BIOLOGICAL RHYTHMS

THE fourth conference of the International Society for the Study of Biological Rhythms took place at the University of Basle during September 18-19. One hundred and twenty-two participants from ten countries heard and discussed forty-two papers dealing with many aspects of biological periodicity.

Prof. F. Georgi, the able local organizer, opened the proceedings.

Following the philosophy of Klages, E. Frauchiger (Berne) indicated the important part which the concept of rhythm plays in the arts and sciences. Contrasting rhythm and beat (*Takt*), he defined the former as the "similar repetition of similar events". K. Wacholder (Rostock), reviewing the physiological field, also stressed the flexibility of biological rhythms, which is absent in many physical models and simple machinery. He discussed in considerable detail the different ways in which rhythmic activities may originate. F. Gerritzen (The Hague) considered biological rhythms as regular alterations of a continuous metabolic flow in an open system.

Mathematical methods for the measurement of period length were discussed by T. Bartels (Göttingen), who based his deliberations on formally similar geophysical and sunspot measurements. A. Sollberger (Stockholm) discussed certain statistical proceedings when testing biological data for the 24-hr. period, while G. Oberhoffer (Bonn) described a new optical method for the frequency analysis of graphs. T. Blume (Düsseldorf) claimed that an ingenious adaptation of Fourier analysis enables him to detect relevant periodic components from fairly short-time series of measurements. Clinical applications of this approach were reported by W. Menzel (Hamburg), who pointed out that disease is often accompanied by a loss of physiological rhythms, which are characteristic for many bodily functions (for example, temperature, sleep, renal function) during health. Thus rigidity of organ functions as well as more serious breakdowns are both signs of a decreased homeostasis. Recovery after illness (for example, from tuberculosis), as E. Dissmann (Klagenfurt) pointed out in the discussion, is frequently accompanied by the resumption of the physiological rhythms.

From the botanical field, which has always been leading in studies of biological periodicity, E. Bünning (Tübingen) reported in particular on the connexion which seems to exist between the long-known phenomena of diurnal leaf movements and of photoperiodicity. The effects of light and darkness on growth and flowering depend on the momentary adaptation of a plant of which its leaf position is yet another indication. This applies both to long- and short-day plants. A. Remane (Kiel) discussed some exogenous and endogenous factors which produce the great fluctuations in numbers, known to occur in arctic and in marine animals. He pointed to the complexity of such fluctuations and to their connexion with periodic migration and epidemics.

H. Kalmus (London) listed some examples of differential responses of genetically differing individuals of polymorphic species to time of day or season. Among the former he mentioned the colour

variants of female *Colias* butterflies and among the latter the chromosomal races of *Drosophila pseudoobscura*. He also discussed the genetical implications of temporal isolation and of the cyclomorphosis of Rotifers and Cladocera. G. P. Wells (London) discussed the very regular changes of water in the tubes and burrows of sedentary polychaetes, which are unconnected with any environmental rhythms; he described ingenious techniques for their recording. O. Köhler (Freiburg) talked about the rhythmic activities in bird song and behaviour and on certain mechanisms in birds and bees which compensate for the daily movement of the sun and thus make navigation possible.

C. P. Richter (Baltimore) showed cycles of several weeks duration in the behaviour and physiology of rats, which occurred after thyroidectomy, during sulphamerazine treatment or after the application of radioactive iodine. Interference with the posterior lobe of the pituitary produced fourteen-day cycles, whereas removal of most of both ovaries often resulted in cycles of ninety days period length. Experiments concerning adrenal cycles of mice and of men were described by F. Halberg (Minneapolis), who then compared adrenal and sexual cycles. T. Staehelin (Basle) reported some success in treating certain rigidly rhythmical manifestations of schizophrenia by various means affecting the brain stem, which he considers to be the region responsible for many rhythmic activities.

H. Reimann and H. Zellweger (Beirut) directed attention to an alarming, if benign, condition, sometimes called 'periodic disease', which by its familial occurrence and by the fact that almost exclusively Armenians and Jews are affected seems to suggest some hereditary basis, but is otherwise of unknown etiology.

Some complexities of circulatory rhythms were discussed by E. Rothlin and A. Cerletti (Basle), while P. Vara (Helsinki) showed the first recorded ECG of an unborn human fetus. H. Mislin (Basle) demonstrated encephalograms of Cephalopods; G. K. Döring (Tübingen), E. von Philippsborn (Oberstdorf) and others discussed rhythm in respiration. T. Petren (Stockholm) described fluctuations in the glycogen content of chick embryos.

Among the factors which influence biological rhythms, W. Frey (Berne) discussed observations and experiments concerning the influence of air ionization on the circulation, while several others discussed the interactions of hydrotherapeutic methods and sport activities with body rhythms.

Problems of the 24-hr. periodicity were attacked from many angles. T. N. Mills and S. W. Stanbury (Manchester) described diurnal variations in the excretion of various substances by the renal tubules. T. Aschoff (Heidelberg) discussed some methods by which external rhythms (for example, temperature, light, noise) can be shown experimentally to be in control of diurnal activities of organisms. A. Kilbinger (Essen) showed that one such factor—important in plant life—may be a greatly increased carbon dioxide content at night of the air above soil.

