And we may have every grade of development, from the simplest case, in which the sporocarp appears as a mere appendage of the parent plant of inconsiderable dimensions, to the most extreme condition in the other direction, in which the sporocarp is capable of independent growth, and therefore represents a second generation which is entirely distinct (*sporophore*). The sporocarp also differs essentially from the oospore in the fact that cells contribute to its formation which have not been directly influenced by fertilization, and that in consequence the part of the fruit which produces the spores is surrounded by what—for want of a more convenient term—we may call the pericarp, in which no spores are developed, and which serves as a mere protective investment, or is subsequently drawn upon for purposes of nutrition. In *Phycomyces*, which belongs to *Zygosporeæ*, it is noteworthy that there is a kind of anticipation of the development of a protective investment to the zygospores.

The principal types of the *Carposporeæ* include all the more highly developed forms both of Algæ and Fungi

In *Coleochæteæ* the carpogonium terminates in an open canal, and fertilization is effected by motile antherozoids.

In *Florideæ*, in the simplest type (*Nemalion*), the carpogonium resembles that of *Coleochæteæ*, only the terminal tube (trichogyne) is closed and not open. Fertilization is effected by passively motile antherozoids, which adhere to the trichogyne. In *Ceramieæ* the carpogonium, even before fertilization, consists of numerous cells, a lateral row of which—the trichophore—bears the trichogyne. Neither trichogyne nor trichophore, however, take any part in the development of the sporocarp. The pericarp is produced by a process of budding from cells beneath the carpogonium.

In the genus *Dudresnaya* the process of fertilization becomes very complicated, and in fact involves a double process, of which the first stage consists in the application of antherozoids to a trichogyne; and the second in the development from below the trichophore of a "conducting filament" which conveys the fertilizing influence to the terminal cells of a number of small branches, with which it successively conjugates; at each point of conjugation a sporocarp is developed. Amongst the *Ceramieæ* there is something comparable to this double process; the fertilizing influence which is conveyed by antherozoids to the trichogyne must afterwards be communicated by a process of diffusion from the trichophore to the cell from which the spores are developed

Characeæ are now to be regarded as a reduced type of *Carposporeæ*. The carpogonium is supported by two basal cells with oblique septa, which it seems quite reasonable to accept as the rudiments of a trichophore. There is, of course, no trichogyne, and fertilization is effected by motile antherozoids, and the pericarp is developed before instead of after this process. In *Chara* the main axis is clothed with a peculiar cortical tissue, which grows over it from the nodes, and is clearly comparable with that which exists in the *Ceramieæ*.

Fungi contribute to the *Carposporeæ* the *Ascomycetes*, *Æcidiomycetes*, and *Basidiomycetes*. In the first and last of these groups the existence of a sexual process preceding the development of the sporocarp is now known. *Ascobolus* has been studied by Janczewski, and the essential features of the sexual process are closely comparable to those of *Ceramieæ*. The carpogonium consists of a row of cells; the terminal one is fertilized by the ramified "pollinodium," and from the central cell of the carpogonium a number of filaments branch out which bear the asci, while the pericarp is formed by the branching of the mycelium below the carpogonium.

Lichenes, in so far as the hyphæ and fructification are concerned, are essentially ascomycetous fungi. Their gonidia are referable to different groups of algæ. The two sets of organisms live together in a kind of modified commensality. The algæ are able to sustain their companion fungus without succumbing to the demands of its nutrition.

Cormophyta.

Alternation of generations exists amongst the *Thallophyta*. But, as in *Œdogonium*, it assumes the form of an occasional occurrence of gamogenesis after more or less prolonged periods of agamogenesis; a series of sporophores is interrupted by the intercalation of an oophore. Amongst the *Cormophyta*, however, we have generally a regular alternation of oophore and sporophore. Both may, however, propagate themselves by the detachment of more or less specialized gemmæ. But apart from this, the agamogenetic production of spores and the gamogenetic production of oospores regularly follow one another.

Cohn, in a classification of Cryptogams published in 1872, established the groups *Bryophyta* and *Pteridophyta*, which, added to *Phanerogamæ*, constitute the groups into which *Cormophyta* appear best susceptible of division.

