a milky juice on being assailed by them. Other plants, as some varieties of the willow, have very slippery flower-stalks, which the ants cannot pass along. The forms of the flower, too, lend themselves to protective purposes: thus *Antirrhinum* and *Linaria* have a close-shutting corolla, which they cannot enter; *Cobœa* is furnished with free hairs growing on the corolla, which block the way to the nectar, and which are insurmountable by the insects. Where such means are not found, in some cases a counter-attraction is provided to draw the unwelcome visitors to parts where their attentions will be harmless: thus *Impatiens* has honey-glands on the leaves which are said to stop the ants on their way to the flower.

Other insects than ants are also to be guarded against. Many flowers are capable of fertilisation by more than one species of insect, but others are especially adapted only to one kind. In these the form of the flower, while affording facilities for the proper insect to receive its pollen upon the proper region of its body, also presents obstacles to others which would be useless. The peculiar construction of the corolla in such cases serves as a protection to both nectar and pollen. This may be carried still further, access to the honey by other than the appropriate channel being hindered by chemical means. An instance of this is seen in the Alpine varieties of the Aconite, which are adapted for fertilisation by bees. Instead of the insect inserting its proboscis into the flower from the front, so as to make it pass the stamens and pistil, one bee (*Bombus mastrucatus*) bites a hole in the back of the hood formed by the sepals, and abstracts the honey. The white variety of the flower is unprotected against the theft, but the other, blue in colour, has a nauseous, bitter taste, and so is let alone.

Besides meeting the attacks of animals in these different ways, plants have to cope with other dangers, and require for these another system of defences, which are more associated with peculiarities of environment. They are assailed continually by varying conditions of climate and temperature, and have in many cases very curious modifications of structure and habit to correspond with these. A danger that threatens most plants, except in a few regions of the world, is that of having their pollen injured by rain. To meet this many varieties of form of corolla have been developed. Many have a long narrow tubular shape, the claws of the petals cohering together, while the free limbs can curve outwards in fine weather, but arch over the tube when wet. Others have a campanulate form, with the base of the bell upwards, so that rain falling on the flower cannot get near the stamens, but is shot off as by a roof. In others the stamens are covered over by development of another part of the flower, as in the Iris; the filament of the stamen, too, may be broad, and bear the anther on its under surface, as in the Naiadaceæ. It is rather curious that flowers that produce large quantities of pollen have not such defences against this danger as those which form but little, while the most complete adaptations are found in the cases of plants that inhabit damp climates.

Many flowers are defended by habit rather than structure. In wet weather they do not open their corollas at all, and not a few, even in fine weather, keep open for a very little while, only a few hours in many cases.

Besides rain, other meteorological conditions are fraught with danger. One of the most commonly occurring is frost; and allied to this is the loss of heat by radiation during the night. The power of resistance to these conditions varies very much, but in many whose constitution makes them peculiarly susceptible to damage thereby there has been developed the so-called power of sleep. The term is no doubt a misnomer, but it has been adopted and associated with certain well-defined movements which the leaves of the plants perform at the close and at the beginning of day. The movements differ very greatly with different plants, but they bring about such a position of the leaves as will protect the upper surface from radiation. Some of them are of a very complex nature, particularly those shown by certain of the Leguminosæ, which have pinnate leaves. It is in this natural order that the property of sleep is most prevalent, certain of the Oxalidaceæ and their allies coming next to them.

A similar mechanism protects very many plants from excess of sunlight, which is injurious to the chlorophyll. In bright sunshine the leaves assume a position which has been called "diurnal sleep." In it they present their edges and not their faces to the light. In other leaves the chlorophyll corpuscles themselves move, taking up a position on the lateral walls of the cells rather than on the front ones, or so placing themselves that their profile and not their surface is exposed to the sun. In some of the Algæ, as *Mesocarpus* and *Vaucheria*, this sensitiveness is seen.

Other protective devices may be seen by studying the adaptations of plants to their conditions of life. Thus the leaves of submerged plants are preserved from being broken by the currents of water by being minutely subdivided, so that they adapt themselves easily to the motion, and do not oppose a resistance. Desert plants are protected from drought by the development of a succulent habit. Aërial parts of plants, again, are protected in many cases from becoming moistened by water by a deposition in the cuticular layers of the epidermis of varying amounts of wax or resin.

THE ORIGIN OF OUR POTATO

THE year 1886, by its tercentenary associations, brings once before us the subject of the introduction of the potato into our islands, but brings it still with most of the connected questions unsolved.

How, and when, and whence it was brought was considered by Banks in 1808, and it was by him attention was drawn to a manuscript statement in 1693 by Dr. Southwold Smith, F.R.S., that his grandfather received it from Sir Walter Ralegh, and sent it to Ireland.

