## Research Notes.

### The Zeroes of the Riemann Zeta-Function.

RIEMANN conjectured that all the complex zeroes of $\zeta(s)=\sum_{n=1}^{\infty}\frac{1}{n^s}$ where $s=\sigma+it$ lie on the line $\sigma=\frac{1}{2}$. No one has proved, till now, that the above famous conjecture is either correct or false. Extensive calculations of numerical kind have, however, shown that the conjecture is true for $t$ lying between 0 and 300 and that the function has 138 zeroes in the above interval. Recently, Dr. E. C. Titchmarsh [*Proc. Roy. Soc.* (*A*), 1935, **151**, 234] has extended the numerical calculations by developing suitable formulæ and has found that the Riemann conjecture is true for $t$ lying between 0 and 390 and that all the zeroes in the above interval, 195 in number, lie on the critical line $\sigma=\frac{1}{2}$. He has also presented some theoretical considerations on the problem of the zeroes.

N. S. N.

---

### Combined Influence of Electric and Magnetic Fields on the Line Spectrum of Helium.

THE effect of crossed electric and magnetic fields on the line spectrum of Helium observed by W. Steubing (*Sitzb. d. kgl. Preuss. Akad. d. Wiss.*, 1935, pp. 1–16) has already been described in these columns (*Curr. Sci.*, 1935, **4**, 114). We may now notice the effect of coaxial electric and magnetic fields. There are a number of alterations in this case also, but the broadening of the Stark effect components does not occur. The Zeeman effect and an alteration of the intensities of the Stark components are observed.

I. Doublet separation is found only in *s*-components while the *p*-components (see III however) remain sharp and unaltered.

II. The sharp series shows a sharp Zeeman effect. The principal series is midway between the sharp and diffuse series in its behaviour.

III. In the diffuse series we have the null component (*p* and *s*) due to the magnetic field as a new line in place of the intense Stark effect pattern, and here the *s*-component becomes a doublet. The actual Stark components are present in the higher series members with low intensity, but their positions and relative intensities are as in the normal Stark effect, but the *s*-components all become double. The combination lines produced by the electric field vanish.

IV. With an electric field of 45,000 v./cm. and a magnetic field of 20,000 Oersted only the strongest Stark components of the diffuse series are faintly present. But with a magnetic field of 10,000 Oersted, the null line, which is very strong in the above case, vanishes while the normal Stark effect components are present.

The alterations in intensity are less important than in the case of crossed fields.

T. S. S.

---

### The Relation between Atomic and Cosmic Constants in the Expanding Universe.

IT is now well known how Eddington has tried to bring about a relation between the dimensions of the atom and of the Universe in his theory of the fine structure constant. H. Ertel in the *Sitzb. d. Preuss. Akad. d. Wiss.*, 1935, deduces a relation between Einstein's cosmological constant $\lambda$, Newton's gravitation constant denoted by the author by the letter $f$, the proton mass $m_+$, the electron mass $m$, which is as follows:—

$$\frac{f\,m_+^{\,2}\,mc}{\pi he^2}=\pm\sqrt{\lambda}$$

where $c$ is the velocity of light, $h$ is Planck's constant and $e$ is the electronic charge. This result is deduced from Einstein's cosmological field equations and Friedman's differential equations which represent Lemaitre's theory of the Expanding Universe, together with a generalization of an equation given by Eddington.

If $l_p$ and $l_e$ are the de Broglie wavelengths of the proton and the electron $\left(=\frac{h}{m_+c}\text{ and }\frac{h}{mc}\right)$ respectively, the above equation can be written in the more symmetric form

$$f\,\frac{m_+m}{e^2}=\pm\,\pi l_p\sqrt{\lambda}$$

$$f\,\frac{m_+^{\,2}}{e^2}=\pm\,\pi l_e\sqrt{\lambda}$$

With the numerical values $h=6{\cdot}547\times10^{-27}$ erg sec., $c=2{\cdot}998\times10^{10}$ cm./sec., $e=4{\cdot}770\times10^{-10}$ e.s.u., $m=9{\cdot}00\times10^{-28}$ grm., $m_+=1{\cdot}662\times10^{-24}$ grm., $m_+/m=1847$ and $f=6{\cdot}65\times10^{-8}$ dyne cm.$^2$/grm.$^2$, $\frac{1}{R}\frac{dR}{dt}=a$ (the Hubble factor) is calculated on the basis of the above theory to be $1{\cdot}812\times10^{17}$ sec.$^{-1}$ while the experimental value is $1{\cdot}811\times10^{17}$

