other half has twelve arcs of concentric circles drawn upon it. Each arc subtends an angle of forty-five degrees. In the first quadrant there are three such concentric arcs, in the next three more, and so on; the only difference being that the arcs are parts of circles of which the radii increase in arithmetical progression. Each quadrant thus contains a group of arcs differing in length from those of the other quadrants. The curious point is that when this disc is revolved, the impression of concentric circles of different colours is produced upon the retina. If the direction of rotation is reversed, the order of these tints is also reversed. The cause of these appearances does not appear to have been exactly worked out.

THE additions to the Zoological Society's Gardens during the past week include a Black Lemur (*Lemur macaco*, ♂) from Madagascar, presented by Mr. Roche; a Snowy Owl (*Nyctea scandiaca*), captured in mid-Atlantic, 700 miles from land, presented by Mr. Harston Eagle: two Levaillant's Cynictis (*Cynictis levaillanti*), two Domestic Sheep (*Ovis aries*, var.), two Puff Adders (*Vipera arietans*), a Cape Bucephalus (*Bucephalus capensis*), six Hispid Lizards (*Agama hispida*), five Rough-scaled Lizards (*Zonurus corydlus*), a Delalande's Lizard (*Nucras delalandi*), a Crossed Snake (*Psammophis crucifer*) from South Africa, two Bennett's Tree Kangaroos (*Dendrolagus bennethanus*) from North Queensland; an Allied Goshawk (*Astur approximans*), three Long-necked Chelodines (*Chelodina longicollis*), twenty-two Golden Tree Frogs (*Hyla aurea*), seventeen White's Tree Frogs (*Hyla cærula*) from Australia, a Spix's Macaw (*Ara spixi*) from North Brazil, deposited; two Caroline Conures (*Conurus carolinensis*) from North America, purchased; two Queensland Tree Kangaroos (*Dendrolagus lumholtzi*, ♂ ♀) from Queensland; four Brush Turkeys (*Talegalla lathami*, 4 ♂) from Australia, received in exchange.

OUR ASTRONOMICAL COLUMN.

THE PARALLAX OF NEBULA *h* 2241.—At the time when Dr. Wilsing took photographs of the nebula B.D. + 41°·4004 for the determination of parallax, he obtained also a series of negatives of B.D. + 41°·4773 (*h* 2241) for the same purpose. This nebula is almost ring-shaped, and displays a central condensation. The latter appears more distinct on the photographic plates than can be seen by eye observations, and its contour is only sufficiently sharp for micrometric measurements on the best plates, so that the centre of the whole apparent disc has been generally used. From June 1892 to August of the following year, 33 plates were obtained, 31 of which have been used in this research. Six comparison stars, the positions of which were taken from the Bonn zones, have been adopted. In the account of the result obtained (*Astro. Nach.* No. 3261), Dr. Wilsing gives a table showing the deduced distances of the nebula from the two comparison stars 3 and 6. A second table contains the mean monthly values of these distances with their differences from the whole *mean* value obtained from all the measurements, together with the most probable errors of the measurements.

The following table shows these differences between the total and monthly means for the two stars 3 and 6:

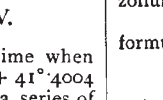
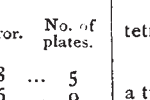
	[N, 3]	[N, 6]	Prob. error.	No. of plates.
	″	″	″	
1892 June 21 ...	−0·03 ...	+0·28 ...	±0·08 ...	5
July 13 ...	+0·11 ...	+0·03 ...	0·06 ...	9
Aug. 9 ...	+0·07 ...	−0·04 ...	0·13 ...	2
Sept. 25 ...	+0·01 ...	−0·06 ...	0·08 ...	5
Oct. 4 ...	−0·13 ...	+0·01 ...	0·13 ...	2
Nov. 8 ...	+0·20 ...	+0·03 ...	0·10 ...	3
Dec. 22 ...	−0·53 ...	−0·44 ...	0·18 ...	1
1893 Feb. 4 ...	−0·13 ...	−0·34 ...	0·18 ...	1
July ...	−0·08 ...	−0·19 ...	0·13 ...	2
Aug. ...	−0·53 ...	−0·14 ...	0·18 ...	1

These differences, when considered in relation with the probable errors of the measurements, have as Dr. Wilsing suggests, to be cautiously dealt with, and he is led to conclude from this series of measures that the relative parallax of this nebula does not exceed one or two tenths of a second of arc.