It was considered by Sabine in 1822, when he concluded a paper before the Royal Horticultural Society with the remark, "The introduction of the potato *into* Virginia is still involved in obscurity."

It has been considered by De Candolle in his "Géogr. Bot. Raisonée" in 1855, and more recently in his "Origin of Cultivated Plants" in 1882. It has also been considered by others. While of the old unanswered questions some are now regarded as of mere antiquarian interest, there are others to which greater importance is attached than there ever has been before.

Among the latter a fresh interest has been given by Mr. Baker's paper before the Linnean Society in January, 1884, to the old question, was it *S. tuberosum* that was introduced from Virginia? The suggestion he, in conjunction with Earl Cathcart, has thrown out, that to strengthen our cultivated potato against disease we should cross with some other species of tuber-bearing Solanum, makes it important we should clearly know what is the species we have been for 300 years cultivating. There are many other questions surrounding the consideration, some of which border on that fundamental question, What constitutes a species?

That simple but highly practical method of approaching the question, "What is our species?" the method of introducing supposed distinct wild species, and watching their changes from year to year in cultivation, has not yet been followed sufficiently long, nor with a sufficient number of such species to effect much more than establish well-founded hopes that by it there is much we may learn. At present the twenty (?) years' cultivation of *S. maglia* is the only experiment on which we can rely. What conclusions such experiments may eventually lead us to it is impossible to predict, but this is certain, that

proceeding by such a method on fact, and untrammelled by tradition, the results will be sure. Hitherto we have relied over much upon traditions and mis-called history. It has been assumed that our species is a Virginian species, and beyond that the question, till recently, has not been pushed.

It would be a fitting observance of the third centenary of the date that may be most reasonably fixed for the introduction from Virginia, if we could celebrate it, not by speeches and after-dinner toasts to the memory of Drake or of Ralegh, but by clearly laying down our lines of inquiry, for they have been very ill-defined.

It may be one useful part of the work to reconsider the traditions and inferred history of our potato—for there is no doubt that botanists, if not perhaps actually led astray, have at least been hampered and puzzled by them.

One of the commonest traditions repeated over and over again in histories, dictionaries, works of gardening and agriculture, is that Sir Walter Ralegh brought the potato from Virginia. The great error in this is that Ralegh never was in or near Virginia.

His patent for founding an English colony in the New World was granted March 25, 1585, and he parted with it on March 7, 1589. We have records of the various expeditions sent out at his cost to endeavour to establish and maintain a colony, with the dates of sailing and returning, the names of the captains, and other details. Ralegh's life all through the period is known, and his time is so fully accounted for that he could not have gone out even *incognito*. The traditions, therefore, that he brought both the potato and tobacco from Virginia, may be for ever laid at rest. Whether some of his returning colonists, or one of the returning ships that had been sent out with supplies, brought it, is another question. There is not even tradition to that effect, far less any statement in the contemporary history of any of the expeditions.

Gerard, however, in his "Herbal," 1597, at p. 781, describing the "Potatoes of Virginia," says:—"I have received rootes hereof from Virginia, otherwise called Novembeya, which grow and prosper in my garden, as in their owne native countrie." The value of Gerard's picture and letterpress will be presently discussed, but the point here to notice is that he makes the statement that he did receive "rootes" (by which, of course, he means tubers) from Virginia. One of the names he mentions for the potato is "papus." The name "papus" also occurs in the first catalogue of plants growing in his garden in 1596, so that the "rootes" he had he received not later than early in that year. The exact date is perhaps unimportant, as there is no record of any expedition to Virginia after 1590 till 1606. The land named Virginia was first visited in 1584. The introduction is therefore limited to some time between 1584 and 1590. At a period when the study of plants was confined almost wholly to apothecaries, and when sea-captains thought more of fighting a Spanish or Portuguese ship than of observing the natural products of a newly-discovered land, it was not expected that the account of a voyage should refer to roots brought home. The sea-lion that roared its presage of Sir Humphry Gilbert's death is of course carefully described as a marvel, but a root is too ordinary a thing for notice. Can we by any consistent inferences account for the introduction between 1584 and 1590?

That learned mathematician, Thomas Heriot, who went out in the expedition of 1585 and returned in 1586, wrote a report on the "commodities" of the then known area of Virginia. The Island of Roanoak contained the head-quarters, and we know from Lane's report that exploring expeditions had been sent to the south for 80 miles, to the north for 130 miles, and also to the north-west for 130 miles. But that was all that was known of Virginia till the time of James I. The second part of Heriot's report is "of such commodities as Virginia is knowen to yeeld for victuall and sustenance of man's life usually fed upon by the naturall inhabitants as well also as by us during the time of our abode; and first such as are sowed and husbanded." Under the sub-heading "of roots" he says:—"Openauk are a kinde of root of round forme, some of the bignesse of walnuts, some farre bigger, which are found in *moist* and *marshy* grounds growing many together one by another in ropes as though fastened with a string. Being boiled or sodden, they are very good meat." In the third edition is added, "Monardes calleth these roots beads or paternostri of St. Helena" ("Monardes," parte 2, lib. 1, cap. 4). This report is dated February, 1587, seven months after his return to England. How far it was written from memory we have no means of knowing. But this should be noticed—that Lane says that when, after much discussion, the colonists decided on returning to England, their departure was so hurried that there were "left or thrown over, cards, books, and writings." Heriot nowhere speaks of writing or making notes on the spot.

