

one who attempts to cleanse the Augean stable of coniferous nomenclature and synonymy.

IV. *On the Vegetable Products, used by the North-West American Indians as Food and Medicine, in the Arts, and in Superstitious Rites.* By ROBERT BROWN, Esq.

On ransacking my various journals and note-books, relating to North-West America, I find scattered through them many notices of the economic plants of the aborigines of these countries. Though these memoranda can be of but little use to civilised art or medicine, yet I have thrown them together, as a contribution to the economic history of plants, and the ethnology of a little known people. The country is however very extensive, and therefore much must be omitted, as there are numerous plants and vegetable products used by some of the tribes which I have never visited, and of which I know nothing except by uncertain hearsay. These notes, therefore, principally relate to my own observations, and chiefly to the Indians on the Pacific seaboard.

The Indians are not much of a phytophagous people. The tribes in the interior live by hunting, and those on the banks of great rivers, such as the Fraser and Columbia, chiefly by fishing, so that they only resort to vegetable diet as an addition to their ordinary food, or as a corrective to the unvarying meals of flesh and fish, chiefly venison and salmon. It is only the miserable Digger Indians—the *gens de pitie* of the voyageurs—who can be said to subsist to any great extent on vegetable food, varying it with grubs, snakes, lizards, and grasshoppers, the latter of which they devour as eagerly as do the Bedouins of the Eastern deserts. Nearly all of the tribes, from the coast to the Rocky Mountains, use as food more or less of the blue lily, the Gamass or *La Gamass* of the voyageurs (*Gamassia esculenta*, Lindl.\*), which, in the spring, lends a characteristic aspect to the Western Pacific prairies and open grounds. In Vancouver Island this plant comes into flower about the middle or end of April, and remains in

\* A good account of this plant will be found in "Hooker's London Journal of Botany," vol. v. (Geyer.)

flower until June, when, just as it is fading, the roots are in a condition to be gathered. Until that time it is watery and unpalatable.

The gathering is nearly wholly done by women and children, who use a sharp-pointed stick for the purpose; and it is surprising to see the aptitude with which the root is dug out. A botanist, who has attempted the same feat with his spade, will appreciate their skill. About this period the Indians come from their permanent village, and encamp under the shade of trees in little brush camps. It is the time when, away from the filth of villages, Indian life appears in its most picturesque aspect; and the twinkling of the Gamass camp fires, as you pass along through the wood at night, have a very pleasing effect. To the Gamass gathering come sober-minded young hunters and salmon-fishers to select a partner; for the hard-working, skilful squaw is looked upon by an Indian of right constituted mind as a much more desirable acquisition than a mere gawky thing, gay in vermilion, brass wire, and hawk bells. In Oregon I have seen the bulbs roasted until they became black. They are then pounded up and preserved in cakes. In Vancouver Island, and generally throughout the country, the roots are roasted to convert the starch into sugar (though, of course, the Indian knows not the *rationale* of the process), and are preserved whole in bags for winter use.\* They are sweet to the taste, and appear to be a nourishing, and far from unpalatable article of food.

The roots of the *Sagittaria sagittifolia*, Linn., were at one time very extensively eaten by the Indians, under the name of *Wappatoo*; and on the Columbia River there is an island called Wappatoo Island, from the abundance of this plant. Since the introduction of the potato the use of the roots of the *Sagittaria* has much declined, and the name is now transferred to the potato. In the vicinity of nearly every Indian village are small patches of potatoes, but the ground is merely scratched up, and the cultivation far from being properly attended to. Their innate laziness and hatred of any work out of the ordinary routine of their

\* In some places they are buried in holes in the ground until fermentation sets in.

life, will not allow of their either properly attending to these patches, or increasing their cultivation and material comforts thereby to the boundless extent which they might—the land costing nothing. However, since the introduction of this useful tuber, the Indians are much less subject to starvation and the uncertain privations of a savage life; and some of them excel in the cultivation of the plant, their potatoes bringing, even from the whites, a higher price than any other. On Queen Charlotte's Islands is held a sort of regular "potato fair" every year, when tribes from all parts come to buy in exchange for the products of their country and industry. Some of them have strange notions of the best method of cultivation. I once lived in an Indian village for some days, when regularly every morning, as the squaws were lighting the lodge fires, and preparing the morning meal, the old chief would solemnly stalk all through the village, shouting in a stentorian voice, "Eat the little potatoes, keep the big ones for seed; eat the little potatoes, keep the big ones for seed!"

The roots of *Lilium canadense*, L., *Brodiea grandiflora*, Sm., and *Endosmia Gardneri*, H. & A. (Shah-gok, Nisqually Inds.), are all eaten in the parts of the country where they are found. Everywhere in Vancouver Island, and the neighbouring country, the Indians gather the roots of the ordinary *Pteris aquilina*, L., and boil and eat them as food. They look upon them as a great luxury. The Thongeisth, near Victoria, call this "Slee-uk," and still use them, notwithstanding the advent of civilised luxury among them.

The root of *Peucedanum fœniculaceum*, Nutt., is also eaten, and by some the roots of *Aquilegia canadensis*, Linn.,\* *Erythronium grandiflorum*, Pursh,† *Fritillaria lanceolata*, Pursh, *Allium canadense*, L., and *A. reticulatum*, Nutt., mixed with other food.

Douglas says that the roots of *Lupinus littoralis*, Dougl., are eaten by the Indians near the mouth of the Columbia

\* Var. *formosa*, Fischer.

† I sent home this fine *Erythronium* in 1863, and it is figured in the *Curtis' Botanical Journal and Kew Miscellany*, May 1868, from specimens which have flowered in the Edin. Bot. Garden. Dr Hooker thinks it is the *E. giganteum*, Dougl.

River (Chinooks). I never knew them do so, but I have seen the natives at the same place eat the roots of *Abronia arenaria*, Menz., which he might have mistaken for the former plant.\* Some of the miserable tribes in California eat the roots of the *tule*† (*Scirpus lacustris*, L.), which chokes up the lakes and swampy land of some portions of Southern Oregon and California.

Among other plants eaten by the Kootanie, Colville, and other tribes in that part of British Columbia and Washington Territory, is the beautiful *Lewisia rediviva*, Pursh. The roots are gathered in great quantities, and boiled and eaten like *salep* or arrowroot. In this state they are not unpleasant to the taste, slightly bitter, and are highly valued by the Indians as a nutritive food for carrying on long journeys, two or three ounces a-day being sufficient for a man even under great fatigue (*Hooker, Flor. Bot. Am. i., 223*). These Indians call it *Petlum-asd-ilsc-ne-mare*, and look upon it as one of the great gifts from the Supreme Master of Life. The white biscuit root, the *racine blanc* of the Voyageurs (*Eulophus ambiguus*, Nutt.), is dried, pulverised, and made into cakes baked in the sun. The roots of *Phaca aboriginorum*, Hook., a plant of the Eastern side of the Rocky Mountains, which, however, probably extends to the west of the range, are gathered by the Cree and Stone Indians in the spring as an article of food. The roots and young stems of *Heracleum lanatum*, Michx., are eaten by some of the coast tribes, and it is also used by the Crees of the eastern side of the Rocky Mountains as a pot herb.

The seeds of many plants are used as cereals. The seeds of various species of *Pinus* (*P. flexilis*, Torr., *P. Sabiniana*, Dougl., and *P. Lambertiana*, Dougl.) are all eaten in the parts of the country where they prevail, and they are the nut pines of that part of the country, though the name is often thought to apply to *P. Sabiniana* alone. The Indian climbs the tree, and throws the cones down to the squaw beneath, who carefully secures them; otherwise the squirrels would make short work with them. The cones are then scorched, to open them and destroy the troublesome resin;

\* *Vide* also Cooper's Nat. Hist. W. T. Bot., 55.

† *Tule, tula, tularé*, as variously pronounced, derived from the Mexican *tulill*.

so that the winter supply of pine seeds, which might have supplied a harvest to the botanist, is perfectly useless. When I visited Oregon in 1865, I found that in *P. Sabini-ana*, as in nearly all other Conifers, the pine seed harvest had failed, and the Indians suffered much. One of these pines, *P. Lambertiana*, yields a sugar which is occasionally eaten, though it has cathartic properties. It is only found on scorched trees, and in very small quantities. I have, however, heard of a man who devoted himself for a few weeks to the business of collecting it, and obtained 150 lbs. It can scarcely be distinguished from the manna of the shops, except by a slight terebintline flavour. In times of scarcity the Indians will eat the liber of *Pinus contorta*, Dougl. Along both sides of the trail in the passes of the Galton and Rocky Mountains, many of the young trees of this species are stripped of their bark from a foot or so above the ground to a height of six or seven feet. This is done by the Indians, during their annual buffalo hunting expeditions from the Kootanie and Kalispelm country to the plains east of the Rocky Mountains, for the sake of the inner bark, which they use as food, as well in its fresh state as when compressed into thick cakes, so as to render it portable (Lyall, *Linn. Journ., Bot.* vii. 141). I am not aware of the coast Indians making any use of it for food. The seeds of *Vicia gigantea*, Hook., are also eaten. Many species of grass seeds are collected for food. They are ground in a mortar, and roasted or made into soup. The seeds of the wild rye (*Hordeum jubatum*, L.) is especially held in request among the Shoshones of Southern Oregon; and a staple article of diet among the Klamaths, near the Klamath Lake, in Southern Oregon, are the seeds of *Nuphar advena*, Ait.—the yellow water lily of the lakes of that part of the world. I described its gathering and preparation in one of my letters.\* “Chestnuts” (*Æsculus californica*, Nutt.) are usually made into a gruel or soup. After being ground in a mortar they are mixed with water, in a waterproof basket into which red hot stones are thrown, and then the soup is cooked. As the stones, when taken from the fire, have dirt and ashes adhering to them, the soup is not clean, and it often sets the teeth on edge. The

\* “Farmer,” Nov. 1865, &c.

acorns of several species of oak (*Quercus*) are eaten with perhaps as much avidity as they were by the ancient Britons, only we are too familiar with the process as practised now-a-days by the digger to throw any shade of romance around it. The acorns of California are mostly large, and the trees in general produce abundantly, though in some years there is a great scarcity, and much misery ensues among the poor natives. They do not, however, contain, in proportion to the bulk, an equal amount of nutriment with cereals. The acorns are gathered by the squaws, and are preserved in various methods. The most common plan is to build a basket with twigs and rushes in an oak tree, and keep the acorns there. The acorns are prepared for eating by grinding them and boiling them with water into a thick paste, or by baking them into bread. The oven is a hole in the ground about eighteen inches cubic. Red-hot stones are placed in the bottom, a little dry sand or loam is placed over them, and next comes a layer of dry leaves. The dough or paste is poured into the hole until it is two inches or three inches deep. Then comes another layer of leaves, more sand, red-hot stones, and finally dirt. At the end of five or six hours the oven has cooled down, and the bread is taken out, an irregular mass, nearly black in colour, not at all agreeable to the eye or to the palate, and mixed with leaves and dirt. For grinding the acorns a stone pestal and mortar are used.\*

The nuts of the hazel (*Corylus americana*, Walt.) are also extensively gathered as food in some parts of the country where they are found. The fruit of the crab apple (*Pyrulus rivularis*, Dougl.) is prepared for food by being wrapt in leaves and preserved in bags all winter. When the apples have become sweet, they are cooked by digging a hole in the ground, covering it over thickly with green leaves and a layer of earth or sand, and then kindling a fire above them. The fruit of *Cerasus mollis*, Dougl., is also eaten. All of the edible berries of the country are eagerly collected by the Indians, and either eaten fresh or preserved for winter use. Indeed, the "berry sun" is a great season with them, and all through the lovely summer

\* "Hittel's California," 392. *Vide* also "Paul Kane's Journey," for some other methods of preparing acorns for food.

weather of North-West America you ever and anon come upon parties of women and children in the woods, engaged in this agreeable pursuit. Equally so is it with the frontier white women and children, who go in parties of this nature for days and even weeks together into the mountains. I used often to come across these "berrying parties" in my wanderings, and some of the pleasantest remembrances I have of my wild North-Western life is the kindness I received from these little-polished, but good-hearted people—acts which I can never return, save by this general acknowledgment in a circle of my fellow-botanists; and I assure them that I gladly embrace the opportunity of so doing. Some of the berries, such as the strawberries (*Fragaria vesca*, Linn., *F. virginiana*, Ehr., and *F. chilensis*, Ehr.), will not admit of being dried, and are accordingly eaten fresh, or brought down to the frontier settlements and towns, and there sold to the whites. Nearly all of the others are dried and pressed into cakes for winter use. During the latter end of the summer and autumn all around Indian villages, but chiefly on platforms and on the flat roofs of the houses, vast quantities of these berries may be seen drying, and being superintended by some ancient hag, whose hands and arms are dyed pink with them. When required for use they are boiled, and form an agreeable dessert to salmon, beaver, or venison diet. The berries treated thus are various species of *Vaccinium*,\* *Gaultheria Shallon*, Pursh,† *Amelanchier canadensis*, L.,‡ *Rubus nutkanus*, Moc.,§ *R. spectabilis*, Dougl.,|| *R. leucodermis*, Dougl., *Ribes divaricatum*, Dougl., *R. niveum*, Lindl., &c.; in fact, all the edible berries of the part of the country where the particular tribe lives. One of the *Vacciniums* (*V. ovalifolium*, Sm.) is well known to all North-Western travellers (at least those who have been much among the Northern Indians) as the *le brou* plant, being used to make a dainty of that name. The berries are gathered in the autumn, before they are quite ripe; and after being pressed into a cake, are dried and wrapped in bark, and laid by. When the cake is to be used, a quantity is put into a vessel among cold water, and then stirred rapidly round with the hand,

\* "Huckleberry," &c.  
‡ "Thimbleberry."

† "Salal."  
|| "Salmonberry."

‡ "Serviceberry."

which must be free from grease, until it assumes a paste-like form. More water is added, and more stirring applied, until it assumes a form not unlike soap-suds. In this frothy state it is supped with long wooden spoons (made of *Pinus monticola*). It is pleasant to the taste, with a slightly bitter flavour, and is often prepared in Hudson's Bay forts as an Indian dish which no traveller ought to leave the North-West without tasting. At their high feasts the Indians will sup of this until they are ready to burst, and then waddle to the water, drinking of which seems to allay the distention caused by the other. The Indians and the grizzly bears of Southern Oregon and California eat the berries of the *Manzanitta* (*Arctostaphylos glauca*, Dougl.); but I have never seen the northern tribes make the same use of the berries of the allied species *Arctostaphylos* (*Arbutus*) *tomentosa*, Pursh. The tender shoots of various plants are eaten in the spring, such as the shoots of *Rubus Nutkanus* (canoe-loads of which can be seen in the season on their way to Indian villages), *Rosa fraxinifolia*, Bork., the green stem of *Ligusticum scoticum*, Linn., and *Peucedanum leucocarpum*, Nutt., which are peeled and eaten, as well as the stem of *Erodium cicutarium*, L'Her., the *Alfilerilla*, or "pin-grass" of the Californians, and some other plants of that sort. They seem to make use of no species of lichen for food,\* but make compressed cakes of a *Rhodymenia* for winter use. Grass and clover the Digger Indian (little elevated in his dietary above the lower animals) looks upon as great blessings, and eagerly eats them, and grows fat on them too. The California white clover is, however, very sweet, and I daresay to these poor people forms, either raw or boiled, a very agreeable salad to their grasshoppers. Beyond the potato, they have no cultivated plant. Some of the Indians in Oregon used to grow a little wild tobacco, but they now buy it from the whites. I have seen some of them, when tobacco was scarce, in order, as they thought, to get the full benefit of it, inhale in turns the smoke, gulping it down until it came out at the nostrils and ears. They would

\* Captain Mayne, R.N. ("Four Years in British Columbia," p. 256), however, says that they boil and compress into cakes *Lichen jubatus*. Though I never saw them do so, the statement is probably correct. (See also Lauder Lindsay: Journ. Linn. Soc. Bot. vol. ix. p. 413-14.)



repeat this once or twice, then hand the pipe to another, and lie down almost senseless to sleep off the stupor. I have often heard them say, in reference to the whites, "They waste the food by puffing it out; they do not use it properly." In times of scarcity they will smoke the twigs of *Thuja gigantea*, Nutt.; and the bark of *Cornus sericea*, L. (the *bois rouge* of the Canadian voyageurs), is usually mixed with tobacco, even in times of plenty—a habit which the fur-traders have learned from them. The leaves of *Arctostaphylos Uva-ursi*, L., are also extensively used among the Indians and fur-traders all over the American continent, either alone or (more usually) mixed with tobacco, under the Ojibway name of *kinikennick*. Luckily for them, though passionately fond of intoxicating liquors, they have not acquired the art of preparing any. *Acer macrophyllum*, Pursh, contains much juice, but the North-Western Indians have never attempted to make sugar from it, as in the case of *A. saccharinum*, L., in the eastern provinces. The Crees, however, make a sugar from *Negundo fraxinifolium*, Nutt., a plant which probably extends over the Rocky Mountains.

## 2. In the Arts and Domestic Economy.

In the first rank I place the tree I have so frequently spoken of before the Society, *Thuja gigantea*, of which the Indians make many articles for domestic use. I have referred to them before.\* There is no birch in North-West America, of the bark of which they could make canoes. It is therefore chiefly of this tree that these elegant craft are manufactured. In some parts of the country they will make them of cottonwood (*Salix Scouleriana*, Hook.), and in Southern Oregon, and elsewhere, the rude "dug-outs" of the natives are made of the heavy trunk of *Pinus ponderosa*.

The bark of the white pine (*P. monticola*) is in like manner used for weaving blankets. The maple (*Acer macrophyllum*) is used for making paddles, hence it is called by the Cowichans *Kammalelep*, or paddle-wood. The vine maple (*Acer circinatum*, Pursh), in like manner, when it can be procured, is used for making bowls, and the

\* Trans. Bot. Soc., April 1868.

