proved that crystallisation is only caused by the introduction of a crystal of the substance, or of a strictly isomorphous substance. For example, fused salol (melting point 39°·5) cannot, at ordinary temperatures, be induced to crystallise by any of the usual means; but if a fine thread of glass be lightly drawn over a crystal of salol, it acquires the power of inducing crystallisation in the liquid; it loses it again by exposure to the air for a few minutes, by wiping with soft sheet india rubber, or by warming above 40°. There is, however, only a limited range of temperature below the melting point in which spontaneous generation of crystals is impossible; the liquid is here in stable equilibrium, except with respect to a ready-formed crystal. Ostwald proposes the name *metastable* for this condition. At still lower temperatures, crystals form spontaneously and without the presence of ready-formed nuclei; the equilibrium is here really labile. The analogy between the phenomena observed during the passage from the liquid to the solid condition, and those observed in the passage from gas to liquid, is pointed out. Notwithstanding the very minute quantity of substance required to start the crystallisation, Prof. Ostwald has succeeded in showing that it has a lower limit. The two methods employed (successive dilution with an indifferent solid substance in the way practised by the homœopathists, or evaporation of minute drops of successively more and more dilute solutions of the solid on a platinum wire, and introduction of the residues into the supersaturated liquid) gave practically identical results. With sodium chlorate solution, for example, containing 107 parts of the salt to 100 of water, the smallest quantity of solid, which would still induce crystallisation, was from a millionth to a ten-millionth of a milligram. The fact that a very minute quantity of ammonia alum induces crystallisation of a solution of potassium alum, instead of being itself dissolved, may be explained by supposing that the dissolved salt diffuses into the solid particle as soon as it comes in contact with the solution; a nucleus of the solid potassium alum having been thus formed, it continues to increase. This explanation is in agreement with the facts that only truly isomorphous salts are capable of forming solid solutions, and also that they alone are capable of mutually inducing crystallisation. For the statement and discussion of a proposition, which may be paraphrased as follows, the paper must be consulted. When a system passes from any given condition to a more stable one, it will not pass into the state which, under the circumstances, is the most stable, but into that which is nearest to the original state.

THE additions to the Zoological Society's Gardens during the past week include a White-throated Capuchin (*Cebus hypoleucus*) from Central America, presented by Sir Henry A. Blake, K.C.M.G.; a Pig-tailed Monkey (*Macacus nemestrinus*) from India, presented by Mr. W. B. Orme; an Egyptian Jerboa (*Dipus ægyptius*) from Egypt, presented by Mr. S. Whitehouse; a Kinkajou (*Cercoleptes caudivolvulus*), a Sharp-nosed Crocodile (*Crocodilus acutus*) from Venezuela, a Rough-eyed Cayman (*Caiman sclerops*), two Tuberculated Iguanas (*Iguana tuberculata*), a Black-pointed Teguexin (*Tupinambis nigropunctatus*), a Chequered Elaps (*Elaps lemniscotus*), an Anaconda (*Eunectes murinus*) from Trinidad, two —— Geckos (*Thecadactylus rapicauda*), a Cuvier's Scolecosaurus (*Scolecosaurus cuvieri*), an Agile Lizard (*Mabuina agilis*), three Thick-necked Tree Boas (*Epicrates ceuchris*), four Common Boas (*Boa constrictor*), five Cooke's Tree Boas (*Corallus cookii*), a Mocassin Snake (*Tropidonotus fasciatus*), a Boddaert's Snake (*Drymobius boddaerti*), a —— Snake (*Coronella calligaster*), a —— Snake (*Helicops angulatus*) from the West Indies, presented by Mr. R. R. Mole; an Anaconda (*Eunectes murinus*) from Trinidad, presented by Mr. F. W. Urich; an Indian Pigmy Goose (*Nettopus coromandelianus*) from India, a Laughing Kingfisher (*Dacelo gigantea*) from Australia, a Temminck's Snapper (*Macroclemmys temmincki*) from the Southern United States, deposited; six Mexican Quails (*Callipepla squamata*) from Mexico, purchased; two Egyptian Weasels (*Mustela subpalmata*), eight Shaw's Gerbilles (*Gerbillus shawi*), an Egyptian Jerboa (*Dipus ægyptius*), three Long-eared Hedgehogs (*Erinaceus auritus*), a Grey Monitor (*Varanus griseus*), nine Egyptian Cobras (*Naia haje*), eight Cerastes Vipers (*Cerastes cornutus*), a Rough-keeled Snake (*Dasypeltis scabra*), three Clifford's Snakes (*Zamenis diadema*), two Hissing Sand Snakes (*Psammophis sibilans*), ten Ocellated Sand Skinks (*Seps ocellatus*), four Vinaceous Turtle Doves (*Turtur vinaceus*), two Lesser Pin-tailed Sand Grouse (*Pterocles exustus*) from Egypt, received in exchange.