1. *Bryophyta.*—In such a case as *Œdogonium*, sporophore and oophore each attain a tolerably equal degree of vegetative development. In others, however, this may be very much curtailed in one or the other generation. Amongst the *Thallophyta* the sporophore not uncommonly suffers this reduction. Thus in *Mucor* the zygospore only develops a short filament, which terminates in a sporangium filled with spores. If we suppose the filament suppressed, the spores belonging to the second generation will be produced directly from the oospore itself. Thus, amongst the *Cœloblastæ*, in *Cystopus* the oospore produces zoospores, and, according to Cienkowski, this is also the case with *Volvox*. In such cases the oospore itself is the sporophore. Amongst the *Bryophyta* there is an alternation of generations which is hardly less abridged. The oophore—which in *Hepaticæ* is often a thalloid body, while in mosses it is a leafy plant—bears female organs (*archegonia*) and male organs (*antheridia*). The oospore, or fertilized central cell of the archegonium, gives rise to a complicated structure which produces the spores. The first division of the oospore appears to be inclined to the axis of the archegonium. The sporophore is retained in a kind of attachment to the oophore, and never attains to any vegetative development of its own. From the fact that the vegetative structure of some *Hepaticæ* is thalloid and leafless (*Aneura*), while in others (*Marchantia*) leaves are present in a very reduced condition, it may be inferred that the former have lost their leaves rather than that they represent an original leafless condition. The ancestral type of the *Bryophyta* was probably more like a moss than like any of the *Hepaticæ*. And it is worth while considering what claims *Chara* may have to be regarded as a transition from the *Thallophyta*, of which it is an anomalous type in its possession of distinct lateral appendages to the axis. Cohn placed it amongst the *Bryophyta*; but its removal to the *Thallophyta* probably assign i it its true position. The investment of the carpogonium, however, cannot have more than an analogy with an archegonium. The fertilized carpogonium (sporocarp) might perhaps be regarded as a very reduced form of that of the *Bryophyta*, producing only a single spore. It is certainly an interesting and it may be a significant point, that the spore of *Characeæ* produces in germinating a filamentous chain of cells, apparently comparable to the protonema of mosses, and from this the fully developed sexual plant is produced as a lateral bud.

2. *Pteridophyta* are sharply divided from *Bryophyta* by the high vegetative development of the sporophore and gradually increasing suppression of that of the oophore. This never, however, as in the succeeding group, completely loses its independence of the sporophore.

The whole direction of the attempts at classifying the *Pteridophyta*, which correspond to the so-called vascular Cryptogams, has been completely changed by Fankhauser's discovery of the long-sought reproduction of *Lycopodium*. It proves to be totally unlike that of *Selaginella*, which, from the close agreement that exists between the two types in every other respect, it might have been expected to closely resemble. On the contrary, in the formation of a monœcious subterranean prothallus, it may be compared to *Ophioglosseæ*. Yet, as Sachs has pointed out, it is impossible to use this striking divergence for the purpose of breaking up a group of plants which in all respects is perfectly congruous. The anomaly of forms so closely allied, exhibiting two modes of gamogenesis, has now, however, found a parallel amongst the *Filicales*, in which group *Rhizocarpeæ* seem to find their proper place.

The *Pteridophyta* are divisible into three probably natural classes, which may be briefly defined by the following characters, in themselves, no doubt, artificial:—

i. *Filicales.*—Leaves highly developed and bearing numerous sporangia.

ii. *Equisetaceæ.*—Leaves rudimentary, reduced to sheaths on the barren stems, the fertile ones bearing 5–10 sporangia.

iii. *Dichotomæ.*—Leaves small, simple; sporangia solitary.

The *Filicales* include, according to the arrangement proposed by Sachs, three orders. In *Stipulatæ* the sporangia are not trichomes, but are either wholly endogenous products as in *Ophioglossum*, or are formed from cellular protuberances, and the tissue beneath the epidermis takes part in the formation of spores (*Marattiaceæ*). In *Filices* proper the sporangia are, as already mentioned, trichomes, and these are developed upon the normal fronds. In *Rhizocarpeæ* the sporangia are borne by metamorphosed leaves, which are united into a capsular body in a way comparable to that in which carpels bearing ovules are united into a syncarpous ovary. The germination of the spores also presents important differences in the different orders amongst the *Stipulatæ*. In *Ophioglossaceæ* it gives rise to a tuberous monœcious oophore (prothallium), destitute of chlorophyll. In *Osmunda* the prothallium exhibits some tendency to become diœcious; it resembles the normal type of prothallium in ferns, but has a kind of mid-rib, and produces adventitious shoots from marginal cells. These shoots become detached, and constitute a mode of agamogenesis. Such a structure cannot fail to recall the thalloid *Hepaticæ*, which also possess a mode of agamogenesis by means of gemmules (*e.g.*, *Marchantia*). In *Rhizocarpeæ* the diœcious condition of the oophore has been carried so far that it is indicated even in the spores themselves; the microspores are male, the macrospores female. In *Salvinia* there is a rudimentary prothallium bearing the antheridia; and a last trace of such a structure appears to exist in *Marsilea* and *Pilularia*. The macrospore also develops a prothallium, in which numerous archegonia are produced, one only of which is fertilized. The development of the prothallium is so far external to the macrospore that it effects its rupture at the apical papilla. In the *Rhizocarpeæ* the development of the oophore has been almost entirely compressed within the limits of the spore.

