7. To provide for the post graduate training of suitable doctors in the diagnosis and treatment of cancer.
8. To arrange for fellowships in cancer research.

Any satisfactory scheme must provide hospitalization. It must also include the care of incurable patients. There should be a free tumour diagnostic service where any physician or hospital may have suspicious tissue examined to determine the presence or absence of cancer. This service would also be used by pathologists who desired confirmation of their own opinions.

Until we have found the cause of cancer and while the successful treatment depends so much on its early recognition, the education of the physician must remain the paramount factor in the control of this disease. Actually, as Ewing, the renowned pathologist of New York's Memorial Hospital, has so often reiterated—"There is no one cause of cancer. There are many causes, often preventable, and the public should acquaint itself with the nature of these causes. Every community owes it to itself to support cancer control and to provide the means, the organization, and the moral support that will make it effective."

In conclusion, though cancer still remains one of the great problems of the age, we have at our disposal, means by which approximately one-half of the sufferers may be cured if diagnosed early and treated adequately. This still leaves one-half to be cared for through weeks and months of suffering. Research must eventually solve the problem and the annual report of the British Empire Cancer Campaign gives reason to hope that the time may not be too far off. At least a few more truths have been added to the whole body of truth—"dark hints may be; but who groping about in the greyness can picture plainly the glory of the rising sun?" So in this, as in other fields man fulfills his destiny, which is, as Pascal has said, the seeking of Truth.

Science Aids the Fisherman

By D. LeB. Cooper

EDITOR'S NOTE: The flakes covered with drying codfish which have been typical of many fishing communities in Nova Scotia will gradually disappear as the method of artificial drying discussed in this article is being accepted. Our fishing villages will lose in romance but gain in prosperity. Dr. Cooper at present associate professor of Chemistry at Dalhousie University is among those who have been instrumental in devising this new method.

THE purpose of this article is to describe, and discuss the effects of improvements in the method for the preparation of "dried salt cod".

The terms "salt cod" or "dried salt cod" include a number of products manufactured from the fresh fish with the object of producing an edible food capable of transport to, and use in, such localities that fresh fish would spoil. Other methods of preservation are either impractical, too expensive, or unsuitable for markets accustomed to use the salted dried material.

A number of methods, or variants of a single method of preparation are in use. Common to most is a part in which the fish are salted, followed by a period of drying. Salting preserves the fish until the later treatment by drying is complete, for salting alone will not prevent deterioration in temperate climates. When natural means of drying are employed, it is clear that the locality in which the fish are prepared will, among other things, determine the proportion of salt that is used. Cool situations with dry winds will require less salt than warm, humid, localities. Excepting the northern

section of New Brunswick, and the Gaspe peninsula, the majority of dried fish prepared in Eastern Canada is heavily salted. Names given to the final products may vary, for example "hard salted kench cure", "hard salted pickle cure", and "Bank Fish" indicate types which may show individual physical differences but which are nearly indistinguishable chemically. Procedures outlined below refer specifically to "Bank Fish" but it can be assumed that the improved methods of drying will apply to all.

That an improvement has been effected will be clear by comparison with the common method of treatment of which the following is one description.

Fish, brought into one locality, are caught on outlying banks and salted in vessels. Since the latter remain at sea from four to seven weeks the fish are heavily salted in kench, which means that they are cleaned and interlayed with dry salt in such proportions that the resultant product will have taken up nearly all the salt it is capable of holding. Reaching home port, this cargo is "sold" to a local dealer subject to delivery, dried. The vessel carries the fish to skilled tradesmen along the coast who, for a fixed sum per unit, do their best to dry the fish left with them in trust. When the fish are sufficiently dried they are delivered to the "original" purchaser who pays only for the amount received.

The climate of Nova Scotia is a variable one. Days of fog follow hours of sunshine. Salt fish cannot be dried in hot sun, for they "burn". Atmospheric humidities greater than seventy-five per cent prevent all drying, and a commercial rate is reached only when the humidity is below approximately sixty per cent. Cut out all days above sixty per cent relative humidity, and all days of brilliant sunshine below that, and the problem of the "fish maker" is a serious one indeed. For in warm weather the fish must be dried quickly or spoil. But the fish maker takes no responsibility, the loss falls to the fishermen.

The amount of loss by spoilage or deterioration during this section of the production is difficult to gauge, and nearly impossible to substantiate. Apparently no records are kept. The manufacturer is concerned mainly with the amount of fish delivered, the fisherman with the amount caught. Any loss that does occur reduces directly the income of the fishermen who are paid by a plan sometimes known as 'sharing with the vessel'. Estimates of loss vary from twenty to twenty-five per cent. Complete loss of full cargos have been mentioned. This is possible when hot humid weather follows their delivery to the 'makers' and seventeen days of consecutive high humidity have been reported. Any means by which these losses can be reduced will aid the fisherman, and it was with this in mind that investigations were commenced.

The vision was somewhat as follows. Suppose the fish could be kept in condition in the vessels, landed in condition at central drying plants, dried independently of climatic conditions, stored in controlled rooms until they could be sold, then the section of greatest loss would have been eliminated. The product will be standardized, and improved, and the fishermen will benefit.

Investigation followed this plan.

Drying equipment is expensive, and cannot be allowed to remain idle, and the fishing season is short. It was necessary therefore to prepare for storage of large quantities of fish under such conditions that they would not spoil. This section of the work caused no trouble, and the results of the short investigation needed were later substantiated on a commercial scale. Salt fish, undried, can be stored for long periods of time without deterioration in rooms maintained at a temperature below about thirty-four degrees, and a relative humidity as close to seventy-five per cent as possible, for at seventy-five per cent the salt fish are in moisture equlibrium with the air.