It has been generally supposed that the root here described under the name "openauk" is the potato. It should not escape notice, however, that Gerard does not in any way allude to the name "openauk," and it is nowhere said that openauk was brought to England. The only mentioned habitat, "moist and marshy grounds," seems strange, but the usual answer (in conversation at least) to the objection is, if the openauk is not the potato, what is it? and Gerard's statement that he received potatoes from Virginia is taken to strengthen the supposition. The suggestion, however, has been made that it was the Jerusalem artichoke.[1] All that can be said is, there stands Heriot's description, and there stands Gerard's statement. To link the two together may be a fair assumption, but it remains a mere assumption. The omission by Gerard of any reference to the name "openauk" is against the supposition he received roots from Heriot personally. Gerard's use of the word "papus" calls for notice, but there is one point that should be referred to before quitting the openauk.

Heriot, who is said to have been Ralegh's mathematical tutor, describes himself in his report as "servant to Sir Walter Ralegh, a member of the colony, and then employed in discovery a full twelvemonths." If he brought potatoes with him, it would be by courtesy said Sir W. Ralegh introduced them. All the expeditions were his. But there is another tradition that Sir Francis Drake brought them. Different writers give different dates for this, which are evidently wrong. He could not have brought them in 1580 from the west coast of South America, because he arrived in November, after coming round by India and the Cape, and they would have sprouted on the voyage. That was the return from his famous circumnavigation. It could not have been 1585, because he left England, after four years ashore, in that year, and did not return till July 1586. If Heriot had anything to do with the introduction of the openauk, it is almost certain Drake brought it in 1586, for the circumstances of his return then were these. His knighthood, conferred upon him after months of deliberation for his great voyage round the world, firmly established his position, and he was intrusted with the command of a fleet to the Gulf of Mexico to harass the Spaniards. His instructions were to visit Ralegh's colony at Virginia on his way home. He called there on June 8, 1586, and found the colonists much distressed that the ship from England that it had been promised should be sent with supplies in the spring had not arrived. He stayed there many days, granted their request for a ship to be left with them, but, as many unexpected troubles arose, which are described by Lane,

[1] Asa Gray and Trumbull, *Amer. Journ. Sci. and Art*, xiii., May, 1877, p. 351.

they asked to be taken home, and this was done. Although at the last their departure was so hurried that writings, &c., were not embarked, it does not follow that there had not been opportunity during previous days to embark roots among other provisions. As openauk was among the products "husbanded," Heriot may have had a supply of unplanted roots ready to send home. If this were so, then two traditions would be reconciled. It would be Drake's ships, but Ralegh's colonists, that brought the potato, assuming the openauk to be the potato. This, however, is mere assumption. For the fact that Drake brought home the people there is abundant evidence, but respecting the roots there is not a word. If we wish, however, to account at all for Gerard's receiving potatoes from Virginia, this seems the only likely way in which he could have received them. The overdue relief ship that arrived a few days subsequent to the departure of the colony, and returned after a brief search, may possibly have brought them. All the other expeditions were later in the season than even Drake's return, while of the 349 colonists who went out in 1587 nothing was ever known after they were landed, though a relief expedition made search for them. Gerard distinctly says it was the "rootes" he received, and these could not, like seeds, be available at any time of the year.

It is commonly supposed that the introduction of the potato from Virginia is a duly authenticated historic fact. What forgotten manuscript records or letters there may be it is impossible to say, but at present our sole authority that it was brought thence is Gerard, while the linking of two traditions as here suggested is only assumption.

It has been already mentioned that while Gerard does not use the word openauk, he does give the name papus. Papus is not mentioned by Heriot as a word in use in Virginia; *how then did Gerard come to use it?*

From the travels of Pedro Cieza de Leon [1532–1550] we know that papas was the general name in Peru for an edible root in his time. The root was cultivated, and it was eaten boiled, or else dried in the sun and preserved, when it was called chuña. Acosta, whose travels in the same regions were later [1570–1587], gives almost identically the same information, as also does the native-born Garcilasso. They none of them, however, give any description of papas by which it is possible to identify the plant known by that name.

