

regions. A list of lines is also given for the near Infra-Red region.

Plates of the Iron Arc Spectrum till  $\lambda$  8824 are available after Meggers and Kiess' and Dingle has given a photograph till  $\lambda$  10,218.

The members of the International Astronomical

Committee are considering the question of the Iron Standard lines in this region and very soon standard wavelengths will be available.

My thanks are due to Prof. H. Kayser and Prof. H. Koenen for making their excellent libraries accessible to me and encouragement.

## Research Notes.

### Moments of Hypergeometric Series.

A. A. KRISHNASWAMI AYYANGAR obtains a general expression involving determinants for the moments of the Hypergeometric series about its mean (*J. Ind. Math. Soc.*, 1934, 1, 4). The author considers his formula to be more useful than the one given by Romanovsky (*Biometrika*, Vol. XVI) for the first six moments. The author also gives a recurrence formula for evaluating his determinants for higher moments.

In the same number of the *Journal* Brij Mohan Mehrotra has a short note on "Some Self-Reciprocal Functions," in which he formulates some corollaries of theorems published by him previously.

Ram Behari discusses an integral invariant connected with rectilinear congruences. Considering the ruled surface  $\xi = x + uX$ ,  $\eta = y + uY$ ,  $\zeta = z + uZ$  where  $(x, y, z)$  denotes a point on a closed curve, the invariant considered is  $p = \int_c (Xdx + Ydy + Zdz)$ . Several interesting properties of  $p$  and  $\frac{dp}{dS}$  are discussed.

### Artificial Radioactivity produced by Neutron Bombardment.

In the *Proceedings of the Royal Society*, 1935, 149, 522, Fermi and his collaborators have given a description of a further instalment of their interesting experiments on artificial Radioactivity. Having noticed that the activity produced by neutron bombardment is profoundly influenced by hydrogenated substances, they have systematically studied the effect of water on the activity of all the newly-produced radio-elements. There are some cases in which the activity is largely influenced as, for instance, Na, Al (2.3 m.), V, Ag, Cu, Rh and I; in others the influence of water is very small as in the case of Si, Al (10 m.), Mg, Mn and Zn. In every case in which the active element is known to be an isotope of the bombarded one (about 20 instances), they find that the activation is increased by the presence of

water. This result is explained by assuming that the slowing down of the neutrons by the protons contained in the hydrogenated substances makes it easier for these neutrons to be captured by the struck nucleus. In order to verify this hypothesis experiments were made to determine the absorbing power of various materials for slow neutrons and they found that the absorption was abnormally high in some instances as B, Y and Cd. Except in these cases of abnormal absorption it was found that each absorbed neutron produced one activated nucleus; the abnormal absorption is probably connected with the formation of stable isotopes. The mean energies of the activating neutrons have also been measured and all the results are given in a table at the end of the paper. The effect of non-hydrogenated substances is also to increase the activation by slowing down the neutrons but the effect is not so intense as in the case of hydrogenated substances. Another important result due to the new investigation is the conclusion that when a new radio-element isotopic with the struck nucleus is produced, the new nucleus is of higher atomic weight and results from the capture of the neutron. The separation of the radio-active isotope from the bulk of the bombarded element was also found possible since the activated molecules are left in an atomic or ionic condition. The method was employed in the case of bromoform, chloroform, carbon tetrachloride and sodium chlorate, to separate radio-active bromine and iodine. Radio-active arsenic was obtained from cacodylic acid and radio-active manganese from potassium permanganate. A systematic investigation of all the elements revealed a number of new facts both as regards the induced activities and the properties with respect to slow neutrons; all these are consolidated in a useful table at the end of the paper. The authors have also carried out new chemical tests on the products obtained by bombarding uranium and find further support for their previous claim about the production of transuranic elements. They

conclude that the 15 sec., 13 min., and 100 min. activities are due respectively to products with atomic numbers 92, 93 and 94 and atomic weight 239.