*Pinus monticola* for spoons. *Cupressus Nutkaensis*, Lam., *Thuiopsis borealis*, Fisch., is also used for that purpose among the Tsimpshians, and for making boxes, the sides and bottoms of which are hollowed out of one piece. The roots of *Abies Menziesii*, Dougl., are used for making hats. I have seen a pack of cards ingeniously imitated on the bark of *Pinus monticola* and *Thuja gigantea*, for gambling purposes. The gambling disks and polished sticks used by many tribes are generally made of *Acer macrophyllum* or *Cupressus Nutkaensis*. Yew (*Taxus brevifolia*, Nutt. = *Lindleyana*, Murr.), is often called, in various languages, "fighting wood," being used to make bows. Much of this yew grows near Mount Shasta in California; and among the Oregon Indians a bow of "Shasta Yew" is as much prized as in Europe used to be a "coat of Milan steel," or a "Toledo blade." The arrows are made of cedar and various species of reeds; though in the North, the former is almost universally used. They have, I may mention, no arrow-poison; but I have known some of the Californian Indians get a rattle-snake (*Crotalus lucifer*, Baird), and irritate it until it had repeatedly struck into the liver of some animal, impregnating it with its virus. They would then dip their arrows into this poisoned mass. All wood is used as fuel, but principally *A. Douglasii*, the branches of which are (in common with other trees) put into a canoe when it is leaking, to keep the loads or paddlers from the water. At their great winter feasts bark is often used as fuel, as it gives out a greater heat.

*Pinus contorta*, Dougl., from being full of resin, is used as torches by the Indians in salmon-spearing at night, and at their feasts and dancing. The leaves of *Philadelphus Gordonianus*, L., and *P. Lewisii*, Pursh, are used by the natives as a substitute for soap. The *amole* (*Chlorogalum pomeridianum*, Kunth) or soap plant has a bulbous root, which, when rubbed in water, makes a lather like soap, and was much used for washing by the Indians and native Californians prior to the American possession of the country. It is also used for making saddle-mats, &c. Baskets are made of various species of roots, and the neat ornamental boxes sold to the whites are manufactured from some species of Cyperaceæ.

In California the aborigines make hats and vessels from a grass generally known as the Wire-grass, and coarse mats of *Scirpus lacustris* and other rushes. Bottles are made of the bulbous stipes of *Macrocytis pyrifera*, Ag., the giant tangle of the North-West coast, and used to hold eualachon oil (*Osmerus pacificus*, Rich.), out of which a little is squeezed, every now and then, when required, as a painter squeezes his colours out of a tin-foil tube.\* Excellent fishing lines are commonly made from the stipes of *Phyllophora Menziesii*, Ag. The textile plants of the Indians are few, the bark of *Thuja gigantea* supplying the place of most fibrous plants. They can extract a fibre from the stem of the native nettle (*Urtica gracilis*, Ait.), and I saw a fishing-net made of it which the owner valued at \$100. Some of the Indians in the Columbia River used to make salmon fishing-nets of the twigs of *Cornus sericea*, L., and the more southern tribes still use the native flax (*Linum perenne*, L.) to make nets, twine, and ropes. Near the Klamath Lake, I saw it growing in such abundance as to suggest the idea of a cultivated field; and a friend has just sent me the following interesting extract from the San Francisco "Bulletin" on the subject of the wild "hemp," which doubtlessly refers to this or an allied plant:—

"A morning contemporary calls attention to the fact, recently verified, that large quantities of native hemp grow in the valley of the Humboldt River, in the State of Nevada, where it is gathered by the Indians, who strip off the bark from the dried wood and make from it very fine and strong nets. The fibre is said to be longer, finer, and stronger than common hemp; longer than flax, and more abundant in proportion to the wood, and more easily separated from the wood than either. It is said, 1000 tons of the stripped fibre can be collected in the Humboldt Valley this season, and its prospective value as a cheap substitute for cultivated hemp is suggested to our cotton and cordage factories. We may add to this interesting statement, a fact within our own observation, that a native hemp is found in many parts of California, especially in the moist bottoms of the Sacramento and San Joaquin Valleys. The early

\* Brown in "Pharmaceutical Journal," June 1868.

Spanish colonists mention that it grew about the Tulare lakes, and was used by the Indians, as on the Humboldt, to make their fishing nets. Its use for this purpose, however, has always been common to the Indians of every part of the State. Some years ago it was quite abundant along the Upper Sacramento. The fibre was long and fine, easily stripped with the fingers from the stalk as it dried in the earth, and very light-coloured. We have seen the Indians twist it into very fine and strong thread, with which they made not only small fish nets, but nets 20, 30, or 40 feet long and nearly as wide, with which they caught wild geese while feeding on the plains. Setting their stuffed geese skins as decoys, the nets are arranged flat behind them with wooden springs, and are sprung over the live geese, when they alight, by concealed Indians. As many as twenty geese were sometimes caught in this way at a single haul. As they struggled to get loose, the Indians rushed forward with sticks and knocked them senseless, when they poked their heads through the meshes. The nets required for this use were of course very strong. When a large net was to be made a number of Indians assembled to assist in its completion—the women being excluded from the sacred circle, though allowed to sit and gossip on the outside. It was enough for them that they were permitted to strip and dress the fibre, sometimes to pound the pinola (pine-seeds) and acorns, and to carry in conical baskets, steadied on their backs by straps bound about their brows, the burdens imposed by their lords and masters. All the work of thread and net-making was done with the fingers, assisted by sticks something like the modern crochet needles; and this does not seem at all strange, when it is remembered that the exquisite cotton fabrics of the Hindus are all made by manual appliances. In the same manner the Indians made from the native hemp some very fine small mats, in which they bound their thick massy hair behind, in a like manner, and with much the same effect, as the fashionable *chignon* of our own day. These hair-nets were variously coloured, ornamented with beads, and pierced with feathers or long sticks, covered with snake-skin. The despised Digger Indian of California may therefore fairly claim to be the inventor of that most astonishing

article of head-gear now in use among civilised white women. But all this is a digression from the main object of these remarks, which is to suggest the propriety of a practical inquiry concerning the extent and value of the indigenous hemp growth of our State. We do not know if it is still to be found in its old abundance anywhere; perhaps not, since so large a portion of the bottom lands where it flourished so luxuriantly, but not exclusively, has been occupied for cultivation. If it can still be obtained in sufficient quantities, it would certainly be valuable for manufacturing purposes. The excellence of its fibre, for many inferior purposes at least, entitles this suggestion to consideration; and the fact that we have a native hemp of such fair quality, warrants the inference that the cultivated staple could be grown here to advantage. Possibly Indian labour on the valley reservations could be turned to profitable account in gathering and preparing the native production.”\*

### 3. *Medicine and Superstitious Rites.*

All medicine with the Indian is superstition, and all superstitions have a bearing more or less on medicine. Medicine is with them a mere piece of pagan empiricism. It is emphatically Napoleon's axiom—more trite than true—putting what we know little about into a body concerning which we know still less. I would have you to guard, however, against the notion that the “Medicine-men” are equivalent to the doctors—not so. They are mere “sorcerers;” and though practising medicine in so far as “leger-demain” and superstition goes, yet the healing art proper is in the hands of old women, who are supposed to be skilful in that way, and large fees are sometimes exacted from the patients. Surgery they know little or nothing about. I know a very celebrated (and also a very brave) chief who had rheumatism of the knee joint. He diagnosed it to be caused by dirt getting in, and accordingly he absolutely proceeded to bore a hole through the patella, in order that he might get a stream of water in to wash out

\* Curiously enough, both Pursh (*Fl. Am.* Sept. 1, p. 210) and Douglas (Hooker, *Fl. Bot. Am.* 1, p. 106) expressly state, though erroneously, that it is never used by the Indians of North-West America for economical purposes.

the foul joint. For fractures they use, as we do, splints. On one occasion I was travelling in the Mountains, my only companion an Indian boy, who, at a distance of several miles from the nearest abode of man, fell and snapped the femur. Luckily it was not displaced. With the aid of cedar bark used as paste-board splints, and tearing the boy's shirt into bandages, I managed to adjust the fracture, then raising the boy as well as I could on my back; in this manner the north-western surgeon and his patient took their way, through forests and through swamps, over fallen trees, and crawling along cliffs, and fording swollen mountain streams, until they reached an Indian village, when the patient was committed to more skilful nurses. Aided by a good constitution and wonderfully good luck, the boy recovered; and when last I visited that part of the country I found that he was perfectly well, and that my fame had grown very great in the land. The liber of *Abies Mertensiana* is used as sticking-plaster. Their knowledge of the virtues of plants are, as I have said, merely empirical; but, nevertheless, the plant is used sometimes in acts more honoured in the breach than in the observance. No crime is more common among Indian women than that of procuring abortion. They generally accomplish this by mechanical means, but some species of plants, such as a species of orchid, are also used. From the plant, root, leaves, and stem, is formed a decoction which is drunk by the woman several times a-day, until the effect is produced. It is said to be very effectual. The scrapings of a human skull are used in the same way, and some species of shells are also looked upon, as what old Master Pomet would have called "the sovereignest remedy on earth," for the same purpose. The infusion of the young cones of various pines is thought to be very useful in preventing women bearing children. The roots of a *Geranium* are also used among the Lilloets in British Columbia for the same purpose, and among the Pondéville Indians the rattles of the rattlesnake are thought to ease labour.

I heard much from the Hudson Bay officers about the virtues of a species of *Valeriana*, called "Kunko" by the M'Leod Lake and other Takali tribes in British Columbia, in rheumatism. The berries of *Symphoricarpus*

mit "crum" them

*racemosus*, Michx., are used about Lilloet for colds. *Berberis Aquifolium*, Pursh, the juice of the *Betula*, *Echinopanax horridum*, Sm., and an infusion of the leaves of *Abies Douglasii*, are all held in great estimation in venereal diseases.\* A decoction of the roots of the *Berberis* has long been held in great esteem among the Indian tribes in the north-west, and is equally well-known and valued among the backwoodsmen and frontier miners, hunters, and others accustomed to mingle much among the native races. It is an excellent tonic, and there seems to be some good grounds for this universal appreciation of its properties against syphilitic and other venereal diseases, now becoming so common among the Indians.

I saw the roots of some species of Umbelliferæ (? *Archangelica peregrina*, Nutt.) applied as a poultice to inflammatory swellings with manifestly good effect. A decoction of *Achlys triphylla*, DC., is used as a remedy for pain in the breast; the leaves of *Psoralea physoides*, Dougl., are used as a poultice; the leaves of *Heuchera cylindrica*, Dougl., are bruised, and applied to boils by the Nisqually Indians; *Prunella vulgaris*, Linn., is mixed with grease, and applied to swellings; the roots of *Trillium ovatum*, Pursh, are used as a poultice; and an infusion of the roots of *Polypodium vulgare*, Linn., being sweet, is drunk with the decoction of *Berberis Aquifolium*, formerly referred as a remedy.

An infusion of *Conium maculatum*, L., is used in diarrhœa. One would think that this would be a dangerous drug to meddle with; but still the infusion is mild, and I never heard of any deaths ensuing from its use. They do not use the classical juice in any way. Like all superstitious people, they have "medicines" to produce mental effects, or to make them skilful in their employments. The notion is very old, and is not extinct in Europe yet; while in Africa and other savage countries it is one of the canons of superstition. Shakespeare referred to it in his day. Thus, in Henry IV. (Part 2), the following passage occurs:—

\* The roots of *Aralia nudicaulis* are said to be used by the Crees in venereal diseases. They also apply the bruised bark to recent wounds. (Hook. loc. cit.; vide Richardson, i. 274.)

“ I am bewitched with the rogue’s company. If the rascal had not given me medicine to make me love him. I’ll be hanged; it could not be else. I have drunk medicines.”

A belief in “love philtres” is very prevalent among the Indians. The Tsongeisth girls rub themselves with the roots of the orchid mentioned, to gain the affection of their sweethearts. The roots of the *Erythronium grandiflorum* and *Ranunculus* \* are also used with a view to the same end. The roots of a species of Umbelliferæ (? *Conioselinum Fischeri*, Weem. & Grab.) are also used in this superstition by the Tsongeisth. The roots are dried, and then pounded or mixed with some others, put on the garments of the person on whom it is desired to operate, or kept in the mouth of the person who is employing this piece of witchcraft. They have even a plant which is used to make a man cry; but I could never learn what plant produced this lachrymo-poient medicine! They have a medicine to help them to be skilful in killing whales, and even one to simulate virginity!

I do not think the North-Western Indians know of any poisons; though I have heard of some individual who had a box burned near his lodge which contained medicines, with which he threatened to poison the whole family of an unwilling bride if she and they did not yield to the marriage. The infusion of the huge roots of *Megarhiza Oregana*, Torr. & Gray, put in little ponds in the wood, is said to be used to stupify deer which come down to drink, and thus fall an easier prey to the Indians. There used to be a scandal in San Francisco that it formed the principal ingredient in “Stoughton’s bitters.” Pine gum is continually chewed by the Northern Indian women, and to the use of it may be attributed their beautiful white teeth. The natives make no turpentine, but much is now manufactured in Oregon and California, and an experiment was made in Vancouver Island which promised success.

The Poison Oak (*Rhus Toxicodendron*, Linn.), grows abundantly in many parts of southern Oregon and California. There are several species, but the present one is the most common; and as the effects of all the others are similar, these may be considered under its description. It thrives

\* Various species—*R. reptans*, L., *R. occidentalis*, Nutt., &c.



best on a moist soil, and in the shade. In a thicket, with other bushes, it sends up many of its stalks eight or ten feet high, with large luxuriant leaves at the top. In the shade the leaves are green. In the open dry ground, exposed to the sun, and without support from other bushes, the Poison Oak is a low, poverty-stricken little shrub, with a few red leaves. If it can attach itself to an oak tree, it becomes a parasitic vine, and attains a thickness, though very rarely, of four inches in the trunk, and climbs to a height of forty feet.\* It affects the skin of most people in a very painful manner, and the inflammation speedily spreads from one part of the body to another. Some people are so affected that their faces could not be recognised; others (like the writer of this paper) are not affected by it; but instances are not uncommon of persons who have long supposed themselves proof against the poison, but have at last been affected. After once being injured, they are ever afterwards very susceptible to the poison. Even passing to the leeward of a bush on a windy day, or through the smoke of a fire in which it is burning, will "bring the poison to the surface" again. In some parts of California cattle eat it, and are then affected by what is known as the "milk sickness." On breaking a stem of the *Rhus*, a milky fluid is exuded, which is exceedingly poisonous, and, if applied to the skin, will produce effects like that of nitrate of silver—a black welt is produced, which in a few hours becomes sore, destroys the cuticle, which sloughs off, and, upon healing, leaves a circular cicatrix. So poisonous is it, that it pollutes the air where it grows; children, and even grown-up people, who are gathering berries, or otherwise approaching its vicinity, are often badly poisoned. Their faces are frequently swelled until their eyes are shut; the neck, hands, and arms are covered with inflamed vesicles, the cuticle highly inflamed, and not unfrequently constitutional symptoms are observed, resembling those of "milk sickness." The nostrils of cattle grazing amongst it are often covered with pustules. Indeed, its effects upon some people are described as almost approaching to the fabled Upas tree, which that "Puck of Commentators," George Stevens, invented, and Erasmus Darwin handed down to fame in the

stately verses of the "Botanic Garden." Though known for a long time (there is a paper on it in the "Philosophical Transactions" of last century), it has never been thoroughly investigated.\* The Indians seem rarely to be troubled by it, and the native Californians look upon an infusion of *Grindelia hirsuta*, H. and A., a composite plant, as a cure for its noxious effects.†

There may be said to be no rattlesnakes west of the Cascade Mountains, at least north of the Columbia River,‡ though they are sufficiently abundant to the eastward of that range as far north as Fraser River, where I have known several Indians to be bit by them. Their usual plan is to brand the wound, having previously tied a ligature between the heart and the bite, or to push the wounded limb among mud immediately on receiving the poison. It is said that by this means the poison is washed off, and that the person often escapes death. The only effectual cure I have found is drinking immoderately of spirits. I know a gentleman who was bit once by the well-known copperhead snake of the Western States (Missouri), and twice by rattlesnakes in Oregon, and recovered by this treatment. The country people have innumerable specifics for their bites, but I cannot learn that any of them are reliable. The Indians in Central America have several remedies derived from the vegetable world, and all the tribes north to British Columbia are said to possess some herb or other; but I have generally seen them adopt the treatment given above. In California the leaves of *Daucus pusillus*, Mich., the *Yerba de la vibora*, or "rattlesnake herb" of the Spaniards, are said to be a specific for the bite.

I will conclude these stray notes by an account of the extraordinary effects of the roots of *Clematis Douglasii*,

\* *Vide* Dr Isaac Mendhall in the "Cincinnati (U.S.) Lancet and Observer," March 1861; Chase in *Ibid*, May 1861; article in the "Chicago Medical Journal," June and July 1861; Caulfield in "Edinburgh Botanical Society's Transactions," vol. vi. p. 377; "Bigelow's Medical Botany;" and "Farmer," August 1868.

† The frontier settlers, when "stung," apply the pulp of sour milk or a poultice of Indian corn meal to the injured place.

‡ Near Eugene in Oregon, and in various places in Marion County, they are quite abundant, and appear to be indigenous. The statement that they are not found anywhere west of the Cascade is not true. Floods occasionally bring them as low as the mouth of the Columbia, but they soon die in that moist climate.