sec.$^{-1}$ with an uncertainty of 20%. $\alpha$ is connected with $\lambda$ by the equation

$$\frac{1}{R_0^2} + \left(\frac{\alpha_0}{c}\right)^2 = \lambda = 3\left(\frac{\alpha_\infty}{c}\right)^2$$

where $R_0$ = the equilibrium radius of the Universe and $\alpha_0$ and $\alpha_\infty$ are the values of $\alpha$ for R tending to 0 and $\infty$. The theory gives $\alpha_0 = 1{\cdot}134 \times 10^{-17}$ sec.$^{-1}$ and $\alpha_\infty = 1{\cdot}833 \times 10^{-17}$ sec.$^{-1}$.

T. S. S.

## Passivity of Gold.

THE resistance of gold to ordinary reagents and atmospheric influences has been traced to the formation of an adherent film of oxide on its surface. On the other hand, the anodic passivity of gold has been a matter of some controversy. Müller and Löw (*Trans. Far. Soc.*, 1935, **31**, 1291) have extended their "Surface Layer Theory" (Bedeckungstheorie) of passivity for gold electrodes. They have examined gold electrodes, under a reflection-polarisation microscope, when subjected to electrolysis in hydrochloric acid, taking care to protect the electrodes from convection currents. Simultaneous measurements of the current density have also been made. The surface at first appears dark under crossed nicols, and after a certain interval of time during which the current passes, it becomes bright. Corresponding to this latter stage when the current density falls, a diffuse layer of crystalline deposit is observed. The results show that gold exposed to air becomes coated with an oxide layer which is removed during anodic passivation in concentrated hydrochloric acid. An adherent film of the metallic salt now takes the place of the oxide layer. Discharge of $OH^-$ ions at the anode can give rise to a 'secondary' oxide film. When the solution is well stirred the film of the metallic salt is easily disturbed. The natural oxide coating on gold is very stable and dissolves only in strong (5N) hydrochloric acid. The 'secondary' layer produced during anodic passivation is much less stable and disappears quickly even in dilute acids. In 5N hydrochloric acid, the 'secondary' layer formed, is dissolved out even during the passage of the current. The oscillations in current density when electrolysis is carried out are due to the alternate formation and dissolution of the film. The work of Müller and his co-worker brings out the close analogy between the behaviour of gold and of other metals less 'noble'.

M. P. V.

## The Effect of Magnesium Deficiency on Crop Plants.

THE response of various crops to a deficiency of magnesium in the soil is described as the result of experiments conducted at the Massachusetts Agricultural Experimental Station by A. B. Beaumont and M. E. Snell (*J. Agri. Res.*, 1935, **50**, No. 6). Plants sensitive to magnesium deficiency developed characteristic physiological symptoms which have value in diagnosis. Chlorosis of the older leaves developed in the intravascular tissue. In the leaves with parallel veins this produced a striped appearance while in plants with a netted venation, a mottled pattern was produced. Curling of the leaf margins and marked necrotic areas also appeared in certain plants. Buckwheat and spinach were most affected, and turnips, mangels, corn and tobacco considerably so. The small grains, grasses, clovers and potatoes were only slightly affected. The addition of magnesium sulphate to the soil increased the percentage of magnesium in the plant or portions of it, the increase being greatest in the plants which were most affected in yield or appearance by a magnesium deficiency. It appears that to avoid magnesium deficiency a soil should contain from 30 to 40 parts per million of easily replaceable magnesium or 60 to 80 pounds per acre.

A. K. Y.

## Pollination Studies in Toria and Sarson.

CROP improvement work relating to the two most important oil seeds of the Punjab *viz.*, Toria (*Brassica napus* L. var. Dichotoma Prain), and Sarson (*Brassica campestris* L. var. Sarson Prain) with particular reference to the special features of their pollination undertaken at the Lyallpur Agricultural College by Ali Muhammad is described (*Indian J. of Agr. Res.*, 1935, **5**, Part II). In both crops, cross fertilisation appears to be the usual method in nature chiefly through insect agency. Attempts at selfing under bags yield very poor results; in the six years' trials on the average only 12·3 and 20·3 per cent. respectively formed pods and many of these were not normally developed. The high self-sterility is surmised to be due not to external causes alone but internal causes also such as self-incompatibility. The explanation is suggested that the self-pollen is subject to an inhibiting action by the stylar tissue which makes it of slower growth than foreign pollen. The

observations also indicate that the inhibiting action is not equally effective in flowers of different ages, the secretion responsible for the action being produced actively between one to two days before and after flowering. Inbreeding and pure lines being thus of no economic value, group breeding has been resorted to and considerable improvement is reported to have been achieved already by mass-selection. It is stated as the result of hybridisation studies that self-fertility behaves as an inhibited character independent of the colour of the seed and that self-compatible brown seed plants have been evolved.