T. S. S.

#### Masses of Some Light Atoms.

AN accurate determination of the masses of some of the fundamental particles such as the proton and the neutron is a most important necessary preliminary work in a programme seeking to elucidate the nature of these particles. The values obtainable by considering the results provided by the mass-spectrograph and those deduced from considerations of the masses and energies of the particles taking part in a nuclear encounter seemed to be in conflict. But recently Aston has been constructing a new mass-spectrograph designed to study the masses of (light) atoms by comparing the positions of close doublets such as O and CH<sub>4</sub>, C<sup>++</sup> and D<sub>2</sub> etc. and has reported the result of some preliminary measurements in *Nature*, 1935, 135, 541. The values he obtains are much higher than those previously given by him and the difference he attributes to imperfect resolution in his older instrument. The new values are in agreement with those deduced by Oliphant, Kempton and Rutherford (*Proc. Roy. Soc.*) from a consideration of a number of nuclear reactions, particularly those arising when beryllium and boron are bombarded by deuterons. According to the new estimates, the mass of the neutron is slightly larger than that of the proton, but not so high as 1.0092 as estimated by Curie and Joliot. Possibly Wentzel's conclusion that the mass of the neutron is equal to that of the hydrogen atom is near the truth. The following table gives a comparison of the values found by Aston and those estimated by Oliphant, Kempton and Rutherford:—

	Aston	Oliphant <i>et al</i>
${}^1_0n$		$1.0083 \pm 0.0003$
${}^1_1H$	1.0081	$1.0081 \pm 0.0001$
${}^4_2He$	4.0041	$4.0034 \pm 0.0004$
${}^{12}_6C$	12.0048	$12.0027 \pm 0.0003$

T. S. S.

#### Absolute Rates of Migration of Ions.

THE moving boundary method for the determination of the transference numbers of ions is reliable only if the potential gradient under which the ions move is accurately

measured. Mukherjee and his co-workers (*J. Indian Chem. Soc.*, 1935, 12, 177) have developed a method for the accurate determination of the migration velocity of ions, involving a technique similar to the measurement of the cataphoretic speeds of colloidal particles as described by Mukherjee (*Proc. Roy. Soc.*, 1923, A 103, 102). Considering the boundary between hydrochloric acid solution and picric acid, it has been shown that with the movement of the ions under a potential gradient, the migration of the picrate ion increases with time while that of the chloride ion decreases. Though the boundary remains sharp during the interval of the observations, it has been shown that a slight mixing up of the solutions may account for large variations of the mobilities. Hence the initial migration velocity of the ions before mixing takes place with simultaneous measurement of the potential gradient across the boundary gives reliable values.

M. P. V.

#### Krypton Content of Atmospheric Air.

THE literature on the quantitative estimation of Krypton and Xenon in the atmosphere is very scanty. Sir William Ramsay, the pioneer research worker in rare gases of the atmosphere, published an estimate of the Krypton concentration (*Proc. Roy. Soc.*, 1900, 67, 329) and gave a value of  $1 \times 10^{-6}$  which was later on corrected to  $5 \times 10^{-8}$  and still another correction was made in a subsequent paper. His method was fractional distillation. Moureu and Lepape adopted the method of fractional adsorption on cocoanut charcoal and estimated by spectro-photometric examination of Krypton line in a "Plucker" discharge tube and gave the value of  $1.31 \times 10^{-4}$  Krypton: argon (parts by volume).

Dr. Brody and Dr. Körösy (*Trans. Faraday Soc.*, 1935, 31, 547) adopted a purely chemical procedure for the separation of the rare gases of the atmosphere, avoiding all doubts arising from fractional distillation or adsorption, obtained spectrograms of emission in an electric discharge and determined the relative intensity of the spectrum lines of Krypton in relation to some of the weaker argon lines. A series of argon-Krypton mixtures of known composition were prepared, the relative intensities of the same lines determined and the Krypton content of "air argon" calculated by interpolation. They arrive at the value of  $1.6 \times 10^{-4}$  Krypton:

argon. The argon content of air being 0.935 per cent. by volume, the Krypton content is  $1.5 \times 10^{-6}$  volume parts (i.e.,  $1.5 \times 10^{-4}$  per cent. by volume) the most accurate value up to the present as claimed by the authors.

