

background of the major experimentation that has led to the present views.

The first three chapters are devoted to a survey of auxins, gibberellins and kinins, giving the historical events leading to their discovery and isolation, together with the major effects of each of these types of hormones on different growing systems. The bias, as the title of the book implies, is towards physiological responses rather than to the biochemical implications of hormone regulation. The fourth chapter describes the phenomenon of polar transport in plant cells, and although there is little discussion or speculation on the mechanism by which molecules of hormones or other growth substances are moved through cells more easily in the downward than the upward direction, the author provides a comprehensive review of the facts as they are at present known.

There follows an exciting chapter on apical dominance in which the reader is led through the different theories which might account for suppression of lateral bud growth. The experiments are well described and the discussion ends with a set of clear summaries. The chapters on geotropism and phototropism follow in the same vein, and both define the major problems that still need clarification. Nastic responses are covered in an excellent chapter with a special emphasis on the rapid and so far unexplained movements of the sensitive plant *Mimosa pudica*.

A discussion of the factors governing the movement of stomata leads on to a clear chapter on photosynthetic processes and to another which sets out the problems and the theories of how carbohydrates synthesized in the leaves are translocated from one part of the plant to another. The evidence for long distance transport of metabolites within the highly specialized cells of the phloem is then summarized. The problem of how water is taken up and moved in a plant is described from a thermodynamic viewpoint. The pathway followed from root to leaf receives very adequate treatment, and an associated chapter deals with the mechanisms by which ions are taken up from aqueous solutions, and discusses how they too can be moved from one part of the plant to another.

The discovery and properties of the photosensitive pigment phytochrome are attractively told by one of the collaborators in this work. It precedes a comprehensive account of the part now seen for phytochrome in the regulation of plant morphogenesis in response to specific quanta and wavelengths of light. A discussion of photoperiodism and vernalization follows, in which the reader is acquainted with the effects of other environmental factors, day length and low temperatures, on the development and differentiation of plants. In a subsequent chapter the author discusses the problems of how and why and to what signals plants respond when they stop active growth and enter into the latent stage of dormancy, and what factors initiate the resumption of growth, as in the germination of a seed.

But the pattern of plant growth is not confined to a direct response to changes in the environment, for plants also measure time. In a final chapter on circadian rhythms the problem of why once a response to the environment is set in motion, it can be repeated at near 24 hour intervals under uniform conditions, serves as a good introduction to the study of biological clocks.

The errors in this volume are few, the references are comprehensive and are generally well chosen and the presentation is clear. Each chapter states the problems and the major facts and theories and seldom falls into the trap of supplying an unquestioned solution. The reader is left with ideas of how future research may develop and some of the experimental difficulties to be encountered. Most of all, this book encourages thought and achieves what it has set out to be—a very useful textbook for both undergraduates and postgraduates.

DAPHNE J. OSBORNE

## COMMUNICATION UNDISPUTED

### Communication

A Discussion at the Nobel Conference. (Organized by Gustavus Adolphus College, St Peter, Minnesota, 1969.) Edited by John D. Roslansky. Pp. ix+131. (North-Holland: Amsterdam and London, 1969.) 42s.

ONCE again a group of people from widely diverse fields have been brought together to state their positions in terms which are clear to laymen and students alike. Communication is interpreted in the widest possible sense and the result is hardly the "discussion" that the subtitle claims. If you get people as diverse as these, and ask them to speak simply, they inevitably deal largely in generalizations making everything seem black or white. This is not to say that the participants did not say things which were interesting and often important. Augenstein considers the implications of our ability to change the "little black box called the mind"; whose ideals shall be inculcated? To judge from this chapter, there must have been some splendid audience participation during the paper. The dangers of over-simplification are vividly demonstrated by the argument that Caryl Cheesman's beliefs enshrined in his memory were all that caused him to rape and murder; *ergo* change his memories and your criminal is reformed. Marler is on happier ground with his review of communication in the animal kingdom, pointing out clearly how all the design features of a language, proposed by Hockett and Altmann, can be exemplified somewhere in the animal kingdom, but appear together only in human language. Chomsky would find the essentially human character of man's language in its creativity which, he believes, reflects inherent properties of the human mind. Kaplan, speaking as a philosopher, underlines the importance of communion as distinct from communication; all too easily humans may communicate without communion.

But it is Lenneberg's contribution—as a psychologist—in which there appears the only real sign of the interdisciplinary sparring which should be the real purpose of such gatherings. He criticizes the experiments by the Gardners on chimpanzees in which they taught the animals sign "language"; unlike Marler, he believes that the existence of this language is not proved, and he describes the critical experiments which he would like to see performed in order to settle the question.

There is therefore little real discussion and little comparison of the viewpoints of linguistics, philosophy, animal behaviour, psychology and so forth. Nevertheless, the papers make good reading as brief reviews of their authors' viewpoints.

J. D. CARTHY

## Correspondence

### NERC Support for University Research

SIR,—Your issue of December 6 last contained two constructive articles about my council's activities and policy arising from the publication of our annual report for 1968/69. Each raised, however, certain misgivings about the support by the council of research at universities. I would be grateful to have a little of your space to explain the position, and perhaps in so doing to assist your readers to distinguish between fact and hearsay in the article "Goldfinger no longer" of your issue of January 3, 1970.

There are perhaps three main points made in this series of articles concerning our policy for support of research in universities that deserve an answer. The first is that on the face of it NERC loaded itself with too many commitments when it was being encouraged to expand. I think the trouble here is partly due to a misunderstanding about

our funding of university research arising from the difference between the total value of new grants awarded in a given year and the total expenditure on all grants, new or existing, in that year. The former figure is not expenditure but new commitments extending for several years ahead, depending on the duration of the grants. In steady conditions the figures for both new awards and annual expenditure will move together, but in practice these conditions have never arisen.