Equisetaceæ call for little remark as regards the oophore. It is diœcious, and irregularly branched, but in other respects there is a close agreement with the oophore of ferns.

The *Dichotomæ* present in the morphology of the oophore a parallel series with the *Filicales*. The *Lycopodiaceæ* develop from the single form of spores which they possess a monœcious subterranean prothallium like that of *Ophioglosseæ*. The *Ligulatæ* (comprising *Selaginella* and *Isoetes*) produce, like *Rhizocarpeæ*, microspores and macrospores. In this group the suppression of the oophore is carried still further; the microspores possess, according to Millardet, the merest rudiment of a male prothallium. The macrospores produce a female prothallium, which is an endogenous structure in even a higher degree than in the *Rhizocarpeæ*. The first divisions of the oospore have not as yet been sufficiently studied. But while in Ferns proper, *Equisetaceæ* and *Ophioglossaceæ*, the first septum is more or less inclined to the axis of the archegonium, it is parallel with it in *Rhizocarpeæ* (a position into which a very oblique inclination would readily pass), while in *Selaginella* it is at right angles with it.

3. *Phanerogamæ.*—In at any rate two of the three groups of the *Pteridophyta* we see that the progressive tendency of the oophore (prothallium) is to lose its independence. In *Ophioglosseæ*, *Filices*, and *Equisetaceæ*, its growth, independent of the spore, often continues for a considerable period. In *Rhizocarpeæ* and *Lycopodiaceæ*, where male and female spores are produced, the oophore remains attached to the spore, although protruding from it. In *Isoetes* it fills the cavity of the macrospore as a mass of tissue, and the bounding wall is only ruptured to allow the access of the antherozoids to the archegonia. In the *Phanerogamæ* even so small an assertion of independence as this is suppressed. The macrospore (embryo-sac) is never detached from the sporophore previous to fertilization, and the oophore, which is moderately developed in the *Gymnospermæ*, but in the *Angiospermæ* is reduced to the merest rudiment, always remains entirely enclosed within the macrospore.

In the *Gymnospermæ* the endosperm is the homologue of the prothallium (oophore). The so-called "corpuscula" are the archegonia, or rather the central cells of reduced archegonia (secondary embryo-sacs of Henfrey). The neck of the archegonium is represented by the "rosette" first described by Hofmeister. Strasburger has pointed out that a small portion of the contents of the central cells is divided off at the upper end, and this is the rudiment of the canal cell which, running the length of the neck of the archegonium in the *Bryophyta* and *Pteridophyta*, leaves a pervious track by its deliquescence for the access of the antherozoids to the central cell. Strasburger considers all the rest of the contents of the embryo-sac to be the equivalent of the oosphere. The result of fertilization is to cause a transverse partition of the lower part of the oosphere, as in *Selaginella*. From the lower cell thus constituted, by successive longitudinal and transverse partitions, the suspensors are developed, the ends of each of which bear an embryo. It is noteworthy that the development of a suspensor as an intermediate structure between the fertilized oosphere and the embryo is also met with in *Selaginella*.

It only remains to point out, as far as they are understood, the comparable structures in *Angiospermæ*. Here the prothallium (oophore) has completely disappeared, unless we regard, with Sachs, the "antipodal cells" as a last rudimentary trace; their appearance is, however, inconstant. Within the embryo-sac (macrospore) "embryo-vesicles" are formed, usually two or three in number. One of these is the oosphere, and may be compared to the central cell of an evanescent archegonium, to which another of the "embryo-vesicles" performs the function of a canal cell; for while it is that which is usually in nearest proximity to the pollen tube, it only apparently transmits the fertilizing influence. In a few cases this dormant embryo-vesicle is replaced by a somewhat more highly developed arrangement—the filamentary apparatus—the homology of which, with a canal cell, is more obvious.