K. S. R.

#### Chemical Composition of Root-Rot Affected Peas.

CHARACTERISTIC differences in the chemical composition of peas affected with root-rot as compared with peas from healthy plants are noted and discussed by Kertesz, Horsfall and Rouse in the *Journal of Agricultural Research*, Vol. 49, No. 9. The root-rot under reference is not due to any single organism but a complex comprising *Pythium* Spp. and *Rhizactonia solani* Kuhn. The striking difference in outward appearance, is the decidedly larger size of the affected peas in really all stages of ripeness, due, it is suggested, to the quicker translocation of Carbohydrates into the ovules. The injured root system seems to curtail the water, nitrogen and ash supply, which results in the setting of peas with a lower water-content and a lower ash and nitrogen contents in the dry matter.

A. K. Y.

#### Plant Growth as Influenced by the Deficiency of Available Soil Manganese.

CHLOROSIS associated with insufficient available manganese in the soil has been studied by B. E. Gilbert and the results of several years' experiments connect definitely Mn chlorosis with soil alkalinity (*Rhode Island Sta. Bul.*, 246). In the soils studied the critical range seemed to lie between pH 6.8 and 7.6, though it could not be linked with soil type. Crops differed greatly in their susceptibility. In certain cases Mn deficiency resulted in decreased yield without visible chlorotic symptoms.

Spraying the plants with sulphate of manganese at the rate of 8 lbs. per acre afforded a ready means of correcting the defect, as likewise in the alternative by manuring with the sulphate at the rate of 30 lbs. per acre; the effects of the manure did not persist, however, for more than a year as a corrective. Manuring with sulphate of ammonia or other means of counter-acting the effect of excessive liming also

acted as a preventive (abstracted from the *Expt. Stn. Record*, January 1935).

A. K. Y.

#### The Sugar Content and Odour of Clarified Extracts of Plants as related to Their Susceptibility to Insect Attacks.

INVESTIGATIONS tending to show that the susceptibility to attacks by the Japanese beetle (*Papillia Japonica* Newm.) is more in plants, the clarified extracts from which are low in their content of reducing sugars and which possess a fruity odour than in those whose extracts show a higher sugar content and possess no such fruity odour, are described by Metzger, Van der Meulen, and Mell in the *Journal of Agricultural Research*, Vol. 49, No. 11. The plant extracts were mostly from leaves, and with ethyl alcohol, the clarification being effected by lead acetate; the investigations related to 97 species and varieties of plants. The extent to which plant extracts of various kinds can act as an attractant or as a repellent affords a study of much economic value in combating insect pests either by the method of baiting and destroying or by that of keeping them off, and it will be a fruitful line of work if a study with this subject should be systematically undertaken in regard to crop pests of this country.

A. K. Y.

#### Kiln Drying of Wood with Ozonized Air.

THE use of ozonized air for kiln-drying of wood has been advocated, particularly in France, as it is claimed to give better results than the usual methods. The addition of a small quantity of ozone to the air has been supposed to accelerate and facilitate seasoning, especially in the case of refractory timbers. It has also been claimed that ozone-dried timber suffers less from seasoning defects and is less susceptible to atmospheric influences. In his little book of twenty pages, Mr. Kapur (*Indian Forest Records*, Economy Series, Vol. XX, Part XIII) describes the experiments carried out by him at the Forest Research Institute, Dehra Dun, on the kiln-drying of various species of Indian timber with ozonized air. Experiments with and without ozone carried out under otherwise identical conditions showed conclusively, that from the practical point of view, kiln-drying with ozonized air has

absolutely no advantages over the usual methods. In fact, the idea that ozonized air has any beneficial effect in seasoning wood is proved to be more or less a superstition.

