reference to a paper by E. Fraenkel, published in the *Deutsche Medicinische Wochenschrift*, on the treatment of fifty-seven cases of typhoid fever by injection of a sterilised culture of typhoid bacilli. Fraenkel states that the results obtainable by this method of treatment are superior to those of any other method which has been previously employed. The earlier the treatment commences the more successful are the results obtained. The injections are said to be perfectly harmless when made into the muscle, but cause much pain when introduced subcutaneously. Dr. Kellogg contributes an article on the "Relation of Modern Physiological Chemistry to Vegetarianism," which is to be continued. The other longer papers are chiefly of medical interest.

THE explosive halogen compounds of nitrogen form the subject of a memoir contributed to the current number of the *Berichte* by Dr. Seliwanow, of St. Petersburg. Pure trichloride of nitrogen, NCl_3, was prepared for the first time in a state of purity in the year 1888, by Dr. Gattermann, in Prof. Victor Meyer's laboratory at Göttingen. It was shown to be an oily liquid of so unstable a character that strong sunlight, or the light waves emanating from a powerful artificial source such as burning magnesium, instantly provoke its extremely violent explosive decomposition. By working in a dull light, however, Dr. Gattermann succeeded in weighing a quantity of the liquid and analysing it. He showed, moreover, that the crude liquid substance obtained by the action of chlorine on ammonium chloride is a mixture of two or perhaps three different chlorides of nitrogen, and that the pure trichloride is only to be obtained by subjecting this product, after removal of all sal-ammoniac by washing and subsequently draining from water, to the action of a rapid stream of chlorine. Iodide of nitrogen has frequently formed the subject of investigation, and last year Dr. Szuhay, of Buda-Pesth, showed that the substance obtained by adding excess of ammonia to a solution of iodine in potassium iodide consists largely of the compound, NHI_2. The existence of an iodide containing hydrogen had previously been indicated by Dr. Gladstone and M. Bineau, but it appears probable that in presence of excess of iodine, the tri-iodide NI_3 is also produced in large quantity. That halogen compounds of nitrogen containing likewise hydrogen are capable of existence would appear, therefore, to be fully proved by the work of Drs. Gattermann and Szuhay, and the latter chemist actually succeeded in preparing a silver derivative $NAgI_2$, a substance as explosive as the iodide of nitrogen itself. Dr. Seliwanow now brings forward evidence to show that the formation of chloride or iodide of nitrogen by the action of the halogens upon ammonia occurs in two stages, hypochlorous or hypo-iodous acid being first produced. When a dilute instead of a concentrated solution of iodine is employed, no separation of iodide of nitrogen occurs, and the solution is found to contain both ammonium iodide and hypo-iodous acid HOI; the latter is readily detected by means of a reaction with potassium iodide in which iodine is liberated, which Dr. Seliwanow has recently discovered during the course of his work on certain organic derivatives of this acid. Upon increasing the strength of the solution of iodine, iodide of nitrogen at length commences to be deposited, and this is found to occur at the expense of the hypo-iodous acid. Hence iodide of nitrogen appears to be formed directly by the action of ammonia upon the unstable hypo-iodous acid produced in the first stage of the reaction. A similar explanation is also shown to hold with respect to the formation of chloride of nitrogen. It is interesting to observe that Dr. Seliwanow actually proves the existence of hypo-iodous acid in a solution of ammonia, a fact which may perhaps be accounted for by the recent remarkable discovery of Prof. Victor Meyer that this so-called acid is really endowed with basic properties. When it does react with ammonia, the chief product, as above shown, is iodide of nitrogen. The two equations for the formation of the latter are formulated by Dr. Seliwanow as follows:—