A. K. Y.

---

### Spiral Structure of Chromosomes.

IN three papers of the July number of the *Proceedings of the Royal Society*, London, C. D. Darlington has described the detailed spiral structure of chromosomes in the several species of Fritillaria, and has deduced certain generalisations regarding the internal mechanics of chromosomes. The first paper [*Proc. Roy. Soc. Lond.*, (B), No. 807, 33], may be regarded as the general part where the broad features of spiral structure are described. The meiotic chromosomes possess both the major and the minor spirals and the first meiotic telophase, the major spirals relax to form relic spirals and by further expanding their loops form superspirals. The minor spiral does not relax. In the ensuing prophase the chromosomes contract and the relic and super-spirals disappear. The second metaphase chromosomes show similar spiral structures. During somatic mitosis only the minor spirals are present. The metaphase chromosomes show the threads very compactly coiled, while during the resting stage and during the later stage the threads divide. The nuclear cycle in mitosis shows that older coils are generally uncoiled externally while new coils are formed internally. In this respect prophase is a continuation of telophase and not a reversal of it as is usually supposed. The usual interpretation of the split nature of the metaphase and telophase chromonema are regarded as inconsistent with the spiral structure and with genetic and cytogenetic data. Several general assumptions have been made the chief of which are that the spiral arrangement is determined by a compensating molecular change, that there is a hysteresis or lag in the adjustment of the external form of the chromosomes to its internal molecular stresses and that paired chromosomes and chromatids on this account develop a "relational coiling".

In the second paper [*Proc. Roy. Soc. Lond.*, (B), No. 807, 59] a special study of the meiotic pairing in Fritillaria has been made. Pairing in this genus is incomplete and is liable to fail in parts attached to the nucleolus and the unpaired parts become relationally coiled. In fifteen species, pairing is interrupted very early and is therefore confined to the proximal regions. This leads to the localisation of chiasmata. The interruption of pairing is presumed to be due to the division of unpaired parts.

In the third paper [*Proc. Roy. Soc. Lond.*, (B), No. 807, 74] the relationship between chiasmata and the relational spiral is dealt with in detail. Three species of Fritillaria, *F. Elwesii* with intermediate localisation, *F. Meleagris* with extreme localisation, and *F. imperialis* with free distribution, have been studied. In the first two species the pairing is incomplete while in the last one it is nearly complete. Chromosomes remain associated at diplotene stages by chiasmata in the paired regions and by relational coiling in the intercalary unpaired regions. This can be understood if it is presumed that coiling occurs throughout the chromosomes but is replaced by chiasmata in the paired regions. In most organisms this replacement is nearly complete, but in diploid organisms with localised chiasmata and in triploids, coiling survives.

---

### Dominance in Poultry.

A PRELIMINARY report of experiments of R. A. Fisher intended to throw light on the nature of dominance observed in certain well-marked breed characteristics in domestic poultry has recently been published [*Phil. Trans. Roy. Soc.*, 1935, **225** (B), 195]. The paper gives detailed data for the three factors responsible for crest, polydactyly and barred plumage.

The belief of Darwin and earlier writers that hernia was connected with the crest was abandoned by geneticists early in the 20th century on inadequate evidence but from his experimental data he has been able to conform completely with the view that crest and hernia are due to the same gene. This view also explains other significant features in the data; notably the complete absence of grown birds showing hernia without crest and the linkage relations with the Polish comb and with Pile.

Polydactyly when introduced into the wild jungle fowl is a typical example of the mutations with intermediate heterozygotes in which dominance is absent. The heterozygote is distinctly variable and occasionally overlaps the normal homozygote.

Barred plumage is more nearly a recessive than a dominant mutation; the heterozygous males are more like the wild than like the barred homozygotes. The barred hen when young is indistinguishable from the heterozygous male. The barred mutation thus introduces a sexual differentiation and when this sexual differentiation does not exist barred may be described as a dominant.