Hook., on exhausted horses. It was at a horse-racing of the Nez Percz Indians that it was witnessed. One horse was seen which had fallen down. The Indian put a piece of the root (the outer coat scraped off), into the nostrils of the animal. "The effect was surprising; the creature sprang up under convulsions, and was then brought to the river and bathed, and I found several which had been so treated afterwards grazing with the herd, apparently without having sustained any injury." \*

What I said in the introduction to these stray notes, I may now say in conclusion, viz., that they are by no means complete, especially in the latter section. An Indian "sorcerer" or doctor will search for a whole day for the proper plant; and however ridiculous we may look upon their virtues, they think otherwise, and naturally are in no way willing to ventilate the secrets by which they earn large fees. I know one woman who got five blankets, worth about L.2, 10s. for allaying a very simple swelling. They may, however, serve as examples of the superstitions of a fast-dying off race.

V. *Report on the Open Air Vegetation at the Royal Botanic Garden.* By Mr M'NAB.

At the last meeting of the Botanical Society (9th April 1868), I stated that vegetation had gone on at the same rapid pace as it had done during the previous months, most plants being from three to four weeks in advance of ordinary seasons. The weather since last meeting has been comparatively mild, with the exception of the 10th, 11th, 12th, and 14th April, when the morning temperatures fell respectively to 30°, 27°, 31°, and 28°; also on the 6th of May, when the thermometer again indicated 28°, all other morning temperatures varying between 35° and 48°. This last frost has done considerable damage to the young growths of many of the Sikkim Rhododendrons, while the hybrid varieties are apparently untouched. During the past month the progress made by many of the trees and shrubs is remarkable, and, for my own part, I have never seen so many of them in flower during the month of April as have been observed

\* Geyer; Hook, Journ. Bot. vi. 66.

this year. Amongst them may be recorded lilacs, laburnums, thorns, particularly *Crataegus præcox* and *C. Oxyacanthoides* (the last being in full flower on the 22d April), also the perfumed cherry (*Prunus Mahaleb*), double flowering cherry, Gean, *Wistaria sinensis*, *Robinia Caragana*, numerous species of *Cytisus*, *Azalea pontica*, &c. Many herbaceous plants are also far advanced when compared with former years. The lily of the valley, for instance, which in this part of the country is rarely seen in flower in open borders before the end of May, was partially in bloom this year on the 1st of May. At the present date (14th May) the horse-chestnut, double, single, and scarlet thorns, bird cherry, service trees, *Rhododendron catawbiense* and *R. ponticum*, Ghent azaleas, with many others, are now in flower—kinds rarely seen in bloom before the end of May, and in this part of Scotland generally not sooner than the beginning of June. However, locust trees, deciduous magnolias, tulip trees, hop and common hornbeam, Catalpa tree, liquidamber, walnut, *Platanus occidentalis*, deciduous cypress, with many oaks, chiefly the American varieties, also ash, and some varieties of beech, are not much further advanced than during ordinary seasons. As a rule, it may be stated that most of the North American trees are generally the last of coming into leaf.

The strong and continued north-westerly gales during the month of April have done considerable damage to many of the forest and ornamental flowering trees, particularly those kinds where the foliage was early developed, the western side of many being nearly leafless, or with scanty foliage, while the eastern side is full of foliage, and of a rich green colour. This is particularly remarkable in limes, horse-chestnuts, birches, sycamores, geans, and larches. In the case of thorns, many of the trees, where much exposed, are perfectly brown on the western side, while the east side is green, and now flowering abundantly.

#### VI. *Miscellaneous Communications.*

Mr M. Nab stated that, since the formation of the new Arboretum on the ground recently added to the Royal Botanic Garden, the Coniferous section has received some

large and important additions. Messrs P. Lawson & Son, with a liberality characteristic of their firm, have presented 130 coniferous plants, consisting of 32 specimens of the genus *Abies*, 22 of *Cupressus*, 22 of *Biota*, 10 of *Picea*, 10 of *Juniperus*, 10 of *Taxus*, 7 of *Thuja*, 7 of *Pinus*, 3 of *Cedrus*, 3 of *Retinospora*, 2 of *Thujopsis*, 1 of *Cryptomeria*, and 1 of *Dacrydium*. Messrs P. Robertson & Co. have likewise presented a collection of the genus *Pinus*, consisting of 18 species and varieties, all strong established plants. Messrs Rollison & Son, of the Tooting Nursery, Surrey, have sent 6 plants of their new upright *Juniperus excelsa*; and Mr Thomas Methven, of the Leith Walk Nurseries, has presented a plant of the variegated *Wellingtonia gigantea*.

Professor Balfour stated that, while lately on a visit at Monzie Castle, in Perthshire, he had taken the measurements of several old larch trees growing in the neighbourhood. One trunk measured, at 2 feet from the ground, 21 feet 4 inches in circumference, and at 4 feet, 17 feet 8 inches; diameter, 6 to 7 feet, and spread of branches from 40 to 50 feet. Another tree, measured at 4 feet from the ground, 13 feet 8 inches in circumference, and 4½ feet in diameter.

Rev. Mr Macmorland of Minto sent specimens of *Anemone ranunculoides*, which he had found growing in quantity in Minto woods. Dr Macdonald of St Andrews sent a fasciated branch of *Daphne Laureola* from Kilcarue House, County Meath.

R. H. Alcock, Esq., sent sections of stems of Bignoniaceous plants, which had been sent to Liverpool surrounding bales of cotton, from Paraiba, in the manner of ropes.

Dr Haynes presented specimens of *Polyanthus*, with the calyx developed as ordinary leaves.

Mr Curle, Melrose, presented specimens of *Veronica Buxbaumii*, collected in that district.

Mr J. F. Robinson presented specimens of rare British mosses.

Professor Parlatore of Florence presented to the Museum cones of *Pinus Mughus*, *P. Koraiensis*, *P. densiflora*, *Chamaecyparis obtusa*, *C. pisifera*, *Callitris quadrivalvis*, *Torreya nucifera*, &c.

Mr M'Nab placed on the table a collection of alpine

plants, in flower, including *Tulipa persica* and *Narcissus dubius*, which have lately been presented to the Garden by Messrs P. Lawson & Son.

Mr Stark exhibited a growing plant of *Fritillaria Kamtschatica*.

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11th June 1868.—WILLIAM GORRIE, Esq., Vice-President,  
in the Chair.

The Secretary laid on the table a letter from the Secretary of State, in reply to the loyal Address which the Society had forwarded to Her Majesty the Queen, and which she has been graciously pleased to accept.

Professor Balfour intimated the death of Mr William Ivory, who had long taken a warm interest in the Society, and at whose hospitable mansion of St Roque many of the members had met on several occasions to inspect the trees and shrubs which ornamented the grounds. Mr Ivory was an early supporter of the Caledonian Horticultural Society, and took much pleasure in cultivating rare plants. He was long a member of Council of the Botanical Society, and his loss will be severely felt.

The following Communications were read:—

- I. *On the Reproduction and Cross Fertilisation of Passifloras.* By Mr ROBERTSON MUNRO. Communicated by Mr SADLER.

It is well known that many species of *Passiflora* seldom produce fruit when impregnated with their own pollen, and yet they do so frequently when impregnated with pollen taken from another species or even distinct genera. Many self-impotent species are found capable of producing ovaries by merely dusting their anthers with pollen taken from such distinct genera as *Disemma* or *Tacsonia*, although when thus fertilised the ovaries either drop off prematurely or very rarely contain any seed. With a view of further illustrating such singular phenomena, I have, through the

kindness of Professor Balfour, the honour to lay before the Society an account of various experiments performed by me during several years in the Royal Botanic Garden of Edinburgh, and in the Nurseries of Messrs P. Lawson & Son. My attention was first directed to the subject in consequence of a self-impotent species (*Passiflora alata*), being cultivated at Keith Hall for several years without showing the least sign of fertility, although grown under the best possible treatment. Hundreds of flowers have been impregnated from time to time on this plant, with its own pollen, but in no single instance has the gardener (Mr Donaldson) been able to induce it to "set" a single fruit. In the Botanic Garden of Edinburgh there is a plant in the same condition. Many experiments have been tried to induce this plant to produce fruit, but if self-impregnated, failure has been the invariable result. As a curious experiment, I got pollen of the Keith Hall self-impotent species, and impregnated a few flowers on the self-impotent plant at the Botanic Garden; the result was the production of three ovaries, one of which arrived at maturity, and contained a large number of perfect seeds. Seedling plants from this union flowered in the garden in 1864. I impregnated a considerable number of these flowers with their own pollen, every one of which proved abortive. But on impregnating eighteen flowers on the mother plant with pollen from her own self-impotent seedlings, I got eighteen fine plump ovaries full of seed! This remarkable fact has already been published by Mr Darwin, as well as some interesting facts communicated to me by Mr Donaldson, gardener at Keith Hall, showing the very singular circumstances by which *P. alata* was rendered self-fertile at Taymouth Castle by being grafted on another species. Seedling plants obtained from this grafted *P. alata* were found by Mr Donaldson to be irretrievably sterile, not only when fertilised with its own pollen, but also when impregnated with pollen of the self-impotent *P. alata* previously referred to.

In order to test the fertility of *P. alata*, as well as other species of *Passiflora* when crossed, I began by impregnating eight flowers of *P. alata* with pollen of *P. cœrulea*, and had five fine ovaries full of seed, which germinated freely when

sown. Six flowers of *P. alata*, impregnated with *P. racemosa*, proved abortive, but conversely nine flowers of *P. racemosa* impregnated with *P. alata* produced five ovaries full of seed. Eight flowers of *P. alata*, impregnated with *P. macrocarpa* (evidently a variety of *P. quadrangularis*, and like that species perfectly fertile when impregnated with its own pollen), yielded four fine ovaries full of excellent seed. Six flowers of *P. alata*, impregnated with *P. Kermesina*, proved abortive; but two flowers of *P. Kermesina*, impregnated with *P. alata*, produced two ovaries which contained no seed. I may here observe that many species, as well as hybrid *Passifloras*, are often found destitute of pollen; but I have invariably found species thus rendered self-impotent from the imperfect development of their reproductive organs could easily be excited to produce seed when impregnated with good pollen. Eight flowers of *P. alata*, impregnated with *P. Loudoniana*, proved abortive; two flowers of *P. alata*, impregnated with *P. fulgens*, proved abortive; six flowers of *P. alata*, impregnated with *P. Belottii*, proved abortive; four flowers impregnated with *P. Newmanii*, yielded one ovary containing good seed; eight flowers of *P. alata*, impregnated with *P. palmata*, proved abortive; two flowers of *P. alata*, impregnated with *P. cardinalis*, produced no fertile ovaries. On *P. racemosa* I impregnated thirty-eight flowers with its own pollen, but failed to get a single fertile ovary. Nine flowers, *P. racemosa*, impregnated with *P. alata*, produced five ovaries full of seed; fifteen flowers of *P. racemosa*, impregnated with *Tacsonia pinnatistipula*, produced six ovaries, which dropped off before they arrived at maturity, and contained no seed; five flowers of *P. racemosa*, impregnated with *Tacsonia mollissima*, yielded two ovaries, which arrived at maturity, but contained no seed; sixteen flowers of *P. cærulea*, impregnated with their own pollen, proved abortive. A plant at Trinity Cottage, however, has frequently produced plenty of fruit, but on dissecting a great number of ovaries I found that they contained no seed, nothing but the seed walls being developed. Four flowers of *P. cærulea*, impregnated with *P. racemosa*, produced one ovary which arrived at maturity, but contained no seed; six flowers of *P. cærulea*, impregnated with *Tacsonia pinnatistipula*, proved abortive;



ten flowers impregnated with *T. mollissima*, yielded eight ovaries, which dropped off at an early stage, and contained no seed. *Passiflora Belottii* proved abortive when impregnated with its own pollen, and also with the following species:—*P. alata*, *P. cærulea*, *P. palmata*, *P. Kermesina*. I have tried this species at different hours of the day, but I have not yet been able to induce it to yield a single ovary. Six flowers of *Tacsonia pinnatistipula*, impregnated with its own pollen, produced six ovaries full of fine seed. Three flowers, impregnated with *T. mollissima*, produced one ovary which arrived at maturity. It contained a few apparently good seeds, none of which, however, germinated when sown. Sixteen flowers of *P. Kermesina*, impregnated with its own pollen, proved abortive. Two flowers, impregnated with *P. alata*, yielded two ovaries which contained no seed. Twenty-three flowers of *P. holosericea*, impregnated with its own pollen, proved abortive. Seventeen flowers, impregnated with *Tacsonia mollissima*, produced twelve ovaries, which arrived at maturity, but on dissection I found they contained no seed. On *Passiflora fulgens* I impregnated three flowers with its own pollen, but failed to get an ovary. Fifteen flowers of *P. cardinalis*, impregnated with *P. alata*, proved abortive. Three flowers, impregnated with *P. palmata*, proved also abortive. One flower, impregnated with *P. Loudoniana*, has produced an ovary which I fear will not contain seed.

On a hybrid passiflora between *P. alata* and *P. racemosa* (*P. alata* being the mother) I impregnated six flowers with *P. alata*. This union produced six ovaries, some of which dropped off in three weeks, but three remained until nearly mature; these, however, contained no seed. I tried the same plant with pollen of *P. cærulea*, but failed to get an ovary.

Specimens of the following species and hybrids were laid on the table:—*Passiflora alata*, *P. cærulea*, *P. Loudoniana*, *P. fulgens*, *P. cardinalis*, *P. Kermesina*, *P. racemosa*, *P. laurifolia*, *P. Houletii*, *P. macrocarpa*, *P. Newmanii*, *P. palmata*, *P. Belottii*, *P. edulis*, *P. alata* crossed with *P. cærulea*, *P. alata* crossed with *P. racemosa*, *P. alata* crossed with *P. macrocarpa*, *P. alata* crossed with *P. Newmanii*, also *Tacsonia pinnatistipula* and *T. mollissima*.



Fig. 1.

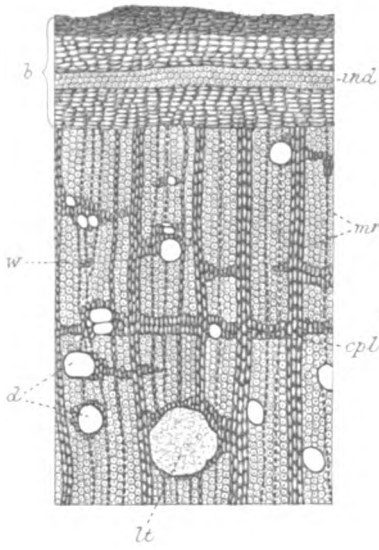


Fig. 4.

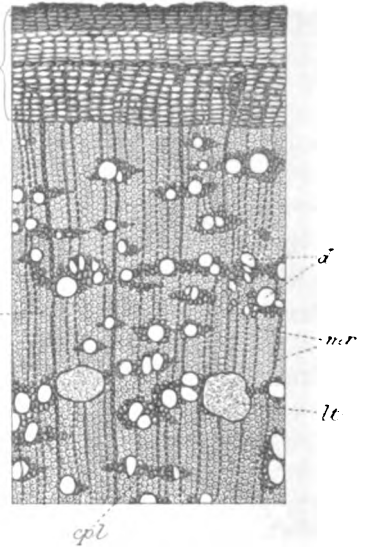


Fig. 2.

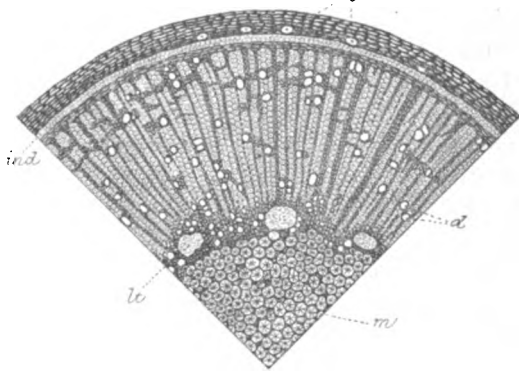
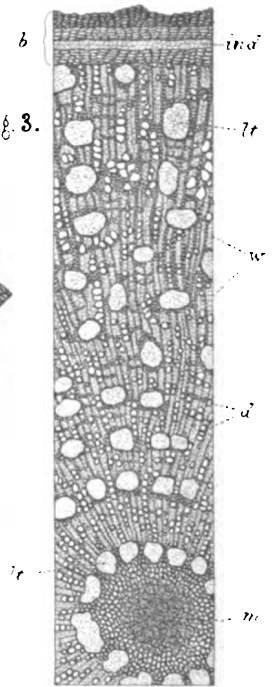


Fig. 3.



II. *On the Characters of the Akazga Plant, and the difference between the Structure of its Stem and that of Strychnos Nux-vomica.* By THOMAS R. FRASER, M.D., F.R.S.E., M.R.C P.E., Assistant to the Professor of Materia Medica in the University of Edinburgh. (Plate VII.) R

We have been indebted, within recent years, to several travellers in West Africa for interesting accounts of the properties of a poisonous plant called akazga, which is extensively used as a judicial ordeal. The chemical characters of this poison were examined, in 1862, by Messrs Attfeld and Simmonds. The results obtained by these gentlemen were, however, unsatisfactory, as they had only a small quantity of akazga at their disposal; but they supposed that they obtained indications in it of the presence of strychnia. Its physiological action was investigated, in 1866, by MM. P cholier and Saintpierre, and found to be very similar to that of nux-vomica.\*

Some specimens of akazga were lately sent to Scotland by the Rev. A. Bushnell, of Baraka, and these were given to me for examination by Mr Thomson, of Glasgow. I am also indebted to these gentlemen, and to Dr Nassau, of Bonita, for the very interesting and trustworthy information they have supplied regarding the employment of the ordeal; by which, principally, I am enabled to communicate the following particulars to this Society.