The two oldest known Continental botanists that give the name papas *in conjunction with a description* of the plant, are Clusius and Bauhin. In addition to descriptions, both give figures.

In his Φυτοπίναξ (1596) Bauhin describes a plant to which he gives the name *Solanum tuberosum*, but without any figure [Lib. v. Sec. 1, No. xix.]. In his "Matthiolus" (1598) he refers to it with a figure. Here he adds, "Vulgo Pappar Hispanorum vel Indorum dicitur." Clusius, in his "Rariorum Plant. Hist." (1601), describes a plant clearly the same, with a figure, under the name *Papas peruvanorum*. He says there is no doubt this was the plant Cieza de Leon refers to. The expression, "there is no doubt," is, however, somewhat removed from certainty. In 1620, Bauhin again, in his Πρόδρομος, in describing *Solanum tuberosum*, to which he here adds "esculentum," refers to Cieza; and again, in 1623, in his Πίναξ, mentions that this is the plant from which Acosta says chuña is made. Both Bauhin and Clusius give their descriptions as from growing plants.

It might be readily surmised that with such continuous traffic as there was between Spain and the domains she had conquered in South America, the roots so highly prized by the Indians should be carried home. To strengthen this surmise there is the tradition that gives the name of the first to introduce them, a "doctor" named Hieronymus Cardan. What is the history of the introduction into Spain is beside the present question. It is not improbable that with the sustained and frequent intercommunication between Spain and America it was repeatedly introduced. The case is by no means parallel to the question of the introduction into England from Virginia, in Gerard's time, when out of the six expeditions sent out only one made any explorations inland. The opportunities of introduction from Virginia were few. From South America to Spain they were numerous. It seems sufficiently established, both by Bauhin and Clusius, that a plant called papas was introduced and grown in botanical gardens, if not as a food; and that it came to be known as the papas of the Peruvians, of the Indians, and of the Spaniards, for Peruvanorum, Indorum, and Hispanorum seem indiscriminately used. That Clusius suggested its identity with the Arachnida of Theophrastus and other Greek writers is now of little interest. Bauhin was the first to recognise the plant as a Solanum, and his *tuberosum* occurs as No. XIX. in his list of Solanums, in his Φυτοπίναξ.

Though Cieza, Acosta, and Garcilasso drew what appears to have been a consistent distinction between papas (potato) and battatas (sweet potato), that distinction was not always maintained by later European writers. In a way it seems hopeless to endeavour to trace, the Portuguese and Spaniards now use different words for the potato: the former call it batata, and the latter papa. The confusion is more bewildering when the two names were used as synonyms. In botanical nomenclature we have lost papas, but retained battatas. The identity or not of *Battatas edulis* with the battata of the three Spanish travellers is wide of the present consideration. So also would be the question why the Quichan word *ascu* was not used by them. This, however, appears a safe rule—that when papas is mentioned by sixteenth-century writers it may be read as = Solanum (but not necessarily *tuberosum*); when battatas is mentioned it is requisite to see whether it is wrongly used as a synonym or intentionally used for a distinct plant. To the present day chuña is made in Peru from "papas," but apparently not from "battata."

Assuming the rule is a safe one that papas cannot be taken to mean battatas, but battatas may and often does mean papas, then such chronological data as the following are of interest as some indication of the spread of the plant among botanists in Europe. There may be others, but these are all the writer has been able to collect.

Dr. Scholtz had papas growing in his garden at Breslau (Vratislavia), 1587; Clusius received two tubers at Vienna from Hannonia, 1588; Bauhin, in his Πρόδρομος, mentions "iconem suis coloribus delineatam," 1590; Dr. Scholtz's "*Papas hispanorum*" is mentioned in a "Carmen" (pub. at Vratislavia), 1592; Bauhin refers to a "*Pappar hispanorum*" growing in his garden, of which he gives a description, 1596.

It was in this year (1596) that Gerard published the catalogue of plants growing in his garden in Holborn. There occur in it the two names *Papus orbiculatus* and *Papus hispanorum*. In this 1596 catalogue these names, as all the rest, occur without any English equivalent or any description or note. The catalogue is simply a list of names. The word batata does not occur, but Sisarum does. Another catalogue, commonly called a second edition, was published in 1599. The "Herbal" had been published in the meantime (1597). In this 1599 catalogue English names are added to the Latin. These occur: *Papus orbiculatus*, bastard potatoes; *Papus hispanorum*, Spanish potatoes. Batata does not occur. Sisarum does, but without any adjective (we cannot call these second names "specific," while the first were in no sense of the word "generic"), and the English name with this is skyrrits.

