benefit any number of technical branches of the War and Navy Departments. A board such as we visualize would be in better position than any of these technical services to attack the problem in a comprehensive and well-coordinated manner. It is quite probable that some of the tasks which the board should undertake will require years of continuous high talent research.

In this connection, I wish to mention a conclusion reached by the Wilson Committee, *viz.*, that such a board should not operate laboratories of its own but should have its research done by contract with existing organizations. This for several reasons, the first and most important being that operation of its own laboratory or laboratories would almost certainly narrow its field of interest. We believe, however, that the charter of the board should be broad enough so that it can, if necessary, establish laboratories for specific purposes and then turn them over to an appropriate agency for operation. This to cover cases where there are no suitable facilities available for carrying on special work.

So much for the purely scientific work which we believe the board will do. There are many other problems which may be broadly termed the human relations problems, which such a board should study and on which it should advise the Services. For example, a study should be made of the kind of problems which pressed for immediate solution when we entered World War I and World War II—the kind of machinery which was available to solve the problems and the additional machinery that was found necessary. Were the steps taken satisfactory? Are there any lessons to be learned from these experiences which can be applied to the next emergency? It can be assumed that no matter how much advance planning is done, no democracy will ever be completely ready for a war. Only the totalitarian nation, preparing for a war of aggression, can be ready for every eventuality before the war begins.

A study should be made of the incentives that motivate scientific and technical men, and appropriate mechanisms should be worked out to provide these incentives. This is a very broad field and includes the financial rewards of scientists in Government service as compared to the rewards in private life. The question of restraints imposed on laboratory workers as compared, for example, to the mechanics or the white collar worker should be studied. The relationships between scientists in the laboratory and operating personnel in the field are deserving of study, especially the relationships between the professional officers of the Army and Navy and the civilian scientists. The degree to which the parallel attack under independent direction is desirable, especially in so far as it affects the morale of the laboratory worker, is deserving of much thought.

In conclusion I want to mention the great personal interest that the Secretary of War, Mr. Stimson, and the Secretary of the Navy, Mr. Forrestal, are taking in post-war military research. There is a growing belief that important as it may be to maintain after the war ground forces, air forces and sea forces of a size commensurate with our national responsibilities, it may be even more important to keep the weapons and the matériel in general which we supply to these forces in step with the advances of science. Stocking our arsenals with the weapons of this war is no guarantee that we can win the next war with them. In fact, that may be the quickest way of losing the next war. It would be wiser to maintain arsenals of only modest size whether we are speaking of ships or guns or aircraft and to use the money saved thereby to continually replace the old things with the new creations of the research laboratory and of American inventive genius. Our industry should be kept alert to begin quickly the production of the vast quantities of materials needed when war threatens; and this readiness should concern itself especially with the new things. We hope for your aid in supporting this position among those who are engaged in research. No matter what organizational mechanisms may be provided to bring this about we should adopt the policy and adhere to it that expenditures for research must henceforth be a substantial part of our peace-time preparedness program.

OBITUARY

CHARLES B. LIPMAN
1883–1944

CHARLES BERNARD LIPMAN, professor of plant physiology and dean of the Graduate Division in the University of California, died in Berkeley, California, on October 22, 1944, shortly after he had suffered a heart attack. He was a distinguished biologist, an esteemed teacher, a successful administrator and a felicitous writer, whose stimulating influence on botanical science and on graduate study in all fields was far-reaching.

When he joined the staff of the University of California in 1909 he was associated with the late Professor E. W. Hilgard and devoted his chief attention to soil bacteriology, a subject in which his brother, the late Jacob G. Lipman, of New Jersey, was also interested. He was appointed professor of soil chemistry and bacteriology in 1913, dean of the Graduate Divi-

sion in 1923 and professor of plant physiology in 1925. Professor Lipman's researches on micro-organisms concerned in nitrogen-fixation and nitrification in arid and semi-arid soils grew out of his work with Professor Hilgard and were followed in later years by pioneer investigations on the necessity of certain micro-elements essential for plant nutrition, demonstrating that copper and zinc are necessary for the higher plants.

Having discovered that bacteria could survive many years in desiccated soils, Professor Lipman was impelled to study some fundamental problems in longevity which others, lacking his courage, had declined to investigate. He found that many specimens of geologically old sedimentary and even metamorphic rocks contained small numbers of bacteria consisting mainly of spore-bearing rods. Similar examinations made of igneous rocks showed them to be entirely free from any living forms. Since the length of time during which micro-organisms have survived in many geological specimens can not be determined with certainty due to the possible contamination by ground waters and other means, Professor Lipman also investigated the occurrence of micro-organisms in old materials, such as herbarium specimens, bottled soil samples and bricks from the interior of pre-Inca pyramids in Peru which could be assumed to have been free from outside contamination. His results provided convincing evidence that the resting forms of some types of bacteria can survive in a dry condition for hundreds and probably thousands of years and that cells of the blue-green alga, *Nostoc commune,* may remain viable for at least 88 years. Other micro-organisms such as *Azotobacter chroococcum* can survive in a desiccated condition only a few years.

Other noteworthy contributions which Professor Lipman made in the field of micro-biology are the demonstrations of symbiosis between green algae and nitrogen-fixing bacteria and the isolation of a new type of sulfur-oxidizing bacterium, *Thiobacillus coprolyticus.*

He was interested in the problems of life in an environment which putatively existed when planetary conditions were emerging from a cosmos consisting mainly of rock fragments and water.

His career as dean of the graduate division gave Professor Lipman an opportunity to uphold his high ideals of liberal education, through personal conferences with each candidate for the doctorate. During the twenty-one years that he served in that office he raised measurably the standards of graduate study in this university.

Furthermore, he was genuinely interested in the broad international field of education, and cordially welcomed foreign students who came to the University of California. He was a member of the board of directors of International House in Berkeley, president of the California Chapter of the American-Scandinavian Foundation in 1941 and a member of the advisory committee appointed in 1941 by the Department of State to provide facilities for foreign students in those tumultuous times. For many years he was a member of the advisory board of the John Simon Guggenheim Memorial Foundation, which grants funds to scholars for research or for other creative work. As a result of his intimate knowledge of such organizations and acquaintance with various universities, Professor Lipman was able to expedite the progress of many a promising young student in California and elsewhere.

Lipman's breadth of view in science was demonstrated not only by his membership in professional societies at home and abroad but by his service on the editorial boards of the *Journal of Bacteriology,* of *Plant Physiology,* of *Soil Science,* of the University of California Publications in Agricultural Sciences and of the committee on the organization of the Sixth Pan-Pacific Science Congress, which convened in Berkeley in 1939.

Personally attractive, a genial conversationalist, well poised socially, blessed with a sense of humor and with a gift for innate friendliness, he was esteemed wherever he went.

Professor Lipman believed implicitly in the power of education to liberate the human intellect from the shackles of ignorance, provincialism and fanaticism. He insisted that higher education and graduate study should confer upon the student not only special skills, but a broad, tolerant attitude and appreciation of human cultures. He observed keenly, worked intensively, conquered obstacles and advanced science in a way which exemplified his own high ideals.

HOWARD S. REED
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SCIENTIFIC EVENTS

THE INDUSTRIAL DEVELOPMENT OF INDIA

THE industrial development of India after the war was discussed on October 16 by the five Indian scientists who recently arrived in England to make contact with scientific, industrial and agricultural research organizations.

The Times, London, reports that the visitors were present at a conference at the headquarters of the Royal Society, Burlington House, presided over by