C. V.

#### The Dutch Elm Disease.

A. W. McCALLUM, Forest Pathologist, has described (Pamphlet No. 159, New Series, Department of Agriculture, Canada) a fungus disease affecting the elms in the United States since 1930. Elms are commercially important in Canada and generally rank fourth among the hard-woods in regard to annual production. It is also one of the most valuable ornamental trees valued for its rapid growth, attractive form and moderate shade.

Sudden wilting and yellowing of leaves is one of the most characteristic external symptoms. The leaves get shrivelled, and become brittle and the disease, particularly in the case of big trees, may be confined to one or two branches at the commencement. Diseased trees often produce vectors along the main stem and the bases of large branches.

Internal symptoms consist of a broken or complete ring of brown dots in the cross-section of the sap wood. A longitudinal section will reveal brownish streaks varying in number according to the roots as well.

The fungus (*Graphium Ulmi*) is principally spread from tree to tree by means of spores adhering to the bodies of elm bark beetles and is also wind-borne. Control measures consist of decapitation of affected limbs in the case of partially affected plants but if the main stem is affected, nothing can be done to save the tree. To prevent the fungus from spreading to healthy trees, it is necessary to destroy those already infected. It is hoped the enforcement of such extreme control measures, if taken early enough, may result in the total elimination of the fungus.

M. S.

#### Rôle of *Tabanus Orientis* Wlk. and *Stomoxys Calcitrans* Linn. in the Mechanical Transmission of Rinderpest.

RINDERPEST being the most common and fatal of epizootics in India any addition to the existing knowledge of this dire disease

is most welcome. Bhatta has reported the results of his experiments to find out if *Tabanus Orientis* Wlk. and *Stomoxys Calcitrans* Linn. are incriminated in the transmission of this disease (*Indian Journal of Veterinary Science and Animal Husbandry*, 1935, 5, Part I). The experiments which were very carefully conducted have proved that *T. Orientis* can transmit the disease under natural conditions from the infected to healthy cattle although *S. Calcitrans* was found to be incapable of doing so. It had been known that *Glossina morsitans* was a confirmed vector of the disease in Africa. The present experiments have conclusively shown that *Tabanus* is involved beyond doubt in the transmission of the disease in India. The writer suggests further experiments with other species of biting and non-biting flies in order to conclude which of them are probable vectors so that necessary control measures may accordingly be adopted to check the spread of Rinderpest among bovines in this country.

S. D. A.

#### The Diet and the Brain in Fishes.

B. S. BHIMACHAR (*P. R. S.*, Series B, 1935, 177) has pointed out some interesting correlations between the feeding habits and the structure of the medulla oblongata in the South Indian Cyprinoid fishes. These fishes, according to their feeding habits, can be divided into two main groups—1. those which feed by taste, and 2. fish which feed by sight. In the former group the fishes are bottom feeders and the taste buds in pharynx (*Lepidocephali*) or on the barbels and the snout (*Nemachilus*) are responsible for sorting out food and correspondingly their nerve centres in the brain, either the vagal or the facial lobes, are very well developed in these forms. In the sight feeders (*Rasbora*, *Nauria*, *Danio* and *Chela*), the vagal and the facial lobes are very small and there is a well-developed central acoustic area or lobe.

#### The Brain of *Gadus*.

AN important contribution to our knowledge of the piscine brain has been made by H. Muir Evans (*P. R. S.*, 1935, 177), in his paper on the brain of *Gadus*. In the first part of the paper he describes in detail the medulla oblongata of the Whiting (*Gadus merlangus*) and compares it, with serial

sections of the corresponding regions, with that of the Roach. An attempt has been made in the second part to correlate the structure of the hind brain with the feeding habits of different *Gadidæ*.

