have been unleashed abroad, you on your part stand prepared to furnish to your government all the resources which can be brought to bear through the academy, and through its instrumentality, the National Research Council, organized for the purpose among other things of strengthening the national defense and cooperating in the interest of the public welfare. And we on our part have offered to our government every man and every facility at our command for such purpose in the national emergency as our government may think helpful in the grave problems it has in hand. Our preparation involves also the organization of base hospitals, the setting up of Army, Navy and Pilot training corps, and our cooperation with plans having to do with registration and special researches and services bearing upon national defense. As before in our history when our services were useful or needed, we stand ready to make available to all departments of the Federal Government the special abilities, experiences and the capacities of each and every activity we possess.

You come to the university in a year of great meaning to us. Founded by the many-sided Franklin two hundred years ago we find ourselves interwoven with the academy through a distinguished group of scholars deeply grounded in the objectives of each institution. Beginning with Bache, and coming through Frazier, Leidy, Lesley and two Rogers, Longstreth, Cope, Donaldson, Mitchell and Wood, we can trace adventures into the unknown through the dramatic lives of those who between us had common interests. By coming here in this special year you demonstrate again the vitality of democracy, the unity of purpose of intelligent men and the power of education, which in these times gives renewed faith and encouragement to us all. It is well that in some place there should be provided at just this time in the history of the world a platform from which the best minds in all fields of useful knowledge could give encouragement to a weary world. And while the location of such an event is not nearly so important as the circumstance it seems appropriate that the scene should be here in Philadelphia which saw the birth of American liberty, and is to-day more than ever a shrine from which free men may renew their inspiration. The bicentennial celebration of this university, which is being observed throughout the year, reached in a sense its high point during the present fall and the observances which have occurred emphasize again the fact that knowledge and learning know no boundaries of nationality, of creed, of race or social preference. We have all been inspired by the fact that great scientists and humanists invited to our commemoration came with enthusiasm and with generosity, and that those who could not come from overseas because of the war heroically stayed at home but sent to us for the benefit of learning and welfare their papers to be read by other colleagues in the free realm of scholarship.

From countries on both sides of the European and the Asiatic wars came messages of hope of a new tomorrow. From men of universities no longer in existence came letters and cablegrams pleading that the fires of freedom be kept burning as the hope of civilization. "Free science in America means free science for all the world," wrote the delegate from the University of Latvia, whose faculties have been banished.

Institutions such as those with which you and we are associated and the forces which lie back of them are older than any government in the world. Around them liberty and independence have grown. Education that is free and virile can exist only in a democracy. And democracy can exist only where education and intelligence grow guided by such institutions as yours and ours leading the people along pathways that are free and upward. Therein rests the hope of civilization for the kind of a future for which intelligent men and women are even now giving their genius, their energies and their lives.

One can not overstate the significance of a meeting such as this at the present time. Nor can one overestimate the lasting values which may result from our association together. There is inherent in the event the acceptance of the challenge to our collective abilities to meet and overcome the onslaught of a world ridden by fear.

THOMAS S. GATES

REMARKS AT THE DINNER BY THE PRESIDENT OF THE ACADEMY

THIS is neither the time nor occasion for any extended remarks on my part. Nevertheless I do wish to trespass on your good nature for a few minutes. I have learned something out of my experience these past eighteen months as President of the National Academy of Sciences which I would like to convey to you—members and guests alike.

To the members, particularly to those who have been members long, it is not particularly new, nor, as they may remember, is this my first reference to it. My justification for reverting to it now is that it is at present an important matter in connection with the functioning of the academy. To these older members I crave pardon in advance.

To you who are our guests, what I have to say is probably new. To all of you, members and guests alike, who are interested in or concerned with the *raison d'être* of the academy it is, I think, something you should understand clearly.

