THE ROYAL SOCIETY'S EXPEDITION TO HALLEY BAY DURING
THE INTERNATIONAL GEOPHYSICAL YEAR

ON February 4 the Royal Society spent a day listening to accounts by various members of the expedition to Halley Bay of the work done in Antarctica by the British team during the International Geophysical Year.

The discussion was led by Sir Graham Sutton, who began by recalling that although a proposal to mount an international expedition to explore the Antarctic continent had been made as long ago as 1861, it was not until the present century that any significant progress was made. The initial phase, of wooden ships and animal or man-drawn sledges, culminated in the large expeditions of 1910–15, and although conditions are vastly different to-day, there are still hardships and even perils to be faced. The choice of a site in the Weddell Sea area was dictated by a number of factors; but there is no doubt that, from the geophysical aspect, the area is of great interest.

Mr. J. MacDowall (who was the leader of the expedition in 1958) opened the discussion with an account of the work done in seismology, glaciology and meteorology. The observatory was built on a floating ice shelf 29 m. above sea-level in latitude $75^{\circ} 31' \text{ S.}$, longitude $26^{\circ} 37' \text{ W.}$ Considerable micro-seismic activity was observed during the summer (December–February), especially with on-shore winds, and he gave examples to show the relation between microseisms and wind force. The short-period three-component Willmore seismograph used on the floating ice shelf was found to detect *P*-waves at most epicentral distances, but *S*-waves were badly recorded. The shelf itself had a yearly addition of about 1 m. of snow of mean density $0.36 \text{ gm. cm.}^{-3}$. Considerable ablation occurred, even in winter, and it is not easy to account for this in terms of the energy balance.

Mr. MacDowall directed attention to the small range of monthly mean air-temperature through the troposphere compared with the very large difference in extremes in the stratosphere, where the records indicate a range of 59° C. at the 30-mb. level. Another interesting fact is that there is a notable difference between the northern and southern hemispheres in the seasonal change in atmospheric ozone. The spectrophotometer measurements of the total amount of ozone made at Halley Bay during 1956–58 do not appear to fit into the hitherto accepted global pattern of seasonal and latitudinal variations, and only the short-period fluctuations were found to be related to upper-air measurements. In south-east England both the long- and the short-period variations are related.

Mr. J. M. C. Burton described observations on the nature of the ice shelf and drew the conclusion that it is partially grounded to the east-north-east, but floating to the south. He suggested that the Dawson Lambton glacier should be taken as the true coastline. The Allan MacDonald glacier, which Shackleton reported in 1914 some 30 miles north of the Dawson Lambton glacier, was not seen during the two years of the International Geophysical Year, and he regarded its existence as doubtful.

Commenting on these contributions, Dr. R. C. Sutcliffe dealt with the ozone distribution and suggested a possible explanation in terms of a thermal circulation. Mr. H. H. Lamb continued with an analysis of upper-air measurements. He pointed out that it is only since 1957 that any general picture of stratospheric circulation over the Antarctic can be constructed, and of the three years in question, it seems fairly certain that 1959 was anomalous in the late winter and spring in regard to winds, temperatures and maximum amounts of ozone in the stratosphere.

Mr. W. H. Belchambers and Mr. W. R. Piggott described the ionospheric measurements. The Halley Bay observatory, being near the centre of the Weddell Sea geomagnetic anomaly and yet sufficiently outside the auroral zone to avoid the effects of minor corpuscular magnetic or auroral activity, is particularly well placed for the study of the electrified part of the atmosphere. The main conclusions reached are that the *F*²-layer variations are dominated by movements of ionization (which can also be seen near the maximum of the *F*¹-layer), and that ionization drift velocities in the *E*-region reverse with season and are greater in winter than summer. The incidence of 'spread *F*' is very anomalous, being essentially a magnetically 'quiet day' phenomenon.

In the general discussion, Dr. R. L. Smith-Rose, after paying tribute to the excellent work done by the team, remarked that two features of the results were surprising. In the temperate and auroral latitudes of the northern hemisphere severe 'spread *F*' is closely correlated with magnetic and auroral activity and is well known as a precursor to the failure of trans-Atlantic radio communication. At Halley Bay, on the other hand, it seems to be associated with relatively quiet conditions. Again, in the northern hemisphere the maxima and minima of *foF*² are approximately at the same local mean time at most ionospheric stations. This does not suggest the type of movements proposed by the speakers. He asked if there is evidence for any fundamental difference in the behaviour of the layer in the two hemispheres.

Mr. P. M. Brennan and Mr. D. P. Harrison gave an account of the work in radio astronomy. It was found that ionospheric velocities, deduced from the motion of the diffraction pattern on the ground, were approximately towards the west in the first part of the night and towards the east for the remainder of the night and most of the following day, the reversals taking place about 0030 and 1630 L.M.T. The speeds were of the order of 400 m.sec.^{-1} in the evening, falling to about 100 m.sec.^{-1} in the easterly motion. The times of change and the magnitude of the drift speeds agree with measurements of the motions of auroral forms made at Halley Bay by S. Evans (1959) using an all-sky camera.

