for example, as go under the name of 'white heads,' for the varieties of which they have peculiar names. It is impossible to give an accurate description of these varieties and their subdivisions, for these depend on many circumstances inappreciable to our senses. It is enough for me to observe, that such heads as possess the above-named qualities—that is, are very white in their blades, and have the outer rim of each blade to the depth of two or three fingers wholly white, and the weight of which amounts to two and a half catties, qualities that are rarely found united—may be valued at 1,000 guilders, or even more (above 24*l.* per pound avoirdupois). The 'feet' or 'noses' of the tortoiseshell are in demand only in the Chinese market. Whenever the two hinder pieces of these have the weight of a quarter of a catty (between five and six ounces), which is seldom the case, they may reach the value of 50 guilders, or more. The whole shell of a tortoise seldom weighs more than three catties (four pounds), notwithstanding it is asserted that there occur 'heads' of four and five catties. Tortoises are sometimes found, of which the shell, instead of thirteen blades, consists of a single and undivided one. The Bajaus call this, which is rarely met with, 'loyong' (brass ?).

"The modes by which these people catch the tortoise are the adang (intercepting), the harpoon, and the net. To these we may add the simplest of all—namely, falling on the females when they resort to the strand to lay their eggs. This is also the most usual, I may say the only way, by which the inhabitants of the coast catch this animal. They need nothing more than, as soon as they have got the creature in their power, to turn it on its back, when, unable to turn itself again, it lies helpless. It sometimes also falls into the hands of the dwellers on the coasts through means of their fishing-stakes, into which it enters like the fish, and from which it can find no outlet, but remains imprisoned in the innermost chamber. When the Bajaus have caught a tortoise, they kill it immediately by a few blows on the head. They then take its upper shield or the back itself off, being the only thing about the animal that has value; but as the shells adhere fast to each other, there would be danger of tearing them if they at once pulled the plates asunder. They usually wait three days, in which time the soft parts become decomposed, and the plates are loosened with very little trouble."

Chelonia imbricata.—The carapace of this turtle is heart-shaped and slightly convex, with thirteen imbricated, semi-transparent, and variegated scales on the disc; marginal pieces, twenty-five. The first four vertebral scales are of an enlarged hexagonal form, the last four are of an elongated form, the lateral ones are pentagonal, and those of the border are much smaller and quadrangular. The blades or scales are very transparent, and more beautifully mottled than those of the *Chelonia Caretta*; but, as these scales are thinner, they are not used for the same purposes, but are employed for veneering and inlaying work. It has a blackish-green colour, with yellowish spots. There are twenty-four plates in four rows on the plastron of this turtle.

C. Caretta.—The carapace of this species is oval and slightly in the form of a heart, convex, and covered with thirteen plates or scales of the thickness of two to nine millimetres (one to four lines), semi-transparent, slender, and imbricated at the extreme edge. The first dorsal plate is the largest, and nearly square; the three succeeding ones are hexagonal, and the last pentagonal. The eight lateral scales and those on the extreme are quadrangular, and the intermediate ones pentagonal. The twenty-four marginal plates vary in size, and approach more or less to the parallelogram form. The colour of all these scales is blackish, with irregular transparent spots of a golden yellow, and veined with red and white, or of a brownish-black, of various shades. The plastron is roundish, slightly salient in front, and obtuse in the back. It is covered with twelve large plates, imbricated, whitish, and leathery.

It is in many respects a not unimportant fact, that tortoiseshell comes to us from more countries than any similar material. We receive it from the East Indies, China, West Indies, South America, Africa, and Australia. This is without reference to the small, well-known land and river tortoises, or the edible turtle; the shell of the latter being of trifling, of the former of no value, in manufactures.

The plates of the carapace of the loggerhead turtle (*C. caouana*) are fifteen in number, and of a dark chesnut brown. The scales of this turtle are very thin, and, besides, are neither clear nor beautifully coloured. It appears exceedingly plentiful, and has very little value (being worth at present about 3d. per pound), as there is scarcely any known use for it.

The Indian islands furnish the largest supply of tortoiseshell for the European and Chinese markets, the chief emporia being Singapore, Manilla, and Batavia, from which are exported yearly about 26,000 lb.: one-half of this quantity is from Singapore.

The Chinese have, no doubt, some markets for obtaining tortoiseshell not yet known to us, as the tortoiseshell we receive thence differs in quality from that we receive from the East Indies (Malay and Philippine Islands); at the same time they compete with us for the purchase of the sorts we get.

From the year 1811 to the year 1830, the aggregate imports of tortoiseshell into the United Kingdom from the East Indies amounted to 98,522, valued at 128,650*l.* The annual quantity imported ranged from 10,000 lb. in some years to 1,100 lb. in others.

Sources of Supply and Prices of Tortoiseshell imported into the United Kingdom in 1859.

	Quantity.	Average Price.	Total Value.
	lb.	s. d.	£
Holland - - -	2,643	14 1	1,861
Egypt - - -	6,265	14 6	4,560
Philippine Islands -	2,233	18 8	2,088
United States - -	819	15 0	613
Central America - -	913	15 0	684
New Granada - -	8,466	15 0	6,349
British East Indies -	14,053	13 5	9,433
Australia - - -	5,812	16 1	4,670
British W. I. Islands -	4,888	14 10	3,637
British Honduras -	823	15 4	637
Other parts - -	1,398	15 0	1,047
	48,313	——	25,579

Tortoiseshell should be chosen in large thick plates; free from cracks, carbuncles, or barnacles; clear, transparent, and variegated. The crooked, broken, and small plates should be rejected.

