IMPERIAL COLLEGE SIERRA LEONE EXPEDITION 1963

THIS summer, Imperial College of Science and Technology is sending an expedition of undergraduate biologists to Sierra Leone. The main purpose of the expedition is to carry out a comprehensive study of the flora and fauna of the Northern Province. It is hoped to direct particular attention to the Scarcies River basin and, if possible, to the Loma Mountains. This will be the third expedition from the College to Africa in two years, others being to Nigeria and Ethiopia. The expedition is being made up of five botanists and three zoologists. Two members have had previous expedition experience and all the botanists have worked on the vegetation of the montane region of southern Yugoslavia. An extensive programme of collection and observation is being worked out. It is hoped to bring back several thousand specimens: these will be deposited either at the Kew Herbarium, the Commonwealth Mycological Institute, or the British Museum (Natural History).

In addition to the general survey, the expedition is undertaking work on behalf of the Food and Agriculture Organization. In particular, a survey will be made of indigenous food plants, and it is hoped to collect wild coffee plants of possible value for future taxonomic or breeding work. The zoologists will be primarily concerned in making observations and collections of the fauna of the area, and in particular on the Heteroptera and Coleoptera. A collection of Mollusca will be made to continue work by the Nigerian Expedition on the Mollusca of West Africa. Collections of mammal and bird parasites will also be made, and blood smears taken for pharmaceutical purposes.

The expedition will spend approximately eight weeks in Sierra Leone, and a full report will be published. If the aims of the expedition are accomplished then further expeditions may well continue the work in future years.

P. ROGERS

TROPICAL PARASITOLOGY

THIS symposium, the first regional symposium of its kind, was organized jointly by the Unesco South-east Asia Science Co-operation Office and the Department of Parasitology, University of Singapore. It was held at the Medical School, University of Singapore, during November 5–9, 1962. It was convened under the chairmanship of Prof. R. S. Desowitz. The purpose of the symposium was to provide an opportunity for an exchange of experiences and results among research workers in the field of tropical parasitology.

The conference was attended by delegates from Australia, Ceylon, Hong Kong, India, Indonesia, Japan, Malaya, the Philippines, Singapore, Taiwan, Thailand and Vietnam. These delegates, as well as representatives from the World Health Organization and the Food and Agriculture Organization, had been invited by Unesco to attend the conference. Dr. N. Ansari, chief of Parasitic Diseases Branch, represented the World Health Organization.

The symposium opened with an address of welcome by the vice-chancellor of the University of Singapore, Dr. B. R. Sreenivasan. This was followed by an introductory address by Mr. L. Mattsson, director of the South-east Asia Science Co-operation Office, Djakarta.

The first day was taken up by a series of survey papers relating to the background and progress of work in the field of parasitology in the various countries included in the region. An interesting feature of these reports was their refreshing variety of approach. Each report, in its different way, described the background of endeavour which had resulted in the establishment of the various institutions where parasitology is studied throughout the South-east Asian region and gave details of the investigations which were being carried on. These reports constituted a valuable contribution and comprise not only a useful compilation pertaining to the history of parasitology in this region but also an index of personnel, institutions, and bibliographies.

Although the scope of these reports was by no means uniform, it was nevertheless a prominent feature that they emphasized the need for further co-operation and interchange of ideas among parasitologists in the South-east Asian region.

It was evident that there has been a marked improvement in the overall facilities available for research on parasitic diseases in the tropics. Places which were once little more than field stations have now become centres of basic parasitological research. The important implication of this is that the most up-to-date laboratory apparatus is now within relatively easy access to the front line of research in the parasitological field, so that direct investigations on the important disease-producing parasites can be conducted. Previously, it had so often occurred that the basic observations on morphology, physiology, immunology, etc., were restricted to parasites which could be maintained in the laboratory.

On the other hand, it was also evident that the old problems of disease and untimely death are still the main concern of parasitologists over most of the South-east Asian region. But the vigorous research programmes relating to the diagnosis and control of parasitic diseases now operating in many of the South-east Asian countries, coupled with the frequent visits being made by specialists in various fields, and the close liaison which has evidently been established with universities and research centres in other parts of the world, gives promise of a successful campaign against the protozoa, worms and arthropods which still cause such widespread disease in tropical regions.

This overall emphasis on medical parasitology is in contrast with the situation in Australia, where the parasites of domestic animals appear to comprise the most important application of parasitology, and where it is evident that funds for research in the field of veterinary parasitology far exceed those available for medical parasitology.

Three full days were devoted to research papers; these again showed a remarkable diversity of interest. Thus, there were papers of a clinical nature, some dealing with lesions and symptoms, others with method of control, epidemiology, and treatment. But there were also papers devoted to the basic principles of parasitology, such as the immunology of parasitic infections, the physiology and metabolism of parasites, as well as systematics, ecology, evolution, and phylogeny in relation to parasitic organisms.

The whole symposium achieved a balance of emphasis between, on one hand, the fundamentals of structure and function in relation to parasitism, and, on the other, the distress and hardship which parasitism involves.

It is not intended to summarize the content of these individual papers, because it has been arranged that a full report of the proceedings of the symposium will be published. Suffice it to say that the admixture of hypothesis, observation and application contributed to no small extent to the feeling which prevailed that we were all, in spite of widely differing specializations, primarily parasitologists.

The delegates were accommodated in the King Edward VII Hall of the University of Singapore near the Medical School. This contributed in a special way to the success of the symposium. Scientific meetings are becoming more and more intensive, consequently programmes are sometimes so full that there is virtually no time for discussion. This means that the younger delegates have little or no opportunity for discussion of their problems with their more experienced colleagues, who are quite understandably occupied with exchanging greetings with their old friends. This symposium showed the value of delegates living in the same residence and sharing the same table at meals. Ample opportunities were thereby available for discussion, and as a result, one really felt that this had been a conference in the true sense, because all delegates had had an opportunity to become acquainted. In this way many new friendships were made, and much valuable information was imparted between the meetings.

