

of objects in connexion with Madame Hauffe in 1825-28,¹ and such movements also occurred in presence of the so-called electric girl in 1846.² The second class of phenomena, which we may call the automatic, consists in table-tilting and turning with contact; writing, drawing, &c., through the medium's hand; convulsive movements and involuntary dancing; entrancement, trance-speaking, and personation by the medium of deceased persons, attributed to temporary "possession"; seeing spirits and visions and hearing phantom voices. This class bears affinity to some of the phenomena of hypnotism and of certain nervous complaints, to certain epidemics of the Middle Ages,³ and to phenomena that have occurred at some religious revivals. According to quotations given by Chevreul,⁴ the divining-rod was used at the end of the 17th century for obtaining answers to questions, as table-tilting now is. In a third class must be placed the cure of disease by healing mediums. This cannot well be treated apart from mesmeric healing and "faith cures" and "mind cures," and belongs to medical psychology.

The class of automatic phenomena are much the commonest. The investigations of Carpenter on unconscious cerebration and of Faraday on unconscious muscular action⁵ have shown that it is not necessary to look outside the medium's own brain and organism for the explanation of such things as automatic writing and table turning. It is about the matter communicated by these means that the controversy now turns. Spiritualists maintain that true information is thus given, provably unknown to the medium or other persons present, or at least expressed in a way obviously beyond their powers to originate. Another view, which is now gaining ground, is that the information in some exceptional cases does not come from the mind of the medium, but is due to the influence wrought on his mind by that of other persons, and more than this is not proved.⁶

At no period of the spiritualistic movement has the class of physical phenomena been accepted altogether without criticism. Most spiritualists know that much fraud in connexion with them has been discovered—frequently by spiritualists themselves—and that the conditions favourable to obtaining them are often such as favour fraud. It is with a full knowledge of these difficulties in the way of investigation that they maintain that unmistakably genuine phenomena are of constant occurrence. Many volumes containing accounts of such phenomena have been printed, and appeal is often made to the mass of evidence so accumulated. "No physical science can array a tithe of the mass of evidence by which psychism" (*i.e.*, what is usually called spiritualism) "is supported," says Serjeant Cox.⁷ But the majority of these accounts have scarcely any scientific value. Spiritualists have, as a rule, sought to convince not by testimony but by ocular demonstration. Yet, if there is not a mass of scientific evidence, there are a number of witnesses—among them distinguished men of science and others of undoubted intelligence—who have convinced themselves by observation of the genuineness of the phenomena,—a fact of undeniable importance, even without careful records, when the witnesses are otherwise known to be competent and trustworthy observers. Mr Maskelyne has affirmed⁸ that he has witnessed table-turning where he was satisfied that there was neither trickery nor unconscious muscular action. Moreover, if

¹ Scherir von Prevost.
² Tanchou, *Enquête sur l'authenticité des phénomènes électriques d'Angoulême*, Paris, 1846.
³ See Hecker, *Epidemics of the Middle Ages*, 1859.
⁴ *De la baguette divinatoire*, &c., 1854.
⁵ *Athenæum*, 2d July 1853; see also on this subject Chevreul, *op. cit.*
⁶ See Ch. Richet, "La Suggestion Mentale," in *Revue Philosophique*, December 1884, and *Proc. Soc. for Psychical Research*, vols. ii. and iii.
⁷ *Mechanism of Man: What am I?* vol. ii. p. 313, 1879.
⁸ See *Pall Mall Gazette*, 18th, 20th, and 23d April 1885.

the phenomena are not genuine, we have to assume a large amount of apparently aimless fraud.

Amongst the proposed explanations of these phenomena that of hallucination need not detain us long. Sensory hallucination of several persons together who are not in a hypnotic state is a rare phenomenon, and therefore not a probable explanation. Moreover, it cannot be regarded as being generally applicable, partly because material traces of what occurs often remain, and partly because of the general agreement not only of all the witnesses but of all the senses as to what is perceived, as distinguished from what is inferred. Nevertheless something of the kind may occasionally have happened, especially at some of the seances of Home.⁹ If collective hallucination really occurs at seances, it is a very interesting fact, and deserves to be carefully studied.

What may broadly be called conjuring is, however, a much more probable explanation of most of the recorded phenomena; and in the vast majority of cases the witnesses do not seem to have duly appreciated the possibilities of conjuring, nor to have taken sufficient precautions to exclude it. Besides, not even a conjuror knows all the possibilities of his art and can describe in detail all the accidental circumstances which may on any particular occasion favour deception, and perhaps never exactly recur. We require, therefore, to know not only that the witness is careful and accurate but that he has allowed a sufficiently wide margin for the possibilities of conjuring; and some leading spiritualists do not allow this. It is often urged that mediums are not conjurors because they frequently fail, whereas "imposture can be reproduced at will," and because they can produce the phenomena in private rooms, and under conditions which exclude the possibility of conjuring. But the phenomena produced by mediums in private rooms would generally be uninteresting and unsuited to public performance, so that it would not pay a professional conjuror to practise them. Amateur conjurors might do something in this way, and the present writer has seen one imitate successfully some of the phenomena of professional mediums for "direct writing"; but to compete with mediums on really equal terms the conjuror must have the same conditions throughout, and this is difficult to arrange, since it involves securing witnesses who are doubtful as to whether what they see is conjuring or not. Still more important to the conjuror is that very privilege of failing whenever he pleases, so largely used by mediums, that he may avail himself of accidental opportunities for trickery, which would be interfered with by a settled programme. The extent to which the absence of programme obtains at seances appears from the following statement by a leading spiritualist who writes under the *nom de plume* of "M.A. (Oxon.)": "In 99 out of every 100 cases people do not get what they want or expect. Test after test, cunningly devised, on which the investigator has set his mind, is put aside, and another substituted."¹⁰ In other words, the evidence is rarely strictly experimental, and this not only gives facilities for fraud but makes it necessary to allow a much larger margin for accidents, mistakes, and mal-observation. It must be borne in mind that the most excellent moral character in the medium is no guarantee against trickery, unless it can be proved that he was in no abnormal mental condition when the phenomena occurred; for extraordinary deceptions have been carried on by hysterical patients and others with no apparent motive but a desire to secure attention.