The principal consumption is in the manufacture of combs (ladies' back and side, dressing and pocket combs); the minor uses—for optical purposes, more particularly for hand-spectacles, eye-glasses, and frames for microscopic lenses ; for the manufacture of fancy articles, such as *étuis nécessaires,* toilet and perfume boxes, needle and card cases.

It is altogether of slight commercial importance, especially at present, being in a very critical and exceedingly depressed state. This is attributable—firstly, to the general position of trade, which, of course, is most sensitively felt by a raw material used solely in the manufacture of expensive articles of luxury; secondly, to one of those incongruous vagaries of taste, in nothing so inexplicable as in feminine attire—the ungainly fashions of wearing the hair either loose, dishevelled over the shoulders in artificial *négligé,* or thrown conspicuously over the face by concealed horse-hair puffs, or suspended behind in a netted bag, having completely superseded the neat and elegant modes formerly in vogue, and their necessary appendages, side and back combs. At the same time, the dressing-comb, not affected by this, was for a time seriously injured by the new appliances of India rubber and gutta percha. It is, however, now recovering from this, as the combs manufactured from these two articles have not been found to answer so well as was expected.

The market value of tortoiseshell is, of course, much influenced by the beforementioned causes. In ordinary times, it ranges from 16s. to 30s.; at the present moment, the 16s. quality may be had at 10s., the 30s. at 25s. The purchase of it is, however, a mere speculation, as its value is dependent entirely on the movement of the fashion in the head-dress of the fair sex. It arrives in packages of all sizes and of all shapes, from the paper parcel containing the skeleton of a single animal (technically a "fish"), weighing from two to four pounds, to the puncheon, or iron-bound cask or case, containing from two to eight hundredweight.

The above particulars refer exclusively to what is generally known as tortoiseshell. We receive, besides, an article technically called "hoof," being that portion of the skeleton which unites the upper to the lower half of the shell. Until lately this was about half the value of the shell, but it has now become of at least equal value, being used for the manufacture of the gold or amber-coloured semi-transparent comb so much admired abroad. Altogether, like most articles of taste, both the manufacture of combs and the appreciation of their value have reached a far higher point on the Continent than in England;—here the endeavour being to manufacture the cheap and durable ; there, the tasty and light.

We also receive, from nearly as many countries as tortoiseshell itself, the material technically known as "turtle-shell." This is used in the manufacture of the cheaper kind of card-cases, workboxes, and small fancy articles ; and, more especially on the Continent, largely in the manufacture of furniture (buhl and marquetry). Its value is now from 1s. to 10s. per pound.

The lower shell of the tortoise or turtle, technically called the "belly-shell," united by the hoof to the upper, differs entirely from it in appearance. Instead of the mottled, shaded colour of the upper shell, with its varying tints and markings, it is of a bright yellow, resembling half the hoof to which we have before referred, and which, it may be incidentally mentioned, is of two colours; the portion attached to the upper shell partaking of its mottled colouring; the portion attached to the lower shell being of the bright yellow, even colour of the belly-shell. This latter is principally used for the same purpose as the gold-coloured portion of the hoof. The imports of both these kinds are trifling, amounting to about two tons per annum, and the value from 8s. to 18s. per pound.

The mode of working tortoiseshell being very interesting, and but little known, the following account, taken from MM. Dumeril and Bibron's 'Epétologie Générale,' may not be unacceptable:

"The substance of the scale, considered as rough material, is unfortunately brittle and liable to split: on the other hand, it possesses most valuable properties. The fineness of its texture, its compactness, the admirable polish and the carving which it is capable of receiving, the facility with which it may be moulded, its fragments soldered together, melted or amalgamated by the aid of powder of the same material—these qualities give to it its value. The scales of the turtle in question, when detached from the carapace, are bent in different ways; their thickness, besides, is not uniform, and often it happens that they are too thin, at least throughout a great portion of their substance.

"In order to straighten them, it is sufficient to steep them in boiling water for a few minutes, and then take them out and place them between plates of metal or smooth blocks of hard wood, leaving them to cool, great pressure being applied at the same time. They then retain the flatness desired. They are next scraped and filed, a smooth surface being obtained with as little loss as possible. When these shells or scales are brought to a proper thickness and size, they may be then used separately, but they are generally submitted to a still further preparation. When, for instance, they are too thin, or when they are not sufficiently long or broad, the following processes are employed:—In order to obtain single plates of great size, two are soldered together, the thin part of one being laid upon the thin part of the other; or, as is sometimes done, the edges of each plate are delicately bevelled and fitted together. In each case they are then put between metallic plates; to these a certain degree of pressure is given, which, when the whole is plunged into boiling water, is increased, and by this mode they are so intimately joined together that the slightest trace of their union cannot be detected.

"It is almost exclusively by means of boiling water that the effects upon tortoiseshell are obtained. The substance of the scales becomes so softened by the action of the heat, that it may be acted upon like a soft mass, or a flexible and ductile paste, which by pressure in metallic moulds will assume every variety of form required.

"The soldering of two pieces together is effected by means of hot pincers, which, while they compress, at the same time soften the opposed edges of each piece, and amalgamate them into one. No portion of the scales is worthless: the raspings and powder produced by the file, mixed with small fragments, are put into moulds, and subjected to the action of boiling water, and thus made into plates of the desired thickness, or into various articles, which appear as if cut out of a solid block."

Such, then, is a summary of the mode in which tortoiseshell is worked. By means of heat and pressure it can be made to assume many forms, and thus it becomes manageable in the hands of the workman for the diverse purposes of use or luxury to which it is applied. Some of the beauty of the tortoiseshell is, however, lost by the soldering process; and that moulded from the dust and raspings is of one uniform colour, without white spots.

