1. To prepare a national census of research, showing what laboratories and investigators are available.
2. To encourage the cooperation of educational and research institutions in working out problems of pure science and industry.
3. To promote research in various branches of science in cooperation with leading national scientific societies.
4. To encourage scientific research in educational institutions. It is proposed, for instance, that in each advanced educational institution there be a committee on research to promote original investigations on the part of the faculty and graduate students.
5. To establish research fellowships in educational institutions, thus affording qualified workers an opportunity to devote themselves entirely to research work.
6. To secure wherever possible endowments for research purposes.

It is evident that so far from being primarily work in the practical application of what we know already, the enterprise is intended to be primarily a stimulus to fundamental research in every direction. It is not *practical application* that is to be stimulated chiefly, but *exploration,* which may or may not result in practical application. It is felt, for example, that the more we know about the structures and activities of plants, the better equipped we shall be to handle plants intelligently. Our botanical program, therefore, is simply to extend the boundaries of our knowledge of plants as far as possible. In pursuance of this program, at least two things are felt to be necessary.

In the first place, there must be developed some scheme of cooperation among our botanical establishments; and notably between the research establishments and the so-called practical establishments. For example, we recognize in general three great botanical agencies at work to-day, working independently, and in too great ignorance of each other's results. These agencies are the Department of Agriculture, the agricultural colleges and experiment stations, and the universities. All these agencies are investigating plants from various points of view, but they are not as mutually helpful or even as mutually stimulating as they should be in the interest of progress. I have met many cases of men intellectually equipped to work, but with no adequate material or equipment; and also even more cases of fine equipment and abundant material, and no man trained to use them effectively. In other words, the distribution of men and equipment is not as effective as it should be.

In the second place, there must be developed some plan of supporting research wherever there is a competent investigator. The movement to establish research fellowships has begun already, and as the value of research becomes better understood, there is no reason to doubt that every botanical explorer will have the opportunity to explore. There is at present a tremendous amount of waste in the investigators produced by the universities. Every year scores of young investigators, well equipped to continue exploration, are automatically side-tracked by a degree, and forced into positions where investigation is killed, or at least becomes anemic. The council proposes to conserve some of this investigative ability, and to give it a chance to express itself. In short, the opportunity now presented to us is to increase the opportunities for botanical research to such an extent by cooperation and conservation of investigative ability that the progress of botany should take on a greatly increased momentum. And all this can be done if at this psychological moment we as botanists can make it clear that a fundamental knowledge of plants is a great national asset.

THE LATE JOHN M. COULTER

REPORTS

THE AUSTRALIAN NATIONAL RESEARCH COUNCIL

IN October, 1940, the Australian National Research Council according to the *Australian Journal of Science* submitted proposals to the Prime Minister at his request, for a Scientific Advisory Committee on the lines of the Hankey Committee in Britain and the President's Scientific Advisory Committee in the United States of America. These proposals proved to be unacceptable, but an alternative arrangement was approved whereby the A.N.R.C. was to maintain close contact with the executive of the Council for Scientific and Industrial Research through a special representative. This arrangement was to be reviewed after twelve months.

As a result of the past year's experience the executive committee has made a request to the Commonwealth Government that it should authorize two men, selected for their knowledge of industry and science, to spend about three months examining the situation by consultation with leaders in industrial and other war activities. These two men would submit to the Prime Minister proposals for increasing the effective use of the country's scientific resources.

This proposal was first discussed fully with the Council for Scientific and Industrial Research, which has agreed to support the A.N.R.C. in this proposal.

The following is a brief review of some of the activities of the executive committee during the past twelve months.

Contact has been established between the Australian National Research Council and the following:

(i) The Executive of the Council for Scientific and Industrial Research.
(ii) The Adjutant General.
(iii) The Director General and Secretary of the Ministry of Munitions.
(iv) The Director General and Secretary of the Department of Supply and Development.
(v) The Chief Draughtsman, Maribyrnong.
(vi) The Controller of Materials, Ministry of Munitions.
(vii) The Assistant Controller of Industrial Chemicals.
(viii) The Chairman, Medical Equipment Control Committee.
(ix) The Department of Information.
(x) The N.S.W. Contracts Board.
(xi) The Army Medical Services.