One of the possibilities to be allowed for is that of un-

⁹ See, e.g., *Report on Spiritualism of the Committee of the London Dialectical Society*, 1871, pp. 367-369, 207. See also Guldenstaben, *De la réalité des esprits*, 1857, p. 66.
¹⁰ *Human Nature*, 1876, p. 267.

usual muscular endowment in the medium. For instance, in 1851, the remarkable loud double raps occurring in the presence of the Fox girls, which in 1849 had puzzled several investigating committees at Rochester, were explained by Professors Flint, Lee, and Coventry of Buffalo as produced by rapidly partially dislocating and restoring the knee and other joints. They stated that they had experimented with another lady who could do the same; and, challenged by Mrs. Fish, they tried some experiments with her and Margaretta Fox which strongly supported their view.

Besides the general arguments for supposing that the physical phenomena of spiritualism may be due to conjuring, there are two special reasons which gain in force as time goes on. (1) Almost every medium who has been prominently before the public has at some time or other been detected in fraud, or what cannot be distinguished from fraud except on some violently improbable hypothesis; and (2), although it is easy to devise experiments of various kinds which would place certain phenomena above the suspicion of conjuring, by eliminating the necessity for continuous observation on the part of the investigators, there is no good evidence that such experiments have ever succeeded. Nevertheless there does exist evidence for the genuineness of the physical phenomena which deserves consideration. Count Agénor de Gasparin, in his *Tables Tournantes* (Paris, 1854), gives an account of what seem to have been careful experiments with his own family and friends, which convinced him that by some unknown force tables could be got to move without contact. He did not believe that spirits had anything to do with it. His experiments were conducted in broad daylight and with sceptical witnesses (whose testimony, however, he does not give) looking on outside the circle. The minutes of the sub-committee No. 1 of the committee of the Dialectical Society (*op. cit.*, pp. 373-391) report that tables moved without contact, whilst all the persons present knelt on chairs (the backs of which were turned to the table), with their hands on the backs. The report, however, would be of greater value if the names of the medium and of the working members of the committee were given—we only know that of Sergeant Cox—and if they had written independent accounts of what they witnessed. The conditions of some of Mr Crookes's experiments with D. D. Home on alterations in the weight of a partially suspended board¹ appear to have been so simple that it is difficult to imagine how the witnesses can have been deceived. Some very remarkable evidence is contained in "Researches in Spiritualism during the Year 1872-3," by "M.A. (Oxon.)," published in a spiritualistic periodical called *Human Nature*, March and August 1874. The papers give accounts of phenomena obtained through the writer's own mediumship, generally in the presence of one or two friends, and extending over almost the whole range of spiritualistic manifestations.

But what chiefly interests spiritualists is the assurance of life and progress after death, and the moral and religious teaching, which they obtain through automatic writing and trance-speaking. It was discovered very early in the movement that the accuracy of these communications could not always be relied on; but it is maintained by spiritualists that by the exercise of the reason and judgment, by prolonged acquaintance with particular communicating intelligences, and by proofs of identity with persons known to have been trustworthy on earth, it is possible to obtain valuable information from beings not infallible, but with the knowledge of spirit life superadded to their earthly experience. Still the agreement between

¹ *Quart. Journ. of Science*, July and October 1871; republished, with other papers by Mr Crookes, under the title of *Researches on the Phenomena of Spiritualism*, 1874 &c.

communications so received has not been sufficiently great for anything like a universal spiritualistic creed to have been arrived at. In France the doctrine of successive reincarnations with intervals of spirit life promulgated by Allan Kardec (Léon Hippolyte Denisart Rivail) forms a prominent element of spiritualistic belief. This view has, however, made but little way in England and America, where the opinions of the great majority of spiritualists vary from orthodox Christianity to Unitarianism of an extreme kind. Probably it would be impossible to unite spiritualists in any creed, which, besides the generally accepted belief in God and immortality, should postulate more than the progress of the spirit after death, and the power of some of the dead to communicate with the living by means of mediums.

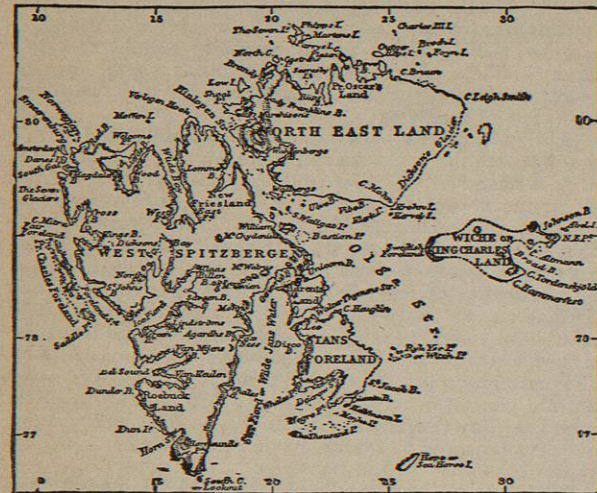
Spiritualism has been accused of a strong tendency to produce insanity; the charge, however, seems to be in the main a mistaken inference from the fact that the delusions of the insane not unfrequently take the form of supposed converse with invisible beings. It is, however, probable that the spiritualistic theories of possession and obsession sometimes injure persons with incipient insane impulses, by weakening their sense of responsibility for these and their efforts to control them. Spiritualism has also been accused of fostering free love and other doctrines subversive of society. But this charge too has been made without adequate grounds; for, though certain spiritualistic bodies have at times taught such doctrines, they have always been repudiated by the mass of spiritualists. The great scandal of spiritualism is undoubtedly the encouragement it gives to the immoral trade of fraudulent mediumship.