What is known in commerce as tortoiseshell, is strictly the thirteen scales which cover the carapace. The names given to these are, two main plates, two plates, three backs, two wings, two tongues, two shoulders—in all, thirteen. In an animal of the ordinary size, about three feet long and two and a half wide, the largest plates will weigh about nine ounces, and measure about twelve inches by seven, and one-fourth of an inch thick in the middle.

CAOUTCHOUC, OR INDIA RUBBER.

BY BENJAMIN NICKELLS.

We propose, in this paper, to offer a few observations on a substance which, from its importance in the industrial arts and pursuits, must be classed among our most valuable productions. Caoutchouc, or, as it is more familiarly termed, *India rubber*, applicable to a vast variety of purposes directly concerned in and intimately connected with the business of life,—combining qualities possessed by no other known material, and capable of being procured in inexhaustible abundance,—is invested with an interest of high order, second only to that associated with iron and timber. Few are probably aware of the comparatively late introduction of caoutchouc into this country, and it may not be uninteresting to state that Dr Priestly, in the preface of his book on Perspective, printed in the year 1770, says—"Since this work was printed off, I have seen a substance (no name is "given to it) excellently adapted to the purpose of wiping from paper the "marks of a black-lead pencil. It must therefore be of singular use to those "who practise drawing. It is sold by Mr Nairne, mathematical instrument "maker, opposite the Royal Exchange. He sells a cubical piece of about "half an inch for three shillings: and he says it will last for several years."

We can scarcely conceive anything more primitive than the condition of caoutchouc at the time it made its first public appearance under the auspices of Dr Priestly; yet, within a few years, it has established for itself an unparalleled reputation. Prior to this date however, and mainly owing to the explorations of M. De la Condamine in South America, caoutchouc was known as a botanical product of certain tropical climates, an account of which was published by him in the 'Transactions of the French Academy' in the year 1736. Although its true source was thus established, its vegetable origin was doubted by a few who considered its nature to partake more of the mineral than of the vegetable: but Dr Roxburgh, a subsequent investigator of this product, fully confirmed M. De la Condamine's statement that the substance was the inspissated juice of a tree, and at once dispelled those somewhat singular notions by a careful enumeration of the then known trees which yielded it.

The botanical history of caoutchouc is in itself most interesting. Its classification is easy, though it is still doubtful whether all its sources have yet been ascertained. The explorations of modern travellers make it probable that other sources, apart from those on which we have hitherto relied for our caoutchouc supply, exist, and promise an inexhaustible yield. To America and the East Indies the early manufacturers were indebted for their supplies of caoutchouc ; and it is an interesting and most significant and hopeful fact, that although the application of the demand for the material has made rapid progress, the supply has in no one instance fallen short of the demand, either in price or quality. On the contrary, the better kinds of caoutchouc—*i.e.*, "Para" and "Bottle"—equal in bulk and quality the supply of any former period. Much of this is to be attributed to greater care consequent upon experience, and the interposition of European agency in the collection and treatment of the "sap," preparatory to consolidating and moulding it for export. Gradually, however, as the demand increased, fears were manifested that the supply would fall short, and ultimately cease altogether : and this probability was the more threatening, as the value of the gum had been fully tested and appreciated. Such fears promoted further search and investigation, in order to discover other sources. The supply, however, notwithstanding all anticipations to the contrary, did not fall off. It was soon found that caoutchouc was not confined to a few districts in America and the East Indies, but that Australia,* Southern China, the Mauritius, Madagascar, Java, Singapore, Penang, Assam, and Africa added their supplies in such quantities as to dispel the apprehensions which had existed ; and, as exploration proceeded, it was found that the whole of the islands dotting and studding the Indian Archipelago abounded in forests of caoutchouc-yielding timber.

Let us here remark that caoutchouc exists exclusively in what is termed the "milk sap" or "juice" of plants, varying in quantity with the plant yielding it, and its geographical position in the tropics. Plants yielding this milk-sap are doubtless to be found on every portion of the earth's surface, obeying the general law governing vegetable life—viz., increased productiveness in proportion to their vicinity to the tropics. Humboldt, in the first edition of his 'Aspects of Nature,' notices this fact, "that the milk-juice of plants increases as they approach the tropics."

Caoutchouc, on the whole, is a substance far more widely diffused among plants than is generally considered. In addition to the two chief families which yield the caoutchouc of commerce, the Artocarpaceæ and the Euphorbiaceæ, caoutchouc has been found in the sap of plants belong-

* The *Ficus Australis* abounds in the northern part of Queensland.

ing to the Cichoraceæ, Lobeliaceæ, Apocynaceæ, and Asclepiadaceæ. Referring to the former, the Indian caoutchouc is principally obtained from the natural family Artocarpaceæ; whilst the American is derived from trees classed among the Euphorbiaceæ. The chief source of the "East India" or "Java rubber," large quantities of which have during late years been imported into this country, is the *Ficus elastica*, known also as the Assam caoutchouc tree. The *Ficus elastica*, again, belongs to a family of plants which yield in abundance a milky juice, possessed of various and singular properties in common with the hydro-carburet emulsion of the order Euphorbiaceæ. This remarkable tree is described as attaining the size of an English sycamore, although it is frequently met with of gigantic proportions. Trees have been found to measure 80 to 100 feet in height, whilst the area covered by their expanding branches has exceeded 150 feet in diameter.