Although it would be a natural supposition that with the aid of the figures and descriptions in the "Herbal" it would be easy to identify the plants named in the cata-

logues, it is, on the contrary, a most perplexing puzzle. There are names introduced into the "Herbal" which do not occur in the catalogues, and names in the catalogues which do not occur in the "Herbal." That the "Herbal" of 1597 should not exactly agree with the catalogue of 1596, hardly excites surprise, but that the catalogue of 1599 should so differ from the "Herbal" is more than surprising, it is perplexing. If the explanation given by Mr. Daydon Jackson in his annotations to the catalogues is correct, then the *Papus hispanorum* of Gerard's garden was not the *Papus hispanorum* of Clusius and Bauhin; but this requires very close attention. It involves not only the question whether the *Papus hispanorum* of Dr. Scholtz was Solanum or Batatas, but also whether Bauhin is to be trusted as a cautious incorporator of statements. However highly Bauhin is to be esteemed as a botanist, he may have had a Pliny-like weakness for accepting anything he was told.

Mr. Daydon Jackson's explanation is this:—

"Herbal" of 1597		Catalogue of 1599
Battata virginiana and *pappus*—Potatoes of Virginia (p. 781) ...	=	*Papus orbiculatus*—Bastard potatoes.
Sisarum peruvianorum, sive *Batata hispanorum*—Potatus or Potatoes (p. 780)	=	*Papus hispanorum*—Spanish potatoes.
Sisarum (p. 871)	=	*Sisarum*—Skyrrits.

Supposing this to be the correct explanation, what are we to think of Gerard allowing his second catalogue to appear so like his first and so unlike his "Herbal"? One point is clear—he uses Papus, Batata, and Sisarum with such want of discrimination that no importance can be attached to his names. But it is strange he should, in both his catalogues, use Papus twice and Batata not at all, while in his "Herbal" he has both *Batata virginiana* and *Batata hispanorum*. According to accounts that have been handed down to us, the "Herbal" was based on Dr. Priest's translation of the Pemptades of Dodonæus, and the plates, with the exception of sixteen, were those that had been used to illustrate works by Jacobus Theodorus ("Tabernæmontanus") and L'Obel. It is said that Gerard so little understood his work that he put cuts in the wrong places, and made so many mistakes that Norton, the publisher and proprietor of the work, engaged L'Obel, who was then living in England, to correct the errors. Gerard resented this, and a quarrel with L'Obel followed. To what extent L'Obel's corrections went we have no record. He would at any rate, we may assume, prevent wrong names and cuts being printed with the letterpress. In the particular case of the three names under consideration, he was already well acquainted with the Sisarum or Batata (p. 780), as he had described it in his "Stirpium adversaria nova," written in conjunction with Pena, and published in London in 1570. He there gives the name Battades, Ignames—Anglicé, Potades. The cut in illustration used in the "Herbal" is that on p. 482 of Tabernæmontanus, where the name used is Sisarum. So that we can account for the names used in the "Herbal" thus:—Sisarum because it occurs in Tabernæmontanus; Peruvanorum is perhaps not to be accounted for. Batata because L'Obel had used it, and Hispanorum because it was first made known to Europe by the Spaniards, who brought it (most probably) originally from the West Indian Islands. Potatus, or potatoes, because that was the Anglicised form of Batata. It is possible that Gerard may have wished to introduce the word Papus, and that L'Obel cut it out.

With regard to the "potatoes of Virginia," Gerard would perhaps have his own way. He thought so much of his having grown some received from Virginia, that in his portrait he has a branch of them in his hand. With regard to the cut used in illustration, we know at present nothing. It is not taken from any other source, and it does not occur anywhere but in this 1597 edition. In the 1633 edition by Johnson the cut from Clusius is used, while Parkinson, in 1640, uses the cut copied from Bauhin. It is one of the sixteen new cuts, but where it was made we do not know, still less do we know whether it was made from a plant growing in his garden.

This last consideration, where the plant grew which is here figured, is closely connected with the question, How did he come by the name papus? In the text Gerard says, under "The Place":—"It groweth naturally in America, where it was first discovered, as reporteth C. Clusius, since which time I have received rootes hereof from Virginia." And then, under "The Names," he says:—"The Indians do call this root papus (meaning the rootes), by which name also the common potatoes are called in those Indian countries."

Although there is no known publication of Clusius so early as this from which Gerard could be quoting, yet, as he had been thrice in England, there is the probability that Gerard and he were acquainted. It is easy to see then that he might easily have had, indeed most likely would have, the South American name papus direct from Clusius.

But did he have anything else from him—a figure, a full description, a dried specimen, or even a tuber? Clusius had two as early as 1538, eight years before Gerard's first catalogue.

We have seen—

(α) That Cieza, Acosta, and Garcilasso speak of papas as a common name in the north-west portions of South America.

(β) That Clusius and Bauhin speak of the "papas of the Spaniards" growing in Europe (which Bauhin recognised to be a Solanum) as the same plant the three mention.