In addition to the works already mentioned, the student, for a general idea of the whole subject, should consult the following:—E. W. Capron, *Modern Spiritualism, its Facts, &c.*, Boston, 1855, for the early history of the movement in America; Edmonds and Dexter, *Spiritualism*, New York, 1854-55; R. Hare, *Experimental Investigations of the Spirit Manifestations*, New York, 1856; Allan Kardec, *Livre des Esprits*, 1st ed. 1853; Mrs De Morgan, *From Matter to Spirit*, London, 1863, with preface by Professor De Morgan; Alfred Russel Wallace, *Miracles and Modern Spiritualism*, 1876; M.A. (Oxon.), *Spirit Identity and Spirit Teaching*; Zollner, *Wissenschaftliche Abhandlungen* (the part relating to spiritualism has been translated into English under the title *Transcendental Physics* by C. C. Massey). A succinct account of typical frauds of spiritualism is contained in D. D. Home's *Lights and Shadows of Spiritualism*, 2d ed., 1877-78. (E. M. S.)

SPITZBERGEN. This group of rocky, barren, and snowclad islands, lost in the solitudes of the Arctic Ocean, 400 miles north-north-west of the North Cape of Norway (see vol. xix. pl. II.), but nevertheless well known for at least four centuries to European whalers and seal-hunters, has of late acquired new interest from the scientific expeditions by which it has been selected either as a base for attempts to reach the north pole or as a field in which to inaugurate a new era of scientific exploration in the arctic regions. From Spitzbergen Parry started in 1827 on the sledge journey which brought him within 480 miles of the pole; it was the starting-point of the investigations which led Charles Martins to his brilliant generalizations of the flora, present and past, of the earth; and numerous Swedish expeditions from 1858 onwards have accumulated an amount of knowledge, so vast and so important, as to be comparable only with the results of the great equatorial and arctic journeys of the first years of the 19th century.

The Spitzbergen archipelago, lying between 76° 30' and 80° 30' N. lat. and 10° and 30° E. long.—half-way between Greenland and Nova Zembla—consists of six large and a great number of smaller islands. The chief, that of West Spitzbergen, shaped like a wedge pointed towards the south, and deeply indented on the west and north by long branching fjords, has an area of nearly 15,200 square miles. High mountains, reaching 4560 feet in the Horn Sound Tind, cover its southern parts; while a wide plateau

with an altitude of from 1500 to 2000 feet and covered by a thick ice-sheet, occupies the north. Several fjords—Horn Sound, Bel Sound, Ice Fjord (15 miles wide and 80 long), and the double fjord of King's Bay and Cross Bay on the west, and Liefde, Wiide, and Lomme Bays on the north—deeply penetrate the island. One of the ramifications (Dickson Bay) of the beautiful Ice Fjord, 150 fathoms deep, nearly reaches the head of Wiide Bay, so as almost to divide the island. A long narrow island, Prince Charles's



Map of Spitzbergen.

Foreland, with peaks of nearly 5000 feet high, runs parallel to part of the west coast of West Spitzbergen, from which it is separated by a narrow strait. The broad Stor (Great) Fjord, or Wide Jans Water, separates the main island from two others to the east,—Stans Foreland (2500 square miles) and Barents Land (580 square miles). Formerly these were considered as one, and named Edge Island, until the narrow Walter Thymen Strait which parts them was discovered. A few peaks, estimated at from 1600 to 2000 feet high, protrude above the snow and ice by which these two imperfectly explored islands are covered. To the north-east of West Spitzbergen, separated from it by Hinlopen Strait (7 to 60 miles in breadth) lies North-East Land, with an area of about 6200 square miles. Its western and northern coasts are indented by several bays and fjords; the southern and eastern shores, on account of the masses of ice by which they are constantly girt, remain unexplored. This island appears like a broad plateau covered by an ice-sheet 2000 to 3000 feet in thickness, from which a few peaks protrude. Slowly moving towards the east, this immense sheet of ice discharges into the sea by a huge ice-wall, unbroken by promontories for 150 miles, thus forming the broadest glacier known,—Dickson's glacier. Eastwards from this group of islands, 100 miles to the north-east of Stans Foreland, rises another island, measuring 90 miles from west to east. Marked either Gillis's Land or Wiche's Land in earlier maps, it was seen from Spitzbergen as a snow-clad mass mingling with the fogs of the sea by a Swedish expedition, and later on by Heuglin and Zeil; but it was not until 1872 that the Norwegian whalers Altman, Johnsen, and Nilsen reached it from the east and nearly circumnavigated it. After some discussion about its name, it has received from Professor Mohn the name of King Charles Land, which is now generally accepted. The wide strait which separates it from Spitzbergen is called Olga Strait. It is now established that Gillis saw Gillis's Land to the north-east of the archi-

pelago, and this land, which may perhaps be a link between the Spitzbergen archipelago and that of Franz-Josef, has been again sighted by Norwegian seal-hunters. Numerous small islands lie around the larger—The Danes and Norwegian Islands on the north-west, the Seven Islands on the north, Outger Repts, Brock, and Charles XII. Island on the north-east, Waygat Islands and William I. Island in Hinlopen Strait, the Ryk Yse Archipelago, Hope Island, and the Thousand Islands (about a hundred small rocks) to the east and south of Stans Foreland, and many other smaller ones. Many of these small islands rise to a height of 1500 to 1700 feet.¹

