

be to the other. An important succeeding paper by Dr. Y. Bar Hillel and Prof. R. Carnap (United States) referred to the mis-application by some men of science of the terminology and theorems of statistical communication theory to fields in which the term information is used, presystematically, in a semantic sense (one involving the contents or designata of symbols) or even in a pragmatic sense (one involving the users of these symbols) and to the misleading consequences which can result. They presented the outlines of a theory of semantic information based on the theory of inductive probability recently developed by Prof. Carnap, and suggested that this should serve as a better approximation than the present statistical theory for application to fields like psychology and the social sciences.

An interesting application of the results and methods of communication theory to optics was described by Prof. A. Blanc-Lapierre (France); and in a paper entitled "Generators of Information", Dr. D. M. MacKay raised a number of difficult questions, such as—Can we trace the information in a channel back to an ultimate source, or are we restricted to considering information transducers only? Communication theory generally accepts the *a priori* existence of an agreed alphabet: where does this arise?—and illustrated his arguments by descriptions of simple electrical machines.

The symposium concluded with a general discussion, in which Dr. E. C. Cherry gave a summary of the main questions which had been raised during the week, and with an expression of appreciation by Prof. Willis Jackson to the British Broadcasting Corporation and the Ministry of Supply for the financial assistance they had afforded. The proceedings of the symposium are to be published by Butterworths Scientific Publications, Ltd.

### THIRD INTERNATIONAL CONGRESS ON ASTRONAUTICS

THE Third International Congress on Astronautics, held in Stuttgart during the week September 1–6, was attended by fifty official delegates and more than a hundred visitors. During the first two days the business of the International Astronautical Federation was discussed. The major item was the constitution of the Federation, which was agreed to and signed by all societies represented, these being the national societies of the Argentine, Austria, Denmark, Germany, Great Britain, Holland, Italy, Norway, Sweden and Switzerland, together with the American Rocket Society, Chicago Rocket Society, Detroit Rocket Society, Pacific Rocket Society and Reaction Research Society of the United States. The following officers were elected: *President*, Dr. E. Sänger (Germany); *Vice-Presidents*, Andrew G. Haley (United States) and Dr. L. R. Shepherd (Great Britain); *Honorary Vice-President for International Relations*, Dr. G. Loeser (Germany); and *Secretary*, J. Stemmer (Switzerland).

Of the twenty-three papers presented during the technical sessions the majority were devoted to problems of detail in space-flight. In his paper "Interorbital Transfer with Minimum Propellant Expenditure", D. F. Lawden (British Interplanetary Society) discussed the problem of the transfer of a rocket between two coplanar elliptic orbits, about the same

centre of inverse square law attraction, along a trajectory requiring a minimum of propellant expenditure. His solution involved a number of impulsive thrusts, and equations were obtained from which the magnitude and directions of these thrusts could be calculated in particular cases. In the case of transfer between circular orbits, the solution was shown to be equivalent to that due to Hohmann<sup>1</sup>.

In "Exposure Hazards from Cosmic Radiation at Extreme Altitudes and in Free Space", Dr. H. J. Schaefer (American Rocket Society) reviewed the present position. In recent years direct evidence has been obtained of the existence of a component of primary cosmic radiation consisting of heavy nuclei. It is known that other types of primary radiation and secondary radiation are not dangerous, but this discovery places the problem of a possible exposure hazard for human beings, in the region of the primary radiation, on a new basis. The heavy primaries are characterized by an extremely high specific ionization and by a large radial spread of the ionization dose around the particle tracks. Either of these properties might endow them with a greatly increased biological effectiveness which cannot be measured effectively in terms of ordinary biological dosage units. The screening effect of the geomagnetic field is such, however, that these particles of comparatively low energy and heavy nuclei would be almost totally excluded from reaching the earth except near the poles. It remains an open question whether such particles are present or not in large quantities in the primary cosmic-ray spectrum in free space away from a body with a shielding magnetic field. It appears that it would probably be safe for human beings to venture a few hundred miles from the earth's surface, but no definite statement can be made for more remote space. A further alternative is the possible existence of a heliomagnetic field which could screen part of the solar system. However, no clear experimental evidence of its existence is available.

Experiments to investigate the biological effects of these heavy primaries were described by Prof. J. Eugster (Schweizerische Astronautische Arbeitsgemeinschaft) in his paper "Die biologische Wirkung der Kosmischen Strahlung, Methoden und neueste Ergebnisse". Investigation of the biological effects on eggs of *Artemia salina* and human and animal living tissue was carried out by taking the specimens to heights of 28,000–30,000 m. in sounding-balloons. Direct hits by highly ionizing components on *Artemia* eggs had a lethal effect, the hatching-rate after exposure being zero. The comparative rates at the surface and at a station shielded by some 2,100 m. of rock were 96 and 9 per cent, respectively. The low hatching-rate of the eggs exposed underground was due to considerable neutron radiation which was found to be present. Evaluation of the results of exposure of human and animal tissues was not complete.