The three factors reported in this paper bear out the suggestions that the supposed "dominants" found in domesticated breeds of poultry show distinct lack of dominance when introduced singly into a wild strain. Any dominance shown by them in breed crosses must be due to modification during the period of domestication.

---

### The Development of the Vertebral Column in the Haddock (*Gadus æglifinus*),

IN this contribution to our knowledge, a set of new observations is made on the vertebral column of the Haddock by A. J. Faruqi (*Proc. Zool. Soc. Lond.*, Part II, 1935, 21). The perichordal sheath forms the centrum of the vertebra in *Gadus* unlike in *Herring* where the notochordal sheath participates in it. The basi-occipital region is a composite structure incorporating in it an 'intercalary' neural arch. As opposed to the tetrapoda, the posterior zygapophyses take their origin from the centrum itself. Confirming the observations of Stannius, it is noted that the spinal ganglia in the trunk region become divided into two,—an upper accessory ganglion and a lower spinal ganglion and these two are connected together by a commissure.

---

### On the Post-Embryonic Development of the Respiratory System of *Dialeurodes dissimilis* (*Homoptera, Aleurodidæ*).

BESIDES Fuller's pioneer work on the post-embryonal development of the tracheal system of termites, not much work has been done on this important problem. M. L. Roonwal gives us an account of the post-embryonic development of respiratory system in *Dialeurodes* (*Quart. J. Micr. Sci.*, 1935, **77**, Part IV, 605). The author points out that the number of spiracles in the nymphal instars is 4 and the tracheal system consists of paired ventral- and dorsal-longitudinal trunks. Tree-like branches arise some of which of course atrophy,—the final number being 156.

---

### Larval Stages of Trilobites from the Middle Cambrian of Alabama.

C. G. LALICKER'S (*Jour. of Palæo.*, **9**, No. 5) observations on the Trilobite Fossils from Alabama show a series of changes in the larvæ specially in the "protaspis stage" not noticed hitherto—the most important being the appearance of eyes later than the facial suture, palpebral lobes and free cheeks on the dorsal side—instead of migrating from over the margin from the ventral side, as formerly suggested. This "spontaneous generation" of the eyes on the free cheeks seems to develop during some critical moult which takes place in some trilobites earlier than in others. Secondly, the migration of free cheeks from an early anterior position to a late lateral position indicates that during the protaspid stages the cephalon is of the proparial type, whereas it becomes opisthoparial in the meraspid and holaspid periods. These observations suggest that the appearance of eyes in a later stage was in the nature of an "adaptational control" as a result of the existence of both larvæ and adults under aphotic or nearly aphotic conditions.

C. P. K.

---

### Paleozoic Foraminifera, their Relationships to Modern Faunas and to their Environment.

OUR knowledge about paleozoic foraminifera was usually confined to the study of *fusulinids*. Improved technique and intensive collection in recent times have revealed a large foraminiferal fauna throughout the paleozoic. The development of the group indicates that the earliest types had chitinous tests. During the next stage there was attachment of various foreign particles to the chitinous test. The upper cambrian form—Spirillina—indicates that the earliest foraminifera were tubular and consisted of an early proloculum. Later on the foraminifera developed an elongate undivided chamber often coiled about itself in one plane. Foraminifera with calcareous tests have not been reported till carboniferous times and this suggests that the primitive forms were predominantly arenaceous. At present the arenaceous forms occur in various habitats but most commonly in waters of

medium depth in temperate regions. In waters where calcareous materials are abundant, the chitinous cement which would hold the foreign particles on the test would be converted to calcareous substance thus giving rise to calcareous tests. From these observations J. A. Cushman (*Jour. of Palæo.*, **9**, No. 3) suggests that calcareous foraminifera developed later and had a limited habitat.

C. P. K.

---

## The Yeravas of Coorg.

By Rao Bahadur L. K. Ananta Krishna Iyer.

*Introduction.*—The *Yeravas* are the aborigines of Wynad, one of the taluks of South Malabar, from which they gradually spread to the forests of South Coorg. They are rarely found in the northern division. They are the lowest of the jungle tribes of Coorg. They appear to have been, from a remote period, in a servile relation to the *Betta* Kurumbas. They are now scattered all over the villages of the two *Nads* of Ponnampet and Srimangala.

