

as this covering is usually designated. The conditions necessary to their growth are moisture and light. Wherever these circumstances coexist, diatomaceous forms will almost invariably be found. They occur mixed with other organisms on the surface of moist rocks; in streamlets and

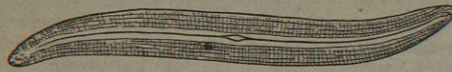


FIG. 6.—*Pleurosigma balticum*. × 200

pools, they form a brownish stratum on the surface of the mud, or cover the stems and leaves of water plants or floating twigs with a furry investment. Marine forms are usually attached to various sea-weeds, and many are found



FIG. 7.—*Navicula cuspidata*. × 400.

in the stomachs of molluscs, holothurians, ascidians, and other denizens of the ocean. The fresh-water forms are specifically distinct from those incidental to salt or brackish water,—fresh-water species, however, are sometimes carried some distance into the sea by the force of the current, and in tidal rivers marine forms are carried up by the force of the tide. Some notion may be formed of the extreme minuteness of these forms from the fact that one the length of which is $\frac{5}{10000}$ ths of an inch may be considered as beyond the medium size. Some few, indeed, are much larger, but by far the greater proportion are of very much smaller dimensions.

Structure.—These minute vegetables are distinguished from kindred forms by the fact of having their soft vegetative part covered by a siliceous case. This covering of siliceous consists of two similar valves nearly parallel to each other, each valve being furnished with a rim projecting from it at a right angle. One of these valves with its rim is slightly smaller than the other, the smaller fitting into the larger pretty much as a pill box fits into its cover. This peculiarity of structure affords ample scope for the growth of the cell-contents usually known as the endochrome. As the endochrome increases in volume the siliceous valves are pushed out, and their corresponding siliceous rims become broader.

As regards the vegetative contents of this cell, in so brief a description the following parts only need to be referred to. There is first what Pfitzer, a distinguished German writer on this subject, designates the plasm-sac, consisting of a fine colourless plasm forming a closed sac of the same shape as that of the cell. The refractive power of this plasm differing but slightly from that of water, the presence of this structure is not always obvious; but on the application of hydrochloric acid its outline may be discerned as it slowly separates from the cell wall,—at first preserving the shape of the cell, but ultimately contracting into a small round mass. Within the plasm-sac is the structure which the writer just named designates the endochrome-plates. They consist of a thick substance, and are of the same colour throughout, varying from bright yellow to a dark yellowish brown. The number and position of the endochrome plates vary in the different genera—some having two, others only one. Within the folds of these plates is sometimes noticeable a collection of plasm which Ehrenberg describes as resembling the embryo in an egg, and which Pfitzer calls the middle plasm-mass. Within this plasm-mass oil globules and vacuoles are diffused, and in the centre of it a small vesicle may often be observed.

Motion.—One of the first phenomena which comes under

the notice of the observer is the extraordinary power of motion with which the frustules are endowed. Some species move slowly backwards and forwards in pretty much the same line, but in the case of *Bacillaria paradoxa* the motion is very rapid, the frustules darting through the water in a zig-zag course. To account for this motion various theories have been suggested, none of which appear to be altogether satisfactory. So while the extraordinary motion of the Diatomaceæ excites admiration, it must be acknowledged that the mechanical agency which produces the motion remains unexplained.

Classification.—In this group, as well as in almost all others, various systems of classification have from time to time been adopted; but that which seems to commend itself most strongly, as well by reason of its simplicity as its facility of application, is the system which has been matured by Heiberg the distinguished Danish writer on the subject, and which he has founded on the symmetrical or unsymmetrical form of the frustule in its several aspects. A diatomaceous frustule may be regarded on what is called the front view, in which the connecting rim or hoop is seen, or on the side view, by which the valve is presented to the eye of the observer. If the outline be symmetrical both on the transverse and longitudinal axis, in both these aspects the frustule is said to be symmetrical; but if the outline be different on one side from that of the other, or if perfect symmetry does not exist as respects the longitudinal or transverse axis, the frustule is said to be unsymmetrical on the aspect or axis in which want of symmetry is found to exist.

