colours with different intensities of light (Pfluger's *Archiv*, v. 24, p. 189). From a large number of measurements it was found that, on an average, the red-colour sensation first occurred with a light-quantity equal to $\frac{1}{1233}$, while for blue the lowest amount of light was $\frac{1}{19735}$. Thus blue gives a sensation with an amount of light sixteen times less than that required for red. With rise in the degree of brightness, the increase of sensibility to red proceeds pretty regularly; but for blue the increase becomes gradually greater (with the weakest degrees of bright ness this increase was = 0·22, with the strongest 0·82, with the mean 0·36). Comparing the two sensibilities together, from the maximum of light strength to the minimum, the sensibility to blue is always found to exceed that to red (maximum thirteen and a half times, minimum sixteen times, mean four times).

ISOETES LACUSTRIS.—In an interesting paper read before the Academy of Sciences of Paris (January 10, 1881), M. E. Mer calls attention to the peculiar conditions under which different forms of this fresh-water plant seem to originate in the Lake of Longemer. The basin of this lake was once occupied by a glacier, and now presents several different sorts of bottom. The soil to a depth of two to three metres is composed in part of a gravel formed of rock *débris* united by an iron cement, in part of ancient moraines, or where near the surface these will be mixed with the remains of plants and form a pretty tenacious mud. In all these situations Isoetes is to be found, but the plants differ most remarkably both as to their form, their structure, and their mode of reproduction as they are found in the different habitats. Taking the leaf-development as a guide, four varieties are easily discerned:—(1) *humilis*, growing sparsely in the gravel and sterile shallows, the leaves are not only few in number, but always of diminutive dimensions; sporange generally wanting or represented by a small cellular mass which rarely ever forms a propagule, and then these with puny leaves; (2) *stricta*, found on the borders of the lake or in the old alluvial, therefore in less sterile quarters than the preceding; leaves more numerous, stout, but still of small size; (3) *intermedia*, growing on ground formed of a mixture of mud and clay, either on the borders of the lake or at a depth of from one to two metres, leaves quite intermediate in character between the previous variety and the next; (4) *elatior*, growing on the clayey depths, with long leaves. The first form is always found isolated, and as to its asexual reproduction there is nothing more to be said; but the other three, according as they are subject to more or less heat, present each three varieties characterised by the mode of reproduction. 1. *Sporifera*, isolated individuals, mostly furnished with well-developed sporangia, stem large, roots numerous, leaves large. 2. *Gemmifera*, few fertile sporangia, but most of the leaves are furnished with propagula, and these well furnished with leaves, generally dextral, stem fairly developed. 3. *Sterilis*, individuals growing in compact masses, stems and roots slender, leaves not numerous, long and narrow, fertile sporangia very rare, and more often undeveloped masses of cells or abortive propagula. It would seem as if these facts had a practical interest to the collector, who may find in them a guide as to where to look for fertile specimens.

GEOGRAPHICAL NOTES

ON Friday, April 1, the French Geographical Society held a meeting in the large hall of the Sorbonne for the reception of Dr. Lenz on his return from Timbuctoo. M. Milne-Edwards was in the chair. Dr. Lenz, as our readers know, has been very successful, although his conclusions are adverse to the construction of a railway from the Niger to Algeria throughout the Sahara. On the following morning the Society received a telegram stating that Col. Flatters had been murdered by Touaregs at some distance from the Lebhkha Amagdor. In the evening the sad news was confirmed by an official message, stating that four starving Arabs from the mission had arrived at Ouargla, and that the Khobfa had left with four hundred mehari and camel horsemen to rescue the survivors, who were besieged south of Messaguer in the Touat region proper. Happily the news of the disaster to Col. Flatters' expedition has not yet been further confirmed, and authorities in Paris are inclined to believe that it has been much exaggerated, and that the story of the four natives has many elements of suspicion about it.

DR. LENZ, in his lecture at Paris, gave some interesting details on the present condition of Timbuctoo. Its houses are built of brick, and the population is now only 20,000. It has greatly decayed, and the inhabited part of the town is surrounded by great spaces covered with ruins. There are numerous schools and rich libraries. Dr. Lenz had a cordial reception, and every night during his twenty days' stay he was present at religious conferences which the learned men of the city held with his interpreter; the commentaries on the Koran formed the only subject of conversation. Timbuctoo is united with the Niger, six miles off, by a series of lakes, formerly canals. Dr. Lenz has also made some interesting observations on the Sahara, tending to confirm the conclusions of Rholfs and other recent scientific travellers as to the variety which is to be met with in the great desert. It is really a plateau about 300 metres in altitude, no part of it being below the level of the sea. Granite hills, sandy plains, shallow lakes, fertile oases, alternate over nearly the whole surface, while beasts of prey are rarely to be met with. Dr. Lenz will contribute a full account of his journey to the Berlin Africa Society, in whose journal many of his letters have already appeared.