The archipelago, which has the Greenland Sea to the west and Barents Sea to the east, rises from a submarine platform that extends from Bear Island north-eastwards to Franz Joseph Land, and probably was an immense arctic continent connected with Greenland during the middle of the Tertiary period. The sea around Spitzbergen has a depth of less than 100 fathoms. Owing to this circumstance the ice readily accumulates round the shores; and, although the glaciers of Spitzbergen do not give origin to icebergs so huge as those of Greenland, the smaller icebergs and the pack-ice are thick enough to prevent access to the shores except for a few months in the year. Happily the Gulf Stream, which washes the shores of Norway, after sending a branch to the east, flows north to the western shores of Spitzbergen, moderating its climate, and leaving an open passage which permits whalers to approach the western coast even under the most unfavourable conditions of ice in the arctic regions. Drift-wood brought from lower latitudes, glass-floats of the Norwegian fishermen, and even the large seeds of the *Entada Gigalobium*, carried by the Gulf Stream from the Gulf of Mexico, are found at the northern extremity of Spitzbergen. On the other hand, a cold current charged with ice descends from higher latitudes along the eastern coast, rendering approach extremely difficult. On this account King Charles Land remained unknown until 1872, and the eastern coast of North-East Land still continues unexplored.

Owing to the warm current, the climate of Spitzbergen is less severe than in the corresponding latitudes of Greenland and Smith Sound. The isotherm of 23° Fahr. (-5° C.), which crosses the middle of Eastern Siberia, touches its southern extremity, and only the north-east coasts of West Spitzbergen and North-East Land have an average yearly temperature so low as 14° to 10°-5 (-10° to -11°-9 C.). At Mussel Bay (79° 53') the average yearly temperature is 16° (January 14°-1, July 39°-3). Bear Island, notwithstanding its more southerly position, has a lower temperature, as the Gulf Stream does not touch it. Even in the coldest months of the winter a thaw may set in for a few days; but, on the other hand, snow sometimes falls in July and August. Spring comes in June; the snow becomes saturated with water and disappears in places, and scurvy grass and the polar willow open their buds. By the end of June the thermometer has ceased to sink below the freezing-point at night; July, August, and September are the best months. In September, however, autumn sets in on shore, though the whalers continue cruising until the end of the month and even reach the highest latitudes. By the end of September the pack-ice rapidly freezes into one solid mass. To move on this mass, however, is exceedingly difficult, for the ice, owing to its contraction and expansion, is either intersected by large fissures or broken up and piled into heaps, which puts insuperable difficulties in the way of sledge expeditions.

Glaciers are largely developed. On the high grounds the snow under a level of from 1200 to 1500 feet disappears every year; but on the plateaus it continually accumulates, so as to cover them with an immense ice-sheet, like that of Greenland, which slowly discharges by the valleys towards the sea in the form of immense glaciers. All North-East Land and the interior of West Spitzbergen are covered with such ice-sheets, which descend to King's

¹ Bear Island, half-way between the North Cape and Spitzbergen, can hardly be reckoned to the Spitzbergen archipelago. It was formerly renowned for its hunting grounds, but is very seldom visited now. Lying outside the course of the Gulf Stream, it is almost entirely ice-bound.

Bay by a glacier 15 miles wide, or by that already alluded to in North-East Land, where the ice-cliffs are from 200 to 400 feet high. These glaciers, however, discharging into comparatively shallow waters, do not produce such icebergs as those of Greenland. The glaciers of the present epoch are but trifling in comparison with what they were during the Glacial period, when the entire country was buried under an ice-sheet, which probably connected all the archipelago into one ice-bound continent and spread far beyond to northern Europe.

The backbone of the islands consists of thick layers of granite, gneiss, and other archaic schists. But more recent formations bearing witness to a much more genial climate are not wanting. The Carboniferous period is represented by extensive coal-bearing strata, the lowest of which are intermediate with the Devonian (Liefde Bay strata). The Trias, also containing a rich fossil flora, is represented by black clay slate. The Jurassic deposits are widely spread; they mostly belong to the Kelloway, and many of them are coal-bearing. To the same period belong the frequently occurring layers of what was formerly called hyperthenite, but has now been proved to be (according to Zirkel's classification) diabase and dolerite. The most interesting formation is, however, the Miocene. At a period close, geologically speaking, to the subsequent Glacial period, and even to our own, Spitzbergen was covered with a luxuriant vegetation the like of which is now found only in the 60th parallel in Scandinavia. The shores of Bel Sound, Ice Fjord, and Cape Starostine in 78° N. lat. were covered with extensive peat bogs, on the edges of which the marsh cypress flowered, dropping its leaves and blossoms into the marshes. *Sequoia*, poplars, birches, planes, and large oaks also grew there, while ivy and thick under-wood freely developed under their shadow, and thousands of insects swarmed in the thicket. The most striking feature of this Miocene vegetation—a feature conclusively established by the researches of Oswald Heer—is that Spitzbergen, Greenland, Franz-Josef Land, and Nova Zembla were at that time parts of one immense continent, thus realizing the very conditions for the coldest climate, if climate had to depend on telluric causes only. Heer has shown, moreover, in a manner that hardly admits of doubt that the luxuriant vegetation so unmistakably borne witness to by the Miocene strata of the arctic regions could not have developed had it been condemned to endure the long arctic night it now undergoes. This feature of the arctic Miocene flora is unexplained, and will remain so until higher cosmical laws are formulated to explain changes of climate. A change in the position of the earth's axis of rotation (recently the subject of a serious discussion in England and on the Continent) would seem to be the only adequate hypothesis by which to account for the warm vegetation of the period in question in such proximity to the pole; but this hypothesis would be so much at variance with the present state of our knowledge that we may well hesitate to advance it. A brief recurrence of a warmer climate—not nearly so warm as the Miocene, yet somewhat warmer than the present—was also experienced by Spitzbergen after the long period of glaciation as is proved by the occurrence of beds with mussels, which are now found only in much warmer latitudes. This warmer Post-Glacial period—traces of which have been met with throughout the arctic and subarctic regions—was followed by a period of slow upheaval, which still continues.