Reproduction.—In the Diatomaceæ, as well as in the Desmidiæ, the ordinary mode of increase is by self-division of the cell (see ALGÆ, vol. i. p. 508). The cell-contents within the inclosure of the siliceous case separate into two distinct masses. As these two masses of endochrome become more and more developed, the valves of the mother cell are pushed more and more widely apart. A new siliceous valve is secreted by each of the two masses on the side opposite to the original valve. When this process has been completed the hoop of the mother frustule gives way, and two distinct frustules are formed, the siliceous valves in each of these new frustules being one of the valves of the mother cell, and a newly formed valve similar and more or less parallel to it.

During the life of the plant this process of self-division is continued with an almost incredible rapidity. On this subject the observation of the late Professor Smith is worthy of special notice:—"I have been unable to ascertain the time occupied in a single act of self-division, but supposing it to be completed in twenty-four hours we should have, as the progeny of a single frustule, the amazing number of 1,000,000,000 in a single month, a circumstance which will in some degree explain the sudden, or at least rapid, appearance of these organisms in localities where they were a short time previously either unrecognized or sparingly diffused" (*British Diatomaceæ*, vol. i. p. 25).

Some authors of reputation have been under the impression that the Diatomaceæ, like other kindred forms, are sometimes reproduced by zoospores, and some few facts from time to time have been recorded by various observers which seem to bear out this view of the case. But in this group, as well as in the Desmidiæ already referred to, there obtains another mode of reproduction which is generally known as conjugation. It would be unnecessary here to describe in detail the various observed modes of this process. Suffice it to say that usually two parent frustules unite, invest themselves in a gelatinous sac in which their cell contents are discharged and formed into two bodies termed sporangia, which soon are developed into two frustules in all respects resembling the parents but usually

double their size. In some phases of this process the gelatinous sac bears a considerable resemblance to that lowest form of animal life known by the name of Amœba, so much so that an inexperienced observer might suppose that the object before him was an Amœba gorged with diatomaceous frustules.

Mode of Preparation.—The Diatomaceæ are usually gathered in small bottles, and special care should be taken to collect them as free as possible from extraneous matter. A small portion having been examined under the microscope, should the gathering be thought worthy of preservation, some of the material is boiled in acid for the purpose of cleaning it. The acids usually employed are hydrochloric, nitric, or sulphuric, according as circumstances require. When the operator considers that by this process all foreign matter has been eliminated, the residuum is put into a precipitating jar of a conical shape, broader at the bottom than at the top, and covered to the brim with filtered or distilled water. When the diatoms have settled in the bottom of the jar, the supernatant fluid is carefully removed by a syringe or some similar instrument, so that the sediment be not disturbed. The jar is again filled with water, and the process repeated till the acid has been completely removed. It is desirable afterwards to boil the sediment for a short time with supercarbonate of soda, the alkali being removed in the same manner as the acid. A small portion may then be placed with a pipette upon a slip of glass, and, when the moisture has been thoroughly evaporated, the film that remains should be covered with dilute Canada balsam, and, a thin glass cover having been gently laid over the balsam, the preparation should be laid aside for a short time to harden, and then is ready for observation.

General Remarks.—Like all other organisms, the Diatomaceæ doubtless have a definite function assigned to them in the grand system of creation, but a special interest attaches to them. Allusion has been made to the fact that the soft cell of these organisms is encased in a siliceous epiderm. When the plant has fulfilled its natural course the siliceous covering sinks to the bottom of the water in which it had lived, and there forms part of the sediment. When in the process of ages, as it has often happened, the accumulated sediment has been hardened into solid rock, the siliceous exuvia of the diatoms remain unaltered, and, if the rock be disintegrated by natural or artificial means, may be removed from what has been called "their stony shroud," and subjected to examination under the microscope. The forms found may from their character help in some degree to illustrate the conditions under which the stratum of rock had been originally deposited.