The poison is known among the various tribes who employ it as *akazga*, *boundou* (or *m'boundou*), *ikaja*, and *quai*. Akazga is probably derived from *nkazga*, which signifies pain or hurt. It is employed as an ordeal on the West Coast of Africa, in a district which extends for a considerable distance north and south of the equator and many miles inland, and also in the adjacent island of Corisco. Witchcraft is believed in almost universally over Africa as the cause of all deaths, of unexplainable misfortunes, and of many crimes; and to detect the sorcerer this poison is employed. The supposed sorcerer is obliged to drink a certain quantity of the infusion prepared from

\* Comptes Rendus, 1866, p. 809.

the bark, and to step over a number of akazga sticks placed parallel to one another at the distance of two feet. If this be done, the person tried is pronounced innocent; if guilty, difficulty is experienced in stepping over the sticks, they appear like large logs, to surmount which suitable efforts are made, and these are rendered more and more difficult by spasmodic muscular twitches, until the victim staggers and ultimately falls in tetanic convulsions. If the poison do not now immediately prove fatal, the knives and clubs of the onlookers quickly free the tribe of the supposed sorcerer. In those cases in which the trial is successfully undergone, a copious flow of urine is described as occurring, and by this means the poison is supposed to be removed.

The akazga was sent to me in bundles which consisted of long, slender, and crooked stems, having their roots generally attached to them, but sometimes their leaf-bearing branches only, and containing also a few complete plants, with roots, stem, and branches. I have also recently obtained a few seeds, the greater number of which, however, have germinated and possess radicles six or eight inches in length.

The plant is usually about six feet in length; but some specimens were only four, and others as long as eight feet. They have generally a diameter of half-an-inch, and this varies from a quarter to one inch. The bark is of a yellowish orange colour, and in some parts light red; and over it a grey efflorescence is frequently found. A few of the stems are of a dark-brown colour, with numerous yellow tubercles. The bark adheres firmly to the stem, but it can be readily detached after exposure to a gentle heat for some days. Its internal surface is light brown.

The wood is dense and hard throughout, the plant being apparently of very slow growth.

The leaves are opposite, and oval-acuminate in form; the apex frequently consisting of a linear prolongation more than an inch in length. They have five parallel ribs, three of which are prominent. The leaves vary greatly in size. The majority are from three to six inches in length, and from one and a-half to two and a-half in greatest breadth. A few, selected at hazard, had the

following dimensions in inches:— $5 \times 2\frac{1}{8}$ ,  $6\frac{1}{2} \times 2\frac{1}{4}$ ,  $5 \times 1\frac{3}{4}$ ,  $5 \times 2$ ,  $5\frac{1}{2} \times 1\frac{3}{4}$ ,  $7 \times 2\frac{1}{8}$ ,  $6\frac{3}{4} \times 2\frac{3}{4}$ ,  $2\frac{3}{4} \times 1\frac{1}{2}$ ,  $5\frac{3}{8} \times 3\frac{1}{2}$ ,  $7 \times 2\frac{1}{2}$ ,  $8\frac{1}{2} \times 4$ ,  $6\frac{1}{2} \times 1\frac{3}{8}$ ,  $3 \times 1\frac{3}{4}$ ,  $4 \times 2\frac{1}{2}$ ,  $3\frac{1}{2} \times 2$ ,  $11 \times 4\frac{1}{2}$ ,  $6 \times 1\frac{3}{4}$ ,  $4 \times 2$ ,  $12\frac{1}{2} \times 5\frac{3}{8}$ ,  $5 \times 2$ .

The characters of the seed cannot be accurately determined from the specimens in my possession, as the non-germinated ones appear to have been injured by exposure. It seems to have a globular form, with two somewhat flattened sides, and to vary in size from  $\frac{5}{8}$  to  $\frac{9}{8}$  of an inch in greatest diameter. Its external surface is covered with a downy layer of long hairs, but it does not present the velvety appearance that characterises the seed of *nux-vomica*. The albumen is easily split into two halves, between which the embryo is found furnished with two five-ribbed, oval-acuminate cotyledons.

The bark has a strongly bitter, faintly aromatic taste, and a distinct bitterness may also be perceived in the wood, leaves, and seed.

These general characters at once suggested that this plant is one of the Loganiaceæ; but with the materials in my possession, it was impossible to identify it. Professor Balfour kindly placed at my disposal a large collection of West African plants, and with his assistance and that of Professor Dickson these were compared with the *akazga*, but we found nothing that exactly corresponded with it. Professor Oliver, of Kew, who is intimately acquainted with the flora of West Africa, also examined some of my specimens, and considers that there is great reason to suppose that the plant is undescribed.

The results I have obtained by a chemical examination of this poison appears to support Professor Oliver's opinion; and, if it be proper to be guided by the nature of the physiological action of substances derived from a plant, I believe there can be little doubt that *akazga* will be found to be a new species of *Strychnos*. I have separated from it, by a process that has been elsewhere published,\* a crystalline alkaloid which closely resembles strychnia, but which is readily distinguishable from it. For this alkaloid I have proposed the name *akazgia*, derived from *akazga*, apparently

\* Proceedings of the Royal Society of Edinburgh, 1866-67, No. 78, p. 159; and "British and Foreign Medico-Chirurgical Review," July 1867.

the most usual as it certainly is the most euphonious of the synonyms of this ordeal. Akazga is principally distinguished from strychnia by a difference in its equivalent, by being precipitated from solutions of its salts by the *bicarbonates* of sodium and potassium, and by the comparative difficulty of obtaining it in a crystalline form. It agrees with strychnia in possessing those colour reactions that have been hitherto regarded as characteristic of that alkaloid, and in producing the same physiological effects.

I have endeavoured still further to ascertain the differences between akazga and nux-vomica by examining the microscopic anatomy of their stems. The following descriptions indicate the principal characters of these:—

*Akazga.* (Plate VII. figs. 1 and 2.)

The *pith* consists of complete parenchyma. Its cells have, in transverse section, a more or less regularly hexagonal form, and, in longitudinal section, they present the appearance of four-sided parallelograms. Their transverse diameter varies from  $\frac{1}{8}$ th to  $\frac{1}{10}$ th of an inch, being usually, however, about  $\frac{1}{8}$ th; while their longitudinal diameter is from  $\frac{1}{8}$ th to  $\frac{1}{10}$ th of an inch. The majority of the cells are indurated and marked by radiating canals. A few non-indurated cells occur irregularly throughout the pith, and these contain starch granules.

The *wood-cells* have pretty constantly a diameter of  $\frac{1}{8}$ th of an inch, and are greatly indurated, the cavity being so much reduced in size as to appear, in cross-section, like a point. Such a section also shows that the wood-cells are divided into irregular four-sided groups; *firstly*, by numerous medullary rays, which vary greatly in thickness—some consisting of only one layer of cells, and others of three or four; and, *secondly*, by portions of concentric rings, which consist of plates of parenchyma placed at right angles to the medullary rays. The *dotted ducts* are almost invariably placed within these parenchymatous plates. They are nearly circular in form, though sometimes compressed radially, and, at others, concentrically; and they vary in diameter from  $\frac{1}{8}$ th to  $\frac{1}{10}$ th of an inch, usually, however, being about  $\frac{1}{8}$ th. Longitudinal cylindrical tracts of delicate parenchyma surround the pith, and occur

also in various portions of the wood. In the latter situations, these tracts vary from  $\frac{1}{100}$ th to  $\frac{1}{100}$ th, and, in the former, from  $\frac{1}{80}$ th to  $\frac{1}{80}$ th of an inch in diameter.\*

The cells of the medullary rays and of the concentric plates of parenchyma are filled with starch granules of moderate size (about  $\frac{1}{100}$ th of an inch in greatest diameter) and of irregular oval forms, which seem identical in appearance with the starch granules in the non-indurated pith cells.

The corky layer and cellular envelope of the bark are moderately developed. In the endophlœum the development of bast cells is very slight, only a few isolated bast cells being seen in cross-section. Immediately internal to these, however, there is a distinct layer, about  $\frac{1}{100}$ th of an inch thick, and three or four cells deep, of indurated parenchyma, the cells of which are small and of various shapes, and exhibit radiating canals.

*Strychnos Nux-Vomica.* (Plate VII. fig. 3).

The *pith* is only slightly indurated; and, in the sections examined, its cells almost invariably contain starch granules—a very few nearly perfectly indurated cells are, however, present. These cells vary considerably in diameter, some being met with of  $\frac{1}{100}$ th of an inch, and others of  $\frac{1}{100}$ th. The majority of the smaller cells occur at the circumference of the pith.

The *wood-cells* are of the same character as those of akazga. The cylindrical tracts of delicate parenchyma are, however, larger, and much more numerous than those in akazga.

The *dotted ducts* are also more numerous, and, in place of being arranged singly or in groups of two or three, they frequently occur in groups formed of radial lines of five or six. In consequence, apparently, of this great development in the number of the dotted ducts, the wood of nuxvomica is divided into much smaller masses than that of akazga.†

\* Similar tracts of parenchyma have been observed by Professor Oliver in *Strychnos tozifera* (Oliver, "On the Stem of Dicotyledons;" *Nat. Hist. Review*, vol. ii. 1862, p. 317.)

† This structural character of nuxvomica is apparent on simple inspection of a cross-section.



The general botanical characters of the akazga plant, the minute anatomy of its stem, the nature of its poisonous action, and the chemical and physiological properties of the alkaloid that it contains, are, therefore, sufficient to show that it is nearly allied to *Strychnos Nux-vomica*; but they are also sufficient to distinguish it from that plant. It will be interesting to see how far this opinion is confirmed when an opportunity is obtained for examining its floral structure, and thus ascertaining its affinities with certainty.

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In the parcels of akazga I received there were a few leafless stems, which were found to contain an immense number of sparkling crystals beneath the bark. These stems also differ from the others in the exterior of the bark having a more smooth appearance. A microscopic examination of the stem revealed the following characters:—

The *wood* has the same general structure as that already described as belonging to akazga, the wood-cells being greatly indurated, and the medullary rays being arranged in the same manner. The cross-plates of parenchyma in connection with the dotted ducts are, however, shorter in cross-section, hardly extending beyond the immediate neighbourhood of the dotted ducts.

The *pith* contains very few indurated cells.

In the inner portion of the *bark*, and also in the longitudinal cylindrical tracts of delicate parenchyma traversing the wood, a number of prismatic crystals, terminated in domes, occur. These are arranged longitudinally to the stem. *There is no layer of indurated parenchyma in the bark.*

Guided by these characters, Professor Dickson—who had kindly interested himself in the subject—pronounced that these were not stems of akazga. I was at first unwilling to adopt this opinion, but a physiological and chemical examination has now convinced me of its correctness; for the bark of these stems is perfectly inert, and the alcoholic extract that is obtained from it does not possess the well-marked chemical reactions of that obtained from akazga.

Fig. 4 represents a cross-section of one of these stems, and, in the absence of any means of identifying the plant, I have, meanwhile, designated it *False Akazga*.

## Explanation of Plate VII.

- Fig. 1. Transverse section of large stem of Akazga, showing a portion of the wood and the bark.  
 Fig. 2. Transverse section of small stem of Akazga, extending from pith to bark.  
 Fig. 3. Transverse section of stem of *Strychnos Nux-vomica*, extending from pith to bark.  
 Fig. 4. Transverse section of stem of "False Akazga," showing a portion of the wood and the bark.

The following lettering applies to all the figures:—*m*, pith; *m r*, medullary ray; *w*, woody tissue; *d*, dotted duct; *c pl*, cross-plate of parenchyma in wood; *l l*, longitudinal tract of delicate parenchyma; *b*, bark; *l*, liber-cell; *ind*, indurated layer of endopleum.

III. Notice of Poisoning of Goats by *Rhododendrons*.

By Mr P. S. ROBERTSON.

The author remarked that on 25th April 1868 he had two goats in a yard, loose and in perfect health—one about four years old and in kid, the other two years old and not in kid. About six o'clock that afternoon, a large armful of branches which had been that day cut from plants of *Rhododendron ponticum*, *hybridum* (the common purple-flowered variety), grown for game cover in nurseries, was given to them. Both animals began freely to eat the leaves and softer parts of the branches, and by next morning the most of them were consumed. About ten o'clock the following forenoon, the old goat was observed to stagger, and when attempting to move fell backwards, as if all power had left the hinder parts. Towards evening, and for the next four days, the animal could not rise at all. It cried piteously, and a large discharge of greenish yellow matter flowed from the mouth. The lips were swollen, appeared whiter than usual, and were turned outwards from the jaws. The eyes, for the first three days, were very full, enlarged, and protruded, but after that they became dull and partially closed, and the animal lay with its feet stretched out as if dead. It seemed pleased when handled, especially when the belly was well rubbed. It was not seen to eat anything for four days. After that, about a pint of gruel, made with water and milk, was given to it from a bottle, and for four or six days this was continued, with the addition of a pint of,

Bass's bitter beer in the forenoon, and a glass of good whisky in the afternoon among the gruel. The effect of the stimulants was very decided. After the second dose the bowels were moved, and the poor creature began to lift its head, look back upon itself, and seemed to get relief. It was fourteen days before it could again stand or eat grass and ordinary food. It lost flesh very much, and parted with its kid (about three months grown) ten days afterwards. It ultimately got quite well. The other animal vomited freely from the very first, and did not entirely lose the use of its legs, but had the same ghastly look about the eyes and mouth as the other, and staggered much backwards when it tried to walk. It got well in six days after eating the rhododendrons, but lost flesh as much as the other.

Dr Cleghorn stated that the poisonous properties of the young leaves of *Andromeda ovalifolia* were well known to the shepherds of the north-west Himalaya, and the following note, contributed by him to the "Journal of the Agricultural and Horticultural Society of India," vol. xiv. 1867, is reprinted for information:—

*On the Poisonous Properties of Certain Species of  
Andromeda.* २

"It is instructive to note every fact illustrating uniformity of action pervading a family of plants; it may, therefore, be useful to direct attention to the following passage in the "Gardeners' Chronicle" of 17th March 1866, page 256, describing the poisonous effects upon a flock of sheep of *Andromeda floribunda*, a shrub introduced into England:—'Mr Deacon of Mapledon has recently lost no fewer than eighteen sheep through their eating a poisonous shrub. It appears that a short time ago the gates leading into the pleasure grounds were left open, and thirty-eight sheep which were grazing in a field near strayed into the grounds, and while there they ate ravenously of *Andromeda floribunda*, a most poisonous shrub from North America. Mr Hewitt, the bailiff, at once treated the sheep, thirty-seven of whom showed symptoms of poison, and then called in Dr Gregory, and under their united treatment nineteen of them recovered.'

“To those who have lived at any of our Himalayan stations, it is probably known that the young leaves of the *Andromeda ovalifolia* poison goats; the deleterious action was first alleged by Doctor Wallich, who figured this tree in the ‘Asiatic Researches,’ vol. xiii. p. 391, giving a communication from Dr Govan, then (1820) superintendent of the Botanic Garden at Saharunpore. ‘Your *Andromeda ovalifolia* occurs first on the hills between Nahun and Sabhatoo, at an elevation of about 5000 to 8000 feet, after which it becomes rare and soon disappears entirely. It is called *Aiaar* or *Airee*, and grows to a tree of 20 to 40 feet in height; the bark of the stem and older branches is much cracked and rough, that of the former almost suberose. With regard to its use, the same opinion prevails here as in Sirinagur, an infusion of the bruised leaves in water being considered a specific against cutaneous complaints of a herpetic nature both in the human species and in cattle; its operation is said to be attended with considerable pain. Sheep and goats eat the leaves which, when young, produce soporific and deleterious effects on them. When used as litter, they are said to destroy insects in the stalls of the cattle.’

“The tradition of the poisonous character of the *Andromeda* prevails everywhere from Nepal to Khagan, and I have myself seen the stimulant and deleterious effects produced on sheep and goats both at Simla, where the tree is known as *Ayar*,\* and at Dhurmsalla, where the vernacular name is *Eliyoan*. The tree is common along the whole outer range of North-West Himalaya, and is usually associated with *Rhododendron arboreum* and *Quercus incana*; the wood is used for the manufacture of charcoal. In the valley of Khagan, the local name is ‘Ratankat,’ which signifies ‘blood killer.’ At one of the hill sanatoria, a municipal commissioner proposed that all the trees of this species should be cut down, on account of the injurious effect upon sheep imported from the plains.

\* In Nepal *Angier*, perhaps from the Sanscrit “*androgyukar*,” causing sickness, the young leaves being very poisonous to sheep and goats. The honey is also considered very deleterious.—Madden in *Jo. As. Soc. Beng.*, vol. xvii. p. 365. *Andromeda ovalifolia*, Wall., is the *A. capricida* of Hamilton’s MS., and *Pieris ovalifolia* of Don’s. Gard. Dict. iii. p. 832.

It is remarkable that the young shoots only are deleterious ; the old leaves are not poisonous, and the sheep of the hills do not appear to suffer.

“ In the Diary of Major Marshall, when passing through Sirmoor in the outer Himalaya, 1827, the following passage occurs:—‘ Our flock, but especially the goats, were affected with a violent vomiting, occasioned by their eating a shrub which grows about pointed out to us by the zemindars, who call it “ Oowar.” They gave them water, which cured some of them.’—*Calc. Jour. Nat. Hist.* vol. vii. p. 544.

“ The Rhododendron tribe exhibit more or less of these deleterious properties. Thus *R. ponticum*, *maximum*, *ferrugineum*, *chrysanthemum*, are poisonous to cattle which feed upon them ; *Ledum latifolium*, more stimulant, is used as tea (Labrador tea), but determines to the head ; *Kalmia latifolia* is accounted poisonous, honey collected by bees feeding on it is of a deleterious nature, as is that of *Azalea pontica*.—Royle’s Ill. p. 259. On referring to Dr Torrey’s Flora of New York, which contains much useful information regarding the properties of North American plants, I find the following remarks upon species of this family:—

“ *Andromeda mariana*, Kill Lamb, or stagger bush. It is supposed to be poisonous to lambs and calves, producing a disease called the staggers.