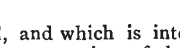
A POSSIBLE NEW ZONE OF ASTEROIDS.—The secular variations of the orbits of the four inner planets has lately occupied Prof. Newcomb's attention, with the result that several elements have been found to vary in a manner unaccounted for by existing theory. (*Astronomical Journal*, No. 327.) "These anomalies," says Prof. Newcomb, "cannot be simultaneously explained either by an intra-mercurial zone of planets, by the action of matter reflecting the zodiacal light, or by a deviation of gravitation from the usually accepted law. The uncertainty as to the mass of Mercury makes the construction even of a working hypothesis difficult; but apart from all considerations of probabilities, *à priori*, the hypothesis which best represents observations, is that of a ring of planetoids of small eccentricity a little outside the orbit of Mercury, and a little more inclined to the ecliptic. The total mass of the ring may range from one-fiftieth to, perhaps, one three-hundredth of the mass of Venus, according to its distance from Mercury." Prof. Newcomb intends to carefully investigate the matter in order "to decide whether the results of the hypothesis are such as to counterbalance its extreme improbability."

A NEW COMET.—*Edinburgh Circular*, No. 43, dated November 23, states that a telegram received from the Central Astronomical Station at Kiel announces the discovery of a very faint comet, by Mr. Edward Swift, at 8 p.m., Californian time, on the 20th inst. It was situated in Right Ascension, 22h. 18m. 24s., and South Declination, 13° 7′, and was moving slowly towards the east.

A NEW SERIES OF NITROGEN COMPOUNDS.

ANOTHER new series of nitrogen compounds, containing four atoms of that element along with one atom of carbon in a closed chain, are described by Prof. v. Pechmann and Herr Runge in the current *Berichte*. They are termed "tetrazolium" compounds, and the parent base of the series is tetrazolium hydroxide, whose constitution is represented by the formula  . The fundamental base itself has not yet been isolated; the compounds prepared comprise the derivative in which the two hydrogen atoms directly attached to the two end nitrogen atoms are replaced by phenyl, together with a large number of salts of this base, formed by replacement of the hydroxyl by halogens or other acid radicles just as in the case of metallic hydroxides. The hydrogen atom attached to the carbon is likewise capable of replacement by many organic radicles, so that a large number of still more complicated bases have likewise been prepared, together with their corresponding salts. The hydroxides of this new series are characterised by possessing strong basic properties. They may all be prepared most conveniently from their chlorides, by the action upon them of silver oxide. They are extremely soluble in water, but are completely precipitated from their solutions by ether. The aqueous solutions absorb carbon dioxide and behave very much like caustic alkalies. They cannot, however, be crystallised, forming resins upon concentration. The salts, on the other hand, crystallise admirably; they are usually soluble in water, react neutral to litmus, and possess a very bitter taste. Diphenyl tetrazolium chloride,  , which may be taken as a typical salt of the series, crystallises in colourless radiating groups of needles very sensitive to light, which renders them yellow. The aqueous solution yields a flesh-coloured precipitate of a chloroplatinate with platinum chloride, and the double salt may be crystallised from hot water. A crystalline double chloride is likewise produced with gold chloride. The addition of a soluble nitrate or iodide causes the precipitation of the difficultly soluble nitrate or iodide of the base. A solution of iodine in potassium iodide precipitates an iodine addition product, which can be crystallised from alcohol in beautiful brown tabular crystals exhibiting a violet reflection. The parent base is produced in solution upon the addition of silver oxide, silver

chloride being likewise formed. The chloride is reduced by ammonium sulphide to a compound of the constitution:



, a substance which Prof. v. Pechmann has previously described, and which is interesting as forming the starting-point for the preparation of the new series. For the chloride may at once be prepared from this latter substance by oxidation with amyl nitrite and hydrochloric acid. The substance is readily prepared by the action of diazobenzene chloride upon malonic acid, constituting the insoluble product of the reaction. It is of considerable interest to observe that the main product of the dry distillation of diphenyl tetrazolium chloride is azobenzene.

THE SCIENTIFIC INVESTIGATIONS OF THE SCOTTISH FISHERY BOARD.

THE Twelfth Annual Report of the Fishery Board for Scotland (Part III. Scientific Investigations for 1893) contains a quantity of new information upon fishery problems, and marks an important stage in the history of the Board, owing to the successful inauguration during the past year of a hatchery at Dunbar for the artificial propagation of marine food-fishes.

A number of important conclusions are formulated by the Board upon various matters. In the first place, the closure of the territorial waters to beam-trawling is admitted to have had no appreciable effect towards arresting the continued decline in the supply of flat-fishes, although the interdicted area has been very large. The greater part of the territorial waters of the East Coast, the Firth of Forth, and St. Andrews Bay have been protected (except for experimental purposes) since 1886, and this area was greatly extended in 1889, when practically the whole of the territorial waters and several extensive bays (the Firth of Clyde and the Moray Firth) were closed against the operations of the beam-trawler. The reason for the failure of this method of protection is sought for in the fact that the present protected area does not embrace the spawning grounds of food-fishes, except in the case of the Moray Firth. It is most unfortunate that, from lack of a sufficiently seaworthy vessel, the Board has been unable to devote the same attention to the Moray Firth as to the Firth of Forth and St. Andrews Bay, for statistics upon the condition of the Moray Firth throughout the year would have been invaluable. But it can be definitely asserted that the mere protection of areas that do not include spawning grounds is practically useless to prevent depletion of the home fisheries. The recommendation of the recent Parliamentary Committee that the present territorial limit should be considerably extended, is accordingly endorsed; and, in order to ensure the enclosure of the more important breeding-grounds, the Board emphasises its recommendation of the previous year, that the limit of jurisdiction should be extended to ten or twelve miles from shore.

Experiments have been made upon the effects of alteration in the size of the mesh of the beam-trawl upon the capture of immature fish. It was found that, contrary to the opinion of most practical men at the recent Parliamentary inquiry, the size of the mesh has a most appreciable influence in determining the size of the fish captured. Dr. Fulton's effective experimental trawlings show that the proportion of fishes that escape through the cod-end of the trawl increases greatly as the width of the meshes is enlarged.

Prof. M'Intosh gives an interesting review of the trawling question in general, and includes a valuable sketch of the changes which have taken place during the past ten years in trawling-vessels and their apparatus. Reasons are adduced which tend to show that line-fishing is quite as destructive as trawling to immature round fishes, such as cod and haddock; and it is maintained that the perennial abundance of the floating fauna, of which larval stages of bottom-animals form so large a proportion, is sufficient to prevent the trawling-grounds from being depleted of fish-food to any serious extent.

The volume includes a number of papers of a more purely biological character upon the development of fishes, on the invertebrate fauna of the Firth of Forth and certain inland lochs, on the oviposition and rate of growth of the sand-eel and certain other fishes, and on some seasonal changes in the histology of fishes. Two papers on the osteology of the tunny and on the anatomy of the pectoral arch in the gurnard seem to us to be completely out of place in an official publication ostensibly devoted to fishery investigations, with which they have nothing to do.

