film sells for $20 per 1,000 feet, and since two pages are photographed upon each 1½ inches of film there would be 16 pages per foot. Allowing for the title page, identification reference and a short blank space at each end, the film for a 10-page article would cost about 2 cents. The developing and labor would probably not amount to more than 8 cents per 10-page article, hence it is likely that the service could be rendered by a library, without loss, at 10 cents per article of 10 pages or less and 5 cents for each additional 10 pages. This, however, is only a preliminary estimate and may be subject to revision on the basis of experience gained during an experimental period of operation.

When one considers the complex and expensive organization required for keeping track of borrowed books, the wear and tear to which they are subjected, and the messenger or other service required to deliver them, the saving effected by reducing the number which would leave the library would certainly be an important item. It is even possible that film-copying service rendered free might be a saving over the present system of lending library books. It is therefore not unreasonable to expect that even at the low price mentioned, the adoption of film-copying by libraries would lead to a considerable economy of operation.

With this end in view and also in consideration of the great service that film copies may be expected to render research workers, Miss Barnett has arranged to have made, at the prices mentioned above, with the equipment of Dr. Draeger, film-strip copies of articles contained in publications on file in the library of the Department of Agriculture.

Those desiring to avail themselves of this service should send their orders to the "Biblio Film Service," care of Library, U. S. Department of Agriculture, Washington. It is expected that within a short time film-strip magnifying and projecting apparatus, such as described above, will be available.

ATHERTON SEIDELL
NATIONAL INSTITUTE OF HEALTH
WASHINGTON, D. C.

ORIGIN OF PETROLEUM

THE notes on this subject by J. M. Macfarlane and E. Berl recently published in SCIENCE are worthy of some comment. Macfarlane appears to favor the old theory of the decomposition of fish oil, or lime soaps of fish oil, by heat. Berl believes there is evidence that the source material of both coal and oil was "carbohydrates and carbohydrate-humic acids."

The writer has pointed out in two recent papers[1] that the older theories of petroleum origin were proposed almost entirely without consideration of the chemical character of petroleum and with little reference to or knowledge of the conditions of its geological occurrence. It was also pointed out that there is abundant factual evidence, of both chemical and geological nature, that petroleum has had a low temperature history, of the order of 100° F. There is also abundant evidence against the early, but still widely prevalent, idea that petroleum is nevertheless the result of heat decomposition of fatty oils or other organic material, these decompositions being assumed to take place at low temperatures by virtue of the great periods of time available, in the case of the older strata, for such change. The evidence is much too abundant to summarize adequately in this brief note.

Berl evidently accepts the evidence of low temperature history. It is a pity that theories of "distillation" and heat decomposition, set up years ago on the simple experiments of Warren and Storer (1867) and of Engler, which do much violence to the many chemical and geological facts that we now know, should continue to clutter up our scientific literature. Surely we owe it to youth, seeking to learn, to clear some of our scientific debris.

The chemical history of petroleum is still bristling with unsolved questions, but how to produce petroleum by cooking fish is not one of them.

BENJAMIN T. BROOKS
NEW YORK, N. Y.

[1] *Bull. Am. Ass'n. Petr. Geol.*, 15: 611, 1931; *Jour. Inst. Petr. Technol.*, 20: 177, 1934.

ARE FISHES THE PRINCIPAL SOURCE OF PETROLEUM?

DR. MACFARLANE'S recent communication in SCIENCE[1] calls to mind his theory that fishes are the principal source of material from which natural petroleum has been derived.[2] Even admitting that petroleum may have been derived from fish oil in the rocks by natural processes, he has failed to present convincing evidence of fish remains in sufficient quantity to account for the enormous quantities of petroleum in some formations, having attempted to account for the large quantities in other formations by assuming, without proof, migration from far distant sources, and ignored all other as likely sources. In his interesting book he assumed, for example, that fish remains are very abundant in the Green River oil shales. As I have elsewhere stated, such remains are confined almost entirely to a thin series of strata in a very small area of that thick, wide-spread formation.[3] Even in the limited region where the beautiful fish skeletons are

[1] SCIENCE, November 23, 1934.
[2] Macfarlane, "Fishes the Source of Petroleum," The Macmillan Company, 1923.
[3] Henderson, *Proc. California Acad. Sci.*, 4th series, Vol. XV, pp. 269–278, 1926.