“ *Kalmia angustifolia*, Sheep Laurel. This plant is believed to kill sheep and other animals. In some places it is called *Sheep poison* and *Lamb Laurel*.”

#### IV. Miscellaneous Communications.

Mr John Sim, Perth, sent an account of an excursion he had recently made to Derry Island, in the Tay, and enumerated the principal plants he met with.

Professor Balfour intimated that Charles Jenner, Esq., President of the Society, had offered the following prizes for collections of dried specimens of British plants:—

*Prizes to Gardeners*.—1st prize, L.5 ; 2d, copy of “ Loudon’s Encyclopædia of Gardening ;” 3d, copy of “ Balfour’s Class Book of Botany.” The collections to consist of flowering plants and ferns, and to contain not less than 400 correctly-named species. The plants must be gathered

between 1st July 1868 and 30th September 1869, and within a radius of ten miles of the competitor's residence. The collections to be sent in on or about 1st October 1869. Further particulars regarding these prizes may be had on application to Mr Jenner, Easter Duddingston Lodge, or at the Royal Botanic Garden, Edinburgh.

*Prizes to Students.*—A gold medal and a silver medal for the best and approved collections of plants made in any little explored alpine district of Scotland, during the months of August and September 1868, to be accompanied by a report of the district visited.

Professor Balfour reported that the Maharajah of Jeypore had offered a prize of L.25 to the Botanical class for the best series of models illustrating any of the organs of plants. The models to become the property of the Maharajah, and to be deposited in the public museum at Jeypore.

Professor Balfour submitted a report by Dr Thomas Anderson, on the progress of *Cinchona* cultivation at Darjeeling in India; he also referred to a description and figure in the Botanical Magazine (tab. 5714) of *Erythronium giganteum*, taken from a plant which had recently flowered in the Edinburgh Botanic Garden.

Dr Fraser sent specimens of *Hypnum bambergeri*, a moss new to the British flora, which he had collected last autumn on Ben Lawers. Mr Wm. Shaw sent specimens of *Daltonia heteromallum*, collected in Berwickshire. Mr Allan Coldstream sent living plants of *Primula scotica* and *Scilla verna* from Sutherland. Mr William Ferguson of Colombo presented specimens of *Hymenophyllum exsertum* (Wall) from Ceylon.

Messrs J. G. Gilmer & Co., Leith, presented to the Museum sample of "Extrait pernod" (a new patent extract of madder for reds and purples), along with a framed card of specimens of calico-printing and dyes from it.

Dr Balfour laid on the table two of a series of monographs by M. Baillon, illustrating the natural orders of plants. He also noticed the publication of a work by Miss Fanny Sharsley on the Flora of Melbourne.

Mr M'Nab placed on the table a collection of alpine and other interesting plants in flower.

9th July 1868.—ISAAC ANDERSON-HENRY, Esq., in the Chair.

The following Gentleman was duly elected a Resident Fellow of the Society:—

W. A. ANDERSON, Esq.

The following Communications were read:—

I. *Biographical Notice of the late Dr Walker-Arnott, Regius Professor of Botany in the University of Glasgow.* By Dr HUGH CLEGHORN, F.L.S.

George Arnott Walker-Arnott was born at Edinburgh on the 6th. February 1799, but his early years were chiefly spent at Edenshead and Arlary, on the borders of Fifeshire and Kinross. He attended the parochial school at Milnathort when at Arlary, and also received instruction from the tutor of the sons of Mr Cheape of Wellfield. He was not considered a quick boy, partly owing to his modest, retiring disposition, but he was a persevering student; and when the subject specially interested him, he sifted it to the bottom, an excellent memory enabling him to retain what he learned. His docile, kind disposition, and his earnestness in study, made him a great favourite with his teachers; but "he took little or no part," writes Dr Wight, "in the wilder school sports, and but little more in the quieter ones."

In the year 1807 he went to the High School of Edinburgh, where he was the pupil of Mr Ritchie and Mr Pillans. Among his contemporaries may be mentioned Professor Christison; Mr Mark Sprot of Garnkirk; Mr David Syme, Sheriff of Kinross; Dr Robert Wight, F.R.S.; and Dr Wm. Jameson, surgeon, Professor of Natural History at Quito. He was in the habit of carefully registering in a note-book the career of his school-fellows, in whose fortunes he cherished through after life a deep and abiding interest.

Mr Arnott entered the Arts Classes of the Edinburgh University in 1813, and obtained a distinguished place both in languages and in mathematics, attracting by his eminence in the latter study the special notice of Sir John Leslie and Professor Playfair. It may be mentioned, as a proof of his mathematic and algebraic attainments, that while a pupil of Sir John, he was in the habit of revising his works and calculations for the press; and that two

papers written by Arnott on mathematical subjects, while he was still a student in arts, appeared in Tilloch's *Philosophical Magazine*. These are "Observations on the Solution of Exponential Equations," May 1817, and a "Comparison between the Chords of Arcs employed by Ptolemy and those now in use," Nov. 1818.\*

With regard to his college life, Mr Isaac Bayley, W.S., his cousin, and one of his earliest friends, writes,—“Such as the boy was, the man became. At the High School and College the same persevering study characterised him, and he equally became the favourite of his teachers and professors, and avoided mixing much with his fellow-students. I well remember how difficult it was to get him to join any social or even family party.”

He took the degree of A.M. in 1818, and after a further period of professional study for the bar, was admitted a member of the Faculty of Advocates in 1821. But law was an uninteresting subject to him, and he soon relinquished the legal profession. He had a dislike to public speaking, and only appeared in his advocate's gown three times. His father, Mr David Walker-Arnott, died in 1822, when the property of Arlary, near Kinross, fell to him.

His attendance on the lectures of Professor Jameson early imbued him with a love for the study of natural science, especially of mineralogy; but the attractions of botany, which, he remarked, deals with lighter and more portable materials, subsequently prevailed, and it speedily became his absorbing pursuit. The lectures of Mr John Stewart, an extra-academical lecturer in Edinburgh, developed his relish for this branch of study. He attended his course in 1817 and 1818, being associated in the latter year with Dr Greville in the Cryptogamic Class. Dr Wight writes,—“Here it was our friendship began, in a friendly rivalry in the formation of our herbaria.” His love for botany was subsequently converted into a life-long passion by his visits to France in 1821 and 1825, and his intercourse with the great French botanists, whose lectures and herbaria he frequented, and whose botanical excursions he joined.

Lady Hooker gives the following account of his inter-

\* Sir John Leslie, in speaking of young Arnott, was accustomed to say that botany had spoiled a first-rate natural philosopher.



course with the late Sir W. Hooker:—"Dr Arnott first came to Dr (Sir Wm.) Hooker's house during the summer course of lectures in 1821, bringing a letter of introduction from Dr Greville, who had made our acquaintance in Suffolk about a year previously. Dr G. was then applying for the botanical chair in Glasgow, and told us so, being ignorant that Dr Hooker had been appointed (on Sir Joseph Banks' recommendation) only a few days before. The excursion of students to Loch Lomond was soon to take place, and Arnott joined it, and continued always to make one of the party to Ben Nevis, or Staffa, or the Grampians, for many subsequent years. His taste for science became so confirmed by his intercourse with Dr Hooker, that he more and more devoted himself to it, though his parents greatly regretted his abandonment of the legal profession, to which he had been brought up. But the possession of the herbarium commenced in Glasgow by the gift of many duplicates from Dr Hooker's collection, and to which constant additions were made during Dr A.'s visits (and he was seldom absent six months at a time), worked like a spell in binding him to botany. I used to sit by, and name the specimens to dictation, thus expediting the work." Many of the herbarium specimens bear Lady Hooker's handwriting.

In 1821, immediately after passing advocate, Mr Arnott went to France, and for two months worked hard in the late Baron Delessert's herbarium, then kept by Achille Richard and Guillemin, and also in the herbarium at the Jardin des Plantes. "When at Paris," he wrote, "I had the good fortune to make a botanical excursion with old Jussieu (author of the 'Genera Plantarum'), the last he ever made. His son, Adrien de Jussieu (now also dead), took the management of the class. It was to the Etang de St Gracieu we went, and we slept all night in the neighbourhood."

One of his earliest botanical papers, "On some Mosses from Rio Janeiro," written in French, appeared in a Paris journal in 1823. Soon afterwards, in conjunction with Dr Greville, he published in the Wernerian Society's Transactions, three excellent memoirs, "*Tentamen methodi muscorum*;" or, a new arrangement of the genera of mosses, with characters, and observations on their distribution, history,

and structure." This was followed in 1825 by the "*Nouvelle Disposition méthodique des espèces de mousses*," contained in vol. ii. of "Mémoires de la Société d'Histoire Naturelle de Paris."

In 1825 he returned to Paris, when the kindness of Baron Delessert again gave him the opportunity of studying in his rich herbarium. Here he examined the collection of Palisot de Beauvois, and was enabled to make out many of his hitherto doubtful species of mosses. During this stay in Paris, he was requested by Mr Bentham to visit him at Montpellier, and his partiality for botanical science induced him to comply. They met at Avignon, in the house of M. Requier, Director of the Public Garden, with whom and M. Audibert they botanised in the south of France, and made a tour to the Pyrenees, the results of which are recorded in an interesting series of letters to Dr Jameson, published in the "Edinburgh New Philosophical Journal," 1826-29.

Dr A. relates the following incident:—"As to *Hedwigia aquatica*, few botanists would credit me should I say I gathered none of it, but fewer still will believe that I was at the pains to fill all my pockets and my hat as full as possible. While thus engaged, one of my companions came up, and assured me I had taken 'bien assez pour tous les botanistes en Europe.' 'Voilà donc pour l'Amérique,' was all I had time to answer, while I proceeded in my labours. There is certainly something very delightful in finding in quantities anything one has been long eager to lay hold of."

The friends next proceeded to Montpellier, and, in company with M. Delile, Professor of Botany, and M. Dunal, author of the monographs on the *Anonaceæ* and *Solanaceæ*, made excursions in the neighbourhood. The following curious fact is recorded in Dr Arnott's journal:—"Every year a great quantity of wool is brought from Africa. It is landed at Pont Juvenal (called also Port Juvenal, for vessels come up this length to unload), and is spread out here to be bleached. Not a few seeds of African plants remain attached to the wool, and are thus sown; and the following years, when the ground for the wool is changed, they spring up. M. Delile, by searching diligently every fortnight or three weeks, has been so fortunate as to meet with several plants

naturalised nowhere else in Europe, and some of them scarcely at all known to the botanist."

In the notes of his tour he institutes an interesting comparison between the botanical gardens of England and the Continent. "In France there are, in addition to the several botanical institutions in Paris, many smaller ones, also under Government, scattered through the country. I may instance those of Lyons, Strasburg, Montpellier, Toulouse, and Perpignan. When any of these receive the root of a new or rare species from another country, or its seeds, the year following either seeds or roots are transmitted to the Jardin du Roi at Paris; and also, when any new plant arrives there, it is as soon as possible disseminated through the smaller establishments of the provinces. The care and attention paid to the naming of the plants at the Museum prevents almost the possibility of an error, and thus in the Government institutions in the country the species is found well determined." Prats de Mollo is mentioned as one of the best points for a botanist's residence in the East Pyrenees. In the herbarium of M. Xatard at this place, in that of M. Marchant at St B at, and in that of M. La Peyrouse at Toulouse, they examined the types of most of La Peyrouse's plants, and comments on them are entered in Arnott's journal.

The party proceeded through North Spain as far as Barcelona. Mr A. then went to Geneva, and studied three months in De Candolle's herbarium, boarding with M. Seringe, who had charge of it. The narrative of the tour was brought to an abrupt conclusion, in consequence of Mr Bentham, who accompanied Mr Arnott, having published at Paris his "Catalogue des Plantes des Pyrenees et du Bas Languedoc," with a sketch of the whole journey.

In 1828 he visited Russia, and acquired during his residence there considerable knowledge of the Russian language. Mr Barclay, whose daughter he afterwards married, had been settled as a merchant in St Petersburg, and Mr Arnott was induced to accompany him on his return from a visit to Scotland. Mr A. had given up the bar, and had no desire at the time to settle at Arlary, but was eager to enlarge his knowledge of botany, and to make the acquaintance of Fischer, Ledebour, and other botanists. About

this time he was elected member of the Imperial Society of Natural History at Moscow.

In 1831 he was married to Miss Mary Hay Barclay of Paris, in Perthshire, and resided at Arlary from 1831 till 1845, when he built additional rooms expressly for the accommodation of his now extensive library and herbarium. The friendship and intercourse with Sir W. Hooker continued during the whole period of that eminent botanist's residence in Glasgow. He often visited him (Sir William) there, and occasionally afterwards at Kew. The excellent article, *Botany*, in the 5th volume of the "Encyclopedia Britannica," 7th edit., appeared from his pen in 1831, and at the time of its publication was the best purely English exposition of the natural system of botany.

From 1830 to 1840 Mr Arnott was engaged, conjointly with Dr (Sir Wm.) Hooker, in publishing an account of the botanical collections of Captain Beechey's voyage to the Pacific and Behring's Straits. This work, executed with great care, furnishes interesting notices of countries then little known, such as the Sandwich and Loochoo Islands, California, &c.

"In the autumn of 1832," writes Dr Wight, "he most kindly and liberally volunteered to assist me in the preparation of my then contemplated 'Peninsular Flora of India,' an offer most thankfully accepted and acted upon." Dr Wight's furlough expired before the completion of the first volume, which Mr Arnott edited and published after his friend's return to India. The Prodrromus, which is in the hands of every botanist, renders a detailed notice unnecessary. It is thus mentioned in Hooker and Thomson's Introduction to the Flora Indica:—"We have already characterised this work as the most valuable and able contribution to Indian botany which has ever appeared, and as one which has few rivals in the whole domain of botanical literature, whether we consider the accuracy of the diagnoses, the careful limitation of the species, or the many improvements in the definition and limitation of genera, and the higher groups of plants." One volume only was published, the progress of the work having been interrupted by Dr Wight's return to India in 1834. "After the publication of vol. i., so much poured in on Mr A. from India,

that although he could have got out a second volume, it would have been necessary to publish a large supplement to the first; and, besides, there was not sufficient sale to pay expenses, so no more was printed, although a vast deal was prepared, and ready for the press."—(Dr Wight.)

The herbarium of Mr Arnott at Glasgow, being particularly rich in Indian plants, is especially valuable, as containing the materials from which the *Prodromus Floræ Peninsulae Indiae Orientalis* was elaborated. It proved afterwards a most material benefit to the authors of the *Flora Indica*, who often applied to it on doubtful points.

In 1837, King's College, Aberdeen, conferred on Mr Arnott the degree of LL.D. In 1839, he lectured in Glasgow for Sir W. Hooker, who was temporarily absent, on account of family affliction, and in 1845 he received the appointment of Professor of Botany in that University, when Dr Balfour was transferred to Edinburgh. From 1825 to 1855 he was continually occupied in elaborate researches, the results of which were embodied in the works already mentioned, and in numerous contributions to the Transactions of learned societies. At the end of this memoir is an enumeration of his botanical writings, which will serve to indicate the extraordinary industry of our lamented friend.

It is a remarkable feature in the scientific work of Dr Arnott, that so much of it was done in conjunction with others; his single-hearted devotion to science was conspicuous in his cordial co-operation with men of different nations and temperaments, such as Sir William Hooker, Drs Greville and Wight, Röper, and Nees Von Esenbeck.

The single-mindedness with which he gave up his time to any one desirous of information, was beyond all praise. He would spend hours of the night in elaborating the collections of foreign botanists, purely for the love of science. Indeed, any survey of what Dr Walker-Arnott has done for the progress of botany, would be incomplete if it was confined to the notice of his published works, numerous and important though they are. Account must be taken of the spirit in which he worked, of the extent of the researches which he carried out, of the correspondence which he kept up, and of the aid and encouragement which

he was ready to give to botanists visiting him, or consulting his herbarium. As a botanist, his careful habits of observation, and minute accuracy of description, render his works peculiarly valuable; and his reputation in this respect is quite as great on the Continent as in this country.

Professor Decaisne of Paris writes,—“*La mort inattendue du Dr Walker Arnott est une perte réelle pour la science, et, je puis ajouter, pour les nombreux amis qui, en Angleterre et en France, ont été à même d’apprécier ses excellentes qualités, comme homme et comme savant.*”

In 1846 Dr Arnott left Arlary, and took up his residence in Glasgow, where he entered upon the duties of the professorship to which he had been appointed the previous year. As a professor, he was much respected and esteemed by all the students who had any real interest in the work of the class; and he had the gratification of imbuing many youthful minds with a permanent love for his favourite study. Dr J. Lindsay Stewart, at present Conservator of Forests in the Punjab, was one of his distinguished students, and is now one of the most rising botanists in India.

In 1860, when editing and remodelling the eighth edition of the British Flora, he addressed two humorous letters in rhyme to Sir W. Hooker on Brambles and Hawkweeds, which are characteristic of his desire to keep down the number of doubtful species. In truth, his zeal for rigid specific distinction has been of great benefit to the student of botany.

Of late years he devoted himself specially to the study of diatoms, with which his capacity for minute investigation, and his unwearying patience of research, pre-eminently fitted him to deal. The diatomaceous collection fills three cabinets, and is the richest in Great Britain. Dr Arnott contributed numerous papers on diatoms within the last few years to the Microscopic Society’s Journal and Transactions, but by far the greater portion of his observations were communicated in letters to his scientific friends in England, on the Continent, and in America. Amongst these may be mentioned Professor Dickie of Aberdeen; Mr Carruthers, British Museum; Messrs W. Wilson and T. G. Rylands, Warrington; S. Roper, London; G. Norman, Hull; F. Kitten, Norwich; and Dr Lewis of Philadelphia. In 1866 he visited several of his correspondents in England,

and also went to France, where he spent about ten days with his friend, M. de Brebisson, at Falaise in Normandy, all the time being constantly at work on diatoms.