Drying was the difficult problem. Consider what may occur when a block of salt fish is dried. Under certain conditions water is vaporized at the surface and removed by the air. More water from the regions of higher concentration near the

centre will seek to replace that evaporated. A migration of liquid from the centre of the fish towards the faces will persist. But the liquid in salt fish is not pure water, it is a saturated solution of common salt in a liquid which contains also small amounts of dissolved protein, making it in effect a solution of heavily salted glue like liquid. Salt is carried with the liquid as it migrates from the centre to the outside and on evaporation the salt may be left on the surface of the fish in the form of a heavy crust. Appearance and texture are spoiled, and the fish is not marketable. Natural drying under suitable conditions does not produce this "salt face", but attempts to dry fish free from it in artificial driers always ended in failure. The problem was to determine why this occurred, and under what conditions it could be prevented.

The simplest commercial method is to design driers which would reproduce the atmospheric conditions of "a good drying day". This is quick, but for obvious reasons, very unsatisfactory. Such methods for example tell nothing of the possible efficiency of such driers. Therefore a more comprehensive study was attempted.

Previous investigations on slow drying materials had shown that in certain cases the rate at which water could diffuse to the surface was much less than the rate at which it could be removed. It was postulated that in these cases the plane of vaporization receded into the interior of the sample. The effect of this subsurface vaporization would be this. If through the layer nearest the surface only vapor diffuses, the salt will remain in the body of the sample for it is carried by the liquid medium. Fish is slow drying material, and preliminary investigation showed that salt face could be prevented by increasing the air speed, and reducing the relative humidity both of which increase the rate of removal of moisture from the surface, or in technical terms, increase the drying potential of the air. This was an indication that the theory of subsurface vaporization could be applied to salt fish and experiments were continued until the limit was fixed At this point a fixed rate of drying was observed. All attempts to increase the rate above this by further increase in drying potential ended in partial failure. In other words, once the limit for crust formation is passed, increasing the drying potential of the ambient air has little effect on the rate of drying of the fish as a whole. Water, in whatever form, can be removed from the surface only as fast as it can reach the surface.

The laboratory results were applied directly to the design of commercial equipment calculated to produce about 700 quintals of dried fish per week. This plant has been in operation a sufficient length of time to estimate its effect on the trade as a whole, and the fisherman in particular. Each stage of production has had its separate influence.

Green fish landed direct from the vessel are accepted and paid for at once. All fish are gauged for quality as they are landed. Practice has demonstrated that this gauge of quality on the raw product over which the fisherman has direct control, instead of on the same product which has passed through the process controlled by the fish maker, has resulted in an improvement in the quality of the fish landed. Assuming that many vessels prefer to land at a point of immediate payment, and that only first grade fish is accepted at this point, all vessels tend to improve the quality of their catch.

The inspectors, known as "cullers" in the vernacular of the trade, pass the fish to the cold holding store in which they await their turn to be dried. As the drier calls for fish they are removed from the cold room and washed either by hand or machine. Great care is taken to remove all traces of dirt and scale. Previously, washing was part of the contract of the fish maker. Sometimes it was neglected. With the certainty that every fish can be dried, and all are potentially first grade the great care taken in the artificial drying plants has forced the fish maker to conform, for the maker must now compete with the fish delivered from the plants. And an improvement in product means

improved conditions even for those fishermen who prefer to follow the older methods.

From the washer, the cleaned fish may be pressed for a short time, and are then passed to the drier proper. The design of the latter may vary according to personal preference but the conditions of the moving air used in the drier must be such that the drying potential is sufficiently high to prevent the formation of salt crust. One such drier consists of two eight foot axial fans one above the other. Fish are arranged about these fans in circles, and the turntable holding the racks of fish can be rotated to permit removal of fish at specified intervals. Necessary fresh air is driven through the drier as required by a system of auxiliary fans and an air conditioning unit. The latter, used only in summer operation, works on the principle that the quantity of moisture in the air can be reduced by blowing wet air through a solution of salt the vapor pressure of which is below that of the air. Banks of sprays, using nearly saturated lithium chloride solution, remove the water from the air. The diluted solution is returned to a regenerator in which its strength is raised to a fixed constant value, and, passing through a cooler, is reused in the sprays. The action is automatic. This maintains the air in the drier at a constant potential just above that required to prevent salt face, the axial fans increasing the air speed to the required value.

Fish may remain in the drier from eight to twelve hours, and may be re-dried if necessary. Experience has shown that re-drying is more economical if a second or subsidiary drier is used. The conditions inside the latter can vary within wide limits, for once drying has taken place without the formation of crust, a re-drying is not likely to cause it.

Every fish placed in the drier can be dried in any chosen manner, and to any degree without spoiling. All fish caught can be sold, for every fish can be dried. Within the limits of the equipment, artificial drying can deliver fish in the amount and at the time required irregardless of atmospheric conditions. And finally the expense is not greater than drying by natural means.

The fisherman wastes no effort, and the manufacturer controls the product with the certain knowledge that he can satisfy any market demand for quality, and type, within the limits of production.

For both, there is the satisfaction of seeing produced a quality product sold in markets hitherto closed to Nova Scotian fish because satisfactory products could not be manufactured by natural means.