The foregoing sketch indicates, in a very brief manner, the outlines of the classification of the vegetable kingdom, which has been constructed in the light of the most recent studies of the comparative structure of different types. It is sufficient to say, that a detailed consideration of the new relations in which many of the groups now stand to one another by no means diminishes, but strongly confirms, the soundness of the arrangement.

The following table gives the classification in a synoptic form:—

VEGETABILIA.

SUB-KINGDOM A. THALLOPHYTA.

With Chlorophyll. (ALGÆ.)	Without Chlorophyll. (FUNGI.)
Class 1. PROTOPHYTA.	
i. *Cyanophyceæ.* Chroococcaceæ. Oscillatorieæ, &c.	i. *Schizomycetes.*
ii. *Pallmellaceæ.* Englenеæ.	ii. *Saccharomyces.*
Class 2. ZYGOSPOREÆ.	
α. Conjugating cells motile.	
i. *Pandorineæ.* [? Hydrodictyeæ.]	i. *Myxomycetes.*
ii. *Confervaceæ.*	ii. *Chytridineæ.*
iii. *Ulvaceæ.*	
β. Conjugating cells non-motile.	
iv. *Conjugatæ.* Desmidieæ, &c.	[? Protomyces.]
	iii. *Zygomycetes.* Mucorini, &c.
Class 3. OOSPOREÆ.	
i. *Volvocineæ.*	
ii. *Sphæropleæ.*	
iii. *Cæloblastæ.* Siphophyceæ.	i. *Cæloblastæ.* Ancylisteæ. Saprolegnieæ. Peronosporeæ.
iv. *Œdogonieæ.*	
v. *Fucaceæ.* [Phæosporeæ.	

Class 4. CARPOSPOREÆ.

h Chlorophyll. (ALGÆ.)	Without Chlorophyll. (FUNGI.)
i. *Coleochæteæ.*	i. *Ascomycetes.* Lichenes, &c.
ii. *Florideæ.* Nemalieæ. Ceramieæ, &c.	ii. *Æcidiomycetes.*
iii. *Characeæ.*	iii. *Basidiomycetes.*

SUB-KINGDOM B. CORMOPHYTA.

Series I. BRYOPHYTA.
- Class 1. Musci.
- Class 2. Hepaticæ.

Series II. PTERIDOPHYTA.
- Class 1. Filicales.
  - i *Stipulatæ.* Ophioglosseæ. Marattiaceæ
  - ii. *Filices.*
  - iii. *Rhizocarpeæ.*
- Class 2. Equisetaceæ.
- Class 3. Dichotomæ.
  - i. *Lycopodiaceæ.* Lycopodieæ. Psiloteæ. Phylloglosseæ.
  - ii. *Ligulatæ.* Selaginelleæ Isoeteæ.

Series III. PHANEROGAMÆ.
- Class 1. Gymnospermæ.
- Class 2. Angiospermæ.
  - i. *Monocotyledones.*
  - ii. *Dicotyledones.*

See *A Text-Book of Botany, Morphological and Physiological*, by Julius Sachs (3d edition), translated by A. W. Bennett, assisted by W. T. Thiselton Dyer; *Lehrbuch der Botanik*, von Dr Julius Sachs, vierte Auflage; *Quarterly Journal of Microscopical Science*, new series, vols. i.–xv. (W. T. T. D.)

