value of mulches and incorporated organic matter and the nitrogen-fixing bacteria.

The projects listed above under active investigation at six institutions in the region is convincing proof of the interest in this field of work. No doubt other investigations at institutions not contacted or reported here are underway. The situation is most encouraging, and it is to be hoped that much progress will be made in all lines of soil microbiological work during the next few years. In spite of all the work that has been done and that which is under way, there are many unsolved problems in this field. The inoculation of legumes has not been uniformly successful, even if it is one of the oldest applications of the science. Much information has been gained concerning the factors affecting the growth of the Rhizobia, but we still know very little about the relative efficiency of different strains of the organisms. Although a few studies have been made on the effects of certain organisms on the growth of Rhizobia very little is known concerning the relationship of these organisms with the complex flora of the soil. The presence of Rhizobiumphage has been noted, but only scanty information is available concerning the occurrence and action of this bacteriophage. In spite of all the work of the past few years on the chemistry of nitrogen fixation much remains to be determined concerning the metabolism and functional relationships of the nitrogen-fixing microorganisms. It is still uncertain whether the Rhizobia fix nitrogen apart from the host plant. Nodule formation is met with in many plants other than the leguminosae, yet it is not known definitely whether symbiotic nitrogen fixation occurs in all cases. The interactions of soil microorganisms and the higher plants, of which mycorrhiza formation is another special case, is a field rich in possibilities. Since the soil microorganisms are plants it seems logical that the biological tests for the availability of plant food constituents and the determination of the fertilizer needs of soil should be more satisfactory than chemical tests. Although several of these tests have been under investigation from time to time, no procedure has been developed which does not leave much to be desired. Soil microbiology is still a virgin field. Many of the earlier findings in other regions are still to be confirmed on our soil types.

THE AMERICAN FEDERATION FOR CLINICAL RESEARCH[1]

By Dr. MAURICE A. SCHNITKER

TOLEDO, OHIO

MY decision to give a chairman's address at this first annual meeting of the society was prompted by my great desire to tell you more about the American Federation for Clinical Research. This new society, which had its conception, birth and successful launching last year in Atlantic City, through the efforts of Dr. Henry A. Christian, of Boston, is a society which is different, and I hope will remain so, from many other similar organizations.

The organization meeting of the federation was held in Chalfonte-Haddon Hall last year, during the meetings of the Association of American Physicians and the American Society for Clinical Investigation. There were over 300 at the meeting, and although all of us were very enthusiastic, those of us who were chosen as your officers had much to learn concerning the details which the founder had in mind when this new society was drafted. It is some of these details, with which Dr. Christian has been most gracious and helpful, that I would like to present to you, and to be passed on to others, for a better understanding of the society.

First, I would like to discuss individual membership. Any young man or woman interested in and doing investigation in any branch of medical science, or allied fields, is eligible for membership in the American Federation for Clinical Research. This includes medicine, surgery, obstetrics, gynecology, pediatrics, pathology, bacteriology, chemistry, physics, and so on, any branch of science which deals with the healing art. Any one of any age so qualified may become a member, but individuals under 35 years of age are preferred. It has been adopted that no one over the age of 40 may hold an office in this society, and to follow somewhat the precedent of last year's meeting, none over the age of 40 is to appear on the program of the national meeting or to raise a voice in discussion at the national meeting. In effect, then, it is truly a society for *young* investigators and run entirely by *young* investigators.

There is no numerical limitation to the society.

However, if one is of the correct age group, it is not sufficient to say that one is interested in investigation. There must be tangible evidence in the form of at least one completed piece of research. Now what constitutes a piece of research may not be so easy to define. That was one of the first subjects discussed at the first council meeting last May in At-

[1] Address of the president, delivered at the first annual meeting, Minneapolis, Minnesota, April 20, 1942.

lantic City. It was there decided that a single interesting case report is not sufficient. The work of investigation should have a question involved, with work carried out in a manner attempting to answer that question. It may be in the form of a statistical analysis of bedside or laboratory observation or an original experimental piece of research. Whichever method is used, the investigator should be endeavoring to answer one or several questions by the work done. What this attempts to do is to place the criterion high enough to make the membership be of value to the individual, in that it must be acquired, but at the same time does not place membership beyond reach of the majority. It is a means whereby membership is attained by the individual through his own merits. For this society does not require, and wishes to dispense with, letters of recommendation in order to obtain membership. This places the full responsibility upon the individual and the work he can produce.

The constitution states further that "membership will continue so long as the member maintains interest in investigation by periodic publication of papers based on research." What is meant by the word "periodic" has not yet been defined, and what shall constitute evidence of "continued interest" is a question for the future; probably it is wisest not to attempt now or in the future a categorical definition with a membership primarily interested in investigation. The spirit of these terms doubtless is all that will be needed. "Forced research" and "forced attendance" seem to your president undesirable. By "forced research" I mean forced attendance at meetings and the presentation of papers at stated intervals. Forced attendance at meetings, by members of limited income such as make up our society, can soon lead to loss of interest. And forcing members to read a paper at least every two or three years is undesirable. Best investigations often come at long intervals. This is a society composed of young men interested in carrying on research. Many of them are in the practice of medicine and of them the same amount of research work is not to be expected as from those who spend the entire day in the laboratory. Furthermore, a forced piece of investigation done to meet the requirements of appearing on some program seldom amounts to much. Good research must be inherent and come spontaneously from the individual. It can not be hurried. Some work more slowly than others. In this society it is hoped that by not restricting its membership numerically and by not forcing presentation of papers there always will be sufficient titles submitted to fill a program with papers that have been inspired by the desire of the individual to solve a problem and not merely for the purpose of getting on a program in order to maintain membership in the society.