(γ) That it was known in several botanic gardens in Europe before the time of Gerard's first catalogue.

(δ) That Gerard in some way received information from or through Clusius that the plant was first discovered in America. America here evidently means South America.

With Clusius's information we can hardly doubt Gerard would also get the name papus. There is no trace of papus being a name used in North America. Fernandez de Soto, who travelled in Florida [Evora, 1557], mentions Batata, but not papas Benzoni, 1572.

It has been a puzzle to some botanists that papas should have such a wide geographical distribution as from Virginia to South America. The puzzle has partly arisen on the assumption that papus was a Virginian name. As there is not a fragment of evidence it ever was, and as we have seen a way in which Gerard might have had it, that part of the puzzle may perhaps be regarded as entirely withdrawn. There are a sufficient number left in connection with the potato to tax ingenuity.

Can we as easily dispose of the cut in the "Herbal"? Are we on the strength of that cut to continue to believe that *S. tuberosum* was wild within the area known as Virginia? For, though we get rid of the name papas we do not get rid of the wide distribution of *tuberosum* if the plant itself grew wild in Peru and in Virginia? Possibly experts in wood-cutting or collectors of old cuts may be able to say whether the cut is English or Dutch. Sequier says the cuts are brass ["Bibl. Bot.," 1740, pp. 72, 73]. Haller says: "In 'Bib. Bodl.' icones dicuntur æneæ esse: sed ligneæ sunt undique" [1771, tome i. p. 389]. Such a point as this could probably be cleared up definitely.

It seems anomalous that we should base our belief that *S. tuberosum* is a native of Virginia, on a single cut about which we know nothing more than this: that it appears in conjunction with the name potatoes of Virginia; that it was placed there by the direction of a man against whom the charge of deliberate misstatement in his so-called scientific work has never been cleared up; that for some reason it does not appear in the second edition

of the work. If it is charitably supposed that in this case Gerard did not intentionally mislead, still, if his reputation for being a muddler of other people's work is as well founded as it appears to be, he may have made some blunder. It is by no means a far-fetched assumption that his figure was from a Continental source, but that he thought it near enough to represent his Virginian "rootes." Apart from all other considerations it is difficult in at least one particular to reconcile the figure and the text. He speaks of "the temperature and vertues" of the potatoes, and says they are the same as of the common potatoes (*i.e.* his Sisarum). Unless this is a pure invention, many must have been eaten for this conclusion to have been arrived at. The size of the tubers is not greater than of fair-sized peas, and it would take the produce of half a hundred plants to furnish a single dish.

It is perhaps worth consideration whether an explanation of the catalogues different from that given by Mr. Daydon Jackson is possible. Is there any insuperable objection to their being read thus?—*Papus hispanorum* (the *P. h.* of Clusius, &c.), received from the Continent. *Papus orbiculatus* (for orbiculatus is a name of his own) received from Virginia. Sisarum—the "Skyrrits of Peru" (p. 780 "Herbal"), and that the common skyrrits were not mentioned in the catalogue. When he mentions papus in his "Herbal" he does not add either hispanorum or orbiculatus, and it might be he included both under papus there.

The important point however is whether that cut truly represents what he received from Virginia.

In close connection with this it cannot be overlooked that Bauhin gives openauk as a synonym. He also says, "Ex insula Verginea primum allata in Angliam, inde in Galliam aliasque regiones.' He had probably seen De Bry's edition of Heriot, and so obtained the name openauk. But his authority for the remainder of the sentence is not clear. Moreover it does not harmonise with his reference to Peru.

The question of the introduction of the potato is a very complex one, involving many other considerations besides those here referred to. The foregoing notes may, however, clear up the traditions about Ralegh and Drake, remove the difficulty about Gerard's use of the word papus, and perhaps lead to something more certain being known about that cut of Gerard's on which so much hangs.

The origin and change in the use of the *word* potato are subjects which, for their satisfactory elucidation, involve considerations that fall within the provinces of the philologist, the traveller, the bibliographer, the historian, the botanist, and, using the word in its wide sense, the geographer.

Potato is but the English way of pronouncing Batata.