IT is with sincere regret that we record the death of Lieut. Karl Weyprecht, at the age of forty-three, on March 29, of consumption. Lieut. Weyprecht will be known to our readers as the discoverer, with Lieut. Payr of Franz-Josef Land, in the Austro-Hungarian Expedition of 1872–4. His observations on the aurora borealis were of especial value, and he has published several papers on the subject. He was also the originator of the scheme for establishing a series of international observations around the Pole, which is likely to be realised next year.

THE Rev. G. Brown, the well-known representative of the church militant in the South Pacific, contributes to the new number of the Geographical Society's *Proceedings* a paper descriptive of a recent journey which he has made along the coasts of New Ireland and the adjacent islands, the latter including Sandwich Island, Portland Islands, and New Hanover. Dr. Benjamin Bradshaw, who has spent some years in collecting natural history specimens in the Upper Zambesi region, also contributes a brief paper on the Chobe River, together with a sketch-map of a portion of its course, adding materially to our knowledge of the geography of this region. Mr. Crocker's paper on Saráwak and Northern Borneo, lately read before the Society, is also given, and is illustrated with a good map. The geographical notes are full of interesting matter, one giving an account, by Mr. Sibiriakoff himself, of the voyage of the *Oscar Dickson* to the Yenisei Gulf in 1880. Another furnishes conclusive proof of the usefulness of the course of scientific instruction provided by the Council for intending travellers in foreign countries. From the last note we learn that Mr. C. R. Markham, the indefatigable secretary, is preparing for the forthcoming volume of the *Journal* a sketch of the Society's work in the past fifty years.

IN the current number of *Les Missions Catholiques*, Père Richard, a missionary in Algeria, commences an account of his journey, in company with Père Kermabon, among the Tuareg-Azguer tribes of the Sahara. The object of their journey was to study this almost unknown region, and to cultivate friendly relations with the chiefs and people generally with a view to the formation of a missionary station. The more interest attaches to Père Richard's narrative, as it deals with the very region which Col. Flatters has been now exploring with the object of settling the best practicable route for the projected Trans Sahara railway. An entirely new map of this part of Africa, based on Père Richard's notes, accompanies the number.

A LATELY-ISSUED batch of *Reports* from H.M. Consuls (Part vi. of last year) contains useful geographical information respecting portions of South America, that relating to Chili and Peru being specially interesting at the present moment.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—On the 31st inst. the honorary degree of LL.D. was conferred on Prof. Helmholtz of Berlin at a special congregation.

Prof. Humphrey will take his usual May classes for the second M.B. and Natural Sciences Tripos next term, and the demonstrator will give demonstrations of the organs.

Prof. Babington will lecture on botany four times a week next term, beginning April 26. Mr. Hillhouse will give lectures on

morphology and systematic botany, with practical work in the Botanical Gardens.

The Demonstrator of Comparative Anatomy will take an advanced class for instruction in the mammalia during the Easter term.

Prof. Stuart next term opens his new workshops and drawing office; in the latter instruction will be given in mechanical drawing and in machine designing, and also in graphical statics and its application to the theory of structures.

Mr. Garnett will commence an elementary course of lectures on electricity and magnetism on May 2 in the chemical laboratory of St. John's College.

The Senate has approved of Lord Rayleigh's appointment of two joint demonstrators of physics instead of one, and of the payment of a stipend of 100*l.* to each.

Mr. Balfour will lecture on the embryology of aves and mammalia next term, and have a practical class in that subject.

THE Court of Assistants of the Haberdashers' Company have have given to each of the schools under their management a cabinet of minerals, purchased from the executors of the late Prof. Tennant. The schools of the Company are at Monmouth, Newport, Hatcham, and Hoxton.

SCIENTIFIC SERIALS

Annalen der Physik und Chemie, No. 3.—Constants of elasticity of fluor-spar, by H. Klang.—On the source of beats and beat-tones in harmonic intervals, by R. Koenig.—Description of a beat-tone apparatus for lecture experiments, by the same.—Contribution to the theory of resonance, by F. Kolacek.—Some applications of the law of dispersion to transparent, semi-transparent, and opaque media, by E. Ketteler.—Researches on the spectra of gaseous bodies, by F. Lippich.—On the electromotive force of galvanic combinations formed of zinc, sulphuric acid and platinum, or copper, silver, gold, or carbon, by C. Fromme.—On a new form of the Töpler mercury pump, and some experiments made with it, by E. Bessel-Hagen.—Researches on the height of the atmosphere and the constitution of gaseous heavenly bodies (continued), by A. Ritter.—On absorption of solar radiation by the carbonic acid of our atmosphere, by E. Lecher.—On the idea of galvanic polarisation, by W. Beetz.—On an artificially-formed body which takes polar directions and shows polar attractions, by W. Holtz.

Zeitschrift für wissenschaftliche Zoologie, vol. xxxv. part 2, February, 1881.—Dr. H. Adler, on the alternation of generations in the oak-gall insects, pp. 150-246, a very exhaustive treatise, with two admirably-coloured plates of the galls and one of the ovipositors, &c., of the gall-insects.—Hans Virchow, on the vessels in the eye and the appendages of the eyes in frogs, with two plates. Elias Metschnikoff, researches on the Orthonectidæ, with a plate.—Jos. Th. Cattie, contribution to a knowledge of the chorda supra-spinalis of the lepidoptera and of the central, peripheral, and sympathetic nerve systems in caterpillars, with a plate.—Dr. H. Bolau, on the pairing and propagation of a species of the genus Scyllium.—N. Kleinenberg, on the origin of the ova in Eudendrium (with a woodcut).