*Internal Structure of the Tribe and Habitat.*—There are four endogamous groups, *viz.*, the *Panjiri*, the *Pania*, the *Badava*, and the *Kagi* Yeravas or *Karatte*. The *Panjiri* stand highest in the social scale, and the *Kagi*, the lowest, because of their habit of eating crows (*Kan Kagi*). The *Panjiri* Yeravas are divided into two subgroups, *viz.*, *Ippumale* Yeravas and *Karatti* Yeravas. The former are said to have immigrated from *Ippumale*, which is situated beyond the Manantoddi river; and are generally found in Srimangala and Ponnampet Nads; and the latter in *Karattimale*, near Bythor. Though they belong to one and the same group, yet there is no intermarriage between them. *Panjiri* Yeravas have come from Mysore. The *Badava* Yeravas who are mostly found in Mysore near Heggadadevanakote, are rarely met with in Coorg. There is no interdining and intermarriage between these two classes. There is also not much difference between the *Pania* and *Karatti* on the one side, *Panjiri* and *Badava* on the other. The *Panias* and *Panjiries* neither interdine nor intermarry. A *Panjiri* can become a *Pania* but not *vice versa*.

*Habitations.*—The Yeravas live in thatched huts. The walls are made of bamboo reapers, interwoven and plastered with mud. They never build a house with mud walls because of their migratory habits. Frequently they run away without provocation from their old masters to some distant places in the forest and on settling down under another landlord, they proceed to build a fresh hut. Their dwelling places generally have a veranda of about 10 feet square. Walls are half built all round. Their fire-place is on one side. They have a small pit to pound paddy in. Their domestic vessels are mostly earthen pots and dishes. The latter are used for taking food. They rarely use copper or brass vessels. Before the occupation of a newly built house, the Yerava worships *Kuttathamma*, their chief deity and *Gulikan* (a demon) with offerings of rice, cocoanut, toddy, banana and fowl, with the prayer, "O! Ye Divine Beings, by your grace we have built this hut; keep watch and ward over us and our family."

*Betrothal.*—Cross-cousin marriage is in vogue amongst them. The Yeravas avoid all relations on the father and the mother's side. The Yerava adults have no voice in the choice of a maid for wife. It is generally their parents who negotiate for the marriage of their sons. When a young man has reached the marriageable age, and a suitable girl is found, his parents and the headman of the tribe* (*Kanalādi*) take the *tāli* or marriage badge, a *sādi*, and all the articles necessary for their food to the hut of the bride-elect. They prepare the food, light an oil lamp filled with cocoanut oil and offer sacrifice to their gods, *Kuttathamma* and *Gulikan* along with cocoanut and banana. Some rice also is placed in a sieve. The maid's *Kanalādi* asks them the object of their visit. The young man's *Kanalādi* replies that they have come to propose the marriage of their daughter to the young man. The girl and the young man's names are also given. Then, the bride's *Kanalādi* says in the presence of the gods and those assembled, that they are prepared to give the maid in marriage to the young man. She is brought to the presence of the parties assembled. They then pray to their gods to help them in the celebration of the marriage. The *Kanalādi* of the bridegroom-elect ties the *tāli* round the girl's neck, and gives the *sādi* to her with one *hana* (three annas). The parties sit together and partake of the food already cooked. The maid's *Kanalādi* fixes the date of marriage (*Mangala Kurippu*). Generally the betrothal takes place a month before the marriage, to the celebration of which the *Kanalādis* on both sides must consent. If the bride's party cancels the betrothal, they have to pay the expenditure incurred by the parents of the bridegroom-elect. If the fault is due to the indifference or neglect of the bridegroom's party they should forfeit everything given to the bride-elect.

*Marriage Ceremonies.*—On an auspicious day before the celebration of the marriage, the relatives of the bride and bridegroom assemble in the respective families. *Chapras* are erected with ten or twelve poles in front of the houses of both the bride and bridegroom. Pigs or fowls are slaughtered. Ancestors are worshipped. Parties assembled are treated to a feast. The night is spent merrily by the beat of drum and the tuning of pipes for dancing. On the day of marriage the young man is bathed, neatly dressed and adorned, and is conducted to the marriage in procession. He is seated on a tripod a foot high. A lamp is lit before him. His mother and other married women throw rice on him as a token of blessings, and give him a present of a few

---

*The name *Wanalādi* in Wynad and Coorg is applied to a class of men who act as "Oracles", "Fire walkers" and "Devil-dancers".