The *Ficus elastica* is also indigenous to Assam, in the districts between the Burrampooter and the Bootan hills. It has a preference for rocky chasms, where its roots are plunged among the *dêbris* of mountains and vegetation. It has been calculated from authentic surveys that there are from forty to fifty thousand trees of this class within a length of 30 by 8 miles of forest near Ferozepoor, in the district of Chardwar, in Assam; and, so far as has yet been determined, the geographical range of the tree in this country is between 25 deg. 10 min. and 27 deg. 20 min. North latitude, and 90 deg. 40 min. and 95 deg. 30 min. East longitude. It is a tree growing with great rapidity, attaining a height of 20 to 30 feet in a growth of five years only. Its leaves are well formed, smooth, polished, and of a lustrous green. From the larger branches, roots descend to the earth, as in the case of several members of the same family, *Ficus indica*.

In addition to the *Ficus elastica*, India has other trees also yielding caoutchouc. We may quote the jack-tree, *Artocarpus integrifolia;* the banyan tree, *Ficus indica;* and the pippula tree, *Ficus religiosa.* Eastward of Bengal other sources have been discovered: the Luti Aru, a description of climbing apple, called Sadal Kowa, abounds in a milky sap containing a large proportion of caoutchouc. The *Urceola elastica*, first described by Dr Roxburgh as the chief source of caoutchouc in India, yields it in great abundance.

The late Dr Royle, who specially studied this question, states that in the East "there might be any quantity of the article procured from a great variety of plants, if the natives could only be induced to collect it with sufficient care."

The American caoutchouc is chiefly obtained from a tree belonging to the Euphorbiaceæ family, and named the *Siphonia elastica.* This tree abounds on the banks of the Amazon and its tributaries. It attains a considerable height, is perfectly straight, and is characterised by having no branches except at the summit, where they form a conical crown; its leaves resemble those of the manioc, are coriaceous, and highly polished on both sides. An oil is also extracted from its seeds.

Caoutchouc is extracted from the various trees already mentioned, by making incisions in the bark around the trunk, beginning at the base, or at the reflex roots, which generally lie exposed. A milky emulsion containing the caoutchouc exudes from these wounds, and is collected in earthen or clay moulds, which, as soon as they are covered with a stratum of the liquid, are exposed either to the heat of the fire or the sun. When dry, they are again dipped, and so on until the coating of caoutchouc attains a thickness varying from one to two inches. The moulds are then broken, and the pieces removed through the neck, leaving the solid coating or envelope—the crude "Bottle" or "Para" India rubber of commerce.

Having so far traced the principal sources of caoutchouc, and leaving its various modes of collection, chemical and other properties, to form the subject of a future paper, we will as briefly glance at the part of the caoutchouc trade which tells of thirty-five years' uninterrupted manipulation of this singular gum; during which period vast transactions have been conducted and carried out in it, while a knowledge of many of its most valuable properties and features has been obtained. Application has followed application, and invention succeeded invention, in an astounding manner—so readily has this elastic substance accommodated itself to the necessities and requirements of the age it has passed through; and in this respect it may be said to stand unrivalled by any similar product. At no former period of its history has this material stood forward so prominently and conspicuously as at the present day, and never have its peculiar properties been so fully appreciated or universally admitted. But, great as are its known advantages, they cannot fail to be multiplied to an unlimited extent, as science aids in the discovery of mechanical and chemical means to apply it to the daily-increasing wants which it alone is capable of fulfilling. Its past applications, worthy of note as materially benefiting the progress of the age, have been chiefly mechanical; but a new era has dawned, in which knowledge is everywhere unfolding and lending her aid towards development and progress. Steam, which has already worked such mighty changes in civilisation and the commerce of nations, is largely indebted to caoutchouc as supplying a want in engineering appliances incapable of being made good by any other material, not excepting metal itself. But this is not all: there are higher points to be arrived at. We are justified in our assertion that caoutchouc is destined to play a yet more important part, in linking together "shore to shore with the uttermost parts of the earth," spreading civilisation and "uniting mankind under one bond of universal brotherhood."

That electricity, as applied to Submarine Telegraphy, will ultimately effect this end, there can be no doubt; and that caoutchouc, whose peculiar qualities are unsurpassed by any material that can be brought into competition with it, will also contribute its share to this end, is almost a matter of certainty.

It has been said that to gutta-percha, a gum now equally well known as caoutchouc, is due the present perfection and success of Ocean Telegraphy.