OUR ASTRONOMICAL COLUMN.

RESOLVING POWER OF TELESCOPES AND SPECTROSCOPES.—In the current number of the *Memorie della Società Degli Spettroscopisti Italiani* (vol. xxvi., 1897), Prof. F. L. C. Wadsworth discusses the question of the theoretical resolving power of optical instruments, distinguishing between four different cases. According to Rayleigh, the theoretical angular resolving power of any instrument having an aperture of width b is

$$\alpha = m\frac{\lambda}{b}$$

where α is the angle between two fine lines or points which can just be separated (a close double, for instance): λ the mean wave-length of the light employed, b the linear aperture of the instrument, and m a constant, varying according as the aperture is rectangular or circular. The spectral resolution of separation of a spectroscope can be determined from this formula by considering the dispersing train of prisms or gratings as a series of spectral images of the slit of the spectroscope. The four cases which are minutely dealt with are: (1) The resolving power (theoretical) of a spectroscope train for an infinitely narrow slit and monochromatic radiations, *i.e.* infinitely narrow spectral lines. (2) The resolving power (also theoretical) for a wide slit and monochromatic radiations. (3) The resolving power (limiting) for an infinitely narrow slit, but for lines of finite width $\Delta\lambda$. (4) The resolving power (practical) for a wide slit and non-monochromatic radiations, ranging for each line over a small value of $\Delta\lambda$, as in (3). This quantity represents the practical resolving power or purity of the spectrum.

The expression for the spectroscopic resolution for the second case differs from that obtained in the first by the presence of a new factor in the denominator of the former. The existence of this necessitates, as Prof. Wadsworth says, a considerable modification of certain statements based on the old formula of purity. Instead of a continual decrease with increase of slit width, the purity of the spectrum actually increases up to a certain point, and is equal to the theoretical resolving power of the instrument. On a further widening of the slit, the purity begins to diminish, but not so rapidly as previously supposed. This modification of the old idea requires, as he points out, a correction in Schuster's remarks on the practical purity of a bright-line spectrum, which gives the purity as 50 per cent. of the resolving power, and not 75 per cent., as Prof. Wadsworth now finds it must be. Other points of equal interest result from this new discussion, and are dealt with in this paper.