N. Kleitman and T. G. Engelmann (Chicago), in a description of the development of the sleep-wakefulness pattern, showed that, contrary to a

widely held belief, the total duration of a baby's sleep does not change up to the twelfth week, but that the day fraction of sleep, which is the smaller from birth, decreases. During the succeeding fourteen weeks the duration of night sleep remains unchanged; but day sleep decreases further until an adjustment to the infant's environment is reached; this consists in one long unbroken period of night sleep and short morning and afternoon naps. H. R. Richter (Basle) stated that sleep and wakefulness, like youth and age, entail different brain rhythms, a fact which can be used for the investigation of sleep. A. W. Eiff (Bonn) succeeded, by altering the clock during a short period of anaesthesia, not only in deceiving the time-sense of people living in a constant-condition room, but also found a shift in certain diurnal body rhythms, though not in others. D. Lüderitz (Münster) showed that thyrotoxic and myxoedematous patients differ from healthy people in their resistance to sleep-disturbing noises. T. Möllerström and S. Svensson (Stockholm) described the diurnal rhythms of various types of diabetes and stressed the success of the adjustment of therapeutic measures to those rhythms. In a more general way this principle was supported by W. Menzel and A. Jores (Hamburg).

G. Metz and P. Andlauer (Strasbourg) reported that in certain selected industries fewer accidents occurred during night shifts than during day shifts, while A. Pierach (Nauheim) described the adverse effects of night work and of frequent changes of working hours, especially on diseased people.

It is hoped that—as was the case after the last conference—the papers and discussions of this conference will be published in a supplement to the *Acta Medica Scandinavica*. Profs. A. Jores and W. Menzel, of Hamburg (2. Medizinische Klinik), were elected president and secretary of the Society. A sub-committee on terminology was also elected. The next conference will be held in Stockholm in 1955.

H. KALMUS

ORGANO-PHOSPHORUS INSECTICIDES

A SYMPOSIUM on organo-phosphorus insecticides, arranged jointly by the Crop Protection Panel of the Society of Chemical Industry, the Association of Applied Biologists, the Biological Methods Group of the Society of Public Analysts and Other Analytical Chemists and the Pharmacological Society, was held at the Imperial College of Science and Technology, London, on the morning and afternoon of October 2. The meeting attracted a large audience, more than filling the large Chemistry Theatre of the College.

The large attendance may have owed more to the participation of four learned societies than to the choice of a topical subject which is much in the scientific news, because the open discussion was not as lively as one might have expected, only a small proportion of those present participating. Coming so soon after the much more active two-day discussion on "Anti-cholinesterases", organized by the British Pharmacological Society and the Society of Chemical Industry, which was held during March 27-28, one wonders whether the subject is not a little 'played out'. A more likely explanation, how-

ever, of the somewhat apathetic discussion may have arisen from the fact that so many societies were interested. One feels that their representatives on the joint committee may have been too polite to press their own interests, with the result that the five invited lecturers presented a rather incoherent display, and the audience was left wondering what were the most important arguments in which they were expected to participate.

There is unquestionable good in different societies coming together for such symposia, but it is more important than when they meet alone that the subject-matter should be selected and restricted, and a clear field of controversy mapped out. Granted this greater care of planning, which is clearly a more difficult task for an *ad hoc* joint committee, meetings of the most diverse societies can be very successful. Where this is lacking, there tends to be a diffidence on the part of the various contributors to discuss the particular aspects of the most interest to them in the presence of representatives of other professions, who they feel may not be particularly interested. It was this factor, I think, which tended to discourage the discussion on this occasion.

The morning session was devoted to toxicology: a paper prepared by Dr. K. A. Lord and Dr. C. Potter, of the Rothamsted Experimental Station, was read by the former, dealing with the insect aspect, and one by Dr. J. M. Barnes, of the Medical Research Council Toxicology Research Unit, Carshalton, dealing with the mammalian aspect. Prof. V. B. Wigglesworth (Cambridge) took the chair.

Prof. Wigglesworth spoke of the importance of biological interactions in the control of insect pests and the importance, therefore, of species-selective insecticides, as well as of the necessity for selectivity of a wider kind in the choice and development of insecticides less poisonous to man. He emphasized that a great deal is still to be learned about the biochemistry of selectivity. The systemic insecticide 'Schradan' is highly selective, but the mechanism is far from clear. Phytophagous caterpillars are notoriously immune, and, although they possess an unusually alkaline gut content, this can scarcely account for rendering innocuous a substance very resistant to alkaline hydrolysis. Something much more subtle is involved. Systemic insecticides also pose new problems in the matter of safety to man, since an insect poison incorporated into the structure of the plant is something new.

Dr. Lord said that, although the function of acetylcholine in myoneural transmission in mammals is well established and the toxic action of the organo-phosphorus compounds is undoubtedly mainly due to their inhibition of cholinesterase, even the existence of acetylcholine is not clearly established in insects, and it is far from certain that it has any important part to play. He felt, therefore, that the scope of investigation in insects should be widened to include other esterases which are also inhibited by the organo-phosphorus compounds. Crude extracts from insects have considerable activity in hydrolysing phenyl acetate, which has been used as a substrate in many experiments.

No general correlation has been established between insecticidal activity of various compounds and their ability to inhibit either cholinesterase or the general esterase *in vitro*. This is doubtless due to prior conversion of the compound *in vivo* as in the case of pure 'Parathion', which does not inhibit either esterase *in vitro* but is converted in *Tenebrio molitor*