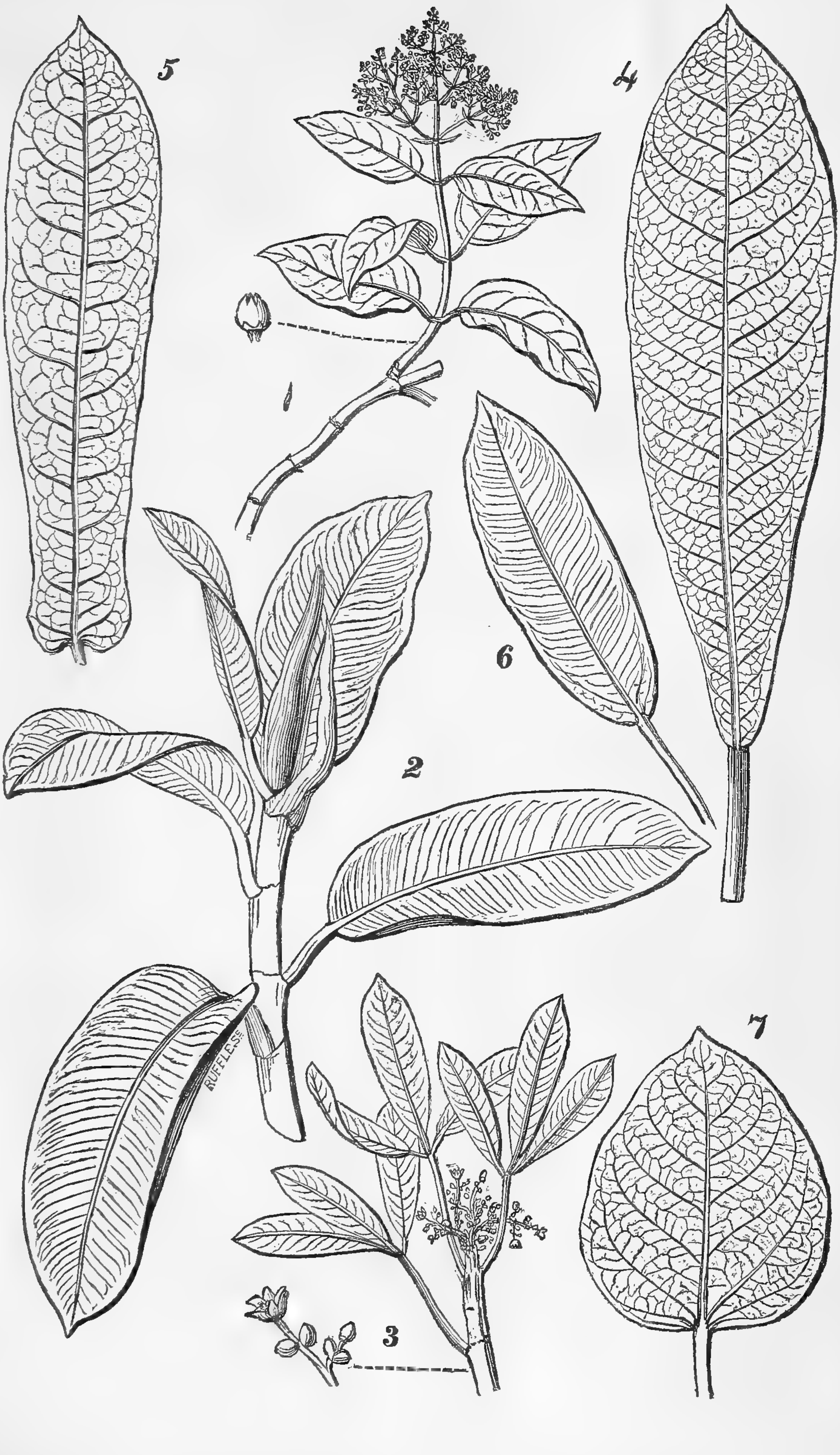
Indirectly this is unquestionably true; but, most unfortunately for its reputation, that gum has failed at the greatest moment of its need, at a period when the requirements of the age render it imperative that Deep-sea Telegraphs should be permanently and successfully established.

It is not, however, the object of this paper to discuss this question, or enter into the relative merits of caoutchouc over gutta-percha. The superiority of the former gum in "telegraphic insulation" is clearly and irrefutably established in the scientific evidence recently given before the Government Committee appointed to "investigate matters connected with the construction of Electric Submarine Cables." Our intention was to allay the apprehensions of imperfectly-informed persons, that if caoutchouc be applied to deep-sea lines, we should speedily exhaust and dry up the supply. How such impressions can have been formed it is difficult to conjecture, especially with the experience and statistics on record. Yearly has the consumption been increasing, and yearly has the supply maintained itself in excess of that consumption. We are warranted, by facts which are incontestable, in assuming that caoutchouc exists in sufficient abundance, and that, with the most extensive application, many years must elapse before its present yield, adequate to meet all requirements, can in any measure exhaust or diminish its supply.

Assuming, however, that the supply should fall short, the pressure would be but temporary: fresh explorations, pushing further back into the untrod and pathless forests abounding with gum, would bring forth supplies equal to any emergency the times might demand. While influencing such marked changes in the manufactures of this country, a corresponding impression is made on those countries where the trees abound, as the demand increases for this material. Whilst in telegraphy it plays an important part, the stimulant to its increased production will excite even the cupidity of a savage. But little skill and attention are required for its collection, and it is not, perhaps, unreasonable to hope that the demand for Caoutchouc may be one of the means for opening up Central Africa to the civilising and humanising influences of Christian Europe. While called for by the necessities of an advanced civilisation, the easy task of collecting and preparing this gum may, by amply rewarding, stimulate the latent industry of the negro, and initiate him into those wholesome habits of work which, according to the proverb, are next in value to prayer.

The plants illustrated in the woodcut on the opposite page are—

FIGURE 1.—*Urceola elastica*, Sumatra, &c.
„ 2.—*Ficus elastica*, East Indies.
„ 3.—*Siphonia elastica*, South America.
„ 4.—*Ficus Brassii*, Sierra Leone.
„ 5.—*Ficus pandurafolia*, East Indies.
„ 6.—*Ficus macrophylla*, Australia.
„ 7.—*Ficus indica* (Banyan-tree).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ANTIMONY.

BY THOMAS D. ROCK.

Many economic substances of great practical utility to man, either lie hidden beneath the vestments of science, or are lost in the obscurity of application. Such a substance is the metal antimony; and although the name *antimony*, as popularly applied to various chemical preparations, is familiar as a household word, yet how few persons know aught of the history of this metal beyond the fact of its being a most subtile poison, or are at all acquainted with its valuable metallurgical qualities!