$$NH_3 + I_2 + H_2O = NH_4I + HOI.$$
$$NH_3 + 3HOI = NI_3 + 3H_2O.$$

THE additions to the Zoological Society's Gardens during the past week include a De Filippi's Meadow Starling (*Sturnella de filippi*) from La Plata, presented by Sir Harry B. Lumsden, C.B.; two Common Peafowls (*Pavo cristatus*, ♀ ♀) from India, presented by Mr. Richard Hunter; a Chicken Snake (*Coluber quadrivittatus*) from Florida, U.S.A., presented by Master James W. Philips; a Common Boa (*Boa constrictor*), two Tree Boas (*Corallus hortulanus*), a Thick-necked Tree Boa (*Epicrates cenchris*), a Carinated Snake (*Herpetodryas carinatus*) from Trinidad, presented by Messrs. Mole and Urich; a Ring-hals Snake (*Sepedon hæmachates*), two Cape Vipers (*Causus rhombeatus*) from South Africa, presented by Mr. J. E. Matcham; a Jaguar (*Felis onca*, ♂) from South America, two Plumed Ground Doves (*Geopelia plumifera*), two White Storks (*Ciconia alba*), two Vivacious Snakes (*Tachymenis vivax*), two Four-lined Snakes (*Coluber quadrilineatus*), four Green Lizards (*Lacerta viridis*) European, four Dark Green Snakes (*Zamenis atrovirens*), two Glass Snakes (*Pseudopus pallasi*) from Dalmatia, purchased; two Senegal Touracons (*Corythaix persa*) from West Africa, received in exchange; two Barbary Wild Sheep (*Ovis tragelaphus*, ♀ ♀) born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE MOON'S APPARENT DIAMETER.—A recent number of *Ciel et Terre* (April 2) contains an article on the moon's angular diameter, by M. P. Stroobant, of which a translation, with copious notes, appears in the *Observatory* for May. The methods employed in the determination of the apparent diameter of our satellite are (1) micrometer measures, (2) meridian passages, (3) heliometer measures, (4) photography, (5) occultation of stars by the moon, (6) eclipses. A comparison of the principal results obtained during the present century by these various methods indicates that occultations give the most accordant values, and M. Stroobant remarks that the method of occultation is the only one in which the apparent diameter of the moon is not augmented by physical or physiological causes. Accurate observations of occultations indicate that the lunar diameter has a value lying between 31′ 5″ and 31′ 6″, but M. Stroobant urges that this approximation is not sufficient. He concludes by saying:—"The application of photography to the determination of the exact instant of disappearance or of reappearance of a star would permit, without doubt, the attainment of great precision, especially when these phenomena occur at the dark limb of the moon, or during eclipses, when a number of small stars can be observed. . . . . About every nineteen years the moon passes over the Pleiades in conditions more or less advantageous for observation; this phenomenon will occur next year. Might not the occasion be profitably used in securing a number of photographs at various observations? If these are sufficiently separated from one another, it would be possible to deduce a new value for the parallax of the moon."

GALE'S COMET.—This comet, for which we gave an ephemeris last week, is now very favourably placed for observation in the northern hemisphere. Its track lies from a point near ζ Hydræ (May 7) to near ζ Leonis (May 15). From South Kensington we have received the following report:—"The comet has been clearly visible to the naked eye for some days past, and when viewed with an opera-glass is quite a conspicuous object. Observed with the telescope it appears as a large slightly elongated nebulous mass with a central condensation, but with no obvious tail. The spectrum of the comet was observed by Mr. Fowler on May 7, and was seen to consist of the three carbon bands which have so frequently been recorded in other comets. The bands were found to be coincident with the corresponding bands seen in the spectrum of the blue base of a candle flame, at approximate wave-lengths 4736, 5165, and 5635. There was also a fairly bright continuous spectrum from the nucleus."

DENNING'S COMET.—M. L. Schulhof (*Astr. Nach.* 3227) has computed an elliptic orbit for the comet found by Mr. Denning on March 26, as the parabolic elements previously determined did not satisfy the observations. The period of the comet appears to be 6·745 years. According to the criterion published by M. Tisserand some time ago, the comet is identical with either Grischow's comet (1743 I.) or Blanpain's (1819 IV.), or it may be with both, for the identity of these two objects is admitted by some astronomers. M. Schulhof points out that it is desirable that Denning's comet, which is fading rapidly, should be followed so long as possible with large telescopes. Periodic comets can only throw light upon some obscure points in celestial mechanics and cosmogony when they have been observed during several apparitions. An ephemeris extending to May 15 will be found in NATURE, vol. xlix. p. 586.

STARS HAVING PECULIAR SPECTRA.—In *Astronomische Nachrichten*, No. 3227, Mrs. Fleming gives a list of five faint objects having spectra of Type V., that is, of bright lines, discovered from an examination of photographs of stellar spectra, taken at the Peruvian Station of the Harvard College Observatory, under the direction of Prof. S. J. Bailey. This brings the list of bright-line stars up to sixty. Two new nebulæ have also been found by means of the photographs of their spectra. The positions and descriptions of the objects are stated as follows:—

R.A. 1900. h. m.		Decl. 1900.		Description.
13 46·5	...	−66·1	...	Type V.
15 10·0	...	−45·17	...	"
17 11·8	...	−34·18	...	"
17 18·2	...	−43·24	...	"
17 38·2	...	−46·3	...	Gaseous nebula.
18 39·3	...	−33·27	...	Type V.
19 10·5	...	−39·47	...	Gaseous nebula.

THE IRON AND STEEL INSTITUTE.

ON Wednesday and Thursday of last week, the 2nd and 3rd insts., the annual spring meeting of the Iron and Steel Institute was held at the Institution of Civil Engineers; the President, Mr. E. Windsor Richards, occupied the chair. The following is a list of the papers set down for reading and discussion:—

"On the Physical Influence of certain Elements upon Iron." By Prof. A. O. Arnold.

"On the Capacity and Form of Blast Furnaces." By William Hawdon.

"On Scandinavia as a Source of Iron Ore Supply." By Jeremiah Head.

"On the Walrand Process." By G. J. Snelus.

"On the Results of Heat Treatment on Manganese Steel and their Bearing upon Carbon Steel." By R. A. Hadfield.