I suspect that most people outside its membership think of the National Academy of Sciences as some sort of a voluntarily created scientific society of limited membership, which differs from numerous other

scientific and technical societies only in that its membership covers a wide range of scientific fields. They may or may not know that membership is attained not by application but by a rigorous and somewhat laborious process of election which involves judgment of a candidate's scholarly fitness. This judgment is not merely that of men in the candidate's own particular field but is equally the judgment of those in all the other fields comprised within the academy structure. Further, they may or may not know that final election is not by ballot of all the members of the academy but is by secret ballot of those members present at the annual meeting, taken after full discussion of the candidate's scientific achievements. So far as men are capable of doing it, this process seeks to select men judged to be eminent in some field of fundamental or applied science. Finally, the outsider may or may not know that the members of the academy gather together occasionally to present and discuss noteworthy new discoveries in science in a wide variety of fields, and once a year to replenish their limited membership.

In normal peaceful times, this is about all there is to the academy, so far as most of its members, as well as those outside its ranks, are concerned. Only the officers and the few members of standing committees or those concerned with the active work of its great agent, the National Research Council, are in such times kept continually alive as to what the academy really is. During these quiescent periods some, even of the members, tend quite naturally to consider the academy merely as something pleasant to belong to—a sort of exclusive scientific club, as it were, made up of men and women of distinction in science with a magnificent marble home in Washington.

Actually the academy is something quite different from this. It is *not* a self-perpetuating voluntary association but a self-perpetuating corporation chartered by Congress for a very definite and specific purpose. It is in fact a permanent quasi instrument of the Federal Government. By accepting election to membership in it men and women accept responsibility to serve the nation without remuneration whenever requested to do so by the government.

The Congressional Charter approved by President Lincoln, March 3, 1863, is an astounding state paper which pays tribute to the statesmanship not only of Mr. Lincoln but of A. D. Bache, the academy's first president, Louis Agassiz, Asa Gray, Joseph Henry, Benjamin Silliman and the numerous other distinguished scientists of the time. These men, who were the original members of the academy, were not a voluntary association of men having a common interest in science. They were designated by Congress as the original members of a permanent corporation created by the supreme authority of the nation. The fact that among these original designated members were a considerable number of distinguished Army and Navy officers is evidence of a primary purpose which Congress and the President had in mind.

The entire Act of Incorporation consists of but three sections and covers less than a single small printed page. The first section, which comprises nearly two thirds of the document, is a mere recital of the names and states of residence of the incorporating members—ten of whom were from Pennsylvania. The second section, of seven lines, gives the corporation what is essentially a white card as to all things pertaining to its operation, including its rules and the election of members. It also provides for reports to Congress.

In the original charter Section 2 also limited the number of members to 50. By further Act of Congress in 1870, all limitation of numbers was removed and membership was left to the sole discretion of the corporation.

The last section, of less than a hundred words, provides that the academy shall hold an annual meeting at some place of its own choosing within the United States. It also imposes the obligation that ". . . the Academy shall, whenever called upon by any department of the Government, investigate, examine, experiment and report upon any subject of science or art . . ." the actual expenses to be paid by government but the academy to receive ". . . no compensation whatever for any services to the Government of the United States."

This Section 3, which is always incorporated in any contracts or formal understandings of the academy with government departments, is the price exacted of the academy for the complete freedom accorded it in Section 2. It is also the proviso which indirectly over the past seventy-five years has determined the qualification of men for membership and the whole machinery of nomination and election.

By this simple expedient of giving the academy essentially unlimited freedom to administer its own affairs and in return exacting merely an obligation to serve the nation when requested, the charter in effect ordained that the membership should always consist of men and women of established scientific competence, since otherwise the academy could not carry out its charter obligation.

In normal times the requests of government on the academy are not numerous and usually not of an urgent character. They never deal with unimportant matters, however.

In times of stress, like the present, things are quite the reverse. Requests for advice then become numerous and more frequently than not, urgent.

Beginning about two years ago, requests began to peak up in accelerated fashion and during the past

eighteen months the academy, either directly or through its agent, the National Research Council, has been called upon to advise, study and report on a wide variety of matters, in which the actual costs paid by government under the charter are running at the rate of a number of hundred thousand dollars a year. When it is remembered that the services of the academy and its members, and the services of all those it appoints on its committees, are furnished without remuneration, the full scope of the aid rendered by the academy under its charter obligations can be appreciated.