The history of antimony, or rather of the most abundant ore of this metal, commences at a very remote period; for the sulphide of antimony was known as early as the year 884 B.C., when Queen Jezebel, of infamous memory, used it as a pigment,—"*put her eyes in painting*, tired her head, and looked out of a window."* The sulphuret was not, however, known at this distant date by the name of antimony, but was distinguished doubtless by some Chaldee or Hebrew name synonymous with the Sanscrit "*Saubira*," or the Arabic "*Kohul*." By the Greeks it was called Στίμμι, and in the Latin tongue *Stibium;* and it is highly probable that our forefathers really imagined this ore, with its bright metallic lustre, to be the metal itself.

The discovery of metallic antimony, now called *regulus of antimony*, is by general consent attributed to the celebrated German monk and alchemist Basil Valentine, who lived in the fourteenth century, and in whose writings the most marvellous virtues are imputed to this metal; especially in one little book devoted exclusively to the subject, and entitled 'Currus Antimonii Triumphalis.' Even the name antimony is traced to this curious and wonder-loving disciple of the mysterious art, in a curious anecdote which I copy *verbatim* from Poiret's 'History of Drugs:'—"It acquired the name of antimony from the aforesaid Valentine, who, in his search after the philosopher's stone, was wont to make use of it for the more ready fluxing of his metals; and throwing one day a parcel of it to some swine, he observed that they had eaten it, and were thereby purged very violently, but afterwards grew the fatter upon it, which made him harbour an opinion that the same sort of cathartic exhibited to those of his own fraternity might do them much service; but his experiment succeeded so ill that every one who took of it died. This, therefore, was the reason of this mineral being called antimony (anti-monk), as destructive of the monks."

In France, during the fifteenth and sixteenth centuries, the medicinal preparations of antimony were alternately permitted and proscribed by Parliamentary authority, just as their properties were esteemed or feared by the practitioners of the day. And with these brief allusions to the ancient history of antimony, I will at once proceed to a more general account of the same.

* 2 Kings ix. 30.

Antimony is altogether a sociable metal—if I may be allowed the use of such a metaphorical expression—for it is neither found alone in nature, nor used unmixed with other substances in the arts. A further and more classical derivation of its name, as given by Webster, is based upon this social property of the metal—*αντι*, against, and *μονος*, alone—but by whom bestowed, or at what period, I cannot ascertain. Antimony is found in combination with oxygen, sulphur, silica, silver, lead, arsenic, iron, &c.; and its principal ores are,

Native Antimony,
Silicate of Antimony,
Arsenical Antimony,
Oxide of Antimony,
Sulphide of Antimony,
Sulphide of Antimony and Lead.

And of each of these ores there are several varieties, separately distinguished by mineralogists.

Native antimony, so called, is the purest ore of this metal, containing in some instances as much as 90 to 98 per cent. of antimony, in combination with silver and iron. It is a beautiful mineral, generally occurs massive, with a lamellated structure, but sometimes in spherical or botyroidal aggregates, with a granular texture; that from Borneo being of this latter description. The colour of native antimony is tin-white, and tarnishes easily on exposure. It is not sufficiently abundant to merit much attention from the metallurgist.

Arsenical antimony is another ore of this metal, found in several parts of Europe, and in Borneo, in considerable quantities; but I am not aware of its being anywhere smelted for its antimony.

In Spain, a silicate of antimony occurs in a mine in the district of Saragossa, containing 60 per cent. of the metal; and in the province of Zamorga, the Society of Marte works a similar ore.

Oxide of antimony occurs most abundantly in Hungary, Siberia, Saxony, Bohemia, Algeria, Borneo, &c. In the province of Constantine, Algeria, two mines of oxide of antimony are worked, which yielded in 1850 about 1,541 metrical quintals of ore = 151½ tons. A large quantity of the oxide has recently been imported from Borneo, where it is found principally on the surface of the ground in the antimony districts of Sarawak, the sulphide being beneath it. Oxides of antimony are so various in their external appearance, that I must not attempt a general description of them in this paper. That from Borneo is in granular, pulverulent masses, of a yellowish brown colour, interspersed with sulphide of antimony, and contains

Oxide of Antimony (antimonious acid)	94·15
Sulphide of Antimony	0·99
Water	3.20
Traces of the Sulphates of Lime and Magnesia	1·66
	100·00

As a source of metallic antimony, this ore, although so rich, will not sell in the English market ; but a limited demand has recently sprung up for it for the manufacture of an antimony paint. Oxide of antimony, prepared artificially from the sulphuret, has been adopted for this purpose for many years, though only on a small scale. It has been cheaper than white lead, is not so apt to lose its colour, has more body, and an equal weight will spread over a larger surface. The new paint from the natural oxide is of a pale brown or stone colour, and appears well adapted for outside house-painting. The yellow oxide of antimony, prepared from the sulphuret, is used for enamel and porcelain painting, also in the manufacture of some of the artificial gems. It is likewise one of the ingredients of Naples yellow, a preparation applied to the bronzing of metals, and especially works in iron.

The most important ore of antimony—indeed, the only really available one—is the sulphuret or sulphide ; and it is found in almost every quarter of the globe ;—in France and Hungary, where it is smelted ; also in Spain, Portugal, Italy, the United States, West Africa, the East Indies, China, Australia, Malay Peninsula, and Borneo. Of the sulphuret of antimony there are numerous varieties ; but it will be sufficient for our present purpose if I describe the ordinary commercial kinds, as either compact and granular, or fibrous and laminated :—Colour lead grey, highly metallic, resembling galena. Sp. gr. 4·13 to 4·51, fusible at a low red heat. They vary in richness from 40 to 75 per cent. of metallic antimony, according to the purity of the ore ; and the following table will evidence the opinion of several chemists as to the constituent parts of the sulphides when separated from the matrix.