The flora is of course poor. The only tree is the polar willow, which does not exceed 2 inches in height and bears a few leaves not larger than a man's finger-nail; and the only bush is the crowberry (*Empetrum nigrum*), to which the recently discovered cloudberry (*Rubus Chamemorus*) may be added. But at the foot of the warmer cliffs some loam has been formed notwithstanding the slowness of putrefaction, and there, in contrast with the brownish lichens that cover the hills, grows a carpet of mosses of the brightest green, variegated with the golden-yellow flowers of the ranunculus (*R. sulphureus* and *hyperboreus*), the *Sileneæ*, the reddish heads of the *Fedicularis*, the *Oxyria reniformis* (a foot high), the large-leaved scurvy grass (*Cochlearia fenestrata*), several saxifrages, *Cerastium alpinum*, *Potentilla emarginata*, fox-tail grass (*Alopecurus alpinus*), *Dispositia Fischeri*, *Poa censis*, *pratensis*, and *stricta*, with a few large-flowered *Polygona* and *Andromeda*; while on the driest spots yellow poppies and whitlow grasses (*Draba*), *Cardamine bellidifolia*, several *Dryades*, &c., are found. Even on the higher slopes, 1500 feet above the sea, the poppy, *Luzula hyperborea*, and *Stellaria Edwardsii* are occasionally met with. Mosses, mostly European acquaintances, cover all places where peat has accumulated. The slopes of the crags and the blocks of stone on the beach are sometimes entirely covered with a luxuriant moss and lichen vegetation, among the last being the so-called "famine bread" (*Umbilicaria arctica*), which has maintained the life of so many arctic travellers. Flowering plants are represented by as many as ninety-six species, of which eighty-one grow in Greenland and sixty-nine in Scandinavia; forty-three species are alpine cosmopolites, and have been met with on the Himalayas. The ferns are represented by two species.¹ Although thus limited in number, the flora is suggestive

¹ According to Mr Naanthor's researches in 1882 (*St. Vetenskaps Akad. Handl. Nyar*, xxx.: *Botanisches Jahrbuch*, iv.), the flora of Spitzbergen is composed

in its distribution. The vegetation of the south has a decidedly Lappish or European alpine character, while that of the north coast is decidedly American, and recalls that of Melville Island. Many flowering plants which are common in north-west Spitzbergen are absent from the east coast, where the cold current is inimical to both flora and fauna; but, on the other hand, one moss (*Pottia hyperborea*) and one lichen (*Usnea melazantha*) are found there which are of American origin and grow both in North America and on the Cordilleras. *Algae* are most numerous, many, like the brown *Laminaria* and *Nostoc communis*, which fill all pools and are the chief food of many birds, being familiar in Europe. *Protococcus nivalis* covers the snow with its reddish powder.

The fauna, although not very rich in species, is exceedingly rich in individuals. It includes fifteen mammals, only two of which are terrestrial—the reindeer and the ice-fox—besides the usual inhabitant of the arctic regions, the polar bear.² The number of reindeer is really puzzling. In a single summer, or rather in the course of a few weeks, no fewer than from 1500 to 2000 reindeer were killed by hunters for several consecutive years previous to 1868. Much emaciated in June, they grow very fat towards the end of the autumn, after feeding on the mosses. Great numbers are "marked" (that is, have both ears cut at the same height), and the hunters are persuaded that these individuals come from an unknown continent in the north-east, where they have been marked by the hand of man. However strange this hypothesis, it must be acknowledged that the objections urged against it by the Swedish explorers are not conclusive, and that frost-bite attacking young calves could hardly account for the symmetrical markings on both ears. The immense numbers of the reindeer strongly support the idea of their migration, and the only question is whether they came from Siberia via Nova Zembla, or whether they did not really come from the unknown archipelagoes on the north-east, the existence of which is supported by so many other data (immobility of the ice to the east of Spitzbergen, dirty ice, birds met with off North-East Land, as well as several other considerations of a more general character).

Eight Cetaceans are met with in the seas off Spitzbergen, viz.—*Balaenoptera boops*, 80 to 110 feet long; *B. gigas* and *B. rostrata*, 30 feet long; the white whale (*Beluga calodon*), three species of seals (*Phoca barbata*, *granlandica*, and *hispidia*), and the walrus (*Trichechus* or *Odobenus rosmarus*). The Greenland whale has completely disappeared in consequence of the great havoc made during the last two centuries: according to Scoresby, no less than 57,500 individuals were killed between 1669 and 1775. A perfectly reckless extermination of seals is still going on. Numberless walrus-tubs tumble about in the water, or lie in crowds on the floating ice; and their number further increases when the flocks of Greenland seals arrive in August.

Birds visit the archipelago in such vast flocks that the cliffs are literally covered with them. The fulmar petrel (*Procellaria glacialis*)—a herald of polar regions—meets the ships approaching Spitzbergen far away from the coasts. Its colonies cover the cliffs, as also do those of the glaucous gull (*Larus glaucus*), or the "burgomaster," *Rotches* (*Mergulus alba*), black guillemots (*Uria grylla*), ivory gulls (*Larus eburneus*), auks, and kittiwake gulls (*Larus tridactylus*) breed extensively on the cliffs, while geese, looms, and snipe swarm on and about the lagoons and small freshwater ponds. The barnacle goose (*Anser bernicla*) is only a bird of passage, as it goes farther north-east to nest. The eider breeds in large colonies on the islands, where its young are safe from the ice-fox, only the glaucous gull and the Brent goose (*Bernicla brenta*) being admitted to keep them company, while the lumme (*Mormon arcticus*) and the tern confine themselves to separate cliffs. These birds, however, are only guests in Spitzbergen, the snow-bunting (*Emberiza nivalis*) being the only species which stays permanently; twenty-three species breed regularly on Spitzbergen, and four others (the falcon, snowy owl, swan, and skua) come occasionally.

