

## Cancer Research.

THE twenty-seventh annual report of the Imperial Cancer Research Fund contains, in addition to the usual survey of the work published from the laboratory during the year, an unusual feature in the form of a review by Dr. W. Cramer of certain aspects of experimental carcinogenesis. It is proposed to include such critical commentaries in future reports, and there can be no doubt that this policy will enhance the value of these publications, for in no branch of medical research is it more necessary to pause from time to time to order our conceptions of the central problems.

The criticism is often made by those who are uninstructed in the facts that cancer research is sterile of results, and if by results is meant the complete explanation of malignant disease and the production of a perfect cure for it, the criticism is justified. But those who are better informed realise that, apart from some stupendous fluke, the secrets of cancer will only be revealed by persistent and laborious work in as many directions as possible. Unemotional work of this nature has been carried on by the Imperial Cancer Research Fund for twenty-seven years, and though it has not resulted in the elucidation of the main questions, it has provided us with such a wealth of detailed knowledge that we may claim to know more about the malignant processes than we do about many other biological phenomena that are accepted as the commonplaces of existence.

In this summary of the work of the current year, Dr. J. A. Murray, Director of the Fund, directs attention to certain observations which are of considerable interest. Continuing his work on carcinogenesis, Dr. W. Cramer has come to the conclusion that the development of carcinoma is not entirely due to changes occurring in the epithelium, but depends to some extent upon the removal of local inhibitory factors present in the other tissue elements. His observations suggest that the process of carcinogenesis consists of two phases—one a process of long duration which induces the condition of potential malignancy in the epithelial cells, and the other, a breaking down of the local resistance or inhibition which prevents the realisation of this potential malignancy. Exactly which of the tissue elements are concerned in this inhibition is not known, but it is possible that the wandering cells which accumulate under the hyperplastic epithelial cells of skin which has been treated with tar may be responsible. Certain observations by Dr. Ludford may have a bearing on this question. He has shown that in tumour-bearing animals vitally stained with trypan blue, the macrophages which take up the dye tend to accumulate around the tumours, though this distribution varies considerably in different types of growths. In view of the fact that the same type of macrophage is concerned with the taking up of metallic colloids from the blood-stream, it is possible that the action of metals on tumours may be an indirect one exercised through the macrophages.

Continuing his observations on the metabolism of the malignant cell, Mr. Crabtree, applying the method developed by Prof. Warburg to the numer-

ous strains of transplantable tumours available in the laboratories of the Fund, has confirmed Warburg's discovery that the cancer cell can split sugar into lactic acid in a far greater degree than normal cells. Since this process is not confined to the cancer cell, it cannot be utilised as a test for malignancy, but it does indicate an important metabolic activity in which the tumour differs from the normal tissue; and since the metabolism of a cell is an expression of its vitality which can be measured, this technique offers a far better method for the study of the mode of action on the cell of therapeutic agents than we have hitherto possessed. Mr. Crabtree has started an investigation along these lines on the therapeutic action of radium which promises valuable results.

Owing to the work of Gye and Barnard, much attention has been directed of recent years to the study of the filterable tumours of fowls. Dr. A. M. Begg has studied such a tumour which in the course of three years has altered in character from a slowly growing fibro-sarcoma of low malignancy to a more cellular, more malignant tumour transmissible by cell-free extracts. It is highly probable, though not proved, that the tumour acquired the property of filterability with its assumption of a greater degree of malignancy.

An exceedingly significant observation on the Rous tumour has been made by Dr. Begg and Dr. Cramer. It has been claimed that it is possible to transform normal cells of the fowl into malignant cells by the action of various substances such as arsenious acid, indol, and skatol. Further reports have been published of the isolated production of the Rous sarcoma by the inoculation of extracts of normal fowls' testis or pancreas. These results have not been confirmed by other workers, but Drs. Begg and Cramer have brought forward evidence to show that such tumours may accidentally occur from the unsuspected contamination of laboratory apparatus with the virus of the Rous sarcoma. Such accidents are not unknown in the history of bacteriology, and the suggestion is made that these anomalous findings were due to experimental errors.

Dr. Cramer's review of experimental carcinogenesis is worthy of special study. The study of tar cancer in mice has thrown new light, for example, on such matters as the age incidence of malignant disease, and its occurrence in certain industrial occupations. It is responsible for the conception that different individuals of the same species vary in their susceptibility to the factors which are known to be associated with the development of malignant disease. If a certain proportion of human beings are susceptible to these factors, irrespective of dwelling-place, climatic or social conditions, the total incidence of cancer in all forms is likely to be the same in every nation; but local circumstances might lead to the relative prevalence of, say, intestinal or uterine cancer in any nation. This conception would offer a satisfactory explanation for the difference in the organ incidence of cancer which is such a striking feature in the statistics of different countries.