PHOTOGRAPHS OF METALLIC SPECTRA.—An investigation of considerable utility in astrophysics (*Sitzungsberichte der König, Preuss, Akad. d Wiss. zu Berlin*, March 4, 1897) has recently been concluded by Dr. O. Lohse in Potsdam. This consists in the determination of the wave-lengths of the lines in the spectra of cerium, lanthanum, didymium, thorium, yttrium, zirkonium, vanadium, and uranium, for the violet region 400 $\mu\mu$ to 460 $\mu\mu$. The spectra were obtained by photography with a spectroscope fitted with a prism filled with zimmtaethyl, the length of the resulting spectrum between the above wave-lengths measuring 180 mm. Spark spectra alone were investigated, and by means of a gas motor and dynamo a considerable strength of current was obtained. During the experiments it was found that the heat affected to an appreciable extent the refractive and dispersive power of the fluid in the prism, although it was not sufficient to be measurable with delicate thermometric instruments. The definition of the lines was therefore to some extent not very good; for the same reason, exposures longer than 70 seconds were not deemed advisable. These temperature variations made the measurements of wave-length a more difficult task than would have been the case had they been absent, but Dr. O. Lohse seems to have taken the greatest pains to overcome this point; the measures were based on the solar spectrum, Rowland's normal lines being adopted; while the spectrum of iron was used as a comparison. It is stated that the measures may be generally taken as accurate up to a tenth of an Angström unit (0·01 $\mu\mu$), and only in the cases of very dim or broad lines is this limit exceeded; the intensities are given on a scale of tenths. The communication concludes with tables of the wave-lengths thus obtained.

THE ROYAL GEOGRAPHICAL SOCIETY.

AT the anniversary meeting of the Royal Geographical Society, on May 17, the President, Sir Clements Markham, F.R.S., in place of the usual annual address, gave a review of the progress of British geography during the sixty years of the Queen's reign. The practice of delivering an anniversary address was commenced in 1837 by the then President, Mr. W. R. Hamilton, in the eighth year of the Society. The first presidential address took the form of a survey of the position of geography at the time, and now forms a suitable landmark by which to estimate the advance that has been made. The Ordnance Survey of the British Islands was fairly under way, and that of India was also in progress. Hydrographic surveys were being pursued by British ships in every sea, and the coasts of Africa had been charted. The whole interior of Africa, most of Australia, and immense territories in Asia and South America were absolutely unexplored. The whole science of oceanography, although created by Rennell, had not yet been recognised.

One of the first pieces of geographical research of the Queen's reign was the memorable voyage of Sir James Clark Ross to the antarctic regions in 1839-41, and this may be held to be the only antarctic expedition ever sent out. Of late years the necessity for an antarctic expedition has become more and more urgent, for many reasons, but chiefly because the science of terrestrial magnetism is at a standstill, owing to the absence of any observations in the far south during the last fifty years. The knowledge which would be acquired by such a magnetic survey will not only be of scientific interest, but will also be of practical importance to navigation. Deep-sea soundings, dredgings, temperatures of the ocean at various depths, meteorology, the distribution of marine organisms, are some of the investigations which would be undertaken by an antarctic expedition with reference to the ocean. Equally important objects would be to determine the extent of the south polar land, to ascertain the nature of its glaciation, to observe the character of the underlying rocks and their fossils, and to take meteorological observations on shore.

Since 1893 the most strenuous efforts have been made to induce the Government to send out another naval antarctic expedition, but without result. We have been told that officers cannot be spared from the ordinary routine of the fleet; that times are much changed from the days of the *Challenger's* commission, and are now much more unsettled. It is forgotten that the naval superiority of Great Britain, in the days of St. Vincent and Trafalgar, "lay not in the number of her ships, but in the wisdom, energy, and tenacity of her officers and seamen," and that these qualities are now to be acquired by such special service as is involved in an antarctic expedition. It is forgotten that in the good old times neither war nor the fear of war were any check to the despatch of naval expeditions of discovery. Captain Cook was sent on his third voyage at a time when France, Spain, Holland, and the American insurgents were all vainly banded together for our destruction. In the midst of the French revolutionary war, Captain Vancouver was calmly surveying the intricate straits and sounds of New Albion, and Captain Flinders was exploring the shores of Australia.

The duty which will not be undertaken by the Government, will now receive the special attention of the Society, which will not appeal in vain for co-operation to the patriotism and energy of private individuals in Great Britain, or to the Governments in Australasia.