	1966/67	1967/68	1968/69	Estimated 1969/70
Total value of new awards (academic year, October–September)	1.8	1.2	0.9	(1.0)
Annual expenditure (financial year, April to March)	0.69	0.89	0.93	(1.2)

In particular, at the end of the last university quinquennium in 1967, a large proportion of existing grants terminated. It was necessary in that year, in order to sustain a steady growth in subsequent annual expenditure, to enter into an exceptionally large commitment on new awards, although this level of new commitment could not, and was never intended to be, sustained. The effect of the transition from one quinquennium to the next can be seen by comparing figures for value of new awards with those for annual expenditure on research grants, both given in millions of pounds.

These figures show that our annual expenditure on university research grants is likely to increase by about 75 per cent over the past 4 years from 1966 to the present time.

The second point concerns the fact that only 15 per cent of NERC's expenditure as shown in our financial statement for last year went to universities. These figures for university support are not, however, comparable as they stand with expenditure on research elsewhere by the council. In particular they exclude capital expenditure on buildings, equipment that is a regular part of the facilities of the department concerned, and supporting costs and services, all of which are provided at universities by the UGC but in our own institutes have to be included in the NERC expenditure. In the marine field the major part of the activities of our Research Vessel Unit, of the RRS John Murray and of the use of marine research equipment held at the Research Vessel Unit, are devoted to the needs of universities. Thus both in actual money and in research effort, our effective support of university research is a substantially larger fraction of our total expenditure than appears from the figures shown in the financial statement under that head for accounting purposes.

Our general policy towards support of university research in the environmental sciences has been dealt with at length in our current annual report. I need only say that we believe our support must be selective, should be guided (but not inhibited) by broad strategic objectives, and ought to link up with the programmes of our institutes whenever it is sensible and productive to do so. This brings me to the third point, namely, the use of the so-called "success rate", that is, the ratio of funds awarded to funds applied for (which last year was just over one-third overall), as a measure of this disappointment.

In fact, this ratio as it stands is a very unreliable index of the true extent to which our support is falling short of the total legitimate and deserving requests. Some of the applications we receive, including the largest ones, are either outside our remit or are for other reasons unsuitable for support. We believe it is right to bring all of them to the attention of one or other of our grant-awarding committees rather than to make the situation look more rosy by pruning them beforehand. Sometimes it is possible to find ways of achieving the desired research objectives more economically, particularly by sharing expensive equipment between universities or with council establishments. In some cases an award is made initially for a shorter period than is requested, with the possibility

of an extension if promising results are achieved. Our grant-awarding committees would be failing in their task of distributing available funds in the best interests of science if they did not give careful and critical attention to such matters.

What my council is concerned to ascertain from our grant-awarding committees is whether, at the end of the day, they feel that a significant proportion of truly deserving applications has had to be turned down through lack of resources. So far, I am glad to say, this has not been the case.

Yours faithfully,  
R. J. H. BEVERTON

Natural Environment Research Council,  
Alhambra House,  
London WC2.

### Mild Thaw on Disarmament

SIR,—You state, sensibly enough (*Nature*, 225, 211; 1970), that with regard to strategic arms limitation, "Relations with the nuclear pigmies—Britain, France and China—are also a complication, if only because nobody can at this stage commit himself to permanent restraint in nuclear weapons when there is no certainty that smaller powers will not seek to become top dogs". Certainly; but also vice versa: few among the "nuclear pigmies" (in esse or posse) can "at this stage commit [themselves] to permanent restraint in nuclear weapons when there is no certainty that" the nuclear giants "will not seek to become top dogs" in the nuclear condominium sense. This is the lesson of the non-proliferation treaty negotiations, and Americans and Russians had better not forget it. If, as *Die Welt* reported two weeks ago, there is a Russian-American plan not to consider Russian medium range strategic missiles until agreement has been reached and put into effect on intercontinental missiles, target states of those medium range strategic missiles—for example, France, United Kingdom, Japan, India, etc.—are unlikely to commit themselves to much "permanent restraint". This fact may well complicate negotiations at Vienna, but it will not go away merely because it is inconvenient.

Yours faithfully,  
ELIZABETH YOUNG

100 Bayswater Road,  
London W2.

### Cover-to-cover Translation

SIR,—Abstracts as a form of journal publication from which subscribers would order full texts as needed are mentioned by your geomagnetism correspondent (*Nature*, 224, 750; 1969) as a possible solution for meeting cover-to-cover translation problems in geophysics.

Such a scheme has been used for some twenty oriental vernacular journals at the Air Force Cambridge Research Laboratories (AFCLR) since 1962. Abstracts are made for each single number of each journal as received, and are circulated to AFCLR scientists. The individual scientist then requests full translation of those articles whose abstracts appear pertinent to his interests. Abstracts from any one journal are eventually bound together and classified by subject subdivisions in order to provide a desk tool for retrospective search. One such oriental abstract translation publication which is available to the public is *Acta Meteorologica Sinica; translated titles and abstracts from volume 27 (1956) through volume 35 (1965)*, published as AD 667 520. There are 360 articles abstracted in this publication, of which 69 (19 per cent) have been requested in full translation.

Your geomagnetism correspondent also suggests that cover-to-cover translation is not the most economical way of bringing Russian work to the attention of western scientists. However, AFCLR records of articles requested