

The maxima occur at the same age-period in each group, being respectively 21.6 and 32.1 per cent. of the total number of animals, there being no evidence that the maximum incidence of cancer has been made to occur at a younger age in mice of recent cancerous ancestry.

Without wishing to minimize unduly the important influence which heredity is thus demonstrated to have, it is necessary to warn against needless alarm or the awakening of pessimistic anticipations of the outlook on future efforts to cope with cancer. It has been sought deliberately to concentrate any tendency to the disease which may be due to heredity, and in this way obtain mice more liable to the disease than are others. Apart from its bearing upon heredity, the obtaining of such mice was most important for furthering the experimental investigation of the genesis, nature, and, should it be necessary, artificial production of cancer, and for attempting to define the reasons for its apparently greater frequency in some geographical areas than in others.

It will be obvious that a large field of investigation has been opened up by the segregation of mice into two groups of different liability, and it should be possible to obtain groups of animals of a still higher and a still lower liability. An effort is now being made to obtain by selection a breed of mice with diminished liability to cancer.

While it is at present impossible to explain how the liability is transmitted, it can be averred with certainty that it does not consist in the inheritance of a soil more suitable for the growth of cancer in general. It is not the inheritance of a general constitutional predisposition suitable for growth, as is shown by the fact that implantation of cancer is not more successful in mice of a cancerous stock than in others. It can only be inferred, with some probability, that it is a local or circumscribed tissue predisposition, in virtue of which the mammary tissue is prone to pass from mere proliferative reaction into continuous or cancerous proliferation. Further, hereditary predisposition is only one of the factors in play, for it has been found that chronic inflammatory changes are remarkably frequent in the mammae of female mice of the laboratory. Other factors still unrecognized may exist. It has been possible to obtain a sequence of all stages from normal tissue through mere chronic inflammation and simple hypertrophy, to adenoma and carcinoma. The manner of the occurrence and combination of these changes strongly suggest their interdependence and reference to a common cause, which becomes effective in producing cancer through the variability of the normal cell as described below.

Individuality and Cancer.

The study of the parallel behaviour of normal and cancer tissue, both as regards absence of continued growth and the nature of the immunity reactions induced, when cancer is transferred from one animal to another of a strange species, showed that cancer had all the properties which distinguish the normal tissues of one species from those of another species. Recent experiment has carried knowledge much further. The fact that transplantable tumours grow in normal animals as well as they do in spontaneously affected animals shows that the latter do not present a soil for the growth of cancer substantially different from that presented by normal animals. When this result is contrasted with the almost invariable success of transplanting a portion of its spontaneous tumour into the animal so affected, and the almost invariable failure of implantation of any spontaneous tumour into other spontaneously affected animals, the demonstration is complete that each tumour is peculiarly and genetically related to the individual in which it arises. This conclusion is drawn from studying the growth of tumours under the different conditions just enumerated, and is supported by the results of elaborate experiments on inducing resistance or immunity to the inoculation of cancer-cells under these different conditions. The results of these two lines of inquiry agree also with the fact that resistance has not been induced either with an animal's own tumour or its own normal tissue.* The individuality of cancer would thus appear to have been placed at last beyond all further discussion. It has long been maintained in various forms on the basis of deductions drawn from histological (microscopical) examination of the tissues at the site of the primary lesion, and from the nature of dissemination, but this interpretation of the findings has been as vehemently combated. The combination of the results arrived at by microscopical investigation and experimental study appears to terminate any need for further discussion. A long step has thus been taken in defining the direction in which the future investigation of cancer is alone likely to be profitable.

The Nature of Cancer.

It follows from the argument pursued in the preceding paragraphs that a closer definition of the nature of cancer will involve an analysis of the relation obtaining between the individual developing cancer and the tumour.

This final analysis will be possible only on animals naturally afflicted with the disease, for, as pointed out consistently from the first annual report onwards, the genesis and the growth of cancer are distinct phenomena which can and ought to be separately investigated. The study of propagated cancer is only a study of its growth under natural and artificial conditions, and has only an indirect bearing upon the genesis of the disease. Hence the breeding experiments, to which allusion has already been made, acquire enhanced significance, and are already being and will continue to be conducted on a much more extensive scale. An adequate supply of animals of differing liability to the disease must be made available for the elucidation of problems, some of which are already suspected, while past experience makes it likely that others, as yet unsuspected, will arise.

In all previous reports guarded reference has been made to the mediate relation obtaining between chronic irritation and certain forms of cancer. The indefiniteness in the way of drawing attention to

* In last year's annual report it was stated that an animal could be immunized against the transplantation of a tumour from another animal by means of one of its own tissues. More extended investigation has shown that this result is not invariably obtained.