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 24.—"Observations on the Locomotive System of Echinodermata." (The Croonian Lecture.) By G. J. Romanes, M.A., F.R.S., and Prof. J. C. Ewart, M.D.

The principal results had reference to the tube-systems and nervous systems of the echinoderms. It was shown by injection that the ambulacral system and the so-called blood-vascular system are each closed systems, save at their common origin in the madreporic plate. Both systems communicate through this plate with the internal medium, but the one much more freely than the other, the ambulacral system being the least patent, so that it is only when a pressure of two feet is maintained for a number of hours that the injected fluid slowly permeates the stone-canal, or sand-tube, to ooze through the madreporic plate. Regarding the nervous system, it was found in Echinus that lateral branches arise from the five radial trunks to escape with the pedicels through the apertures of the pore plates. Each of these branches then courses down the pedicel, with which it escapes to the terminal sucker. From these lateral branches there also arises an intimate nerve-plexus, which covers the whole external surface of the shell, lying almost immediately beneath the surface epithelium, and extending from the shell to all the spines and pedicellariæ. In stained specimens the nerve-fibres and cells were traced to the capsular muscles at the bases of the spines, and delicate fibres were detected running up the spines and pedicellariæ, immediately below their epithelium. In the case of the pedicellariæ it appeared from several preparations that delicate fibres extended as far as the sensitive epithelial pod situated on the inner surface of each trident mandible, a short distance from the apex.

Such being the principal morphological results, the paper went on to detail a number of physiological experiments. First it was pointed out that the natural movements of echinodermata exhibit a high degree of co-ordination. Thus, for instance, all the echinoderms are able when inverted on a flat floor to right themselves. The common starfish does this by twisting the ends of two or more of its rays round, so as to bring the terminal suckers into action upon the floor of the tank, and then by a successive and similar action of the suckers further back in the series the whole ray is progressively twisted round, so that its ambulacral surface is applied flat against the floor. The rays which perform this action twist their spirals in the same direction, and by this concerted action drag the disk and the remaining rays over themselves as a fulcrum. Other species of starfish which have not their ambulacral suckers sufficiently developed to act in this way execute their righting movements by doubling under two or three of their adjacent rays, and turning a somersault over them, as in the previous case. Echinus rights itself when placed on its aboral pole, by the successive action of two or three adjacent rows of suckers—so gradually rising from aboral pole to equator, and then as gradually falling from equator to oral pole. Spatangus executes a similar manœuvre entirely by the successive pushing and propping action of its longer spines.

Experiments in stimulation showed that all the echinoderms observed sought to escape from injury in a direct line from the source of irritation. If two points of the surface are stimulated the direction of escape is the diagonal between them. When several points all round the animal are simultaneously stimulated the direction of advance becomes uncertain, with a marked tendency to rotation upon the vertical axis. If a short interval of time be allowed to elapse between the application of two successive stimuli the direction of advance will be in a straight line from the stimulus applied latest. If a circular band of injury be quickly made all the way round the equator of echinus, the animal crawls away from the broadest part of the band, *i.e.* from the *greatest amount* of injury.

The external nerve plexus supplies innervation to three sets of organs—the pedicels, the spines, and the pedicellariæ; for when any part of the external surface of echinus is touched, all the pedicels, spines, and pedicellariæ within reach of the point that is touched immediately approximate and close in upon the point, so holding fast to whatever body may be used as the instrument of stimulation. In executing this combined movement the pedicellariæ are the most active, the spines somewhat slower, and the pedicels very much slower. If the shape of the stimulating body admits of it, the forceps of the pedicellariæ seize the body and hold it till the spines and pedicels come up to assist.

And here we have proof of the function of the pedicellariæ. In climbing perpendicular or inclined surfaces of rock covered with waving seaweeds it must be no small advantage to an echinus to be provided on all sides with a multitude of forceps adapted, as described, to the instantaneous grasping and arresting of a passing frond; for in this way not only is an immediate hold obtained, but a moving piece of seaweed is held steady till the pedicels have time to establish a further and more permanent hold upon it with their sucking disks. That this is the chief function of the pedicellariæ is indicated by the facts that (1) if a piece of seaweed is drawn over the surface of an echinus this function may clearly be seen to be performed; (2) that the wonderfully tenacious grasp of the forceps is timed as to its duration with an apparent reference to the requirements of the pedicels, for after lasting about two minutes (which is about the time required for the suckers to bend over and fix themselves to the object held by the pedicellariæ, if such should be a suitable one) this wonderfully tenacious grasp is spontaneously released; and (3) that the most excitable part of the trident pedicellariæ is the inner surface of the mandibles, about a third of the way down their serrated edges, *i.e.* the part which a moving body cannot touch without being well within the grasp of the forceps.