Vast deposits of Diatomaceæ have been discovered in various parts of the world,—some the deposit of fresh, others of salt water. Of these deposits the most remarkable for extent, as well as for the number and beauty of the species contained in it, is that of Richmond, in Virginia, one of the United States of America. It is said to extend for many miles, and to be in some places at last 40 feet deep. The material has long been used as a polishing powder, and recently has been largely employed in the manufacture of the powerful explosive agent known as dynamite. It is a remarkable fact that existing species of Diatomaceæ have been traced so far down as the lower strata of the Tertiary formation; and, though the generations of a diatom in the space of a few months far exceed in number the generation of man during the period usually assigned to the existence of the race, the fossil genera and species are in all respects to the most minute details identical with the numerous living representatives of their class.

(E. O'M.)
DIAZ DE LA PEÑA, NARCISSE VIRGILE (1809-1876), a French artist, distinguished chiefly as a landscape painter,

was born at Bordeaux in August 1809. His first works were exhibited at the Salon in 1831, and attracted little notice, being poor in colour, the quality for which he afterwards became conspicuous. The same criticism applies to the pictures he exhibited annually until 1840, when his style underwent a decided change. His *Nymphes de Calypso* (1840), *Le Rêve* (1841), *Vue de Bas-Bréau*, *L'Orientale*, *Le Maléfice*, and *Les Bohémiens se rendant à une Fête* (1844), showed in an increasing degree the richness of colour and the mastery of the more subtle effects of light and shade which ultimately obtained for Diaz a place in the first rank of landscape painters. His powers were seen at their best in his *Baigneuse* and *L'Amour désarmé* (1851), and in the pictures he sent to the Paris Exhibition of 1855, *Les Présents d'Amour*, *La Rivale*, *La Fin d'un Beau Jour*, *Nymphe Endormie*, *Les Dernières Larmes*, &c. As the titles of several of these works indicate, Diaz endeavoured to add to the interest of his landscapes by introducing into them the personages of the classical mythology. Late in his career he devoted himself to *genre* subjects with but indifferent success. Diaz received a medal of the third class in 1844, of the second class in 1846, and of the first class in 1848; and in 1851 he was made a chevalier of the Legion of Honour. He died in November 1876.

DIBDIN, CHARLES (1745-1814), a well-known writer of songs and musical composer, was born at Southampton on the 15th March 1745, and was the youngest of a family of eighteen. His parents designing him for the church, he was sent to Winchester; but his love of music early diverted his thoughts from the clerical profession. After receiving some instruction from Kent, the organist of Winchester Cathedral, he went to London at the age of fifteen. In the following year his first work, an operetta entitled *The Shepherd's Artifice*, with words and music by himself, was produced at Covent Garden Theatre. This proved successful, and was followed by other works, his reputation being firmly established by the music to the play of *The Padlock*, which was produced at Drury Lane under Garrick's management in 1768, the composer himself taking the part of Mungo. He continued for some years to be connected with Drury Lane, both as composer and as actor, and produced during this period two of his best known works, *The Waterman* (1774) and *The Quaker* (1775). A quarrel with Garrick led to the termination of his engagement, and in 1782 he became joint manager of the Royal Circus, afterwards known as the Surrey Theatre. In three years he lost this position owing to a quarrel with his partner. In 1788 he sailed for the East Indies on the invitation of a sailor brother (the "Tom Bowling" of his famous song); but, the vessel having put in to Torbay in stress of weather, he changed his mind and returned to London. A series of mono-dramatic entertainments which he gave at his theatre, *Sans Souci*, in Leicester Square, brought his songs, music, and recitations more prominently into notice, and permanently established his fame as a lyric poet. It was at these entertainments that he first introduced many of those sea songs which so powerfully influenced the national spirit. The words breathed the simple loyalty and dauntless courage that are the cardinal virtues of the British sailor, and the music was appropriate and naturally melodious. Their effect in stimulating and ennobling the spirit of the navy during the war with France was so marked as to call for special acknowledgment. On retiring from public life, in 1805, Dibdin was rewarded by Government with a pension of £200 a year, of which he was only for a time deprived under the administration of Lord Grenville. Dibdin died of paralysis in 1814. Besides his *Musical Tour through England* (1788), his *Professional Life*, an autobiography

published in 1803, a *History of the Stage* (1795), and several smaller works, he wrote upwards of 1400 songs and about 30 dramatic pieces. He also wrote one or two novels which are now forgotten. An edition of his songs by G. Hogarth (1843) contains a memoir of his life. The edition prepared by his son Thomas is referred to below.