There are twenty-three species of fishes, but no reptiles. Insects are few: *Lepidoptera* (one species), *Neuroptera* (one), *Hymenoptera* (four), and *Diptera* (twenty) have been met with by the Swedish expeditions. Arachnids, and especially Pantopods, on the other hand, are very common. Molluscs are also very numerous, embracing no less than 130 species. In June several *Limacinae* are met with in such numbers on the coast and at the mouth of the glacier streams as to constitute the chief food of the gulls. At some places the mussels and univalves reach a comparatively colossal size and appear in incredible abundance. Of Crustaceans no fewer than 100 species have been recognized in the waters of the archipelago.

The marine fauna is exceedingly rich in the bluish warmer waters of the Gulf Stream, and the dredgings of the Swedish expeditions, which were prosecuted even under the ice, never failed to bring to the surface a rich variety of remarkable or new forms. From a depth of 8400 feet the "bull-dog" machine lifted mud of a temperature as follows:—*Rosaceæ*, 7 species; *Saxifragæ*, 10; *Cruciferae*, 15; *Ranunculaceæ*, 8; *Sileneæ* and *Aleineæ*, 12; *Saliz*, 2; *Compositæ*, 5; *Scrophulariaceæ*, 2; *Eriaceæ*, 2; *Gramineæ*, 23; *Cyperaceæ*, 12; *Juncaceæ*, 6; *Filices* (Ferns), 2; *Lyopodiaceæ*, 1. The whole of this flora immigrated during the Post-Glacial period, which was warmer than the present.

² The existence of the *Arvicola hudsonia* is not quite proved.

tune of 33° Fahr. (0°-3 C.) charged with Radiolarians, *Polythalamæ*, *Globigerinæ*, *Biloculinæ*, *Dentalia*, and *Nonioninæ*, together with some Annelids (*Spiochaetopterus* and *Cirratulus*), two Crustaceans (*Cuma rubicunda* and *Apsodes*), one Mollusc, two *Holothurina*, one *Gephyrea*, and one Sponge. Even at a depth of 15,900 feet animal life was found in unexpected profusion, the mud consisting almost entirely of brown and white *Foraminiferæ*, among them one Crustacean (a species of *Cuma*). But marine life is much poorer on the east coast, resembling that of Greenland.

Man does not live on Spitzbergen, and the attempts of the Swedes to winter there have for the most part proved failures, except in the case of the "Sofia" expedition, which succeeded in wintering without great loss, though not without suffering from scurvy. None but the Russian "Pomor" (inhabitants of the Murman coast) have succeeded in enduring the arctic winters. The patriarch of Spitzbergen, the Pomor Staraschin (Starostine), spent no less than thirty-two winters (fifteen being consecutive) on the islands, dying of old age in 1826. There was a time in the 17th and 18th centuries when thousands of Dutch, Danes, and others were attracted to Spitzbergen by the whale-fishing. Whole villages sprang up on the shores, the best being that of the Dutch—Smeerenberg—which is said to have been visited by 18,000 men in a single summer. The "right whale" having disappeared, the whalers ceased to visit Spitzbergen, and only quite recently an attempt has been made to renew the pursuit of the *Balanoptera boops*. The chief object of pursuit is the walrus, carried on by Norwegians; sea-birds and siver are also occasionally sought.

History.—Spitzbergen was discovered in 1596 by William Barents, and his companion, Cornelius Rijp, is believed to have circumnavigated the archipelago. Nevertheless it was long considered as a part of Greenland, and described under the names of East Greenland, Newland, King James's Land, until the old name of Spitzbergen gained the ascendancy. But long before Barents discovered it the Russians had known it under the name of Grumant (a word of unknown origin), and when Chancellor arrived at Archangel in 1553 he learned that the Russians visited Grumant for hunting purposes. After the 17th and 18th century whalers, the Russians began to visit the group, chiefly for walruses, seals, foxes, reindeer, bears, and birds; their huts and crosses are met with at very many places on the coast. Many wintered for several consecutive winters. Since 1830 their visits have almost ceased. The Norwegians began to visit the archipelago about 1795, and their small vessels now visit the Spitzbergen waters in considerable numbers. In 1822 a party wintered successfully, but later attempts have for the most part proved fatal on account of scurvy. To these experienced arctic navigators—assisted by Norwegian savants—we are indebted for so many important discoveries in the Barents, Kara, and Siberian Seas.

Several expeditions have made Spitzbergen their base in attempts to reach the north pole. The Russian admiral Tchitchagoff visited it twice, in 1765 and 1766, and reached 80° 28' N. lat. John Phipps mapped the north of Spitzbergen in 1773, and reached 80° 37' N. lat. In 1814 Buchan and Franklin reached 80° 34' to the north of the archipelago. Clavering and Sabine in 1823 explored the islands, and Sabine made his remarkable magnetic observations, while Clavering reached 80° 20' N. lat. Parry, shortly after his return from his third voyage, went to Spitzbergen and reached 82° 44' N. lat. on sledges. In the same year the Norwegian geologist Keilhau visited the group and has related his experiences in a remarkable book, *Reise i Ost og West Finmarken*. The Swedish professor Lovén was the first to undertake, in 1837, dredging and geological explorations in Spitzbergen and its vicinity. Next year a body of French, Swedish, Danish, and Norwegian naturalists, among whom was Charles Martins, visited the western coast. From 1853 onwards the archipelago has been the object of a series of scientific expeditions. At the suggestion of Lovén, Otto Torell, accompanied by Nordenskjöld and Quennerstedt, opened the series, making many important observations and bringing home rich geological collections. In 1861 a larger expedition led by Torell, Nordenskjöld, Malmgren, Chydenius, and Petersen set out with the object of finding how far it was possible to obtain a measurement of an arc of meridian of sufficient extent. This aim was only partly accomplished, but the expedition returned with an invaluable stock of various observations. The work of the measurement of the arc was completed in 1864 by another expedition conducted by Nordenskjöld, assisted by Malmgren and Duner, who returned again with a vast number of new and important observations. This expedition was followed in 1868 by that of the "Sofia," under Nordenskjöld, having on its scientific staff Holmgren, Malmgren, and F. Smitt, zoologists; Berggren and Fries, botanists; Lemström, physicist; and Nauckhoff, geologist. They were prevented by ice from getting higher than 81° 42' N. lat.; but, to use Oswald Heer's words, the expedition "achieved more and gave a wider extension to the horizon of our knowledge than if it had returned merely with the information that the 'Sofia' had hoisted her flag on the north pole." In 1870 two young Swedish savants, Nauckhorst and Wilander, visited Spitzbergen in order to examine the phosphoric