For radio-echo observations of auroræ and meteors, a low-power equipment working with a rotating aerial on a frequency of 71.3 mc./s. was used, similar to that at Jodrell Bank. The auroral echoes fit

closely the case of specular reflexion for columns of ionization aligned along the local magnetic field at about 100 km.

Commenting on these papers, Dr. J. G. Davies remarked that a clear correlation between the peaks of auroral activity at Halley Bay and the rarer auroral echoes at Jodrell Bank has been demonstrated. The scattering mechanism is clearly specular. He pointed out that in the auroral case, as well as for the work on radio-source scintillations, the fact that the observations appear to be in regions of increased ionization elongated along the direction of the local magnetic field suggests that these may be extensions of the van Allen radiation belts, and may represent the mechanism whereby the radiation zones drain into the atmosphere.

Dr. S. Evans and Dr. G. M. Thomas gave an account of the visual work on aurora. An all-sky camera was used. A plot of the hourly-mean vector movement indicated a systematic diurnal component, reaching a few hundred metres a second in the easterly and westerly directions. Comparison with the horizontal magnetic disturbance vector averaged over the same period was held by Dr. Evans to imply an effective transport of negative charge by aurora.

Dr. Thomas said that a feature of the auroral display at Halley Bay was the almost continuous presence of a quiet arc lying well to the south. There is evidence, supported by observations in other

localities, that there is a migration of quiet arcs to higher latitudes at times of maximum sunspot activity.

Mr. J. Paton, discussing these results, speculated whether the small movement in the position of the quiet arcs recorded at Halley Bay between 1956 and 1958, if it is real, is related to changes in the form of the outer van Allen radiation belt during the period between sunspot minimum and maximum. He also asked if the observations now indicate that the phenomena of 'flaming' occur only on the equatorial side of the auroral zones, and that the somewhat surprising rarity of red coloration in the Halley Bay displays indicates the general rule that persistent red diffuse surfaces are very limited in their geographical position, being virtually confined to the middle latitudes.

Sir Graham Sutton, summing up, said that, in his opinion, the Society had been amply justified in its decision to send an expedition to this remote part. The data obtained seemed to be unique in many ways.

The president of the Royal Society, Sir Cyril Hinshelwood, in closing the meeting, paid tribute to all who had taken part, and said he had never had any doubt that the Halley Bay venture would be worth while. From what he had heard, the geophysical services would benefit greatly.

The contributions and a report of the discussion will appear in a forthcoming number of the *Proceedings of the Royal Society*. O. G. SUTTON

THE TEACHING OF VETERINARY ANATOMY AS A BRANCH OF BIOLOGY

ITS RELATIONSHIPS TO HUMAN ANATOMY

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EVERYONE has the opportunity of gaining inside knowledge in one only of the sciences—biology. He carries around with him until he dies a living specimen about which he can know something at first hand. This intimate knowledge of vital activity is not only unique, it also carries with it a greater depth of understanding than is possible by the use of the intellect alone. Certain branches of knowledge like mathematics claim to depend on the use of pure reason. Any branch of the natural sciences, however, makes use to some extent of man's knowledge of his own body.

Anatomy is fundamentally a branch of biology but, based historically on cadavers and the descriptive method, it is often thought of as a dead science—in more ways than one. It is also mistakenly considered to be a highly concrete science because it deals with the gross aspects of structure which are not only three-dimensionally solid but which can also be prodded with the fingers. To bring the dead organs to life, an older generation therefore added 'function' as something over and against 'form'. Thus was born one of the many antitheses that used to divide biologists into two warring camps. Nowadays they are mostly too busy being experimentalists to worry about these many unsolved

problems, and this is no doubt why words like 'teleological' and 'Lamarckistic' are used less often as epithets of derision.

In fact, as Woodger first remarked¹, the antithesis of form and function is readily resolved in terms of ideas on space/time. A dead organ, far from being one of the most concrete elements in biology, is one of the most abstract. It is a four-dimensional object, from which the dimension of time has been removed. Living structure, by its very nature, has a history. It is changing from moment to moment. Form and function are but two aspects of a single entity—a living organism. To consider any living organism from one only of these two aspects is a highly artificial abstraction from reality. Similarly, because the organism is a structuro-functional whole, considerations in isolation of one of its several organ-systems or of separate organs are still further stages in abstraction, invented by the mind of man. Thus, living structure *is* function.

For some years now in the teaching of human anatomy there has been a tendency to depart from the older descriptive method of dealing with gross structure. Function is introduced in many places, and organs are dealt with in terms of the functions which they are designed to carry out in life. This is