Name of Chemist.	Antimony.	Sulphur.	Totals.
Bergmann - - - - -	74·00	26.00	100
Dana - - - - -	73·00	27·00	”
Thomson - - - -	73·77	26·23	”
Davy - - - - -	74·06	25·94	”
Brande - - - - -	73·5	26·50	”

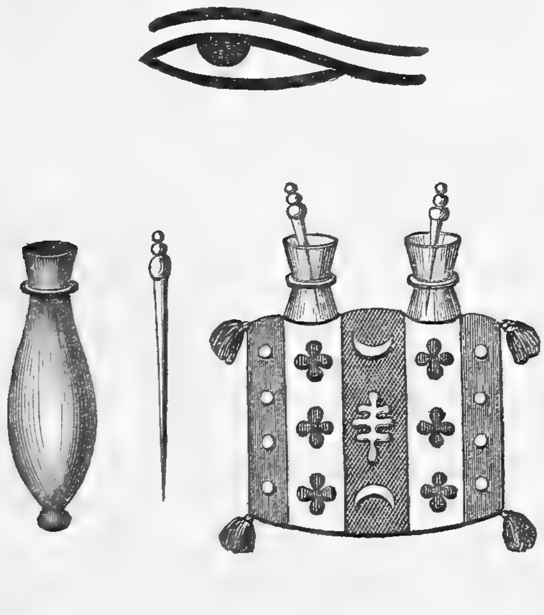
In Italy, large deposits of sulphide of antimony are found at Montanto and Pereta, in Tuscany. At the former place the mineral is extracted with great facility, the lodes lying in the superficial stratum ; but at Pereta the works are underground. These mines together yield about 260 tons of ore annually, and much of this finds its way to England. Sulphide of antimony also exists abundantly in the province of Minho, district of Porto, in the parish of Vallongo, Portugal ; and as we receive ores of this metal from that country, I presume this is the source from whence it comes.

Spain likewise aids considerably in the supply of our markets with sulphide of antimony ; but Borneo is, and must continue to be, the chief available repository of this metal. It is found in several parts of that island, more especially on the west coast, in the interior of Sambas, at

Sarawak, and other places. The antimony districts that are now worked by the Borneo Company are situated a little to the south of the Murong river, a branch of the river Sarawak. It is a limestone district, and the antimony is found either in boulders on the surface, or in veins of great richness in the rock below; the rock being split by the agency of fire until the ore is exposed to view. Chinese coolies, under the superintendence of Europeans, furnish the labour at these mines; and the ore, after being raised, is removed, by means of trucks and a tramway, to native-built barges on the river, which transport the ore to Sarawak, whence it is shipped on board vessels with other Borneo produce for the Old Country. These mines were worked by native Rajahs before Sir James Brooke obtained possesssion of the territory. The quality of the Borneo ore has varied considerably; but on the whole it is exceedingly rich and pure, containing often as much as 70 to 74 per cent. of antimony: it is also a kindly-natured ore, and easily worked. At one time sulphuret of antimony was produced in quantities in Cornwall and Dumfriesshire, and even now parcels of ore from the former place do occasionally reach the London market; but in a general way these English ores are inferior, and bear no comparison with those from Europe and Borneo.

Sulphuret of antimony possesses the singular property of staining the skin black; hence its ancient and modern employment as a pigment in Oriental countries. I subjoin the following highly interesting and instructive account of this ancient practice, as given by the celebrated missionary of Palestine, Dr Thomson, in his recent work entitled "The Land and the Book."

That which has been and still is the favourite mode of beautifying the face among the ladies of this country, he thus describes :—" They paint or blacken the eyelids and brows with *kŏhl,* and prolong the application in a decreasing pencil, so as to lengthen and reduce the eye in appearance to what is called *almond-shaped.* The practice is extremely ancient, for such painted eyes are found on the oldest Egyptian tombs. It imparts a peculiar brilliancy to the eye, and a languishing, amorous cast to the whole countenance. The powder from which *kŏhl* is made is collected from burning almond-shells or frankincense, and is intensely black. Antimony and other ores are employed. The powder is kept in phials or pots,



Bottles and Case for holding the Kohl and Egyptian Eye.

which are often disposed in a handsomely-worked cover or case; and it is applied to the eye by a small probe of wood, ivory, or silver, which is called *meel*, while the whole apparatus is named *mŭkhŭly*."

The cases which contain these small bottles are very commonly made of plaited or coloured straws or reeds, split, as in fine basket-work. In Persia the practice of painting the eye is not confined to the females, but is also generally adopted by the men, who carry the prepared powder about with them, in small round ivory boxes of the size and thickness of a florin. Under the Hindoo name of *Surmeh* or *Soorma*, native sulphuret of antimony is used in India as a drug. Sulphuret of antimony is also the base of a variety of medicines in our own Pharmacopœia; only it is the refined sulphuret, termed crude antimony.

Crude antimony results from the first process in antimony smelting, which consists of fusing the ore in crucibles at a low heat; the impurities thereby rising to the surface, and the crude metal either settling in the bottom of the crucible, or passing through a perforation into another crucible or vessel below. It is met with in commerce in the form of conical loaves, possesses a structure highly striated, and has considerable brilliancy: colour, leaden grey; fracture, splintery. This crude antimony or refined sulphuret is administered as a drug in this country, and is also the original source of all the various medicinal preparations of the metal: as, antimonii vitrum—glass of antimony; antimonium tartarizatum—tartar emetic; vinum antimonii tartarizati—antimonial wine; antimonii sulphuretum præcipitatum—precipitated sulphuret of antimony; pulvis antimonialis—antimonial powder; &c. &c.