DIBDIN, THOMAS (1771-1841), English dramatist and song writer, was one of the sons of the subject of last notice, and was born on the 21st of March 1771. He was apprenticed to a London upholsterer, but after four years' service he broke his engagement and joined a company of country players. From 1789 to 1795 he performed in every department of the drama, composing during the same period more than 1000 songs, and making his first attempt as a dramatic writer. He returned to London in 1795, having married two years before; and in the winter of 1793-1799 his *Jew and the Doctor* was produced at Covent Garden. From this time he contributed a very large number of comedies, operas, farces, &c., to the public entertainment. Some of these brought immense popularity to the writer and immense profits to the theatres. It is stated that the pantomime of *Mother Goose* produced more than £20,000 at Covent Garden Theatre, and the *High-mettled Racer* £18,000 at Astley's. Notwithstanding this run of popularity, and the author's connection with theatrical notabilities, his last years were passed in comparative indigence. In 1827 he published two volumes of *Reminiscences*; and at the time of his death he was preparing an edition of his father's sea songs, for which a small sum was allowed him weekly by the lords of the Admiralty. He died in London, September 16, 1841.

DIBDIN, REV. THOMAS FROGNALL (1776-1847), an enthusiastic bibliographer, born at Calcutta in 1776, was the son of Thomas Dibdin, the sailor brother of Charles Dibdin, whom the latter has immortalized in his song "Poor Tom Bowling." His father and mother both died on the voyage home to England in 1780, and he was brought up by a maternal uncle. He was educated at St John's College, Oxford, but left the university without taking his degree. Intended for the bar, he was entered at Lincoln's Inn, and studied for a time in the chambers of Basil Montague. After an unsuccessful attempt to obtain practice as a provincial counsel at Worcester, he resolved to abandon law for the church, and he was ordained a clergyman at the close of 1804. His ecclesiastical preferment was slow. For a number of years he had to content himself with the appointment of preacher at various chapels in the West End of London, and it was not until 1823 that he received the living of Exning in Sussex. Soon afterwards he was appointed by Lord Liverpool to the rectory of St Mary's, Bryanstone Square, which he held until his death on the 18th November 1847. The first of the numerous bibliographical works on which Dibdin's fame entirely rests was his *Introduction to the Knowledge of the Rare and Valuable Editions of the Latin and Greek Classics* (1803), which, though superficial, incomplete, and untrustworthy in many of its details, supplied a blank in English literature. A fourth and greatly enlarged edition appeared in 1827. The first edition rendered a valuable service to its author in bringing him under the notice of Earl Spencer, to whom he owed not only his first living but much important aid in his bibliographical pursuits. The rich library at Althorp was thrown open to him; he spent much of his time in it, and in 1814 published his *Bibliotheca Spenceriana*, giving an account of the many rare works it contained. As the library was not open to the general public, the information given in the *Bibliotheca* was found very useful, but the work was marred by the inaccuracy in matters of detail which more or less

characterized all its author's productions. This fault was naturally least obtrusive in a series of playful, discursive works in the form of dialogues on his favourite subject, in which great exactness was not necessary. The first of these, *Bibliomania* (1809), was republished with large additions in 1811, and was very popular, passing through numerous editions. To the same class belonged the *Bibliographical Decameron*, a larger work, which appeared in 1817, and has a higher value than its predecessor, though it did not attain the same circulation. In 1810 he commenced the publication of a new and much extended edition of Ames's *Typographical Antiquities*. The first volume was so great a success that Dibdin realized £600 by it. This, however, was not maintained, and the fourth volume, which did not appear until 1819, fell almost still-born from the press. The work was scarcely half-finished when its publication was thus checked. The chief cause of its failure was that Dibdin had not critical sagacity enough to make a thorough change in the arrangement his predecessor had followed, and to enable him to distinguish what was valuable from what was worthless in the vast stores of information he had himself collected. In 1818 Dibdin was commissioned by his patron, Earl Spencer, to purchase books for him on the Continent, and he afterwards published an account of his journey in his *Bibliographical, Antiquarian, and Picturesque Tour in France and Germany* (3 vols. 1821), which was got up in a most sumptuous style, the engravings alone, it is said, costing £5000. In 1824 he published an ambitious venture in his *Library Companion, or the Young Man's Guide and Old Man's Comfort in the Choice of a Library*, which was intended to point out the best works in all departments of literature. His culture was not broad enough to render him competent for the task, and the *Library Companion*, being severely criticized in the *Quarterly* and *Westminster Reviews*, seriously injured his reputation. He had been for some time involved in pecuniary difficulties, from which he tried to free himself with only partial success by extending the range of his literary activity. He wrote for periodicals, published many of his sermons, and for some years gave himself chiefly to religious literature. He returned to bibliography in his *Bibliophobia, or Remarks on the Present Depression in the State of Literature and the Book Trade* (1831), and the same subject furnishes the main interest of his *Reminiscences of a Literary Life* (1836), and his *Bibliographical, Antiquarian, and Picturesque Tour in the Northern Counties of England and Scotland* (1838). Dibdin was the originator and vice-president, Lord Spencer being the president, of the Roxburghe Club, founded in 1812,—the first of the numerous book clubs which have done such service to literature in the present century.