BION, the second of the three Greek bucolic poets, was born in the neighbourhood of Smyrna,—according to Suidas, at Phlossa on the River Meles. The few facts known to us of his life are to be gathered from the beautiful Ἐπιτάφιος Βίωνος of his friend and scholar Moschus. From his account it appears that Bion left his native country and, during the latter part of his life, resided in Sicily and cultivated the form of poetry peculiarly associated with that island. He was contemporary with Theocritus and somewhat older than Moschus. His death was due to poison, administered to him by some jealous rivals who afterwards suffered the penalty of their crime. The subjects of his verses are described by Moschus as "Love and Pan;" but though his works are included in the general class of bucolic poetry, they have little of the pastoral imagery and description characteristic of Theocritus. They breathe a more refined air of sentiment, and show traces of the overstrained reflection frequently observable in later developments of pastoral poetry. The longest and best of his extant works is the *Lament for Adonis* (Ἐπιτάφιος Ἀδώνιδος), the prototype of many modern poems. His other pieces are short and in many cases fragmentary. Two of the Idylls (xix. and xx.) of Theocritus are frequently ascribed to him. Bion and Moschus are edited separately by Hermann (1849) and Ziegler (1869). The best annotated editions are those of Heindorf (1810), Meineke (1856), Ahrens (1855–9), Fritsche (1870), all of which contain also the works of Theocritus. The *Epitaphius Adonidis* is edited separately by Ahrens, 1854.

BIOT, JEAN BAPTISTE, French physicist, was born at Paris, 21st April 1774. After leaving school he served for a short time in the artillery, but again resumed his studies at the École Polytechnique. He distinguished himself in mathematics, and was appointed to a professorship at Beauvais. There he carried on his researches with the greatest assiduity, and gained the acquaintance and friendship of Laplace, from whom he solicited and obtained the favour of reading the proof-sheets of the *Mécanique Céleste.* In 1800 he was recalled to Paris as professor of physics at the Collége de France. Three years later he was elected a member of the Academy of Sciences, a distinction rarely accorded to one so young as he was. In 1803 Biot, in concert with Arago, investigated the refracting properties of gases, and in the following year accompanied Gay-Lussac in his balloon ascent. He was again associated with Arago in the great undertaking of the measurement of an arc of the meridian in Spain, and at a later date (1817–18) he crossed over to Britain and measured carefully the length of the seconds' pendulum along an arc extending to the extreme north of Shetland. In 1814 he was made a chevalier of the Legion of Honour, an order of which he became a commander in 1849. He was a member of the French Academy and of the Academy of Inscriptions and Belles-Lettres, as well as of most foreign scientific societies. In 1840 he received the Rumford gold medal for his researches in polarized light. He died at an advanced age in 1862. Biot's researches extended to almost every branch of physical science; but his greatest discoveries were made in the department of optics, mainly in connection with the polarization of light. He had a thorough command of the best methods of analysis, and applied mathematics rigidly and successfully to physical phenomena. His various dissertations in the *Memoirs* of the Academy are very numerous; a selection of the more valuable was published in 1858. His systematic works—*Traité Elémentaire d'Astronomie Physique* (1805, 3d ed., 1841–57, 6 vols.), *Traité de Physique* (1816, 4 vols.), *Précis Elémentaire de Physique Expérimentale* (1817, 3d ed., 1824, 3 vols.),—are of great merit, though necessarily in some respects behind the present state of physical science.

BIR, or BIREJIK (the former being its Arabic and the latter its Turkish name), a town of Asiatic Turkey, in the pashalik of Rakka, built on the side of a chalky range of hills that skirts the left bank of the Euphrates, about 90 miles N.E. of Aleppo, in long. 38° 6′ E., and lat. 36° 48′ N. It consists of about 2000 houses, surrounded by a dilapidated wall and protected by the citadel of Kalai-Beda, which, with its earthquake-shattered interior, occupies a precipitous eminence cut off from the town. Bir is situated on the main route from Aleppo to Orfa, Diarbekr, and the Persian frontier, and had formerly a considerable trade with Baghdad by means of the river. It is now a post and telegraph station. A ferry seems to have crossed the river at this spot from time immemorial, Abraham himself having made use of it, according to tradition, on his passage from Haran to Canaan. The town is identified with the ancient Birtha or Britha, where the emperor Julian rested on his march to Maogamalcha, and found quarters for his army in one extensive palace. In the English Euphrates expedition Bir was frequently visited, Fort William, one of the principal places of rendezvous, being about 2 miles further down on the other side of the river. (See view in Chesney's *Narrative of Euphrates Expedition*, 1868.)