Turning to Prof. M'Intosh's "Remarks on Trawling," justifiable as his general position appears to be, he has, nevertheless, left himself open to criticism on a number of minor points. It is difficult to reconcile with the statistics of the *Garland* trawlings the Professor's remark that "the closure of the inshore waters—*e.g.* St. Andrews Bay—must have conduced to the prosperity of the turbot and the brill of that neighbourhood, most of the turbot (ranging from 9 to 11 inches) *which formerly were captured by the trawlers* now being unmolested" (p. 167). For in Dr. Fulton's introductory report on the work of the *Garland* it is stated that in St. Andrews Bay, as in the Firth of Forth, there was an actual decrease in 1893 of "turbot and brill" in the closed areas as compared with 1892 (p. 26); and the decrease of flat-fishes in general during the eight years of closure is demonstrated on p. 33. Moreover, out of the twenty-four experimental trawlings conducted by the *Garland* in the closed waters of St. Andrews Bay in 1893 only two turbot, and no brill at all, were obtained. Indeed, the average take of turbot was twice as great in the unprotected as in the protected areas of the Bay (p. 42).

In one of the most interesting sections of his "Remarks" (p. 184), Prof. M'Intosh discusses the "effect of trawling on the invertebrate fauna of the sea-bottom (forming fish-food)." It is full of valuable observations from the rich stores of the Professor's experience, but, as an argument, seems to us to be vitiated by a very questionable assumption which underlies it, viz. that all invertebrate life on the sea-bottom furnishes food for fishes. Half the groups, at least, which are mentioned by the Professor in this connection should, in our opinion, be eliminated, viz. sponges, hydroids, anemones, alcyonaria, star-fishes, balani, and ascidians, although we are quite prepared to allow that now and then, in exceptional cases, particular species of some of these groups may be swallowed by fishes. Therefore the Professor's argument that the trawl causes little impoverishment of the supply of fish-food, owing to the rapid powers of growth and repair which the above groups (among some others) possess, is seriously impaired.

In Mr. Harald Dannevig's Report (p. 211) we notice the interesting observation that fishes which spawn during the night in open ponds will do so during the day also if the pond be darkened.

Coming to the biological investigations, we observe that Prof. M'Intosh has overlooked (p. 227) the fact that the Norwegian Topknot (*Zeugopterus norvegicus*) has been recorded by Mr. Cunningham as occurring in considerable numbers at Plymouth (*Jour. M.B.A.* ii. 1892, p. 325). In connection with Mr. Sandeman's investigations on seasonal changes in the histology of fishes, attention may be drawn to another paper by Mr. Cunningham (*Jour. M.B.A.* ii. 1891, pp. 16-42), in which a number of remarkable histological changes are shown to take place in the female conger during the period of the maturation of her eggs.

The main results of Mr. Dickson's physical investigations in the Faröe-Shetland seas seem to us to be of profound importance. If, as he contends, a mass of Atlantic water is every year admitted through the Faröe-Shetland Channel, winds round the Shetlands, and bores its way down the eastern coasts of Scotland in the summer months, guided by a bank of dense water in the upper regions of the North Sea, it is clear that we have at once an explanation of numbers of isolated facts of occasional or periodic distribution of pelagic animals in those regions, which have hitherto seemed merely freaks of Neptune or Æolus. And it cannot be doubted that a further extension of such investigations as Mr. Dickson has been carrying out in H.M.S. *Jackal*, if coupled with a corresponding survey of the pelagic fauna, will provide the long-sought solution of the migrations of the herring and other nomad fishes round our coasts.

In congratulating the Board upon its scientific achievements for the year, we cannot help expressing our intense regret that the recently vacant chairmanship was not offered by the Government to Dr. John Murray. His experience and energy would at all times be invaluable, but at the present juncture, when so many important fishery problems of a physico-biological nature are pressing for solution, the loss to the Board and to the country of his counsel and aid is incalculable. W. G.