DICÆARCHUS, a celebrated Peripatetic philosopher, historian, and geographer, was a native of Messana, in Sicily. He was the contemporary of Theophrastus and Aristotle, and flourished towards the close of the 4th century B.C. The exact dates of his birth and death are unknown; the time of the latter event is approximately fixed by good authorities as the year 285 B.C. Nothing is known with certainty concerning the life of Dicæarchus except that he was a disciple of Aristotle and a friend of Theophrastus, to whom he dedicated the majority of his works. Of his writings, which comprised treatises on a great variety of subjects, none have descended to our day. Nothing but their titles and a few fragments survive. The most important of them was his *Life in Greece*, in which the moral, political, and social condition of the people was very fully discussed. Among the philosophical works of Dicæarchus may be mentioned the *Lesbiaci*, in three books, in which the author endeavours to prove that the soul is mortal. This work is written in the form of a dialogue,

and derived its name from the fact that the scene of the dialogue was laid at Lesbos. To it the author afterwards appended a supplement, likewise in three books, which he called *Corinthiaci*. The only complete edition of the fragments of Dicæarchus is that published at Darmstadt in 1841 by Max Fuhr. An excellent dissertation on them will be found in Osann, *Beiträge zur Griech. und Rom. Literatur*.

DICK, THOMAS (1775-1857), a popular writer on astronomy and other scientific subjects, was born in 1775. He was educated for the ministry in connection with the Secession (now United Presbyterian) Church of Scotland, and was ordained at Stirling in 1803. About two years afterwards his connection with the church was severed, and he became a teacher, first at Methven, a village in Perthshire, and afterwards at Perth. In 1824 he published in two volumes the *Christian Philosopher*, a work whose "aim was," in his own words, "to illustrate the harmony which subsists between the system of nature and the system of revelation, and to show that the manifestations of God in the material universe ought to be blended with our view of the facts and doctrines recorded in the volume of inspiration." The success of this work enabled him to resign his labours as teacher, and in 1827 he removed to Broughty Ferry, a suburb of Dundee, where he devoted his whole time to literary and scientific pursuits. Besides the *Christian Philosopher*, he is author of the *Philosophy of a Future State* (1828), the *Improvement of Society by the Diffusion of Knowledge* (1833), *Celestial Scenery* (1837), *The Sdereal Heavens* (1840), and several smaller treatises. These works were all intended to supplement and extend the aims of the *Christian Philosopher*, and may be regarded as endeavours by means of scientific discoveries to illustrate particular aspects of religious truth, and to suggest solutions of difficult religious problems. They are written in a popular and fascinating style, and manifest great aptitude for simplifying scientific subjects, and rendering them interesting to non-scientific readers. Some years before his death, which took place 27th July 1857, a pension was conferred on him by Government.