The property of marking or staining paper possessed by the crude antimony has caused its adoption as an ingredient in the manufacture of cheap lead-pencils. For this purpose, the crude antimony is finely powdered, and mixed with a suitable proportion of plumbago; the whole being afterwards compressed by a patent process into a solid block, or possibly agglutinated with a gummy cement, and then sawn into slabs and strips for the pencils in the usual manner. The name black-lead (*plumbum nigrum*) has sometimes been given to the sulphuret of antimony, in consequence of its staining property; and from this circumstance, possibly, arise the misstatements in many Bible commentaries, that the eye pigment of the ancients was an ore of lead. I need scarcely remind the reader that the marks of an inferior pencil containing antimony are permanent, not being influenced in any way by the application of India rubber. Sulphuret of antimony has, amongst other applications, been employed as a constituent in the manufacture of lucifer-matches: it is also used in pyrotechny.

It now remains for me to notice the method by which metallic antimony is obtained from the sulphuret, or crude mineral; and this is effected by melting the crude antimony in crucibles, in conjunction with tin-plate clippings (narrow strips of tinned iron). The sulphur having a stronger affinity for iron, leaves the antimony, and forms with the strips a sulphide of iron. The impure metallic antimony thus freed is then subjected to fusion with small quantities of sulphate of soda and slag from the first process. The product of this second operation—called bowl antimony, from the shape in which it is cast, is finally smelted with pearl-ash and slag, in order to obtain the best regulus, or star antimony,—so named from a singular surface crystallisation, in the form of a star, common to some metals, but in a marked degree to antimony. Another, and, I believe, the Continental process for procuring regulus of antimony, is by carefully roasting the ore, to expel the sulphur, in an open furnace until grey oxide of antimony alone remains. The oxide is then mixed with one-tenth of its weight of crude tartar, and reduced in large earthenware crucibles in a wind furnace.

Metallic antimony, or regulus, is of a bluish or silvery-white colour, is laminated in structure, possesses some tenacity, but no ductility whatever. Sp. gr. 6·712, or thereabout ; atomic weight, 64 ; principal property, that of hardening metals—hence its use as an alloy. Fuses at 810 deg. Fahr. The presence of antimony in minute portions affects the ductility of some metals to a most serious extent, and even the fumes of antimony in the vicinity of melted gold will destroy its malleability. Copper likewise receives material injury from antimony, even though the quantity be so infinitesimal as not to be discoverable by assay.

Regulus of antimony is principally employed in metallic alloys, as type-metal, which consists of

9	Lead,	and	1	Antimony,
7	,,	,,	1	,,
6	,,	,,	1	,,
5	,,	,,	1	,,

according to the size and nature of the type required. A mixture of tin and antimony composes the plates on which music is engraved. Some kinds of pewter, especially that used in the manufacture of plates and dishes, contain antimony. Large quantities of antimony are also used in the production of Britannia metal—as much as 10 per cent. in some cases. A mixture of tin and antimony, called anti-friction metal, has been used of late for railway axles and other bearings, also in metallic rings or collars : the name arises from the supposition that it is not so easily heated as other alloys, and less grease is required. Shot for cannon made of antimony, either "hard and brittle, or tough," were introduced to the notice of the public a few years ago by a firm at Lambeth. Against iron ships, however, they could not be effective ; and their great cost would prove a fatal obstacle to their employment, even if they were effective.

I have only one other application of antimony to mention, and it is both ingenious and singular, although long since exploded. During the earlier portion of the seventeenth century, small half-pint mugs or cups were either turned or cast in antimony, and were known under the names of "*Pocula emetica*," "*Calices vomitorii*," or emetic cups, as they imparted to wine which had been kept in them a short time an emetic quality, the tartar in the wine acting upon the metal, and forming tartarised antimony. Antimonial wine probably derived its name from this source. The cups were painted or lacquered on the outside, and the inscription on one of these cups in the Museum of Economic Geology is,

"Du bist eim Wunder der Natur,
Und aller Menschen sichere cur."

Or,

"Thou art a wonder of Nature,
And to all men a certain cure."

The quantity of antimony ore imported from Borneo during the last six years is very considerable, and will show the capabilities of the island as a source of antimony.

In 1856 - -	1,104	Tons were received
1857 - -	1,054	„ „
1858 - -	763	„ „
1859 - -	1,386	„ „
1860 - -	2,074	„ „
1861 - - (to 30th April.)	1,313	„ „
	7,694	Tons.

With these figures the Board of Trade returns do not altogether tally, which may arise from want of discrimination between the ore and the crude antimony. However, I append a statement for four years:

IMPORTS.

	Antimony Ore.	Crude Antimony.	Regulus.
1856 - -	1,750 Tons.	3,121 Cwt.	1,004 Cwt.
1857 - -	833 „	421 „	958 „
1858 - -	849 „	1,456 „	237 „
1859 - -	1,192 „	2,386 „	357 „

EXPORTS.

	Antimony Ore.	Crude Antimony.	Regulus.
1856 - -	9 Cwt.	157 Cwt.	745 Cwt.
1857 - -	4 Tons.	899 „	595 „
1858 - -	3 „	16 „	77 „
1859 - -	19 „	274 „	528 „

The value of antimony ore ranges from 10*l.* to 18*l.* per ton, according to quantity and quality. Crude antimony is worth from 25*l.* to 30*l.*, and regulus from 50*l.* to 53*l.* per ton.