THE HISTOLOGIC REACTION OF MUSCLE TISSUE TO
THE PRESENCE OF A RAPIDLY GROWING
MALIGNANT TUMOR

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Neoplastic tissue progresses either by the multiplication of its constituent elements, in an encapsulated tumor, or by the penetration of its cells into the interstices of the adjacent surrounding tissue, in an infiltrating tumor. In the first form the relation of the tumor to the surrounding structures appears to be essentially that of a foreign body, and the local response to its presence an attempt on the part of the connective tissue of the host to inhibit the growth of the invader by fibroblastic activity, which reaches its ultimate fruition in the fibrous capsule of many benign neoplasms. In some instances, perhaps as the result of trauma, there may be a few foci of round cells at the margin of such a tumor; and if it is located in muscle tissue the adjacent fibers may be compressed to the point of atrophy.

In the infiltrating variety of tumor, which extends its boundaries by the invasion of tissue spaces and even by the penetration of blood and lymph channels, there is accumulative evidence that growth is attended by the production of a biologic by-product which influences local metabolic activity and stimulates local tissue response beyond that occasioned by the presence of a foreign body. A very significant feature of the growth of malignant epithelial tumors is the ability of the cancer cells to stimulate the growth of the host's connective tissue to become the stroma of the growing neoplasm. In experimental transplantations it has been observed repeatedly that, although the center of the graft may undergo necrosis as the result of devascularization, fibroblastic activity and the formation of new blood vessels to support and nourish the peripheral cells permit the graft to "take" and produce a new tumor. Similarly in tumor metastases, the tumor cells adapt the fibroblastic activity of the organ in which they are located to assist in the formation of new histologic units simulating those of the parent tumors.
Voluntary muscle fibers are but bundles of fibrillae separated by undifferentiated sarcoplasm, which are surrounded by a delicate connective tissue sheath, the sarcolemma. Unlike smooth muscle fibers, which have one centrally placed nucleus, voluntary muscle fibers have several nuclei, which are perhaps better termed "muscle corpuscles," lying beneath the sarcolemma.
Sokolow (1) has described the changes taking place in muscle substance and sarcolemma in sarcomatous lesions. He observed that the muscle corpuscles increase in number and occasionally fill the whole lumen of the sarcolemma, assuming the character of new cells. "After the destruction of the sarcolemma, the muscle fibers in which the transformation of the nuclei takes place, merge into a uniform sarcomatous tissue. Only some of the muscle fibers which are attacked by sarcoma undergo the above described changes, while the majority of them do not participate in these processes, and atrophy. During all these transformations the muscle substance itself undergoes only passive changes. The latter consist as a rule in simple atrophy. The muscle substance sometimes becomes granular or fatty and may be partly absorbed by the cells which develop in the fibers."

Fujinami (2) described similar changes, which he concluded resulted from the invasion of the sarcolemma by tumor cells. This process he found more common in carcinoma. He had observed it in sarcoma only when the tumor was composed of round cells. He was of the opinion that there is no fundamental difference between sarcoma and carcinoma as far as muscle invasion is concerned,
The muscle fibers are broken down and contain large vacuoles. The nuclei, or corpuscles, are numerous in spite of the devastating effects upon the remainder of the muscle substance. One appears in mitosis and others, breaking from the surface of the fibers, enter into the tangled mass of the new growth.
and that under certain circumstances cellular elements originating in the muscle may participate in the formation of the tumor. These cellular elements he termed "sarcolytes" and "sarcoblasts" and attributed their origin to stimulation of muscle corpuscles by chemical and biologic products of tumor growth.

The material for the present study was obtained from a neoplasm, probably a neurogenic sarcoma (Figs. 1 and 2) located in the pectoralis major muscle. The tumor was one of several nodules from a massive local recurrence removed a few months after the original growth had been excised. The nodules were separated and covered by infiltrated muscle tissue. Their cut surfaces were densely fibrous and pearly white.

Photomicrographs of the muscle tissue invaded by the tumor cells are presented to show: (1) the manner of cellular invasion upon and between the sarcolemma sheaths (Fig. 3); (2) the changes taking place in the muscle fibres just beyond the margin of the tumor (Fig. 4); (3) the apparent entrance of muscle corpuscles into the new growth as neoplastic cells (Fig. 5).

References