tributing Funds, an editorial committee and a business manager. Those serving are: *Advisory Board:* S. Bayne-Jones, representing The Jane Coffin Childs Memorial Fund for Medical Research; C. C. Little, as chairman of the Journal Committee of the American Association for Cancer Research; James B. Murphy, as chairman of the Editorial Committee of *Cancer Research;* Mildred W. S. Schram, representing The International Cancer Research Foundation, and G. M. Smith, representing the Anna Fuller Fund. *Members of the Editorial Committee* are: James B. Murphy, *chairman;* S. Bayne-Jones, for immunology and the viruses, and secretary of the committee; John Bittner, for genetics; Alexander Brunschwig, for physiology; L. F. Fieser, for organic chemistry; Jacob Furth, for the leukemias; W. U. Gardner, for hormones; Balduin Lucké, for general biology, including tissue culture and cytology; M. J. Shear, for biochemistry, and Shields Warren, for pathology. The business manager is A. Vaughn Winchell, American Oncologic Hospital, Philadelphia. It is hoped to start publication with the issue of January, 1941. Manuscripts should be addressed to the Secretary of the Editorial Committee, 333 Cedar Street, New Haven, Conn.

A "Bibliography on Arthogonal Polynomials" has been published as a Bulletin of the National Research Council. A Committee of the council, consisting of Professors Hille (Yale), Shohat (Pennsylvania), and Walsh (Harvard) has spent several years in the compilation of the bibliography, with the cooperation of several other mathematicians here and abroad. The Faculty Research Committee of the University of Pennsylvania and its Sigma Xi Chapter has given financial aid.

THE British Royal College of Physicians has announced that the Harveian Oration, the Bradshaw, the Fitzpatrick and the Lumleian Lectures for 1940 have been postponed.

IN spite of the war, the Engineering Societies Library reports that it is experiencing no difficulty in its receipt of technical periodicals from Great Britain. However, only a few engineering magazines reach the library now from continental Europe. The three hundred and fifty or more periodicals from England and other parts of the British Empire are coming through with unusual regularity except in one or two instances since the beginning of the war when the ship carrying a batch of them was sunk by a torpedo or a mine. However, correspondence with the publishers soon brought replacements for all lost copies. The Allied blockade of Germany failed to stop the flow of German magazines to the library through Italy. But, with the entrance of the latter country into the war, the library failed to receive German and Italian publications for several months. Now, some of the German periodicals are being received again through Siberia and Japan, as indicated by the postmarks on the wrappers. *Genie Civil* and other French periodicals ceased arriving a few weeks after the surrender of France. To avoid the loss of valuable publications being sent to and received from the British Isles and continental Europe through exchange agreements between engineer institutions there and the Engineering Societies Library and its cooperating organizations, arrangements have been completed to store them in the country of origin until the end of hostilities. Similar arrangements during the world war proved so satisfactory that only one or two sets of foreign periodicals failed to be completed with the resumption of commerce between belligerents.

DISCUSSION

CORAL-REEFS AND THE FORMATION OF PETROLEUM

IN his recent article on the "Progress in Petroleum" Egloff[1] has presented a brief discussion of a theory of continual petroleum formation from marine sediments, as for example diatoms, foraminifera and radiolaria. In reference to this theory the preliminary results of investigations which are in progress in this laboratory may be of some interest, because they indicate that coral-reefs should also be taken into consideration as one of the possible sources of petroleum.

Reef-building corals contain a by no means inconsiderable quantity of organic material. One hundred years ago, Silliman[2] in his classical paper on the composition of stony corals has stated that the organic matter of various corals amounted to from 4 to 8 per cent. of the total, and that it was intimately united with the inorganic material throughout the structure of the coral. Silliman's observations have been verified in recent years by Clarke and Wheeler[3] (1922), who found that the organic matter of twenty-eight species of corals amounted to from 2 to 7 per cent. It is also of considerable interest that Silliman called attention to the fact that part of the organic matter consists of some wax-like material which can be separated from its inorganic surroundings by boiling with water. After the boiling of the corals it was found floating on the surface of the water in "transparent, jelly-like masses of yellowish color. It was insoluble

[1] G. Egloff, SCIENCE, 91: 533, 1940.
[2] B. Silliman, *Am. Jour. Sci.,* (2) 1: 189, 1846.
[3] F. W. Clarke and W. C. Wheeler, *U. S. Geol. Surv. Paper* No. 124, Government Printing Office, Washington, 1922.

in alcohol, but readily so in cold ether, and the evaporation of its ethereal solution yielded a yellow solid, resembling wax." Since Silliman's time practically no work has been done on the organic constituents in corals, which is rather surprising because the reef-building corals occur in almost unlimited abundance in the coastal regions of tropical waters.