For twelve months prior to his decease Dr Arnott's general health had evidently declined, and he was unable to take his accustomed exercise. At the commencement of the summer session he made an effort to resume with wonted zeal the labours of his class; but it was obvious to all his friends that the effort was attended with great pain and much risk, and that the conscientious desire to discharge his duty was impelling him to overtask his strength. After a few days the writer, who had just returned from India, was requested to carry on the duties of the class, to which he gladly acceded. It was a pleasure to aid in time of need one from whom he had received valuable assistance in botanical research, and he was an inmate of Dr Arnott's house during the tedious and painful illness which proved fatal. Jaundice appeared in April, and remained prominent till his death on the 17th of June, in the seventieth year of his age. He was interred on the 20th at Sighthill Cemetery, near Glasgow, in the presence of a large number of friends, members of the senate, and students. Mrs Arnott, three sons, and five daughters survive this distinguished botanist.

One of the trustees appointed is Dr Hooker, F.R.S., and it may be mentioned that after inspecting the valuable herbarium and library left by Dr Arnott, it was resolved to offer them to the Glasgow University, and it is hoped that they may thus become available to the nation. Dr Hooker remarks as follows:—"During this inspection, I became strongly impressed with the great importance of the books and plants being kept together, as being portions of a whole, and the work of one mind devoted for half a century to one object—the promotion of botanical research. There is another point of view under which it appears to me to be a matter of great moment that the books and plants should not be dissociated, and this is, that both of them illustrate in a most remarkable manner the rise and progress of systematic and descriptive botany during the earlier part of the present century, during which period exotic botany first became a science properly so called. Under the latter

point of view, these collections of books and plants possess a rare interest and value for a public and especially an educational institution, such as Glasgow University, to which the trustees are empowered to offer them at a fair valuation."\*

A memorandum in Dr Arnott's handwriting gives the following dates:—

Entered at College of Edinburgh, Nov. 1813.

Took degree of A.M. 1818.

Was admitted to the Faculty of Advocates, 1821.

Got degree of LL.D. from King's College, Aberdeen, 1837.

Appointed Regius Professor of Botany, Glasgow, 1845.

Fellow of Royal Society of Edinburgh, 1822.

Membre de la Société d'Histoire Naturelle de Paris, 1822.

Member of Wernerian Society of Edinburgh, 1822.

Member of Botanical Society of Ratisbon, 1824.

Fellow of Linnean Society of London, 1825.

Member of the Imperial Society of Natural History of Moscow 1829.

Member of the Royal Physical Society of Edinburgh, 1830.

Member of the Acad. Cæsar Leopold Nat. Curiosorum, under the cognomen of "Sibbald," 1834.

Member of Botanical Society of Edinburgh, 1836.

Member of the Lyceum of New York, 1837.

Was appointed Deputy-Lieutenant of Kinross-shire in 1825.

Dr Arnott was also Vice-President of the Royal Caledonian Curling Club, and was lately acting Depute Grand Master of the Royal Order of Masons of Scotland.

*Botanical Writings.*

1. *Tentamen Methodi Muscorum* (Arnott and Greville). Wern. Soc. Mem. IV. V. 1822-24.
2. *Sur quelques Mousses de Rio Janeiro*. Paris, Mem. Soc. Hist. Nat. I. 1823.
3. *Notice of a Journal of a Voyage from Rio de Janeiro to the Coast of Peru*, by W. Jameson; the Plants described by Dr Arnott. Wern. Soc. Mem. V. 1823-24.
4. *Nouvelle Disposition Méthodique des especes de Mousses exactement connues*. Paris, Mem. Soc. Hist. Nat. Vol. II. 1825.
5. *A Tour to the South of France and the Pyrenees in the year 1825*. Ed. N. Phil. Journal. Vols. I. to VI. 1826 to 1828.

\* The systematic works on Indian Botany, Cryptogamia, and Diatoms, are full of marginal notes and cross references of great interest and value.—H. C.



6. Notulæ Botanica. Loudon's Mag. Nat. Hist. Vol. I. 1829.
7. On the Hyahya, or Milk-tree of Demerara. Ed. N. Phil. Jour. Vol. VIII. 1830.
8. Remarks on the Genera Callitriche and Elatine. Ed. Jour. Nat. Geog. Sc. Vol. I. 1830.
9. Notes on some Species of Veronica, Melampyrum, and Helianthemum. Same work and vol. 1830.
10. Notes on *Aspidium aculeatum* and its Allies. Same work. Vol. II. 1830.
11. Botany of Beechey's voyage (Hooker and Arnott). 1 vol. 4to (plates). 1830-40.
12. On some New Species of Loasæ. Edin. Jour. Nat. Geog. Sc. Vol. III. 1831.
13. On some New Species of Portulacæ. Same work and vol. 1831.
14. Notes on Alismacæ, Euphorbiacæ, and a Flora Virgiliana. Same work and vol. 1831.
15. Article "Botany." *Encycl. Brit.* Vol. V. (7th ed.) 1831.
16. Contributions towards a Flora of South America and the Islands of the Pacific (Hooker and Arnott). *Hook. Bot. Misc.*, Vol. III. *Hook. Jour. Bot.* (1st series) Vols. I. and II. *Hook. Comp. to Bot. Mag.*, Vols. I. and II., (in all ten papers). 1833.
17. Characters of some New or Little Known Genera of Plants (Wight and Arnott). *Edin. N. Phil. Jour.* Vols. XIV. XV. XVI. 1833.
18. On some New Genera of Plants. Same work, Vol. XVII. (Arnott and Nees von Esenbeck). 1834.
19. Note sur la plante qui produit la Coque du Levant (*Cocculus Indicus*). *Ann. Sci. Nat.* Vol. II. (Bot.) 1834.
20. Observations sur quelques Plantes décrites dans la Flore de Sénégambie. Same work and vol. 1834.
21. *Historia Balsaminearum systematica accessionibus nonnullis aucta.* (Arnott et Röper) *Linnæa*, Vol. IX. 1834.
22. *Prodromus Floræ peninsulae Indiæ Orientalis.* Vol. I. 1834. (Wight and Arnott.)
23. On the East Indian *Asclepiadacæ* (Wight and Arnott). "Wight's Contributions to Botany of India." 1834.
24. *New Indian Balsaminæ.* *Hook. Comp. Bot. Mag.* Vol. I. 1835.
25. *Remarques sur la Flore de Sénégambie.* *Ann. Sci. Nat.* Vol. III. (Bot.) 1835.
26. *Neue oder wenig bekannte ostindische Pflanzen-Gattungen.* *Flora.* Vol. XVIII. (Arnott und Wight). 1835.

27. *Pugillus Plantarum Indiæ Orientalis*. Acad. Cæs. Leop. Nov. Act. Vol. XVIII. 1836. Ann. Sci. Nat. Vol. XI. (Bot.) 1839.
28. *New Ceylonese Melastomacææ*. Hook. Comp. Bot. Mag. Vol. II. 1836.
29. *Synopsis of the East Indian Species of Drosera and Parnassia*. Same work and vol. 1836.
30. *Illustrations of Indian Botany* (Wight and Arnott). Same work. Vols. I., II. Ann. Nat. Hist. Vol. I. 1836-38.
31. *Professori D.F.L. Schlechtendal hæc pauca de Grabowskia scribit*. Linnæa. Vol. XI. 1837.
32. *Clavis Analytica of the Convolvulacææ of the Peninsula of India*. Madras Jour. Sci. Vol. V. 1837.
33. *On the Genus Torreya*. Ann. Nat. Hist. Vol. I. Ann. Sci. Nat. Vol. X. (Bot.) 1838.
34. *On the Rhizophorææ*. Ann. Nat. Hist. Vol. I. 1838.
35. *Observations on some New or Obscure Species of Plants*. Jard. Mag. Zool. Bot. Vol. II. 1838.
36. *Some Account of the Genus Langsdorffia*. Ann. Nat. Hist. Vol. II. 1839.
37. *Descriptions of some New or Rare Indian Plants*. Ann. Nat. Hist. Vol. III. 1839.
38. *Exaci species ex peninsula Indica ac ex insula Ceylano*. Ann. Sci. Nat. Vol. XI. (Bot.) 1839.
39. *Notes on some South African Plants*. Hook. Jour. Bot. Vol. III. 1841.
40. *On the Cucurbitacææ*. Same work and vol. 1841.
41. *On the Introduction of Anomalous Genera into Natural Orders*. Glasgow Phil. Soc. Proc. Vol. II. 1844-48.
42. *Correction of certain errors in Dr Balfour's Communication to Bot. Soc. Glasgow*. Phytologist. Vol. II. 1845.
43. *Notice Regarding the Measurements of Heights by means of the Boiling Point of Water*. Glasgow Phil. Soc. Proc. Vol. III. 1848-53.
44. *Account of a Botanical Excursion to the Rhinns of Galloway*. Same work and vol. 1848-53.
45. *Notice of the Species of Salvadora*. (1851.) Same work and vol. 1848-53.
46. *Note on Samara læta, L.* Linn. Soc. Proc. Vol. I. 1849. Linn. Soc. Trans. Vol. XX. 1851.
47. *Synoptical Tables to Hooker's British Flora*. 5th edition. 1849. (These were incorporated in future editions.)
48. *British Flora* (Hooker and Arnott). 6th edit., 1850; 7th edit. 1855; 8th edit. 1860.
49. *Observations on some British Plants*. Ann. Nat. Hist. Vol. VI. 1850.

50. Note on *Platynema*. Hook. Jour. Bot. Vol. III. 1851.
51. Note on *Campylodiscus Hodgsonii*. Micro. Soc. Trans. Vol. VI. 1858.
52. On *Rhabdonema*, and a new Allied Genus. Jour. Micro. Sci. Vol. VI. 1858.
53. On *Arachnoidiscus*. Same work and vol. 1858.
54. On the Structure of *Amphora*, a Genus of *Diatomaceæ*, and the Diagnosis of its Species. Same work and vol. 1858. Roy. Soc. Edin. Proc. Vol. IV. 1862.
55. Notes on *Arachnoidiscus*, *Pleurosigma*, *Amphiprora*, *Eunotia*, and *Amphora*. Jour. Micro. Sci. Vol. VI. 1858.
56. Dr Walker-Arnott in Reply to Dr Donkin. Jour. Micro. Sci. Vol. VII. 1859.
57. What are Marine Diatoms. Same work and vol. 1859.
58. Note on *Hypericum Anglicum*. Ann. Nat. Hist. Vol. VI. 1860.
59. On *Cyclotella*. Jour. Micro. Sci. Vol. VIII. 1860.
60. Notes on *Cocconeis*, *Nitreschia*, and some allied genera of *Diatomaceæ*. Proc. Nat. Hist. Soc. Glas. 1868.

II. *Obituary Notice of N. B. Ward, Esq.* By Professor  
BALFOUR.

I have this evening the painful duty of recording the death of Nathaniel Bagshaw Ward, one of the oldest fellows of our Society, having been elected on 9th June 1836, and having acted as our local secretary in London from that time till his death.

He was born in 1791, in the east part of London, where his father, Stephen Smith Ward, acted as a medical practitioner. His views were at first directed to a sea life, and at the age of thirteen he made a voyage to Jamaica, where he had an opportunity of observing the luxuriant vegetation of that island, and was led to take an interest in natural history pursuits, more especially botany, to which science he afterwards devoted his attention with great ardour. On his return from Jamaica he entered upon the study of the medical profession at the London hospital. After passing through the usual curriculum of study, he became a member of the Royal College of Surgeons, and of the Apothecaries' Company of London. He then became assistant to his father, and afterwards succeeded him in practice, taking up his residence in Wellclose Square. Here he continued

for many years, and practised his profession with great acceptability. He became vaccinator to the National Vaccine Establishment in the locality. He was a kind, generous, and attentive practitioner, and won the affection and esteem of his patients.

I often visited Mr Ward in Wellclose Square, and I recollect well the delight which I experienced in my early days, in seeing the beautiful plants which he cultivated in his double-sashed window frames, even in the murky and uncongenial atmosphere of Whitechapel. He was a great admirer of nature, and specially of flowers; and he occupied the leisure which he could secure from a laborious profession in prosecuting botany. He had attended the lectures of Mr Wheeler, of the Apothecaries' Company, and to him he was indebted for much of his early botanical knowledge. He often occupied the morning hours in botanical trips to Wimbledon and Shooter's Hill, and he made collections of plants in these localities. He paid frequent visits to Kew, Loddiges, and Chelsea gardens, and he took excursions with his family to Cobham, in Kent. He entered the Linnean Society on 21st January 1817.

It was during his residence in Wellclose Square that he first entertained the idea of constructing those plant cases which have been called after him, and which have been so useful in the transport of plants from foreign countries, and in the cultivation of plants in towns. He had been disappointed in his attempts to cultivate the vine, Virginian creeper, and other plants, in consequence of the soot and dust, which caused the leaves to fade and wither, and he resolved to try the effect of close glass cases in preventing these injurious effects.

The following account is given by his son of the invention of the Wardian Case:—

“Actuated by an ardent zeal for botany, Mr Ward had for years striven to realise the *rus in urbe*. Not content with the plebeian myrtle, geranium, and rhododendron, he had extended his attention to the more delicate members of the vegetable world. All the protective care and nursing that he could bestow upon his pets were, however, ineffectual in enabling them to maintain the struggle with opposing influences. The soot and dust clogged up their

tender lungs, and impeded their respiration; the cold, dry winds carried off the vapours from their leaves, and the moisture from the mould in which they were planted, and caused them to shrink and wither; the deleterious gases entangled in the smoke-cloud poisoned them. The only resource left him was, on each occasion of a visit to the country, to bring back a fresh relay of plants, and thus maintain a fluctuating appearance of freshness and verdure. In the summer of 1829 he had placed the chrysalis of a sphinx in some mould in a glass bottle, covered with a lid, in order to obtain a perfect specimen of the insect. After a time a speck or two of vegetation appeared on the surface of the mould, and, to his surprise, turned out to be a fern and a grass. His interest was awakened. He placed the bottle in a favourable situation, and found that the plant continued to grow and maintain a healthy appearance. On questioning himself about the matter, the answers readily presented themselves, inasmuch as air, light, moisture, and other requirements of the plant were contained within the bottle.

“This parent closed case gave birth to numerous others; the plan was tested, and its success demonstrated, under various conditions as regards size, aspect and different tribes of plants; and after a few years Mr Ward had the satisfaction of feeling that through his discovery he had been the means of introducing nature into the crowded city, in all the attractiveness and purity, if not on the extended scale in which she exhibits herself in the country.”\*

A writer in the “Gardeners’ Chronicle” says:—“In 1836, Mr Ward wrote a letter to the late Sir William Hooker, announcing his discovery, and the letter was published in the “Companion to the Botanical Magazine” for May of that year. In 1838 Mr Faraday lectured upon the subject to a large audience at the Royal Institution. In 1842 the first edition appeared of Mr Ward’s work, “On the Growth of Plants in Closely-glazed Cases;” a second edition followed some years after, with illustrations by E. W. Cooke, R.A., and the late Mrs S. H. Ward. A second lecture upon the

\* On Wardian Cases for Plants, and their Applications. By Stephen H. Ward, M.D. London, 1854.

subject was delivered at the Royal Institution in 1854. Mr Ward himself, in a strikingly happy manner of his own, also explained his plan at various societies, and at meetings of the British Association."

Wardian cases have now become familiar to us in our dwelling houses, and by means of them many valuable plants have been successfully introduced into this country. Even among the inmates of our crowded closes and lanes these Cases have been introduced, and have acted in ameliorating to a certain extent the condition of the poor.

Mr Ward expressed great delight in showing to visitors his cases and window frames filled with plants, which grew luxuriantly in one of the apparently most unsuitable situations in London. He inspired others with a portion of his own enthusiasm for botany, and was instrumental in diffusing a taste for plant culture. His love of botanical science continued throughout his whole life; and when he removed his residence to Clapham Rise, he was able to carry on his labours under more favourable circumstances. He had the art of adapting the mode of culture to the constitution of the plant. Ferns were made to grow in circumstances best fitted for their full development. The dripping water was made to promote the growth of the *Trichomanes radicans*. Alpine plants were grown in suitable localities, and a winter covering was given to them, to supply the lack of snow. Every plant was treated in the way most suited for its development.

Mr Ward showed at all times a great desire to introduce botany among the working classes, as a science which could be prosecuted at all times even by the poorest member of society, and one which contributed greatly to healthy recreation and enjoyment.

Mr Ward was a zealous member of the Apothecaries' Company, and he filled the important office of Master in 1854, and of Treasurer at a later period. For a long time he took the direction of the Apothecaries' Garden at Chelsea, and did much to improve it and make it available for medical students. He became a Fellow of the Royal Society of London on 8th June 1825. He was one of the founders of the London Microscopical Society. In this he acted with Mr Edwin Quckett and Dr Bowerbank. I was present at

many pleasant microscopical reunions with him, at a time when less attention was paid to such studies than at present.

Mr Ward was a great favourite with every one who came in contact with him. He was very modest and retiring, and did not get the credit due to him for his persevering efforts to advance botany and horticulture. In 1863 some friends proposed to have a portrait of him executed. The required sum was speedily collected, and the portrait is now in the hall of the Linnean Society at Burlington House.

Mr Ward contributed several communications on botany to our Society, his last being "Under the Snow, or Notes of Alpine Plants and their Mode of Growth." He was fond of studying the aspects of nature in a botanical point of view, and he had specimens in his collection arranged so as to exhibit the flora of different regions.