DICKENS, CHARLES (1812-1870), the great English novelist, was what would generally be described as a self-educated man, and yet, if by a man's education we understand preparation for the work he has to do in life, he was indebted to circumstances for an education on which it would have been difficult to improve. His father was a clerk in the Navy Pay Office, stationed at Portsmouth when Charles was born, but soon afterwards at Chatham, and soon after that in London,—a conscientious man, industrious and punctual in his occupation, but too easy tempered and unpractical to expend his income so as to keep pace with the wants of a rapidly increasing family. The boy's mother seems to have been a person of more energy, as well as of considerable accomplishments; she taught him the rudiments of Latin, and tried to establish a boarding school in Gower Street. The one parent was the original of Micawber, the other the original of Mrs Nickleby. With all their united efforts they could not keep out of distress; the boarding school scheme came too late; and when Dickens was nine years old the family was living in abject poverty in Bayham Street, Camden Town, then one of the poorest London suburbs, and their difficulties were increasing upon them. Charles was sent out to earn six shillings a week in a blacking warehouse, tying blue covers on pots of paste-blackening. For two years the child led a very hard, uncared-for life at this congenial work. He bitterly felt that it was uncongenial, for he was a very precocious boy, had read many books, and had formed an ambition to be "a learned and distinguished man." It must have been very galling to him, with his

prematurely developed sensibilities and aspirations, to be thrown among such companions as Bob Fagin and Poll Green. And perhaps he was right in afterlife to wonder at the thoughtlessness of his parents in subjecting him to such a humiliation. His sufferings were so acute, and made such an impression on him, that years afterwards he could not think of them without crying; and there were certain quarters of the town through which he used to pass to his daily work, and where he used to loiter with less than enough to eat, that he habitually shunned for their painful memories. "It is wonderful to me," he wrote when in the height of his fame, "how I could have been so easily cast away at such an age. It is wonderful to me that, even after my descent into the poor little drudge I had been since we came to London, no one had compassion enough on me—a child of singular abilities, quick, eager, delicate, and soon hurt, bodily or mentally—to suggest that something might have been spared, as certainly it might have been, to place me at any common school. Our friends, I take it, were tired out. No one made any sign. My father and mother were quite satisfied. They could hardly have been more so if I had been twenty years of age, distinguished at a grammar school, and going to Cambridge."

And indeed, if his parents could have foreseen the future, they would have had cause to be much more satisfied. For when the fragile little boy was sent into his cousin's blacking warehouse, he entered a better school, as it happened, than his father could have chosen for him. It was an infinitely more painful school than Harrow or Eton, but for one whose destined work was to describe the poorer houses and streets of London, and the many varieties of life, odd and sad, laughter-moving and pitiful, that swarmed in them, it was a more instructive school, it was the true road to knowledge. The chances were that a delicate boy like him succumbed to his wretchedness, and that a clever boy like him became a rogue and vagabond; but he survived these dangers and became a great novelist. Instead of sinking into the depths of the thronging atoms, he rose above them, or kept apart from them, observed them, and became their describer.

It is impossible to say how this watchful habit began, and when it connected itself with his love of literary distinction. We have Dickens's own testimony that he was a singularly observant child, and that at a very early period he had an ambition to become "a learned and distinguished man," but it would be going too far to suppose that from his childhood he held himself apart and kept a keen eye on the doings of others with a view to making capital out of his observations. At first in all likelihood the distinction which he coveted was a kind of distinction that seemed to him possible only through the medium of grammar-schools and universities. To the last no doubt he regretted this want of academical study, and believed that it had placed him at a disadvantage. Still accident is so very much better a schoolmaster than design, that from the first it gave him also the literary training needful to make him a painter of manners. His father, the navy pay clerk, had a small collection of books, with which the "very small and not over-particularly taken care of boy" had made himself familiar while he was living at Chatham, before his experiences in Camden Town and the blacking warehouse. Among these books were *Roderick Random*, *Peregrine Pickle*, *Humphrey Clinker*, *Tom Jones*, the *Vicar of Wakefield*, *Don Quixote*, *Gil Blas*, *Robinson Crusoe*, the *Arabian Nights*, Mrs Inchbald's *Farces*, and the *Tales of the Genii*. This literature did not glide over the boy's mind like water over marble; it found congenial soil, and fell into it as seed. He lived the life of his favourite characters. "I have been Tom Jones," he says, putting his own case into the mouth of David Copperfield "a child's Tom Jones, a