In the arctic regions Englishmen have discovered the whole of the American side from Bering Strait to the north coast of Greenland, and have explored the intricate system of channels and straits which separate the numerous islands. They have thus thrown open to the knowledge of the world a vast amount of information in all branches of science, and have especially taken the largest share in preparing for the solution of the polar problem. Dr. Nansen, by his memorable drift of the *Fram*, has supplied what was needed to complete the means of comprehending what had previously been a mystery. For this great service to geography Nansen has received a special gold medal from the Society; and he has rendered ever memorable, in arctic history, the sixtieth year of the Queen's reign. It saw the solution of the north polar problem.

The main points in the history of the exploration of each continent were touched upon, and the part taken by the Society in the work made plain, the President summing up the results as follows.

"When we contemplate these immediate consequences of our geographical work, it will, I am sure, be felt by all who are connected with this great Society, that it occupies a position of national importance, a position which entails most serious duties and heavy responsibilities. It is our privilege to render frequent services to several departments of the Queen's Government; to take the lead in numerous enterprises, many of which are eventually recognised, in their results, as involving considerable benefits to the nation; and to prepare the means, by our great collections of books and maps, and by the facilities we can give for instruction, for others, including the authorities under Imperial guidance, to follow in our footsteps."

As regards the new departures in the work of the Royal Geographical Society, the President mentioned the institution of a diploma for proficiency in practical astronomy and surveying, and the according of a large measure of support to Mr. Mackinder's scheme of a London School of Geography.

The Royal medal awarded to Dr. G. M. Dawson was handed to Sir Donald Smith, the High Commissioner for Canada; that awarded to M. P. P. Semenoff was given to M. Lessar, of the Russian Embassy. The Danish Minister received the awards given to Dr. Thoroddsen and Commander Ryder, while Lieutenant Seymour Vandeleur received the Murchison grant in person.

THE IRON AND STEEL INSTITUTE.

THE annual spring meeting of the Iron and Steel Institute was held on Tuesday and Wednesday of last week, in the theatre of the Institution of Civil Engineers. There were twelve papers down on the list, as follows:—"On the Permeability of Steel-making Crucibles," by Prof. J. O. Arnold and F. K. Knowles; "On the Practice of the Combined Open-Hearth Process of Bertrand and Thiel," by E. Bertrand; "On the Agricultural Value of Sulphate of Ammonia from Blast-Furnaces," by F. J. R. Carulla; "On the Specific Heat of Iron," by Prof. W. N. Hartley, F.R.S.; "On Charging Open-Hearth Furnaces by Machinery," by Jeremiah Head; "On the 'Weardale' Reheating Furnace," by H. W. Hollis; "On the Effect of Phosphorus on Cold Shortness," by Baron Hanns Juptner von Jonstorff; "On the Determination of Hardening and Carbide Carbon," by Baron Hanns Juptner von Jonstorff; "On Malleable Cast Iron," by G. P. Royston; "On Carbon Changes connected with Malleable Cast Iron," by G. P. Royston; "On Microscope Accessories for Metallographers," by J. E. Stead, Member of Council; "On Central Blast Cupolas," by T. D. West.

Of these six were read and four discussed. Six papers were taken as read, and not discussed. The latter consisted of the papers of Messrs. Carulla, Hartley, Stead, and West, and the two papers of Baron Juptner von Jonstorff. Mr. Royston's papers were those read and not discussed.

The formal proceedings having been got through, and the report of the Council having been read, the past-President, Sir David Dale, introduced the new President, Mr. E. P. Martin, who, as is well known, is the manager of the Dowlais Iron Company of South Wales. Sir Frederick Abel was next presented with a Bessemer medal; and then the President proceeded to read his inaugural address. This was of an eminently practical nature, and gave a most interesting description of the growth of the iron and steel industry at Dowlais almost from the earliest times, these historic works having been established for over a hundred years. It is interesting to notice that in the year 1791 the quantity of coal consumed in making a ton of iron in