He died at St Leonards, on Thursday 4th June, at the age of 77, and was interred in Norwood Cemetery, his friends Hooker, Wight, Cooke, and others, attending the funeral. He was a truly Christian man of science, and his loss will be felt by a large circle of naturalists.

III. <sup>#</sup>*Florula Discoana: Contributions to the Phyto-Geography of Greenland, within the Parallels of 68° and 70° North Latitude.* By ROBERT BROWN, F.R.G.S., &c.

I. *Review of Greenland Botanical Literature.*—The flora of Greenland has been at various times partially examined by different botanists. The early missionaries Egede, Fabricius, Saabye, and others, made collections of the plants of the districts over which their ministerial functions extended, and some of these are yet in the herbarium at the Botanic Garden in Copenhagen. In 1826 the Chevalier Charles Louis Giesecke (better known as Sir Charles Giesecke) Professor of Mineralogy to the Royal Dublin Society, who had passed several years in Greenland as a mineral collector, published a list of the plants of that country.\* His list comprehends a large number of species, but he is manifestly wrong in regard to many of them. Some, which may possibly be members of the Greenland flora, have never been found since his day. The various explorers in search of Franklin, and the surgeons of whalers,

\* Article "Greenland," Brewster's Edinburgh Encyclopædia.

have at different times added to our knowledge of the distribution of the plants, by collecting on various portions of the coast.\* But by far the most important collections which ever came from Greenland were those of Vahl, who botanised with the utmost assiduity over the whole extent of Danish Greenland, and has published various papers on the plants. The most valuable literary contribution, however, to the history of the Greenland flora, is the list in the appendix to Rink's "Grönland Geographisk og statistisk," by my friend Professor Johann Martin Lange of Copenhagen, forming a summary of the labours of all former Danish botanists, and a determination of the collections of Egede, Vahl, Rink, Holböll, and others contained in the Herbarium of the University of Copenhagen.† Drs Kane‡ and Hayes§ have added to our knowledge of the plants of the extreme northern shores of Greenland. Professor Lange's list, dealing only with the Danish possessions in that country, does not touch upon these. It is to be hoped, however, that he will yet undertake an extended flora of Greenland, a task for which he is so well qualified, both from his knowledge of the subject and the opportunity which he possesses of consulting Herbaria.

\* Lyall's collections, by Hooker, in Journ. Linn. Soc. Bot. vol. i. pp. 114-124; Notes on Arctic Plants, Dickie, Journ. Linn. Soc. Bot. vol. iii. (1859) pp. 109-112 (plants collected by Clarke, Clark, Maitland, Philips, Craig, and Sutherland); Dickie (Sutherland's Plants) in Appendix to Inglefield's "Summer Search for Sir John Franklin," (1853); Sir W. J. Hooker and Dickie in Appendix to Sutherland's Narrative of Penny's Expedition; Account of the Botany of M'Clintock's Expedition (Walker's Plants) Hooker and others, Journ. Linn. Soc. Bot. vol. v. p. 86; Taylor on Davis' Straits Plants, Trans. Bot. Soc. vol. vii. p. 323, or Edin. Phil. Journ. 1862; Sadler's Notice of Cryptogamia collected by R. Brown on islands of Baslin's Bay, Trans. Bot. Soc. vol. vii. p. 374; Sutherland on *Cystopteris alpina*, Trans. Bot. Soc. vol. vii. p. 393; and generally Hooker, Linn. Soc. Trans. 1864.

† Oversigt over Grönlands Planter af Joh. Lange (Bibliothekar og Assistent ved den botaniske Have) Tillæg Nr. 6 til Rink in lib. cit; Vahl om *Stellaria Grönlandica* og *Dryas integrifolia* (Nat. Selsk. Skirv. 4 Baud. 2 h. ss. 169-172); vide also Rink, "Om den geographiske Beskaffenhed af de Danske Handels districter i Nördgrönland med Kart, &c." (Afskrif. af Vidensk. Selskab. Sk. 5 B-3 B). Drejers *Revisio Critica Caricum borealium* (Kroyers Tidsskr. iii. p. 423). Hornemann in Graah's Journey to East Coast of Greenland (Trans.) Appendix; Flora Danica; Retzius' *Floræ Scandinaviæ Prodromus*, &c.

‡ Elias Durand in Appendix to Kane's "Arctic Explorations," vol. ii.

§ Hayes' Open Polar Sea, and Durand in Proc. Phil. Acad. Nat. Sciences, March 1863, as well as partially in "Das Nordlichste Land der Erde."—Petermanns Geographische Mittheilungen (1867) p. 176, *et seq.*



II. *The present Collections*.—During the summer of 1867, from June until September, I passed the season in Danish Greenland, collecting specimens in all departments of natural history, and pursuing scientific investigations. The summer was very favourable for botanical research. Accordingly, though my time was very limited, and greatly occupied with other pursuits, I made a large collection of plants, of all orders, found in the country between Egedesminde and Kudlesæt. As the country was chiefly in the vicinity of Disco Bay, I have denominated the account of these collections the *Florula Discoana*. These plants are here enumerated by the assistance of various botanical friends, whose reputation is a sufficient guarantee for the accuracy of the lists under their names. Though containing few plants really new to science, the list is interesting as being the most complete one of the plants of that section of country, and as adding to our knowledge of the phyto-geography of the coast,—the earlier collections being to a great extent useless for that purpose, as the labels merely afforded the information that they were collected in “Greenland.” As far as I can learn, it is the largest collection of Arctic plants ever brought to Britain, and perhaps the fullest ever collected in the same time in Greenland. The present lists were intended for a more extended joint account by myself and my companions of our travels in that country. Accordingly, I have only published the localities, &c., in abstract, reserving a more elaborate description for that work when completed. The only exceptions to this are in the case of the lists prepared by Dr Dickie and Mr Croall, which I have given in full, their observations not admitting of being abstracted. Mr Croall likewise furnished extended notes on each individual marine alga, which I have incorporated in his general account of the marine algæ. Dr Lindsay hopes to publish a memoir on the Greenland lichen-flora at a future period, and his more extended descriptions will be incorporated in that treatise. For the same reason (with the exceptions mentioned) I have not thought it necessary to make any further classification of the species, than into genera and species.\*

\* Of this collection made by me, which contained a very large number of duplicates, a full and authentic set of the Phanerogamia and Mosses has

III. *Climate*.—During the winter the country is covered with snow, and the plants protected under its warm covering. Darkness then covers the whole face of the country for about four months. About May and the beginning of June, according to the state of the season, the earth again begins to appear. By July the snow has generally cleared off all the lower grounds, and only lies in hollows, on the hills, or in places shaded from the sun. From this period until the middle of September, very little snow ever falls, and the climate is mild, and even warm and sunny, as during the summer of 1867. A little rain also falls during most seasons. Vegetation springs up apace, and during the long summer day, of four months, soon comes to maturity. By the beginning of August the flowers are on the wane, and by the end of that month have wholly disappeared. The weather in September is uncertain, showers of snow falling, and the nights being dark and cold. By October “bay ice” begins to form in quiet harbours or inlets, and the ground gets its winter mantle of snow. The soil freezes hard to the depth of several feet (where it is so thick), and all nature slumbers. Meteorological observations have been taken at various royal trading posts throughout

been incorporated in the Kew Herbarium. The rest of the specimens are, in common with the geological and zoological (undescribed) collections, in the possession of my companion, Mr Edward Whympster, Canterbury Place, Lambeth Road, London, who undertook the management of the business arrangements of the party, and was of much assistance to me in packing the collections and in seeing them through the custom-houses in Copenhagen and London. It is only right to state that the British Association and the Government Grant Committee of the Royal Society liberally contributed £300 towards the expenses of the expedition, and that the collections made were of very considerable pecuniary value. The Royal Geographical Society and the Meteorological Department of the Board of Trade, through the good offices of Sir R. I. Murchison and Mr R. H. Scott respectively, also gave the use of some valuable instruments. Though, possibly, this expedition may have, *primarily*, cost more, yet I coincide in the universal opinion of the Danish officers and others, that with equal facilities to those granted to us by the Danish Government, through the thoughtful kindness of the Chevalier C. S. M. Olrik, Direktor af Den Kongelige Gronlandske Handel, the *actual* and *necessary* expenses of any expedition on an equal scale, judiciously and intelligently conducted by experienced travellers, *need* not cost more than the sum mentioned, in addition to what might be derived from the sale of the collections. I have embraced the permission accorded to me by the articles of the expedition, to publish this account of its botanical results, as this is only due to the botanists who were engaged in the work.

Greenland.\* At Jakobshavn, one of these settlements, Dr Rudolph, now Governor of Upernavik, kept for upwards of three years a careful register of the thermometer. Jakobshavn was our head-quarters, and the locality for the chief portion of the species here enumerated, and it may be taken as typical of the climate of Disco Bay. I therefore present the means of temperature there, as a mean of the climate over the region embraced in the title of this paper.

THEMOMETRICAL MEANS OF THE CLIMATE OF JAKOBSHAVN.

Lat. 69° 13' 26" N.

January, ÷	2·4 Fahr.	July,	45·4 Fahr.
February,	0·3	August,	42·4
March,	8·2	September,	34·6
April, +	18·8	October,	25·1
May,	32·5	November,	12·5
June,	41·5	December, ÷	7·5
Winter (Mean Temp.) ÷	3·4	Summer, +	43·1
Spring,	„ 19·9	Autumn,	24·1
	Whole year,		22·5

IV. *Character of the Country over which the Plants were Collected.*—The character of the country over which the specimens were collected consists chiefly of bare rounded granitic hills, planed by old ice action, and covered with boulders and travelled blocks of stone. In the hollows, where the melting of the snow collects, are peaty bogs, and in other places dry heathy-looking tracks, covered with *Empetrum nigrum*, *Cassiope (Andromeda) tetragona*, *Betula nana*, and such like plants. The eastern side of these glens is richest in plants, and the vicinity of streams and dripping springs yields a considerable variety. In the Waigatz Straits, about Kudlesæt, Ounartok, and Atanakerdluk, the geology changes, and bold trap cliffs and dykes burst through sedimentary rocks of miocene age. Here is the limited district containing the now celebrated fossil beds of Greenland.†

I may shortly describe each individual district, taking the Danish trading divisions as guides, and looking upon the

\* *Collectaneu Meteorologica*, Fasc. iv. Haunice, 1856. Rink Tillæg Nr. 8, "Meteorologio" til *Grönland geographisk og statistisk beskrevet*, Andet Bind, 1857.

† The plants of these beds are now being described by Professor Heer of Zurich, and the lithology by the author.

chief post in each district as the centre and type of the division. It was also in the immediate vicinity of these posts that the greater number of the plants here enumerated were collected.

(1.) *Egedesminde*.—Lat.  $68^{\circ} 42' 39''$  N., long.  $52^{\circ} 43' 48''$  W.\* The island on which the settlement is built is low-lying, bare, and bleak. The vegetation is very stunted, and is affected by the cold wind—no high mountains being in that vicinity to shield the low-lying ground, and few cliffs which can radiate the sun on the soil. The climate here is more foggy than in other places further to the east and nearer the mainland. The cranberries and whortleberries on the small hills in general bear no ripe fruit; the arctic willows and the birch do not grow in any great luxuriance; and the greater part of the country is covered with swampy moss, only allowing a little green to appear now and then. Warm springs (so called, I daresay, on the principle of *lucus a non lucendo*, for, though warmer than the air, they are yet sufficiently cold) are found on the island of Sakartloek, lying at the head of Tessiursak Bay, about eight miles from Egedesminde, and near the mouth of a little river flowing over a level tract scattered with boulders. One of these springs runs out in a large stream out of a very solid granite wall and over a smooth mossy ground, out of which other two or three springs run between the stones and moss with about the same force. The temperature, according to Dr Rink, is  $42^{\circ}\cdot 1$  Fahr., or  $20^{\circ}\cdot 2$  Fahr. higher than the mean temperature of the island. A little basin, a few hundred feet in length, which the spring forms, is never frozen; and at the bottom of the bay, where the stream debouches, no ice lies in the winter. Large banks of *Bartramia fontana*, &c., form round the springs, which

\* In most cases, and in reference to the latitudes invariably, I follow my own observations made during the past summer. In reference to the longitudes, my own observations not being all yet (owing to the arrangements of the expedition) accessible, I have followed either Graah's observations (in "Tabel over adskillige punkters observerede Brede og Laengde paa Vestkysten af Grönland," in "Beskrivelse til det Vixende Situations kaart over den Vestlige Kyst af Grönland," &c., &c. Kjobenhavn, 1825), or others given to me through the politeness of Premier Lieutenant H. L. M. Holm of the Kongl. Kaart Archiv in Copenhagen. The position is that of the chief "colonie" or trading post.

keep these moss banks always in a tremulous motion. On the island of Aito, and the surrounding islands, the same characteristics prevail as in the vicinity of Egedesminde. The vegetation is exceedingly scanty, and but little can be seen but brown rust-coloured rocks and stunted vegetation. Here is found *Sedum Rhodiola*, D.C.—found nowhere farther north than South-East Bay. It is said to be here very abundant on the top of the small sterile islands, tipped by turf and the excrement of birds. We arrived at Egedesminde on the 6th of June, and left on the 14th of the same month. During most of this time the weather was snowy, and little or nothing except a few lichens and mosses rewarded my search. I am, however, under obligations to Freoken Julie Leveson for most kindly presenting to me a small collection of Egedesminde plants, made by her in the preceding year, which has enabled a few localities to be added to the Disco flora, and one or two additions to be made to the scanty list. The general character of the country at this season of the year may be gathered from the following jotting in my journal; and as it is equally characteristic of other portions of Disco Bay, I may be excused quoting it:—

“June 6.—To-day we took an excursion over the island on which the settlement of Egedesminde (‘the memory of Egede’) is built. The Eskimo name of it is *Arsiat*, and means the summer place; and they remark, not inaptly, that it lies in its little archipelago of islands, like a spider in its web. Nothing was to be seen but bare granite rocks, worn by ice, or covered with poor Franklin’s *tripe de roche*—the *tudluak* of the natives—with snowy drifts in every shady place, and bogs in the hollows, or lakes with the surface ice yet unmelted. Few living things were out: a bee, a spider or two, and a *Dyticus* in the pools, with a snow-bunting (*Emberiza nivalis*) looking out for a nesting-place, were the only specimens of animal life we came across in our rambles. No flowers were as yet above the ground to any extent. The willows were shooting up, and the *Empetrum* was green above the half-thawed soil. *Eriophorums* were coming into flower, but the only plant in bloom was *Cassiope tetragona*. Masses of woolly-looking matter, apparently bleached *Confervacæ*, mantled some of the stagnant pools near the village, which were half choked

up with rotting fragments of seals and other animals. Near the top of the island were found larvæ and cocoons of Lepidoptera, pieces of the shell of *Echinus drobachiensis*, Mull., and the shell of a decapodous crustacean, apparently carried up there by sea-birds, or perhaps by the wind. If we are to credit the Eskimo tales of *Asaminak*, the south-east wind, it has force enough to carry for some distance much heavier matters than shells. In some of the little valleys we met Greenland women laden with the dwarf birch, *Empetrum*, and willows—collectively the *Brændsel* of the Danes—for fuel in their houses."

(2.) *Christianshaab*—Lat.  $68^{\circ} 49' 19''$  N., long.  $51^{\circ}$  W.—I visited this locality for two days in the first week of August, and added several plants to my collection. My recollections of it are very pleasant indeed, and my notes describe it as possessing "more varied scenery than any of the other settlements I have yet seen, lying in a long 'hope' with green slopes to the water's edge, and fells of syenite 1600 feet in height in front of the 'colonie,' and beyond,—the way leading through a green grassy valley,—a lake alive with wild geese (*Anas acuta*, Linn.). Behind and all around are sunny 'braes,' green with the moisture of rushing rivulets, and many flowers as yet strangers to my collection." The coast between Christianshaab and Claushavn is low and easily landed on, with green slopes and streams running down from the hills and bursting through the boulder clay. On one of the islands (particularly *Krikertasasuk*, "the long big island") about six miles from Christianshaab, I added several plants to my collection, particularly *Potentilla anserina*, L., which, though found further north, is yet only entered in Lange's list on Vahl's authority, and was not found by me elsewhere in the vicinity of Disco Bay.

(3.) *Claushavn*—Lat.  $69^{\circ} 7' 31''$  N., long.  $50^{\circ} 55' 30''$  W.—This commercial establishment is built on a flat, backed by hills of considerable height. On this flat is a small lake, round the marshy borders of which plants grow luxuriantly. This flat is divided off into one or two little glens by *roches moutonnées* like knolls of rocks, each glen ending in a terminal moraine at the lower edge, and exhibiting the same evidences of ancient glaciers. Many

plants are found here on this sunny flat which I did not observe at Jakobshavn, only seven miles north of it across the Icefjord. For Greenland, Claushavn is a sunny spot, and not unpleasant. Here *Epilobium latifolium*, L., luxuriates, and *Lychnis apetala*, L., is found growing in considerable quantity among the rocks behind the Colonibestyrers house. *Armeria vulgaris*, Willd., *Trisetum subspicatum*, P. B., and *Juncus triglumis*, L., were found by me only in this locality. From Il-ül-iä-mîn-ër-sūāk ("the big mountain overlooking the Icefjord"), rising to the height of 1400 feet, can be seen the Icefjord, and little lakes lying in rugged valleys, with the commencement of the Tessiusak just peering out, and away beyond to the eastward the dreary stretch of the inland ice. *Rhododendron lapponicum*, Stellarias, and Drabas were the plants most prominent. *Papaver nudicaule*, the hardiest of all arctic plants, was found here long after *R. lapponicum* had disappeared. I visited Claushavn first on the 24th June, and subsequently at various times in July, and afterwards while travelling to Christianshaab in the beginning of August.