But what is the word Batata? To what language does it belong? The first European knowledge of it appears to be traceable to Cuba, San Domingo, or some of the neighbouring isles at the time they were discovered by Columbus, 1492, &c. But then the sixteenth century writers on Peru also use it as if it were a common word there, and, if it were, it is at least interesting, if not strange, to find a word thus widely spread over and across districts where, it has been said, languages so vary with tribes that one cannot even understand another, though neighbouring, tribe. But first we have to consider is there any *contemporary* evidence that the West Indian natives did make use of a word which, when written by the Spaniards, appeared as *batata*? It would involve a special search among such materials as Navarette had at his disposal to decide that. Compilations are not to be trusted, and English versions are of no avail. What the actual word was, written by Columbus or his companions, is what is wanted. Then, if it were a true West Indian word, and introduced and known with some plant in Spain and Portugal in the early part of the sixteenth century, what is the probability that, at the middle of it, writers on Peru used it as a name that would be understood at home, even though not used by the South American natives. With regard to papas, it is distinctly stated by Acosta it was a native name in South America, but the writer does not know of any passage in which batata is said to be. It has been pointed out above how the mistake arose that papas has been considered a Virginian name, and it is possible batata may prove to be not a South American name at all. There is a Quichau word, Ascu, equivalent, apparently, to Papas, to which only Mr. Clements Markham among English writers seems to have drawn attention. At present, in English translations of travels in Peru, papas and batata appear often confounded.

Then in regard to our own use of the word batata, did we have it with roots through the Spaniards, or direct from the West Indies? The earliest use of the word does not yet seem to have been fully searched for. It may, however, be found earlier than in the list of literary quotations usually given. For example, it occurs in the account of Sir J. Hawkins's voyage, 1565: "Hennes, potatoes, and pines." The earliest description the writer has been able to trace of what the potato was is in the botanical work of 1570, published in London, Lobel's "Stirpium adversaria nova." A figure is given of the root of the Batata, and at the heading is "Anglice Potades."

But we might have had the word half a century before that through Spain, and the fact that Lobel introduces such a curiously-spelled form as the usual English one would imply it had been for some time in use among the common people. The mention of potatoes in the Hawkins voyage without any reference to what they were like would also imply that they were then as familiarly known as pines or hens.

The change of sounds from Batatas to Potades is curious. Why should the flat labial be changed to the sharp, and the sharp linguo dental be changed to the flat, in the same word? Again—the question is not so undignified as may at first appear—when was the form "taters" introduced? It has no doubt been a gradual change, but as a fact country people of the Victorian era no more think of using the form potatoes than those of the Elizabethan era did of using batata. In 1596 the form potaton is met with. In 1627 and 1676 potadoes, and in 1655 pottato. Batata itself, by the Spaniards, seems to have been spelled indifferently batata or battata.

Then there is another curious point. How has it come to pass that for the same plant the Spaniards of to-day retain papas, while the Portuguese use batata, for the plant we *now* call the potato.

In speaking of questions in connection with our having changed the use of the word potato from one plant to another it is an advantage for preventing confusion to refer to the two plants by their present botanical names, the *Batatas edulis*, which belongs to the convolvulus "order," and the *Solanum tuberosum* (perhaps including the supposed different species, *Maglia*), our common potato, which belongs to the nightshade "order." Of the two it was *Batatas edulis*, called then, long before Linnæus's binomial system, simply Battata, that seems to have been first known in Europe.

The first European knowledge of the plant *Solanum tuberosum* (or *Maglia*) was under the name papas, by which it was known till Caspar Bauhin recognised that it was a Solanum in 1596. The date 1596, if not exactly that of his knowledge, is the date of his first publishing it in his "Φυτοπινοξ."

Then as to dates of introduction.

As already said, the first European knowledge of Battata was in 1494 or 1495, that is, assuming that it was among the valuable products of the West Indies Columbus sent home to his patron sovereigns to demonstrate the value of his discoveries. It is mentioned he sent home vegetable products as well as gold. He sent spices,

dye-woods, fruits, and herbs, or intended to. In the history "Primer viage de Colon" (Navarette, cap. 1) is the passage,[1] "And besides there are trees of a thousand species, each having its particular fruit and all of marvellous flavour, so that I am in the greatest trouble in the world not to know them, for I am very certain they are each of great value. I shall bring some home *as specimens*, and also *some of the herbs*." Taking Washington Irving's inspection of Navarette's materials as reliable, Columbus knew the potato—the battata.

Then it is also probable, for here we have to deal with probability only, that the Solanum [under the name papas] was known in Spain soon after the conquest by Pizzaro [1527], when Cieza de Leon wrote [1532-50].

Both of these are at present but assumptions in respect to dates. The exact dates may perhaps be known in Spain. Possibly some people in England may know what is known, but the writer has been unable to trace anything more through the published second-hand statements.

We in England somehow knew the battata, pronounced and spelled potade or potate or potato, before the time of Hawkins's voyage, and before Shakespeare wrote his "Merry Wives of Windsor," where he uses the word. That Shakespeare's potato was the batata is clear from Gerard's reference to the confectioners using the battata as a basis for their sugar work (p. 781 of his "Herbal").

It was Gerard who called the papus (papus, as he chose to spell it, instead of papas) the Virginian potato, or bastard potato.