deposits, and two years later a colony was formed in Ice Fjord, and a small railway constructed to work the beds. The attempt, however, did not prove successful. Mr Leigh Smith and the Norwegian Captain Ulve visited and mapped parts of East Spitzbergen in 1871, returning with valuable information. They reached 81° 24' N. lat. In the same year Mr Lamont visited the archipelago. In 1872 a great polar expedition set out to winter on Spitzbergen with the intention of attempting in the spring to advance towards the pole on sledges drawn by reindeer. But the expedition encountered a series of misfortunes. The ships were beset in the ice very early in Mussel Bay, and six Norwegian fishing vessels having been likewise overtaken and shut in, the expedition had to feed the crews on its provisions and thus to reduce the rations of its own men. The reindeer all made their escape during a snow-storm; and, when the sledge party reached the Seven Islands, they found the ice so packed that all idea of going north had to be abandoned. Instead of this, Nordenskjöld explored North-East Land and crossed the vast ice-sheet which covers it. The expedition returned in 1873 with a fresh store of important scientific observations, especially in physics and submarine zoology. In 1873 Drasche, the geologist, paid a short visit to Spitzbergen, and the Dutch polar expedition approached it in 1882. In 1882 the Swedish geologists Naathorst and De Geer made a journey to which we are indebted for most interesting data about the flora of the islands. In the same year a polar meteorological station was established at Cape Hordsen for carrying on the observations desired by the international polar committee. The year 1883 being very favourable, the Norwegian walrus-hunters Andreassen and Johannessen pushed to the north-east of Spitzbergen and discovered new land to the north-east of the archipelago apparently extending as far as 39° E. long.

Bibliography.—The literature of the subject is very voluminous, and for full bibliographical details reference must be made to such works as Chydenius's *Svenska Expeditionen til Spetsbergen*, translated into German by Passarge (Gena, 1869); A. Leslie's *Arctic Voyages of A. E. Nordenskjöld* (London, 1879); and Chavanne's *Bibliographie der Polar-Regionen*, 1878. The earliest maps of Spitzbergen up to 1864 have been reprinted in a Dutch publication (*Tijdschrift van het Aardrijkskundig Genootschap te Amsterdam*, pt. II.); it contains the maps of 1596, 1612, 1625, 1634, 1642, 1648, and so on. Petermann's *Mittheilungen*, with *Ergänzungshefte*, the *Geographische Jahrbücher*, the *Iner* (Journal of the Swedish Geographical Society), and the *Journal of the Roy. Geog. Society* contain more or less detailed accounts of all the Swedish expeditions up to date. The scientific results of the Swedish expeditions are embodied in very many papers, amounting to from 6000 to 7000 printed pages, reference to which will be found in the above-mentioned works and periodicals. Oswald Heer's *Flora Fossilis Arctica* deserves special mention. Every volume of the memoirs and proceedings (*Handlingar* and *Förhandlingar*) of the Swedish Academy of Sciences contains some remarkable contributions to our scientific knowledge of the far north, and the same can be said of many volumes of the Christiania Academy of Sciences and the Swedish Geological, Botanical, and Zoological Societies. (P. A. K.)

SPLEEN. See VASCULAR SYSTEM. For diseases of the spleen, see PATHOLOGY, vol. xviii. p. 376 sq.; also MALARIA and WOOL-SORTER'S DISEASE.

SPOHR, LUDWIG (1784-1859), violinist and composer, was born at Brunswick on 25th April 1784, but spent his childhood at Seesen, where in 1789 he began to study the violin, and worked so industriously that at six years old he was able to take the leading part in Kalkbrenner's trios. He received his general education at the Brunswick grammar-school,—taking lessons on the violin from Kunisch and studying composition under Hartung. The little he learned from the last-named professor was the only theoretical instruction he ever received, for, as he himself tells us, he taught himself to compose by studying the scores of Mozart. After playing a concerto of his own at a school concert with marked success, he was placed for a time under Maucourt, the leader of the duke's band; and so rapid was his progress that in 1798 he was able to start on his first artistic tour. This proved a failure; but on his return to Brunswick the duke gave him an appointment in his band, and defrayed the expense of his future education under Franz Eck, in company with whom he visited St Petersburg and other European capitals. His first violin concerto was printed in 1803. In that year Spohr returned to Brunswick and resumed his place in the duke's band. A visit to Paris was prevented by the loss of his favourite violin,—a magnificent Guarnerius, presented to him in Russia. Having played in Berlin, Leipsic, Dresden, and other German towns, his increasing reputation gained for him in 1805 the appointment of leading violinist at the court of the duke of Gotha. Soon after this he married his first wife, Dorette Scheidler, a celebrated harpist. At Gotha he composed his first opera, *Die Prüfung*, but did

not succeed in placing it on the stage. *Alruna* was equally unfortunate, though it was rehearsed with approval at Weimar in 1808. During this year Spohr accomplished one of the most extraordinary musical exploits on record. Hearing that Talma was performing at Erfurt before the reigning princes assembled for the famous congress, and failing in his attempt to obtain admission to the theatre, he bribed a horn-player to send him as his deputy; and, though he had never touched a horn in his life, he learned in a single day to play it so well that in the evening he was able to fulfil his self-imposed duty without exciting suspicion or remark. Spohr's third opera, *Der Zweikampf mit der Geliebten*, written in 1809, was successfully performed at Hamburg in the following year. In 1811 he produced his (first) *Symphony in E♭*, and in 1812 composed his first oratorio, *Das jüngste Gericht*.¹ It was while employed in the preparation of this work that he first felt the inconvenience inseparable from an imperfect theoretical education; and, with characteristic energy, he set about the diligent study of Marpurge's *Abhandlung von der Fuge*.