BÍRBHÚM, a district of British India, within the Bardwán division, under the lieutenant-governor of Bengal, situated between 24° 23′ 10″ and 23° 34′ 54″ N. lat., and 88° 3′ 54″ and 87° 7′ 41″ E. long. It is bounded on the N. by the districts of Santál Parganás and Bhágalpur; on the E. by the districts of Murshidábád and Bardwán; on the S. by the River Ajai, separating it from the district of Bardwán; and on the W. by the districts of the Santál Parganás. The census of 1872 returned the area of the district at 1344 square miles, and the total population at 695,921 souls, residing in 2471 villages and 159,904 houses. Pressure of population per square mile, 518; per village, 282; per house, 4·3. Of the total population, 576,908, or 82·9 per cent., were Hindus; 111,795, or 16·1 per cent., Mahometans; 249 Christians; and 3440, consisting principally of aboriginal tribes, of unspecified religions. The eastern portion of the district is the ordinary alluvial plain of the Gangetic Delta; the western part consists of undulating beds of laterite resting on a rock basis, and covered with small scrub jungle. The Ajai, Bakheswar, and Mor or Maurakshí, are the principal rivers of the district, but they are merely hill streams and only navigable in the rains. Rice, wheat, sugar-cane, pulses, oil-seeds, and mulberry form the agricultural products of the district. The chief manufactures are silk, silk cloth, and lacquered ware. The principal seats of trade are Dubrájpur, Ilámbázár, Bolpur, Sinthiá, Purandarpur, Krinnáhár, Muhammad Bázár, and Ahmadpur. The total net revenue of the district in 1870–71 amounted to £97,979; the civil expenditure to £27,278. The land tax forms the most important item of revenue. In 1870–71 it amounted to £73,261, paid by 556 estates, held by 2036 proprietors, under the Permanent Settlement as in other parts of Bengal. The district and municipal police force amounted to 320 officers and men, at a total cost of £5895 in 1871. Besides these there were 8554 men of the village watch, maintained at a total cost of £23,074, paid by service lands and by the villagers. In 1872 Bírbhúm contained 604 schools, attended by 9338 pupils, costing £989 to the state for the education of its people. There are seven principal roads in the district, the total mileage being 191, and the average cost of their maintenance £1784. Thirty-three miles of the East Indian Railway lie within the district. Until lately Bírbhúm was considered to be the healthiest district in Bengal; but during the past few years epidemic fever has made havoc among the rural population of the eastern portion of the district.

BÍRBHÚM, or SURÍ, the principal town and administrative headquarters of the district of the same name, is situated in 23° 54′ 25″ N. lat., and 87° 34′ 23″ E. long. In 1872 it contained a population of 9001, of whom 6746 were Hindus, 2056 Mahometans, 187 Christians, and 12 of unspecified religions. Municipal income of the town in 1871, £483, 18s.; expenditure, £473, 8s.; rate of municipal taxation, 1s. 8d. per head.

BIRCH (*Betula*), a genus of arboraceous plants constituting the principal portion of the natural order *Betulaceæ.* The various species of birch are mostly trees of medium size, but several of them are merely shrubs. They are as a rule of a very hardy character, thriving best in northern latitudes,—the trees having round, slender branches, and serrate deciduous leaves, with barren and fertile catkins on the same tree and winged seeds. The bark in most of the trees occurs in fine soft membranous layers, the outer cuticle of which peels off in thin white papery sheets. The common birch (*B. alba*) grows throughout the greater part of Europe, and also in Asia Minor, Siberia, and North America, reaching in the north to the extreme limits of forest vegetation, and stretching southward on the European continent as a forest tree to 45° N. lat., beyond which birches occur only in special situations or as isolated trees. It is one of the most wide-spread and generally useful of forest trees of Russia, occurring in that empire in vast forests, in many instances alone, and in other cases mingled with pines, poplars, and other forest trees. The wood is highly valued by carriage-builders, upholsterers, and turners, on account of its toughness and tenacity, and in Russia it is prized as firewood and a source of charcoal. A very extensive domestic industry in Russia consists in the manufacture of wooden spoons, which are made to the extent of 30,000,000 annually, mostly of birch. Its pliant and flexible branches are made into brooms; and in ancient Rome the fasces of the lictors, with which they cleared the way for the magistrates, were made up of birch rods. A similar use of birch rods has continued among pedagogues to times so recent that the birch is yet, literally or metaphorically, the instrument of school-room discipline. The bark of the common birch is much more durable, and industrially of greater value, than the wood. It is impermeable to water, and is therefore used in northern countries for roofing, for domestic utensils, for boxes and jars to contain both solid and liquid substances, and for a kind of bark shoes, of which it is estimated 25 millions of pairs are annually worn by the Russian peasantry. The jars and boxes of birch bark made by Russian peasants are often stamped