A further medical problem of great interest in astronautics was discussed by Dr. A. E. Slater (British Interplanetary Society) in his paper "Sensory Perceptions of the Weightless Condition". It has been suggested that the otolith organs of the inner ear might give confused results when not subjected to a gravitational force or acceleration, and might thus induce a feeling of 'space-sickness'—perhaps akin to sea-sickness. In the weightless condition, the impulse frequency of the maculae might or might not fall to zero. If there is a certain basic minimum frequency which is present during the weightless

condition, then the different otolith organs the maculae of which face in different directions would give contradictory information, and a feeling of 'space-sickness' might exist. However, it has been shown by both Adrian and Lowenstein that some nerve fibres of the otolith organs do not carry impulses when the head is in certain positions. In the weightless condition, therefore, it seems improbable that any impulses would be present. Some forms of deafness are due to both middle ears being out of action. No impulses can be transmitted under these conditions, and yet no ill-effects are felt. It is therefore thought that weightlessness also would bring no ill-effects. The main function of the otolith organs is almost certainly that of adapting the body to the effects of gravity by controlling the tone of the muscles used for balancing, and causing instant adjustments of muscular tension whenever necessary.

J. HUMPHRIES

<sup>1</sup> Hohmann, "Die Erreichbarkeit der Himmelskörper" (Oldenbourg, Berlin, 1925).

## PAN-AMERICAN INSTITUTE OF GEOGRAPHY AND HISTORY

**A**MONG the specialist agencies set up by the Governments of the American Republics is the Pan-American Institute of Geography and History (PAIGH). Much of the work of the Institute is carried out by the three Commissions which were set up at the fourth general assembly held at Caracas in 1946. These three Commissions deal, respectively, with cartography, geography and history.

The first meeting of the Commission on Geography or, as it has come to be called, the Pan-American Consultation on Geography, was held in Rio de Janeiro during September 1949; the second in Santiago, Chile, during October 1950; and the third in Washington, D.C., during July 25–August 4, 1952. Future plans are to hold meetings of the Commission every two years. The twenty governments which are members each send official representatives, and interested international organizations, such as Unesco, participate in an observer capacity; the Canadian Government also sends observers.

The chairman of the Consultation meeting at Washington, D.C., was Prof. Preston E. James (United States). All the proceedings were in English, Spanish or Portuguese, with simultaneous translation available for all meetings, which were held in conference rooms provided by the United States State Department. As an official gathering, attendance was limited to delegates officially appointed or special invitees.

Some indication of the wide range of subjects covered by the conference is indicated by the existence of five sections which carried on their meetings simultaneously, and which dealt, respectively, with physical geography and biogeography, human geography, regional geography, geography of the Americas, teaching and methodology.

Between Consultations the action programme of the Commission is entrusted to five permanent committees, which deal, respectively, with basic natural resources, settlement and colonization, land classification and survey of land use, geography of the Americas, and teaching and methodology.

The American republics are acutely aware of the need for a comprehensive study of their geographical

resources as a prelude to schemes of land planning and conservation of resources. Not only are land-use surveys planned and in progress in many areas, but also active steps are being taken to set up a training centre or training centres where those with a basic university training can be given the necessary instruction to enable them to take their place in the survey teams which are planned. It is proposed to set up a government-sponsored college for this purpose, probably in Rio de Janeiro.

L. DUDLEY STAMP

## REACTIVITY OF PROTEIN FIBRES

**D**URING the annual conference of the Society of Leather Trades' Chemists, held at the University of Leeds during September 19–20, the fifth Procter Memorial Lecture was delivered by Prof. J. B. Speakman, professor of textile industries in the University of Leeds, his subject being "The Reactivity of Protein Fibres: Some Analogies between Keratin and Collagen".

After paying tribute to Prof. Procter, and those members of the staff of the Department of Leather Industries in the University of Leeds—Mr. F. C. Thompson and Prof. W. R. Atkin—who had worked with him, Prof. Speakman began to develop his comparison of keratin and collagen in terms of the amino-acid composition. Because of the close similarity in the proportions of basic and (free) carboxylic acid side-chains, close similarity in the reactions with acids and alkalis is to be expected, apart from complications due to the presence of cystine in keratin. The titration curves of the two proteins were compared and their reaction with acids discussed in detail. Prof. Speakman suggested that differences in the acid titration curves of different forms of collagen are due to neglect of differences in swelling, and to errors in the calculated amount of combined acid when no account is taken of the difference in concentration of acid inside and outside the collagen. In terms of the Donnan theory of membrane equilibrium, methods of calculating the 'true' titration curve were outlined, the 'true' curve representing the correct amounts of acid combined at different internal pH values.

Prof. Speakman next turned his attention to the action of neutral salts on keratin, potassium chloride and lithium bromide being chosen as examples of two main types. It was shown that the former causes breakdown of salt linkage through the association of potassium and chlorine ions with the oppositely charged ions of the linkage. Lithium bromide has the same effect but, in addition, causes breakdown of hydrogen bond at concentrations below about 5.8 M. Above this concentration, co-ordination with hydrophilic groups in neighbouring chains leads to some measure of cross-linking.

Close analogy between keratin and collagen is also found in the supercontraction of the former and the hydrothermal shrinkage of the latter. Although the molecular structure of keratin is more stable than that of collagen, because of cystine linkages in the former, breakdown of hydrogen bond by means of a 50 per cent solution of phenol promotes the contraction of wool fibres at high temperatures. By determining the temperature at which 20 per cent contraction occurs in 20 minutes, in accordance with