In the course of a systematic study of the steroids of lower marine animals, the lipoid fractions of a number of stony- or reef-corals (Madreporaria) and sea-fans (Gorgonaceae) were prepared at this laboratory. It was found that these fractions represent a not inconsiderable proportion of the starting material. In the case of the staghorn coral, *Madrepora cervicornis,* concentration of its acetone extract led to the precipitation of a low-melting, crystalline, wax-like material in a yield of about 0.25 per cent. of the total mass of corals. After frequent recrystallizations the wax melted at 50–50.5°; it was identified as pure cetyl palmitate. The remaining extracts of the coral were saponified, and the non-saponifiable fraction, which amounted to 0.25 per cent. of the total, was separated into three fractions containing the following groups of compounds: (A) sterols precipitable with digitonine, (B) non-steroid alcohols, and (C) non-alcoholic compounds like hydrocarbons and ketones. Fraction A consisted of a mixture of sterols containing at least one unknown sterol giving an acetate of m.p. 176°. Fraction B consisted almost exclusively of cetyl alcohol and fraction C of low-melting hydrocarbons and small amounts of ketones. Similar results were obtained with the coral *Meandra areolata,* which contained about 0.3 per cent. non-saponifiable material consisting of cholesterol, an unknown sterol, cetyl alcohol, hydrocarbons and possibly some ketones. The results so far available indicate that stony corals contain from 0.3 to 0.5 per cent. of non-saponifiable material or about 10 per cent. of the total amount of organic material present.

The sea-fans (Gorgonaceae) which also contribute to reef formation are much more abundant in non-saponifiable material than the stony corals. In certain species the calcareous outside layers contain as much as 3 per cent. For example: 1,000 g. of dried and crushed external layers of a brown Gorgonia from Florida gave 33 g. of non-saponifiable material or 3.3 per cent. It consisted of about 20 per cent. of an unknown sterol, 50 per cent. of alcohols (cetyl alcohol) and 30 per cent. of semi-solid hydrocarbons. 1,100 g. of layers of a yellow Gorgonia gave 2 per cent. of non-saponifiable material consisting of about 30 per cent of an unknown sterol, 30 to 40 per cent. of other alcohols and the remainder of a mixture of hydrocarbons and possibly ketones which was liquid at room temperature. The compounds described can be isolated equally well from dried, but unbleached old museum specimens as from freshly collected material.

The presence of such sizable quantities of lipoid material in reef-building animals seems rather significant. It is not confined, as has already been pointed out by Silliman, to the relatively thin living layer, but extends deep into the entire structure of the coral. In view of these findings the idea at once suggests itself that coral reefs may act as gigantic accumulators of "wax-like" substances, especially of the chemically inert hydrocarbons. The bulk of the organic matter of dead marine animals and plants is probably brought back into circulation one way or the other. In the case of the reef-building animals, however, a significant portion of the organic matter becomes trapped in the ever-growing inorganic skeleton and hence is removed from further circulation. If this is indeed the case we must conceive the coral reefs as vast storehouses of compounds which may be considered as potential precursors of petroleum. At some time changes in the physical conditions may loosen this material from its inorganic surroundings and bring it to the surface, similar to the wax-like material which Silliman found floating on the surface of water in which corals had been boiled. The authors of the present article are not petroleum chemists and they do not claim the complicated problem of the formation of petroleum can be solved merely on the basis of the coral reefs. They present their preliminary findings only in order to call attention to the coral-reefs as one of the possible sources of petroleum and to stimulate discussion along this line.

WERNER BERGMANN
DAVID LESTER

YALE UNIVERSITY

THE OCCURRENCE AND ISOLATION OF AZOTOBACTER IN CHINESE SOILS[1]

ON account of their relation to soil fertility, the non-symbiotic nitrogen fixation bacteria, Azotobacter, have received considerable attention since their discovery by Beijerinck in 1901. They are widely distributed in the soils throughout the world, as their occurrence has been reported in the soils of Java, India, Poland, the United States, England, Japan, Russia, etc. The only country whose soils are completely devoid of this microorganism is Finland.[2] As yet, however, there is no information about their occurrence in the vast area of Chinese soils.

The purpose of the present study is to make a general survey of the occurrence of Azotobacter in the soils of Szechuen Province, which, under the present circumstances, is probably the most important agricultural region in China. The work also involves the

[1] The detailed report of this work will appear in *Soil Bulletin* (bimonthly publication, National Geological Survey, Ministry of Economics, China).

[2] W. Brennar, *Geol. Komm. Finland Agrogeol. Meddel.,* 20: 1–15, 1924.