The result of these contacts is that several scientific problems arising out of the nation's war effort have been dealt with by scientists in universities and elsewhere. The following are examples of this:

(*a*) A committee of chemists has, in cooperation with the Assistant-Controller of Industrial Chemicals, Ministry of Munitions, prepared a list of chemicals needed in Australia for industrial and analytical work and not manufactured here. The committee has initiated research work on some of these chemicals.

(*b*) The A.N.R.C. has initiated work on the preparation of fire-foam stabilizers (formerly imported) from peanut shells in Australia. This manufacture is about to begin on a scale large enough to supply all Australian requirements and, if required, to export abroad.

(*c*) The A.N.R.C. has initiated research work on the production of sensitizers, essential for engineering drawings, from chemicals available in Australia. In Maribyrnong alone over 2 million square feet *per annum* of this paper are used in munition manufacture, and it is all imported. Research to produce sensitizer has so far been successful, and at present the A.N.R.C., with the cooperation of the Ministry of Munitions, is about to conduct tests which will determine whether an Australian-made sensitizer can replace the imported material in munitions work.

(*d*) The Drug Sub-committee of the Association of Scientific Workers is affiliated to the Australian National Research Council and conducts its negotiations with the Medical Equipment Control Committee largely through the Australian National Research Council's representative. With the help of these negotiations several pieces of work of national importance have been done by the sub-committee.

(*e*) A sub-committee of the A.N.R.C. in collaboration with the Medical Equipment Control Committee has been examining the situation regarding the supplies of essential veterinary drugs.

(*f*) A sub-committee of the A.N.R.C. investigated the possibility of local agar manufacture, with the cooperation of C.S.I.R., and made recommendations concerning the importation of agar supplies for essential pathological and scientific work.

(*g*) A liaison officer has been appointed between Eastern Command and the Australian National Research Council to assist in the solution of scientific problems arising in the Army. The liaison officer, Major Pulling, is attached to the General Staff of Eastern Command.

(*h*) The A.N.R.C., with the agreement of the executive of C.S.I.R. and the vice-chancellors of Australian universities, will examine and comment upon the annual reports of the expenditure of the Commonwealth Research Grant to universities, and will publish summaries of the reports.

(*i*) Through its contact with the N.S.W. Contracts Board, the A.N.R.C. has been asked to give advice on technical difficulties in the fulfilment of war contracts.

(j) The A.N.R.C. has pressed for the appointment of entomologists to the A.I.F.

(*k*) The A.N.R.C. called a conference of representatives from the Australian universities and from C.S.I.R. to discuss the need for training workers in agricultural economics, in view of the need for collecting information before agricultural policy is determined.

SPECIAL ARTICLES

EQUILIBRIA IN AN ANTIGEN-ANTIBODY REACTION

ACCORDING to a theory of immune precipitation developed elsewhere,[1] an equilibrium constant for the *initial reactions* between antigen (G) and antibody (A)

$$G + xA = GA_x$$

may be written

$$K_v^* = \frac{[\text{Satisfied valences}]}{[\text{free valences of G}]\,[\text{valences of free A}]}$$

$$= \frac{G_o x}{G_o(g-x)Ca}\ \text{mol}^{-1}\ \text{liters}$$

where "valence" is defined by the identity, G_o is the initial concentration of G, C is the equilibrium concentration of A, g is the maximal valence of G, and a is the maximal valence of A. This formulation requires three assumptions: that the initial reactions are bimolecular, that the strength of the forces binding a

[1] A. D. Hershey, *Jour. Immunol.*, 42: 455, 1941.

* The constant k ($= 1000/K_v$) employed in (1) refers to the dissociation of the A–G complex, and to the unit volume 10^6 ml.