39 (648)

Influence of anemia and hyperemia on the growth of sarcoma in the white rat.

By **M. J. SITTENFIELD.**

[*From the Department of Pathology of Columbia University, College of Physicians and Surgeons.*]

From previous experimentation, it becomes evident that certain physiological and pathological factors on the part of the organism, as starvation, pregnancy, the feeding of various salts, racial differences, and so on, exert a decided influence upon the growth of transplanted tumor tissue. Moreschi in his experiments in 1909 concluded that under-feeding and starvation of the animal predisposes to retardation of the transplanted mouse carcinoma. Cluett, Mercier, and others have shown that during pregnancy the progress of the growth of the tumor which may be at a standstill shortly before the ending of pregnancy, is very much lessened, and after labor and during lactation may even recede, *i. e.*, that the growth of one tissue exerts an unfavorable influence upon the artificially transplanted tissue growth of another.

Negré, Borrell's pupil, was able to control the percentage of takes by increasing or diminishing the salt contents of the fluids and tissues of the body. This proves conclusively that the subcutaneously transplanted tumor is dependent upon a great many, as yet unknown, conditions of the host, and also upon its metabolic changes.

The present experiments were undertaken with a view to studying the effect of tumor growth in a locally induced anemic and hyperemic condition in the white rat. The lower extremity of the rat was rendered partially anemic by ligation of the femoral artery at the saphenous opening, and a few hours subsequent, it was observed that the extremity became slightly paler than the opposite one, though there was no evident lack of circulation; and twenty-four, forty-eight, and seventy-two hours after this induced anemia, Ehrlich's rat sarcoma was inoculated subcutaneously into the leg. This experiment was performed on forty animals; of these thirty-three survived four to ten weeks,

and in only six animals, or eighteen per cent., did the tumor grow, and then only to a small size. The same number of controls were inoculated with seventy per cent takes.

To study to what extent anemia was present in these animals, several animals were killed, the blood washed out of both extremities by salt solution, subsequently injected with bismuth, and skiagraphed. These show that there is a marked difference between the vascular supply of the anemic leg, compared to the normal one.

Another set of experiments was performed to study the effect of passive hyperemia of the leg, induced either by rubber ligature, or by a bandage of adhesive plaster strips. A few hours afterwards, the leg became slightly swollen, grayish red, and the arteries still pulsating. This was continued for five to eight days, caution having been taken not to permit edema. Twenty-four hours after the onset of the hyperemia, twenty-five animals were subcutaneously inoculated in the leg with Ehrlich's rat sarcoma, and here the takes were ninety-six per cent.; and the tumor grew more rapidly and to a larger size than in the control animals, in which the takes were sixty per cent.

It is noteworthy that the anemic animals were subsequently inoculated subcutaneously and in only two out of twenty-nine did a growth result. It would seem, therefore, that these animals possessed an acquired immunity, probably from the absorption of substances from the first inoculation.

From these experiments it becomes apparent that partial anemia and passive hyperemia of the leg exert different influences upon the growth of the transplanted tumor, similar to the difference noted by Moreschi in his experiments of over and under feeding of his animals.

Goldman, in his experiments, has shown that the blood supply and the new formation of blood vessels are essential factors in the growth of a cancer cell.

Carl Levin, Bashford, and Gierke, have pointed out that the fibro-plastic and angeoplastic reaction on the part of the host are the deciding factors in the growth of a transplanted tumor cell, and it shall be the aim of subsequent experiments to further study the relation of the angeoplastic reaction on the part of the host in the anemic and hyperemic condition.