The author lays considerable stress on the existence of true facial lobes in *Gadidæ* since their presence in these forms has been denied by previous workers. It has been stated that, while identifying the various lobes of the brain, important consideration has to be given to their histological structure in addition to the nerve trunks and their associated tracts. The somatic sensory area or the 5th lobe is very prominently developed in the predacious members of the *Gadidæ*, while the facial lobes are well developed in the forms which feed on crustaceans, molluscs and worms. The dentition is also modified according to the nature of the diet.

#### Basic Xenoliths and their Grain-size.

DURING recent years a large volume of literature has developed dealing with the various aspects of the basic xenoliths, but few people have attached any importance to the apparent relationship between the

grain-size of the xenolith and that of the host rock. This problem has been lately studied by Miss Joplin of Cambridge (*Geological Magazine*, No. 851, May 1935). She has made a detailed study of the xenoliths and their grain-size, and depending upon the work of such well-known petrographers as Nockolds, Tilley and Campbell Smith, she has come to the conclusion that in most cases xenoliths are more fine-grained than the host rock. This discrepancy is brought about by recrystallisation and hybridisation in rocks. Under the influence of thermal metamorphism, large mineral individuals are broken up into smaller granular units, thus bringing about a reduction in grain-size. Similar effects are produced in metamorphic rocks where poikilitic structure is so common. Discussing the case of hornblende in this connection, she has suggested that when criss cross flakes of biotite are developed it leads to a finer texture. Further it is interesting to note that at a late stage in the hybridisation of rocks, hornblende becomes so highly poikilitic that disruption is imminent, and a slight movement of the magma is sufficient to produce a fine-grained aggregate.

### Science Notes.

*Paraffin Films in the Study of Infra-red Absorption Spectra.*—Drs. N. R. Tawde, Y. G. Naik and D. D. Desai, of the Royal Institute of Bombay observe:—"Great difficulty generally presents itself in the preparation of paraffin windows for absorption chambers in the infra-red work. Essential factors in preparing a proper film are (i) the homogeneity of the film, and (ii) the thickness of the film.

"While studying the experimental technique of infra-red absorption measurements, we tried various methods of preparing such films. The process of preparing a film on the water surface was rather easy, but it had the following defects: (a) The film was not of uniform thickness, (b) it cannot be made very thin, for in doing so, it gets perforated, and (c) it is not homogeneous throughout, for there is every chance of water vapour remaining embedded within the film, thereby increasing the absorption of the infra-red radiation. After enclosing the HCl gas for about 24 hours in a chamber closed with this film, minute acid drops were formed on both sides of this film, showing that it was permeable to HCl gas for the thickness desired. It was therefore best if the films were quite free from any traces of moisture.

"M. Czerny (*Zeit. f. Physik*, 1927, 44, 235) and L. Kellner (*Zeit. f. Physik*, 1929, 56, 215) have described a method of preparing this film by pouring paraffin on a plate of glass which was previously heated, and on which, a thin membrane

of celluloid was spread. The film was taken out by removing and breaking off the celluloid membrane. The thickness of the film thus obtained was rather high, i.e., 1.2 to 1.5 mms. or even more.

"During our experiments, we thought of preparing the film by spreading paraffin on a clean surface of mercury which was kept at a suitable temperature. The advantages of using this method are found to be the following: (a) no trace of water will interfere; (b) the film is of uniform thickness throughout; (c) the film of any desired thickness can be formed; and (d) the film is not permeable to HCl gas or air. There is not the slightest trace of moisture on the outside surface.

"In order to test the homogeneity and uniformity of the thickness of such films, we have examined the absorption for heat rays, of the films prepared both on water and mercury surfaces. These were obtained with thickness within the desired range and examined for absorption at various sections of their area under identical conditions. The mean value of percentage absorption was determined in each case. The deviation of various readings from the mean showed that for the thickness desired for the purpose of these experiments, the paraffin films prepared on mercury surface give, on the whole, better results than those prepared on water surface. This can be verified from the following which is typical of the different sets of readings taken."