These requests for study and advice have come from the President, from numerous branches of the Army and Navy, and from many of the civil departments, boards and commissions, both permanent and temporary. The problems these requests present are vastly more varied than are their origins. Recently numerous requests for assistance involving much work have come from temporary defense organizations, and more are in prospect. Many of them are matters of great urgency involved in decisions of public policy and the expenditure of large sums of public money.

The permanent organization of the academy and council, built up over the years, is of inestimable value in selecting quickly the most qualified men in any field of science for the particular study required.

While the load of work imposed on the officers of the academy and council and on many of the members in handling these requests has disabused our minds of any lurking thought we may have harbored that membership was an ornamental sinecure, it has been an interesting experience. So far as I personally am concerned, it has given me added respect for those men who, in the midst of a devastating civil war, could create in such a simple structure an organization so lasting, so powerful and so flexible to changing conditions as the one they adopted. It is difficult for me to conceive of a more effective structure for insuring that at all times government be in position to avail itself of the most competent unbiased assistance science can provide. Temporary organizations have been in the past, are now and will continue to be created in times of emergency to supplement the work of the academy and council. They are, however, more likely than not to pass off the stage with the passage of the emergency which brought about their creation.

As indicated above, the simple expedient adopted by Congress in the academy's charter forged the strongest possible chains of service. Because it appeals merely to the honor of men, nothing can be more compelling than an obligation to serve, coupled with a guarantee of complete freedom to render that service in the best way they can themselves devise. The strength of the academy and its ability to discharge its obligations lies solely in the character and eminence of its members and of those it selects to aid it. It does not reside in numbers, since there is no limitation to those it may ask to aid on occasion, nor does it reside in any statutory authority to enforce its findings or opinions. Fortunately, the academy has no such power and so no temptation to become dictatorial.

The most powerful force within the academy and about the only one which acts on all of the members is therefore the one concerned with the quality of men. The fact that the load of work is unequally distributed among the membership, and that many of the members may never be called upon to render personal service, matters little. The character of the problems presented determines where the burden will fall. What is important, and what makes it possible for the academy directly and indirectly to render service, is that it should be composed of men and women who have established their competence as real contributors to an enlarging science.

If further proof be needed of the power of the simple setup of seventy-seven years ago, it is to be found in the fact that not once in the many scores of calls for personal time-consuming unremunerated assistance that the academy has made on men during the past year has there been a single declination. While many of the calls have been to members of the academy or National Research Council, the great majority have been to men outside either. Nor has there been, so far as I am aware, a single instance in which the advice given government has not been followed or has been questioned.

So long as the eminence of its membership is maintained, the Congressional Charter provides an almost impregnable citadel for disinterested service to the nation. It is a shield against the pressures of expediency, influence and the thousand and one things which so frequently bedevil and thwart our group undertakings.

I have a feeling that the pattern of permanent formal relationship between government and self-operating groups of its citizens, exemplified by the academy charter, could be copied to great advantage in numerous other fields.

To give you some idea of the scope and variety of the problems which have been submitted to the academy during the past year, the following partial list may be of interest. Some of them have been handled by committees of the academy alone and more by committees jointly appointed by the academy and council. Due to the magnitude and increasing complexity of the problems we are more and more employing the joint committee scheme.

1. From the President of the United States—Study and report on a method of instrument (blind) landing for aeroplanes to be standardized and employed at major flying fields.

2. From the Civil Aeronautics Authority—Comprehensive study of the whole method of selection and training of pilots. This is a very considerable task which is extending over two years, and which involves work at many institutions of learning.

3. From the National Resources Planning Board—Study and report on industrial research in the United States.

4. From the Advisory Commission to the Council of National Defense—(a) Study and report on the whole problem of utilizing domestic low-grade manganese ores; and (b) Study and report on the erection of a tin smelter to refine low-grade tin ores from Bolivia.

5. From the Army and Navy—Numerous problems concerned with National Defense. Some of these are handled by permanent committees of the academy and some by special joint committees. Many of them involve much and long-continued work and the expenditure of large sums of money.

These are but samples picked at random from a long list.