The last day was devoted to a discussion on future policy in relation to co-operation and interchange between parasitologists in the South-east Asian region. Several recommendations were made which, it is hoped, will help to formulate a policy which will ensure further meetings of this kind and possibly the formulation of a permanent panel for the region.

Delegates unanimously resolved to record their sincere appreciation of the services rendered to international science in the field of parasitology to Unesco coupled with the name of its regional representative, Mr. L. Mattsson, and to the host country, Singapore, coupled with the name of Prof. R. S. Desowitz, for the excellent arrangements which had been made. All agreed that the conference had been an unqualified success.

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COSMIC NUMBERS

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It has been suggested many times (perhaps first by Weyl[1]) that there might be a close connexion between the separate domains of atomic or nuclear physics and cosmology. This view is admittedly intuitional and the only evidence in support of it so far comes from the numerical coincidences of large dimensionless 'cosmic numbers'. The most typical of these numbers are[2]:

$$\frac{R}{a_0} \simeq \frac{cT}{e^2/m_e c^2} \simeq 4\times 10^{40} \qquad (1)$$

$$F_1 = \frac{e^2}{Gm_p m_e} = 0{\cdot}3\times 10^{40} \qquad (2)$$

In (1) the characteristic radius of the universe $R \simeq cT$ is expressed in terms of the classical electron radius $a_0 = e^2/m_e c^2$, where T^{-1} is Hubble's constant and $T \simeq 1{\cdot}3\times 10^{10}$ light years is a characteristic age of the universe. The result is similar if the pion Compton wave-length (indicating the range of the nuclear forces) is used instead of the classical electron radius. In (2) the 'force ratio' F_1 is the ratio of the Coulomb and gravitational forces between an electron and proton. In (1) and (2) e is the charge, m_p and m_e are the masses, G is the gravitational constant, and c is the velocity of light. If g is the pion–nucleon coupling constant[3] ($g^2/\hbar c \simeq 15$) the ratio of the strong interaction between two nucleons, separated by a distance of approximately a_0, and their gravitational force is:

$$F_1 \simeq \frac{g^2}{G\,m_p^2} \simeq 0{\cdot}3\times 10^{40} \qquad (2')$$

and this is an alternative expression for the force ratio F_1. If numbers such as $\alpha = e^2/\hbar c = 1/137$, $g^2/\hbar c \simeq 15$, and $m_p/m_e = 1{,}836$, are regarded as occupying a level of order unity, then we can write:

$$\frac{R}{a_0} \sim F_1 \qquad (3)$$

It is possible to construct a range of cosmic numbers, and one of their fascinations is their hierarchical structure. This is shown by the following examples. The gravitational radius of the universe is R, and in the case of a nucleon the gravitational radius is $a_g \simeq Gm_p/c^2$ (a nucleon of radius a_g produces curvature in the metric of equal radius), and therefore:

$$\frac{a_g}{a_0} \simeq \frac{Gm_p m_e}{e^2} = F_1^{-1} \qquad (4)$$

The actual or observable mass of the universe is $M \simeq Rc^2/G$, and its density ρ in terms of the nucleon density $\rho_0 \simeq m_p/a_0^3$ is

$$\frac{\rho}{\rho_0} \simeq \frac{M}{m_p}\left(\frac{a_0}{R}\right)^3 \simeq F_1\left(\frac{a_0}{R}\right)^2 \sim F_1^{-1} \qquad (5)$$

Expressing M in nucleon masses we obtain Eddington's number $N = M/m_p$:

$$N = \frac{M}{m_p} \simeq \frac{Rc^2}{Gm_p} = F_1\,\frac{R}{a_0} \sim F_1^2 \qquad (6)$$

and similarly, $R/a_g \simeq F_1^2$.

The numbers considered so far are of the form F_1^n, where n is either a positive or negative integer or zero. The cosmic numbers, however, are not limited to only integral values of n. Thus, if a mass has as a radius R^s equal to its gravitional radius $2GM_s/c^2$, and a density $\rho_0 \simeq m_p/a_0^3$ equal to that of nuclear matter, the number of nucleons in the mass is $N_s = M_s/m_p$, or:

$$N_s \simeq (\tfrac{1}{2}F_1)^{3/2} \sim F_1^{3/2} \qquad (7)$$

which is close to the number of nucleons in a massive star[4]. It is seen that a star at nuclear density has a radius given by:

$$\frac{R_s}{a_0} \simeq N_s^{1/3} \sim F_1^{1/2}, \quad \frac{R_s}{R} \sim F_1^{-1/2} \qquad (8)$$

and is the geometric mean of the radii of a nucleon and the universe. Furthermore, if we use the natural length $\lambda = (\hbar G/c^3)^{1/2}$ for quantum fluctuations of the space-time metric[5], then:

$$\frac{\lambda}{a_0} = \left(F_1 \alpha \frac{m_p}{m_e}\right)^{-1/2} \sim F_1^{-1/2} \qquad (9)$$

Using this result further numbers can be constructed. (The mass density of the fluctuations is F_1^2 times that of a nucleon; each cell of volume λ^3 has a mass of $F_1^{1/2}$ nucleons, and there are $F_1^{3/2}$ cells per nucleon.)

There is thus a second group of dimensionless numbers of the form F_1^n where n now has half-integral values. The two groups together form a hierarchy of numbers arranged at the discrete levels of the order F_1^n, where $n = 0$,