There in his work we have the word "batata," or patata, or potato, transferred to the papas, to Bauhin's *Solanum tuberosum esculentum*. Though Gerard does not use the word Solanum, his figure and description are sufficient identification. Somehow, though it does not seem possible to trace how, the word "potato" or "taters" has, as an English word, stuck to the *Solanum*. The "battata" has now dropped out of cultivation as an English root, and this no doubt has been the main cause of the transference of the word "battata" from the original battata to the "bastard" potato of Gerard—the Solanum.

The establishment of batata as a botanical name, its recognised description, and its admission into generic nomenclature have a curious history, but that is somewhat wide of the points more immediately under consideration.

The whole question is by no means yet worked out, but the above suggestions may draw attention to the subject. W. S. M.

THE COLONIAL AND INDIAN EXHIBITION

THIS Exhibition was opened on Tuesday by Her Majesty in state. Science in one form or another will be prominent in nearly all of the sections. The Exhibition as a whole will be a geographical education in its widest sense. Not many can follow the example of Mr. Froude and Baron Hübner, and spend the best part of a year in visiting our scattered Empire. At South Kensington, in the course of a few days, however, we may learn even more of the products and people and geographical aspects of our colonies than we might do by an expensive voyage. Of course the main purpose of the Exhibition is to draw attention to the economical and commercial aspects of the colonies and India; but in doing so, necessarily the introduction of a considerable amount of science is involved. In nearly all the sections, for example, we find excellent large maps of the various colonies on the walls, besides the gigantic map of the world in hemispheres beside the gateway of Old London. Again, several of the colonies have sent specimens of their natives, and from India especially there is a considerable number of individuals of all ages representing the various races which form the heterogeneous population of that vast territory. So, from South Africa, we find Kaffirs, Hottentots, Zulus, and Bechuanas; Singhalese from Ceylon, and Malays from the Straits Settlements. In several of the sections, also, notably in India, do we find life-size models of natives; some of the finest of them are in the British Guiana Court, prepared by Mr. Im Thurn. Several of the colonies, again, have had large reliefs either of the whole or part of their territory prepared. Among the exhibits of the Indian Survey is a relief-map of the Peninsula from the Tibetan table-land to Cape Comorin, on the scale of thirty-four miles to an inch. One of the finest of these models is that of New Zealand by Dr. Julius von Haast, under whose care this Court is markedly scientific. He has brought over with him the skeletons of three large moas; mumerous specimens of flora, fauna, and geology, and the exquisitely beautiful skeleton of a ribbon-fish prepared after the method of Prof. Parker of Dunedin. Maori ethnology is also amply illustrated, though we believe no actual live specimen has been imported. One of the finest conservatories of native plants in the Exhibition will be that attached to the New Zealand Court. But such conservatories will be a marked characteristic of this Exhibition, and will be found attached to the Courts of the Cape of Good Hope, Queensland, Natal, and other colonies. India, of course, has much to show of interest to science, besides its numerous groups of life-size models of natives taken from actual casts. Under the care of Dr. Watt the botany is very fully illustrated. The Geological Survey has sent a fine exhibit; while the Topographical Survey will have a Court to itself. In all the Australian colonies geology is a prominent feature, at least in its economic aspects, and so we may say of botany, at least so far as timber-trees are concerned. In the Australian and several other colonies, moreover, large collections of natural history have been arranged in cases, while of course the numerous game-trophies will interest the naturalist. The trophy of trophies, however, will be the great jungle scene prepared by Mr. Rowland Ward, into which it has been attempted to compress the whole of the fauna of India. It is a triumph of arrangement; and we may refer to it in detail in a future article. An almost equally striking scene is the landscape in the South Australian Court, representing an actual piece of country near Lake Alexandrina. Of course, as in the jungle scene, we have *multum-in-parvo*,—features which in reality are spread over a wide area compressed into a few square yards. But everything is on the scale of nature, and nothing introduced that is not actually met with. We have natives at various occupations, including a woman and child under a rude shelter of branches; kangaroos, wallabies, eagles, and other animals deftly posed; characteristic vegetation and rocks, with mountains away in the background. The model of Hong Kong and the neighbouring coast may also be mentioned. The West Indian Court contains much of interest. The woods of Honduras are conspicuous; many curious land and water products from Trinidad; and a fine collection of Columbian pictures and relics, and several fine paintings and photographs of West Indian scenery. Indeed, in all the sections, pictures, and especially photographs, are among the most conspicuous exhibits, and have much geographical value.

Of course this Exhibition is one of many-sided interest, and we have mentioned here only a few of the points that will attract those interested in science. Its educational value is evident, and we hope that teachers will take advantage of so exceptional an opportunity of giving their pupils a practical lesson in physical geography and its economical and "political" developments. Most of the colonies will publish special hand-books, and in several of them we are glad to know that science will hold a prominent place.

[1] Quoted second-hand through W. Irving's "Life of Columbus."