Several have asked whether the society will have a publication, a Transactions, to contain the various papers. For the present time it has been considered not advisable, and members are left free to publish papers anywhere they choose.

The inability of members to afford yearly attendance at the annual meeting, much as it may be desired, has been overcome in this new society in two ways, according to the plan outlined by Dr. Christian. The first is to hold the annual meeting in conjunction with the meeting of some other large society, but in a different part of the country each year. As the name implies, the American Federation for Clinical Research is meant to be a *national* organization and as such the meeting should be placed at some time within the reach of all. By thus having the annual meeting in different parts of the country each year, the meeting will come near enough for the members in a given section of the country to attend. Holding the meeting in conjunction with another large society affords the opportunity for making the cost of the trip even more worth-while by being able to attend two society meetings.

The second feature, and I believe unique for this society, consists in the organization of "local research clubs." Such clubs may be organized in any community by any interested group of investigators. The jurisdiction of such a club lies with itself and is not under the American Federation. But it is hoped that members of the American Federation will make themselves responsible for the organization of such "research clubs" and be the sustaining force, interesting the younger members of such groups to work toward membership in the American Federation. Individual members of such local research clubs may attain individual membership in the American Federation for Clinical Research, but local clubs as groups are not to be admitted "en masse" to the federation. Each local club is to be a unit unto itself, organizing and directing its own policies, admitting and limiting its members according to its own desires.

Such clubs are to hold meetings for the presentation of scientific investigation when and where the local club wishes. Intra-city and inter-city meetings between such local research clubs are to be promoted at frequent intervals for the exchange of ideas. Such meetings, held at frequent intervals, maintain and stimulate investigation and will help to take the place of the annual meeting in those years in which one can not afford the time or expense to attend the national meeting.

The inclusion of "local research clubs" as an integral part and important function in the organization

of this society seems to be a very timely one. Recently we have been hearing frequently of other large societies who are dispensing with their annual meeting for the duration of the war and who are substituting other means of carrying on their function. With the American Federation for Clinical Research, if it becomes desirable, or even necessary, to eliminate the national meeting for the duration, the local research clubs can and should carry on, to maintain an interest in investigation and to take the place of the annual meeting.

According to the policies of this organization, the dues have been set at the maximal figure of one dollar a year. This is to pay for necessary correspondence in the society and for printing the program of the annual meeting. With an adequately large membership a dollar a year should be sufficient. However, with the work carried out in the formation of this new society our funds have not been adequate. The secretary requires more help, so it becomes necessary to increase temporarily the dues, which were set at $2.00 a year. After the treasury contains adequate funds, and when our national membership becomes large enough, the amount should be reduced to that which is just sufficient to carry on the necessary program.

These then are the simple principles upon which the American Federation for Clinical Research is founded and upon which it must prosper. I know that numbers of members can not be here to-day because of military service, and undoubtedly we will be hampered in our growth and activity during the period of this war. But prosper it will, if these simple principles are adhered to rigidly. That there is a definite place for such a society as ours is attested by the fact that it has met with a great deal of enthusiasm and by the fact that other societies have started out along somewhat similar lines, but in the course of time have made themselves complicated and out of reach of the majority. Furthermore, in complicating their organization some of the other societies have lost sight of what they set out to do, namely, to stimulate interest in and to give a place to those who are beginning in medical research. Let us hope that the American Federation will always abide by these principles and remain a society whose prime purpose is the stimulation of investigation among the younger members of our profession.

RESEARCH LABORATORIES IN INDUSTRIES[1]

By Dr. O. E. BUCKLEY
PRESIDENT, BELL TELEPHONE LABORATORIES, INC.

INDUSTRIAL research is my own line of work, so perhaps I can best illustrate it and tell how it has grown by choosing an example from the field with which I am connected, that is, telephony.

There is scarcely any feature of telephony that has not been the subject of research in Bell Telephone Laboratories. Take, for example, the telephone receiver that you hold to your ear when you use the telephone. It is just one of a large number of devices that work together to make up the complex telephone system of to-day. It is a little thing, about the size of a watch, and very simple in construction, but there are embodied in it many great scientific achievements.

The present telephone receiver is a direct descendant of the original telephone invented by Alexander Graham Bell. Bell wound some insulated wire around an iron bar, mounted an iron reed close to the end of the bar and so made the first telephone receiver to convert electric currents into sound waves. You will find these same basic elements in the telephone receiver of to-day. The iron bar has evolved into two pieces of permalloy welded to two pieces of remalloy. Permalloy is an alloy of iron and nickel very easily magnetized. Remalloy is an alloy of iron, cobalt and molybdenum, which makes a good permanent magnet. The iron reed has become a diaphragm of iron, cobalt and vanadium which has other desirable magnetic properties. These are only three of the fourteen special materials which go into the modern telephone receiver. Each of these materials is the product of painstaking investigation, not just testing to select the best materials from those available, but research to discover all the hidden factors that determine behavior. The shapes and dimensions of the parts of the receivers are as important as their composition. Simple though the structure is, the design of the telephone receiver called for intricate mathematical analysis, and to test its performance required the devising of new methods of measurement. There even went into its development a study of the nature of speech and an understanding of the physiology of the ear.

Bell was a researcher as well as an inventor when he devised the telephone. He was then studying the nature of speech. He was, if you please, carrying on a kind of industrial research, but of a very different pattern from that of to-day. Bell himself had a good working knowledge of the essential science of his

[1] World-wide broadcast of the American Philosophical Society and WRUL, Philadelphia, July 10, 1942.