(4.) *Jakobshavn*—Lat. 69° 13' 26" N., long. 50° 55' W.—This was our head-quarters for the whole of our residence in the country, and the greater number of the plants were collected here. The settlement is built on rounded knolls of rocks, with boggy little valleys between, where the vegetation springs; further back are various boulder clay valleys, where considerable vegetation appears, though very little exposed to the sun. The flora is not nearly so profuse as at Claushavn. The whole country in this region is composed of rounded syenitic hills of various heights up to 1200 feet, bare or polished with ice action, or covered with black, horny lichens, and scattered with boulders and angular blocks of stone lying in all kinds of positions over their summits and faces wherever it is possible for them to lie. Between these fells and rocks lie flat valleys, composed of boulder clay beneath, but capped with a boggy covering of turfy peat, which the natives cut and dry in stacks for winter fuel. Early in the summer these are mere bogs or marshes, into which you sink over the knees. Here the melting of the winter's snows accumulate, forming miniature lakes in the hollow places, permanent all the year round,

bordered by a thicket of Cyperaceæ and bright with the yellow ranunculus and other arctic marsh-plants, and finally the overflow is emptied by streams which pour in mimic cascades over the sea cliffs. In some of these lakes or boggy places I found *Hippuris vulgaris*, which I did not observe anywhere else in the district. A fruitful habitat for plants was the dripping rocks, where a little stream flowed in through a valley at the head of the harbour. Outside of the little harbour a few Algæ were found, the continual grinding of icebergs off the shore hardly allowing of their growth. However, just below the "kirke" where we lived, the rocks yielded not a few species, and the scum of pools furnished some interesting fresh-water species. North of Jakobshavn the coast is very similar—low-lying, with glens and valleys, the outlets of former glaciers, scattered with old moraines, but presenting nothing particularly worthy of notice in a botanical point of view. On the site of Eskimo villages (such as *Akotout*, in Rode Bay) a very luxuriant growth of vegetation springs up; and here I gathered some plants, which will be found recorded in their proper places.

(5.) *Illartlek Inlet*.—This inlet breaks the coast in lat.  $69^{\circ} 27' N$ . Like all of such fjords or inlets, it is the site of an ancient glacier which here reached the coast. The entrance of it is in Pakitsok Bay, and is marked by an immense terminal moraine, where many plants grow luxuriantly.\* I have always noticed that plants grow most luxuriantly near large rocks or boulders, the rock attracting a greater amount of heat to the soil. This is very evident on the broad American prairies, where stones are rare; and was equally apparent here, though on a lesser scale. At the head of this inlet (or at least one of the heads) a muddy glacier stream flows in, silting up the head of the inlet for several miles. On the left hand is a bold bluff of boulder (glacier?) clay and boulders, a remnant, as all such are, of the former upheaval of the coast, though at present, in the vicinity of Disco Bay at least, the coast is perceptibly sinking. This clay was in the form of fine sand, and kept together by a turf of *Empetrum*, *Betula*, and grasses; but on the windward side, where it meets the

\* In this catalogue "Illartlek" refers to this locality; "Illartlek glacier," to the immediate vicinity of the glacier and inland ice, &c.



blast from the glacier, it was bare of vegetation, and the fine powdery clay was blown into hillocks around a few willow tufts. On the less exposed places a few stunted plants grew, particularly *Ledum palustre*, here at least belying its trivial name, for it grows mostly on dry ground. Between the glacier and this place is a flat valley, after ascending the first slope, covered with a spongy turf and permeated by streams, and ornated with a little lake where the wild geese breed. On the slope, just before crossing over a little ridge to the glacier, I found the rare lichen *Dactylina arctica*, Nyl., in considerable profusion, but nowhere else. This valley is plentifully tufted with the fragrant *Hierochloa alpina*, which is used for stuffing the native boots. Crossing the ridge mentioned, we descend a little slope and face the glacier, the overflow of that great *mer de glace* which overspreads the whole interior of Greenland with an icy covering. The slope facing the glacier and the cliffs around are bare of vegetation, and the whole vicinity is very chilly and dreary. The cold blasts have even nipped the usual profusion of arctic vegetation, and we have to go far afield to gather the dwarf birch for our cooking fire. "On the slope, however, survive nearly all the species of *Saxifraga*, and on the sunny spots *Vaccinium uliginosum* is bearing its pleasant-tasted berries, all of which tell us that autumn (after which cometh the winter, when no man can work) is travelling on apacè. *Stellarias* and *Oxyria* show themselves frequently, as do also *Epilobium latifolium*, and the *Eriophorum* with its tasselled head of cottony down, in the boggy places here and there, while *Stellaria Edwardsii* is occasionally seen quite abundant at the head of the inlet. *Papaver nudicaule* is coming into seed, as well as the species of *Pedicularis*, which, with *Lycopodium annotinum*, &c., maintain their ground in appropriate situations." The glacier face was in lat.  $69^{\circ} 24' 12''$  N. We entered the inlet on the 20th of July, and left on the 29th of the same month.

(6.) *Ritenbenk*—Lat.  $69^{\circ} 45' 34''$  N., long.  $51^{\circ} 7'$  W.—The island on which this settlement is situated is called *Akpaet*, and presents nothing phytographically remarkable. There is a considerable amount of dwarf willow and turf on it. By the time we arrived here (August 20) the

arctic flora was nearly gone, so that Ritenbenk does not figure much in this catalogue. The shore afforded, however, a few sea-weeds.

(7.) *Sakkak*—Lat.  $70^{\circ} 0' 28''$  N., long.  $52^{\circ}$  W. (approx.)—At this little outpost there is a broad sunny flat, with the "inland ice" appearing as miniature glaciers down between the cliffs behind. Here I found *Festuca ovina*, L., in great luxuriance, but except a few algæ from the shallow muddy ice-choked harbour I did not add greatly to my collection.

(8.) *Atanakerdluk*—Lat.  $70^{\circ} 02' 30''$  N., long.  $52^{\circ}$  W. (approx.)—By the time we arrived here phanerogamic vegetation was nearly over; and except a few cryptogamic plants I have little to add from this locality. Here, as I have remarked, the geology entirely changes from the primitive to sedimentary formations; and the few days we spent here (22d to 24th August) were occupied by me almost entirely in collecting the miocene plants, and describing and making sections of the strata, the arid slope presenting no recent plants to collect. Though, of course, the limited materials possessed will scarcely admit of deciding what influence the change of soil, consequent on the altered geological conditions, may have in giving an altered character to the flora; yet, so far as I was able to judge from the decayed plants which remained above ground, it seems that they were, to a great extent, different from those gathered on the granitic soil.

(9.) *Ounartok*—Lat.  $70^{\circ} 2'$  N., long.  $52^{\circ} 24'$  W. (both approx.)—The locality known under this name seems to have been at one time a native "house-place," and traces can yet be seen of former habitations at the mouth of a gurgling creek which flows from the mountains, and it is yet a favourite camping place for the rare visitors and wayfaring-men along this dreary coast. Much debris has been brought down by this creek as it dashes from the mountains and the inland ice of Disco Island (for it is situated on the opposite shore of the Waigatz Strait, as are also the two next localities mentioned), and bursts through the sedimentary strata which lie in its way.

(10.) *Kudlesæt*—Lat.  $70^{\circ} 5' 35''$  N., long.  $52^{\circ} 32'$  W. (approx.)—This was the most northerly locality reached by

us in 1867. Here are green mossy slopes, but as the sun does not reach this spot for several hours in the day, the vegetation, even on the 27th of August, was backward. Here several streams flow down and form a marshy flat at one place before reaching the sea. On this wet ground, and on the sandy "links" which skirt the coast for a few yards in breadth at this place, I found one or two plants, such as *Juncus triglumis*, L., *Equisetum variegatum*, L., &c., which, though not peculiar to the locality, are yet rather uncommon in this region.

(11.) *Godhavn* or *Lievly*—Lat. 69° 14' 58" N.,\* long. 53° 24' 40" W.—This little post, situated at the southwestern point of Disco Island, is perhaps the best known botanical locality in all Greenland, having been a regular halting place for whalers and the numerous Arctic Expeditions. Hence we find plants from this locality figuring in all the lists hitherto published, and containing some not in this catalogue, as by the time we arrived (4th Sept.) vegetation had almost entirely disappeared. The settlement itself is built on an off-lying islet of syenite; but on the other side of the harbour on Disco Island, where the syenite meets with that great trap dyke which, either in its main body or in its offshoots, traverses the whole breadth of the islands of Disco and the Noursak peninsula, there is a "warm" stream of the same character as that on the island near Egedesminde, already described. This stream falls into the harbour, flowing through a little green valley called Lyngemarken (or the "heath valley"), backed by huge fells of trap. This Lyngemarken is the best botanical locality which I have yet seen in Greenland. Though most of the plants had faded down in this valley, yet, from what I was able to identify, or from other small collections, it appears to be very rich in species. The most characteristic plants are *Salix glauca*, *Betula nana* (seldom over one foot high), *Rhododendron lapponicum*, *Cassiope tetragona*, *Empetrum nigrum*, *Saxifraga tricuspidata*, *S. Aizoon*, *S.*

\* Graah gives the lat. as 69° 14' 22," while the late Lieut. Ulrich (in general a very good observer), according to a meridian altitude given me by the Royal Chart Office of Denmark, states it as 69° 18' 30" N.; but as Capt. Graah's position and mine agree so closely, I believe that we are nearer the truth.

*cæspitosa*, *S. rivularis*, *Azalea procumbens*, *Gnaphalium norvegicum*, *Veronica alpina*, *Arnica alpina*, *Bartsia alpina*, *Campanula uniflora*, *Epilobium angustifolium*, *E. latifolium*, *Dryas octopetala* var. *integrifolia*, *Papaver nudicaule*, *Pedicularis fluminea*, *Silene acaulis*, *Armeria maritima*, *Alchemilla vulgaris*, &c.; and among Cryptogamia, *Cetraria islandica*, *C. nivalis*, *Cladonia glacialis*, *Peltidea aphthosa*, *Polytrichum juniperinum*, *Racomitrium canescens*, *Sphaerophorum coralloides*, &c. (vide Dr Rink, &c.) The valley graduates by a gentle slope to a dark beetling precipice. At between one or two thousand feet from the shore the vegetation seems to be lost, and there is only seen mountain cliffs or debris of rocks rolled from above, through which the stream runs gurgling along. The most remarkable of all the plants, however, which I saw in this valley were remains of the "Qvan" (*Angelica officinalis*, Hoffm.), well known by its native and Norse name (apparently one of the words of the old Norsemen which have got incorporated in the Eskimo language), which grew in patches by the side of the stream, and occasionally in the moist ground. It is one of the most interesting plants of Greenland, and is only found on the island of Disco, in North Greenland. It is, however, abundant in the vicinity of South Greenland fjords, and particularly in the district of Julianshaab, so much so, that the natives say that Disco was once a portion of Julianshaab district, and that a great angekok or wizard towed it north. He would have towed it still further had not a rival cut the rope! This is what may be called a "myth of observation." The Danes and Greenlanders use the leaves much as an antiscorbutic. On the leaves is occasionally found *Vitriinia angelicæ*. By the borders of the stream, and at the northern head of the valley, I found *Achemilla vulgaris*, L., growing. I heard much of a place, about twelve miles from Godhavn, called *Qvanner-soit*, "the place of the Qvan," which, if all stories are true, seems to be the most agreeable spot in the district. It is situated between high falls and "jokulls," with numerous waterfalls from them, and green slopes covered with the most luxuriant vegetation in all North Greenland. *Angelica* has been found at various places on the island of Disco, but nowhere so abundantly as here, as the name indicates.

The willow is here eight feet high \* when raised up from the ground. Numerous flowers grow here. *Rhododendron lapponicum*, *Pedicularis flammea*, *Ledum grönlandicum* (*palustre*), &c., are seen in profusion. Godhavn was the last locality visited in Greenland, and on the 12th of September we left in the royal trader "Hvalfisk," Capt. Hans Seistrup, for Denmark, just as the snow was beginning to cover the hills, and the nights were getting cold, dark, and dreary. My time was much occupied in zoological, geological, and astronomical work, besides having a full share of the varied duties of the party, so that my leisure for botany was limited; and when we take into account the time occupied in going from place to place, the period over which the collecting extended did not much exceed two months, the whole extent of our residence in the country being only three months.†

IV. *Economic Botany of Disco Bay*.—(1.) *Gardens*.—Around most of the little trading posts the Danish officers have attempted to cultivate a few garden vegetables, and by bringing soil from old Eskimo houses, and taking the greatest care, a few of the hardier vegetables are raised in small quantities. Potatoes never get bigger than marbles; but spinach, radishes, lettuces, &c. prosper, and are ready for use about the middle or beginning of August. Of Dr Pfaff's and Hr Anderson's gardens at Jakobshavn and Ritenbenk we have most pleasant remembrances. The garden at the latter place deserves honourable mention, and as it was, perhaps, one of the most favoured and favourable specimens of such, the description will suffice for all. It is situated on a sunny slope, with a southern exposure, and composed of earth brought from Old Greenland houses (and therefore richly manured), heaped up to the depth of two feet. The vegetables were most luxuriant—lettuce, cabbage, turnips (white), carrots, parsley, and onions. This garden parallelogram of 18 by 12 yards, with its luxuriant vegetation, the gravel walk, the miniature

\* I have seen a stem of *Betula nana* from Upernavik (72° 48' N.) two inches in diameter, and another from South-East Bay equally thick.

† It has been necessary to give these dates, in order to show the times of flowering, and to avoid repetitions, though the object of this paper is not to furnish any narrative of the journey.

summer-house in the centre, the green watering-pot, and the bird nets over the lettuce, had quite a home aspect amid the barren Sahara of grey syenite and granite, and with hundreds of icebergs in sight at any hour. The Danish ladies cultivate in their houses most of our garden flowers, geraniums, fuchsias, roses, Nasturtiums (a great favourite), ivy, &c.; but they are apt to be destroyed if placed out of doors.

(2.) *Fuel*.—It is a great mistake to suppose that the Eskimo burn nothing but blubber for fuel. Their principal fuel is the turf, the birch, *Empetrum*, willow, *Andromeda*, *Ledum*, *Vaccinium*, &c., which they collect and store for winter use, or use immediately in the summer. We used this in all our travels, though, indeed, an armful soon blazes up like a bunch of straw. The collection, storing, and cutting of the various descriptions of fuel is interesting; but I must pass it over with this notice.

(3.) *Food Plants*.—Equally erroneous is the notion that they use no vegetable food. Berries form their principal article of vegetable diet, and comprehend blaeberrries (*Vaccinium uliginosum*), cranberries, *Empetrum*, *Vaccinium Vitis-idea*, &c. Though the latter is used by the Danish residents as a preserve, yet it is not eaten generally by the natives; and even the blaeberrries are eaten cautiously by them, on account of some supposed noxious quality.

(4.) *Plants used Hygienically*.—There are some plants, of which the flowers, leaves, or roots are eaten raw or boiled, such as *Sedum Rhodiola*, the flowers of *Epilobium*, *Pedicularis hirsuta*, of which the flower tops are boiled and eaten as a sort of cabbage; the sorrel (*Oxyria*), and the well-known scurvy grass (*Cochlearia*), which is used in scurvy by the natives, who are often affected by that disease, though never touching salt. I have already spoken of the use of the Angelica by the Danes and Greenlanders. Iceland moss (*Cetraria islandica*) is found in various places; but is rarely, if ever, used by the natives. Various species of algæ are used as food, but only resorted to when they are hard pressed by hunger. The species chiefly used is called Aukpadlurtok (*Chorda Filum*, Ag.) *Fucus vesiculosus*, L., *Alaria Pylaii*, Grev. (Sutluitok), (the ally of which, *Alaria esculenta*, is eaten on our own shores), *Rhody-*

*menia palmata*, Grev., are also used. *Lycoperdon Bovista*, is said to be applied to bleeding wounds.

V. *Introduced Plants*.—In another memoir I propose discussing the origin and nature of the Greenland flora, its geographical range in Greenland, and the hypso-metrical distribution of the species; but I believe it will not be out of place to conclude these introductory remarks on the Disco flora, by calling the attention of future collectors to the subject of introduced or colonist species. Species at all tender, if accidentally introduced into Greenland, though they may survive the summer, yet can scarcely be expected to live over the winter. There are, however, some plants found in Greenland, the indigenous character of which is doubtful. On the sides of the fjords, up to 61°, is found, in the form of small shrubs, the well-known *Sorbus Aucuparia*, L., and from its position there seems to be some good reason for supposing it was brought to Greenland by the old Norse and Icelandic colonists. Again, *Xanthium strumarium*, L., was found by Giesecke in the garden of the Moravian Brethren at Lichtenau in the Frith of Agluitsok, near Cape Farewell, in 60° N. lat.; but was probably sent from Europe in seed. These subjects, as well as the means by which plants may be transported from place to place, the hybridising of some of the more variable species, especially the Drabas, are all eminently worthy of being attended to; and as several Arctic expeditions will be in the field next summer, we may hope to obtain some more enlightenment on these matters.

VI. In addition to the gentlemen who have so minutely examined the collections, and regarding whose work I will not say a single word, as it speaks for itself, I have specially to thank Dr Hooker, Professor Oliver, and Mr J. G. Baker, of the Herbarium at Kew, for much assistance, and a *carte blanche* in the way of whatever aid the magnificent collections under their charge could afford to me while studying and assorting my collections. These collections comprehend all the species actually brought home, as far as flowering plants and ferns are concerned. Several other species, however, were identified, but too far gone to be preserved. It is possible that a further examination of some of the marine algæ and