In 1812 Spohr visited Vienna, where his splendid violin-playing created a profound sensation, and he was induced to accept the appointment of leader of the orchestra at the Theater na der Wien. He then began the preparation of his greatest dramatic composition, *Faust*, which he completed in 1813, though it was not performed until five years later. His strength as a composer was now fully developed; and the fertility of his imagination enabled him to produce one great work after another with astonishing rapidity. He resigned his appointment at Vienna in 1815, and soon afterwards made a tour in Italy, where he performed his eighth violin concerto, the *Scena Cantante nello Stilo Drammatico*,—the finest of his compositions for his favourite instrument. The performer was described by the leading critics of the country as "the finest singer on the violin that had ever been heard." On Spohr's return to Germany in 1817 he was appointed conductor of the opera at Frankfurt; and in that city in 1818 he first produced his dramatic masterpiece, *Faust*. The favour with which this was received led to the composition of *Zemire und Azor*, a romantic piece founded on the story of *Beauty and the Beast*, which, though by no means equal to its predecessor in merit, soon attained a much higher degree of popularity. There can, indeed, be no doubt that *Faust* suffered from the very first from the weakness of its miserable libretto. Had the words been worthy of the music *Faust* would have taken rank among the finest German operas in existence.

Spohr first visited England in 1820, and on 6th March played his *Scena Cantante* with great success at the first Philharmonic concert. At the third he produced a new *Symphony (No. 2) in D minor*, written expressly for this occasion, which is remarkable as the first on which the conductor's *bâton* was used at a concert of the Philharmonic Society. Spohr's new symphony met with an enthusiastic reception, as did the earlier one (No. 1, in E♭), which was played, together with his *Nonetto*, at the last concert of the series. Indeed he had a triumphant success both as composer and as *virtuoso*; and he on his side was delighted with the performances of the Philharmonic orchestra. Before leaving London he gave a farewell concert, at which Madame Dorette Spohr played on the harp for the last time. Her health at this period was so delicate that she was recommended to exchange her favourite instrument for the less fatiguing pianoforte; and Spohr, with his accustomed facility, wrote a number of pieces for pianoforte and violin, which the husband and wife played

¹ Literally *The Last Judgment*, but not to be confounded with the oratorio now so well known by that name in England.

together with perfect artistic sympathy. After supplementing his visit to England by a short sojourn in Paris, Spohr returned to Germany and settled for a time in Dresden, where German and Italian opera were flourishing side by side under the direction of Weber and Morlacchi. His artistic relations with the composer of *Der Freischütz* were not altogether satisfactory; nevertheless Weber did not hesitate to recommend him strongly to the elector of Hesse Cassel as "kapellmeister." Spohr entered upon his duties at Cassel on 1st January 1822, and soon afterwards began the composition of his sixth opera, *Jessonda*, which he produced in 1823. This work—which he himself always regarded as one of his best productions—marks an important epoch in his career as a dramatic composer. It was the first opera he ever wrote with accompanied recitative throughout in place of the usual spoken dialogue; and by a remarkable coincidence it was produced in the same year as Weber's *Euryanthe*, a work characterized by the same departure from established custom. Unhappily Weber's early death prevented him from making a second essay in the same direction; but Spohr consistently carried out the idea in his later operas, and always with marked success.

Spohr's appointment at Cassel gave him the opportunity of bringing out his new works on a grander scale and with more careful attention to detail than he could have hoped to attain in the service of a less generous patron than the elector. And he never failed to use these privileges for the purpose of doing justice to the works of other composers. Soon after his instalment in his new office Mendelssohn, then a boy of thirteen, visited Cassel with his father; notwithstanding the disparity of their years, a firm and lasting friendship sprang up between the rising genius and the already famous composer, which ceased only with Mendelssohn's death in 1847; and in other similar cases Spohr always proved himself ready to appreciate and foster the talent displayed by others, though it must be admitted that as a critic he was very difficult to please. The success of *Jessonda* led him to produce in 1825 a seventh opera—*Der Berggeist*—founded upon the old German legend of Rubezahl, the ruling spirit of the Riesengebirge. Though less popular than its predecessor, this fine work attained a very fair success. But a far greater triumph awaited the composer at the Rhenish musical festival held at Düsseldorf in 1826. On this occasion his oratorio *Die letzten Dinge* met with so enthusiastic a reception that it had to be repeated a few days later for the benefit of a charity. This work, known in England as *The Last Judgment*, is undoubtedly the greatest of Spohr's sacred compositions, and is remarkable as the first oratorio in which the romantic element is freely introduced, with marked success throughout, and without detriment either to the solemnity of the subject or the sobriety of style which has always been regarded as an indispensable characteristic of sacred music of the highest order. In 1827 Spohr produced his eighth opera, *Pietro von Abano*, the plot of which depends for its chief interest upon the resuscitation by the famous necromancer of a lady long since dead and committed to the tomb. The work met with a fair, though not a lasting, success; and the same may be said of a much finer opera, *Der Alchimist*, produced in 1830. Spohr's next publication was of a very different character. His *Violin School*, produced in 1831, is so useful as a code of instruction for advanced students that there is probably no great violinist now living who has not been more or less indebted to it for the perfection of his technique. It holds with regard to the violin a position no less important than that which Cramer's *Studies* has so long held in connexion with the pianoforte.

The year 1833 Spohr spent in the preparation of a new