FRANK B. JEWETT

ABSTRACTS OF PAPERS

A white-flowered race of Datura from aged seed which is genetically distinct from similar white races in nature: ALBERT F. BLAKESLEE and A. G. AVERY. In *Datura stramonium* there are two color forms, one with white flowers and green stems, the other with purple flowers and stems. In the current manuals they are recognized as distinct species, *D. stramonium* and *D. tatula,* but differ only in a single pair of genes located in the ·18 half of the 17·18 chromosome. From seeds aged 7½ years, a recessive white-flowered type segregated out in the F_2 generation which was indistinguishable in appearance from the wild whites. When crossed with a standard white from nature, the F_1 plants were purple, a fact which showed we were dealing with a new gene for white. By appropriate tests this new gene has been located in the ·16 half of the 15·16 chromosome. The possibility that more than one recessive gene might be responsible for the different wild whites was tested by crossing standard white testers with over 400 white races from nature. If any of these whites had been determined by a different gene from that responsible for the white flowers of the tester, their F_1's would have been purple. The F_1's, however, were all white, a fact which proves that there was only one gene for white flowers in the 400 races. Since these races were secured from widely separate parts of the world, including all the continents, and represented all the recurrent chromosomal types found in nature, it is probable that no new gene for white flowers in this species has become established in the wild. In *D. ferox,* a gene for white flowers which is located in the ·4 half of the 3·4 chromosome causes the corolla and stamens to be white and the stem and leaves above the cotyledons to be green. In flower color the herbaceous Daturas are limited to two types—purple and white.

Physiological differentiation of Astragalus in response to selenium: SAM F. TRELEASE (introduced by W. J. Robbins). The growth of *Astragalus racemosus* and *A. pattersonii* in solution and sand cultures was greatly increased by the element selenium (as selenite or selenate) in concentrations up to 27 ppm., and the plants accumulated large quantities of selenium. Selenium seems to be an essential mineral element for these species of *Astragalus.* In marked contrast, *A. crassicarpus* was not stimulated by selenium in the culture solution but was instead poisoned, being severely injured by 0.33 ppm. and killed by 9 ppm. This species is able to absorb only small quantities of selenium, and its physiological response is like that of wheat, buckwheat, soy beans or tobacco. *A. racemosus* and *A. pattersonii* are indicators of seleniferous areas. But *A. crassicarpus,* since it is neither benefited by selenium nor poisoned by the very low concentrations existing in natural soils, does not serve as an indicator. Field studies in collaboration with Professor O. A. Beath have shown thus far that twenty-three other species are like *A. racemosus* and *A. pattersonii* in being selenium indicators, whereas many other species of *Astragalus* resemble *A. crassicarpus* in being indifferent to selenium in natural soils. The indicator species fall into six of the twenty-nine groups into which M. E. Jones divided the genus *Astragalus* on the basis of morphological characters. All members so far examined in the groups Bisulcati, Ocreati, Podo-sclerocarpi and Preussii are selenium indicators; and no member studied in the groups Uliginosi, Flexuosi, Inflati, Homalobi, Angophylli and Hypoglottides is a selenium indicator. The groups Galegiformes and Lonchocarpi seem to require revision, since each includes both indicator and non-indicator species. Physiological differentiation of *Astragalus* with reference to selenium provides a new approach to the division of this difficult genus into groups representing relationships and evolutionary development.

Sensitivity of gladiolus corms during an artificially prolonged rest period: FRANK E. DENNY (introduced by B. O. Dodge). Although gladiolus corms when freshly harvested are dormant, they pass through this rest period, usually in one to three months, and then will germinate promptly when planted. This rest period may be prolonged for many months or for two years or more with certain varieties by the simple expedient of replanting the *freshly harvested* corms in *moist soil* and *storing at room temperature* or preferably at about 27° C. With the passage of time, corms with a rest period artificially prolonged in this way become sensitive to low temperatures, such as 0° and 5° C. Germination can then be induced by short periods of chilling such as 48, 24, 12 or even 6 hours, depending on the variety and the duration of the period of enforced rest at the time of the exposure to cold. During this long rest period the corms show an exceptional type of respiration. When first removed from the soil after a sojourn in it of several or even a few months, the carbon dioxide production at the temperature which prevailed during the storage in soil is very low, approximately 2 to 10 mg CO_2 per kg per hour. This low rate is maintained, however, for only 4 to 8 hours,