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A comparison of the growth of sarcoma and carcinoma cultivated in vitro.[1]

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We have used in this study a rat sarcoma, a mouse sarcoma and a mouse carcinoma, transplantable tumors of a high degree of virulence. The technique has been practically the same as that employed by Burrows in the cultivation of the tissues of chick embryos and subsequently by Carrel and Burrows in the growth of various mammalian tissues; that is, plasma was obtained by centrifugalizing fresh blood under conditions that prevent coagulation and allowing it to clot in hanging drops which contained small pieces of tumor tissue. These preparations were incubated at 37° C. We have found that rat sarcoma grows in both rat plasma and mouse plasma, and that this is also true of mouse sarcoma. The growth in both instances, however, seems to be more vigorous and of longer duration when homologous plasma is used.

For the character of the growth in vitro, a description of the growth of mouse sarcoma in mouse plasma will suffice. The edges of a piece of sarcoma embedded in plasma are at first fairly uniform in thickness and the piece of tissue is dense and opaque. After twelve hours of incubation at 37° numerous elongated cells project from all sides of the tissue and these wander out into the surrounding plasma by amœboid motion. The throwing out of pseudopods and the associated streaming of the protoplasm can be seen quite beautifully under the microscope. As the cells wander from the original piece of tissue, it becomes less dense and we have observed very frequently the reduction of the original piece of sarcoma tissue to only a fraction of its initial size. Indeed it may become after several days entirely resolved into its component cells, which wander further and further toward the periphery of the plasma. These migrating cells rapidly fill themselves

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with small droplets of fat. This amoeboid wandering of cells is a striking phenomenon in the cultivation of sarcoma in vitro but mitotic division of these cells is frequently seen in stained preparations. "Ring" formation, as described by Harrison, is often observed especially when mouse sarcoma is cultivated in rat plasma. Within the ring where fibrin is absent the cells are seen growing along the cover glass.

The growth of carcinoma in vitro differs quite markedly from that of sarcoma. At the end of eighteen or twenty-four hours there is noted around the piece of incubated tissue a narrow fringe of polygonal cells with large, distinct nuclei. This change is associated with a general flattening out of the specimen. During the next few days this fringe becomes a wide sheet of cells, spread out in a single layer, surrounding the original piece. The edge of this sheet of cells presents an irregular protoplasmic border with moving processes,—a picture almost identical with that described by Harrison for the growth of the epithelium of frog embryos cultivated in frog's lymph. In some preparations groups of cells invade the plasma at certain points, forming what might be termed "alveoli," with the fibrin network as a stroma. In addition to the growth just described, there may be, particularly during the first twenty-four hours, a migration of irregularly shaped cells, similar in type to those seen in sarcoma. Further study will be necessary to determine whether these are carcinoma cells or stroma cells. In stained specimens of growing carcinoma, we have observed mitotic figures at various periods up to the fifth day of incubation. We have not studied specimens of longer duration.

This study seems to demonstrate how closely the character of the growth of tumor cells in the body may be simulated when these tissues are cultivated outside the body.