"On the Analysis of Steel." By H. K. Bamber.

"On the Application of Electricity as a Motive Power in the Iron and Steel Industries." By D. Selby-Bigge.

"On Methods of Preparing Surfaces of Iron and Steel for Microscopic Examination." By J. E. Stead.

"On the Relations between the Chemical Constitution and Ultimate Strength of Steel." By W. R. Webster.

The last four were taken as read. The usual formal proceedings having been transacted, the Bessemer gold medal for 1894 was presented to Mr. John Gjers, of Middlesborough, in recognition of his great services to the iron and steel industry.

The President then proceeded to deliver his address, which dealt chiefly with the economic side of iron and steel production. This industry appears to be passing through a period of extreme depression, more pronounced even than that of 1885. In the latter year the production of Bessemer steel rails was 706,583 tons. That year was designated at the time as a period of great depression, but in 1893 the production of rails was but 579,386 tons, whilst in 1892 the output was 43,550 tons lower even than in 1893. The price of these rails, which in 1886 was £4 13s. 10d. per ton, fell as low as £3 12s. in 1893. The question arose, the President said, whether this diminished demand was due to any falling off in quality of material, excellency in finished products, or increased cost of manufacture. From careful observations which he had made, Mr. Windsor Richards was convinced that our metallurgists and manufacturers still keep a foremost position. The loss of the continental trade was due solely to protective tariffs, and even the importation of continental rails was to be attributed to the same source, strange as it might seem. The reason for this is that to produce steel economically, it is necessary that it should be made in large quantities; in consequence of the protective tariff the continental manufacturer is freed from foreign competition at home, and can therefore obtain an exorbitant price for his goods. This enabled him to sell in foreign markets, where he had to meet competition, at a lower price than those who had not the same lucrative home market. In fact it was necessary to produce largely, and the surplus quantity could in this way be sold at what would otherwise be a loss. In face of these facts, the President said it was useless to expect relief by resource to labour-saving machinery and other methods of cheapening cost, and it was to be remembered that the foreign manufacturers could take these up as readily as we could. Technical education, he also seemed to think, would be powerless to avail us against the conditions he had pointed out. "Never," said the address, "since the organisation of this Institute (a period it may be mentioned of over twenty-five years) has the metallurgist experienced a more difficult time than the depression we are now passing through. Added to his commercial troubles were constant demands from the workmen for either higher wages or fewer hours of work. We may well anxiously look round to see where markets for our products, and employment for our workmen and capital are to come from." Some English steel makers have been building hopes on the relaxation of the American tariff, but these hopes the President looked on as fallacious, and indeed the United States steel makers have been passing through a period of greater depression than even we ourselves in this country. It is to our colonies, therefore, that Mr. Richards tells us we must look for relief, and he points out the vast field there is for the further development of rails in India, Australia, and Africa. The introduction of steel for rails has not proved an unmixed blessing for the iron and steel manufacturer. The President quoted an instance in which Goliath rails of 105 lbs. per yard had been laid down five years ago on a continental railway, and it was shown that on the basis of the wear already observed during those five years, such rails would last a century. The carbon in the steel was from ·4 to ·5. Rails are being laid down even harder than this, containing from ·6 to ·7 carbon. The extreme hardness obtained in this way entailed, the President said, an unnecessary risk. The address next went on to speak of the uncertainty of phosphorus analyses, and to the desirability of dealing with steel in large masses, in the ingot. He stated that Messrs. John Brown and Co., Sheffield, are having constructed a forging press for steel ingots, which will exert a force of 1000 tons, whilst ingots 6 ft. 9 in. square, and weighing up to 70 tons, are being dealt with by the forging press, the appliance used in handling them having a capacity of 100 tons.

The first paper read was by Mr. G. J. Snelus, and was on the Walrand-Legénisel process for steel castings. This process consists of adding to the metal in the converter at the end of the ordinary blow a definite quantity of melted ferro-silicon, then making the after-blow, turning down when the extra silicon has been burned out, and adding the ordinary final additions of ferro-manganese, &c., as circumstances required. The advantages of this process are that firstly an ordinary Bessemer pig can be used with 2 to 3 per cent. silicon, thus insuring a steel perfectly free from carbon; secondly, the combustion of the added silicon produces such a large amount of heat at the right time, and so rapidly that the metal becomes very fluid; the third advantage claimed is that as the silicon burns to a solid, it leaves the metal perfectly free from gas, and the steel is sound and free from gas cavities; fourth, that in consequence of the metal being so fluid and already free from oxide of iron, the ferro-manganese or other substances added, such as aluminium, are more effective and remain in the final steel. Another advantage secured by this process is that in consequence of the fluidity of the metal much more time and facility is given for casting operations. The author gave detailed descriptions of experiments he had seen made with this process, and quoted figures in support of his contentions. The system of casting is, however, confessedly expensive, and it would seem to be more especially suitable for those engineering works where it is desirable to have a steel foundry attached, and in which the demand would