The results on the whole are evidence that earlier CFU-S possess significantly less ability to repair after sublethal radiation damage than more mature CFU-S. This raises the question of whether ability to undergo intracellular repair appears only after the early precursors have reached a certain level of cellular differentiation. In particular, this may be linked with the appearance of sensitivity to thymic factors in the CFU-S, for it has been shown that CFU-$S_{8\ days}$ in thymectomized animals lose their ability to undergo intracellular repair [2].

The authors is grateful to Candidate of Biological Sciences O. I. Gan for help and valuable advice in the course of this research.

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REPAIR PROCESSES IN NERVE TISSUE AFTER BRAIN TRANSPLANTATION IN YOUNG RABBITS

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UDC 616.831-089.843-092.9-07: 616.831-003.9

KEY WORDS: brain; transplantation; regeneration; CNS

Experimental brain transplantation has been widely undertaken in recent years. Besides problems of survival of the graft, the study of the effect of brain transplantation on regeneration of nerve tissue of the CNS has also aroused interest.

The aim of this investigation was to study repair processes in the nerve tissue of the brain after transplantation of large fragments of neocortex in young rabbits.

EXPERIMENTAL METHOD

Experiments were carried out on 168 rabbits of the same litter or obtained from different parents, and aged 2-4 days; transplantation of neocortical fragments into the parietal region of the right cerebral hemisphere was performed on the animals by the method described in [2]. The duration of the experiments was from 1 to 45 days. A particular feature of them was the nonobservance of the special conditions [3] that facilitate survival of the graft. The animals were killed by decapitation and the brain was embedded whole in paraffin wax. Histotopographical sections were stained with hematoxylin and eoxin, and by Van Gieson's, Nissl's, and Spielmeyer's methods; some sections were impregnated with silver by the Cajal and Bielschowsky–Gros method.

EXPERIMENTAL RESULTS

On the 1st day edematous, dystrophic, and necrobiotic changes predominated in the graft and in the recipient's brain. On the 3rd day, active proliferation of neurogliocytes de-

Department of Morbid Anatomy, No. 12 Hospital, Gor'kii. (Presented by Academician of the Academy of Medical Sciences of the USSR D. S. Sarkisov.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 105, No. 5, pp. 599-601, May, 1988. Original article submitted April 17, 1987.

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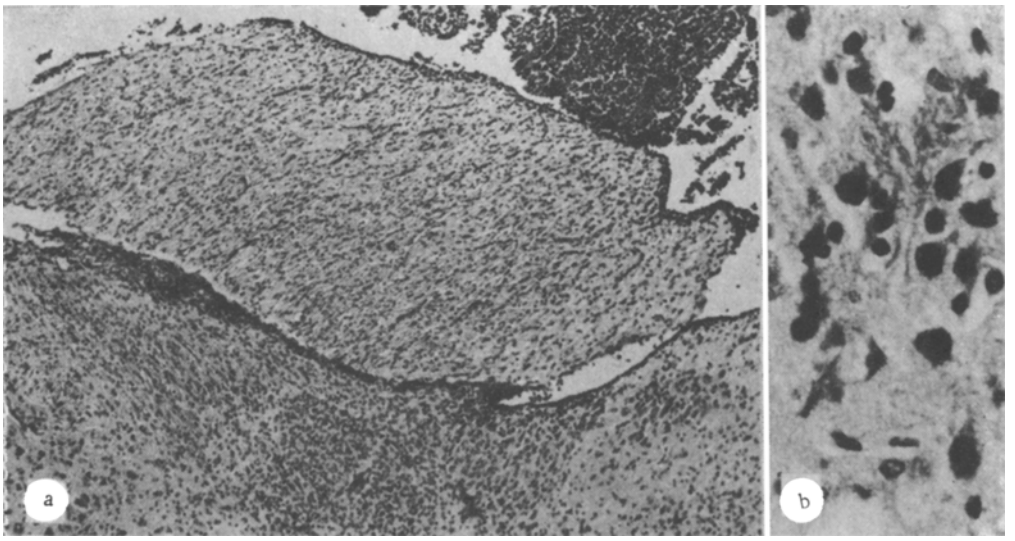

Fig. 1. Morphological structure of the graft: a) general view of graft on 40th day after operation. Capsule present between graft and recipient's brain. 80 ×; b) Histological picture of graft. 250 ×. Stained with hematoxylin and eosin.

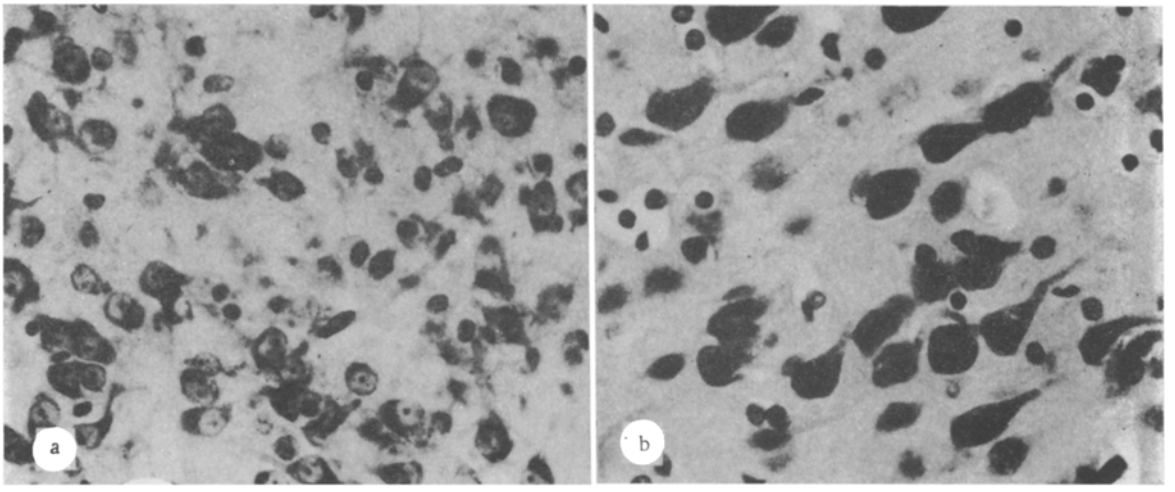

Fig. 2. Manifestations of regeneration in nerve tissue: a) many binucleolar neurons in hemisphere on side of operation. 900 ×; b) Hyperchromic and normochromic neurons in recipient's brain. Stained by Nissl's method. 1000 ×.

veloped in the graft and in the recipient's brain. Because of this, a focus of proliferation consisting of neuroglial cells mixed with a few young connective-tissue cells was formed on the boundary between the graft and the recipient's brain. After the 11th day a glio-fibrous capsule began to form (Fig. 1a). Some of the neurons of the graft died during the 1st day after the operation; later, glial tissue developed in this site, but viable neurons still remained in the graft until the end of the experiment (Fig. 1b). In the late stages after the operation, atrophy of the neurons of the graft was observed in some cases.

Regeneration of the nerve tissue of the brain at the tissue level was manifested as proliferation of neuroglia, mainly of astrocytes. No reliable evidence could be obtained of division of neurons, and I am convinced that the mitoses observed in the recipient's brain are mitoses of neurogliocytes; they were relatively small and were observed in places where there was marked proliferation of neurogliocytes. Binuclear neurons observed occasionally in the recipient's brain in my view were in most cases artefacts, due to the dense distribution of cells in the brain of young rabbits. In the course of the experiment a sharp increase in the number of binucleolar neurons was found (Fig. 2a). This was observed as early as on the 1st day after the operation, and it continued at a fairly high level until

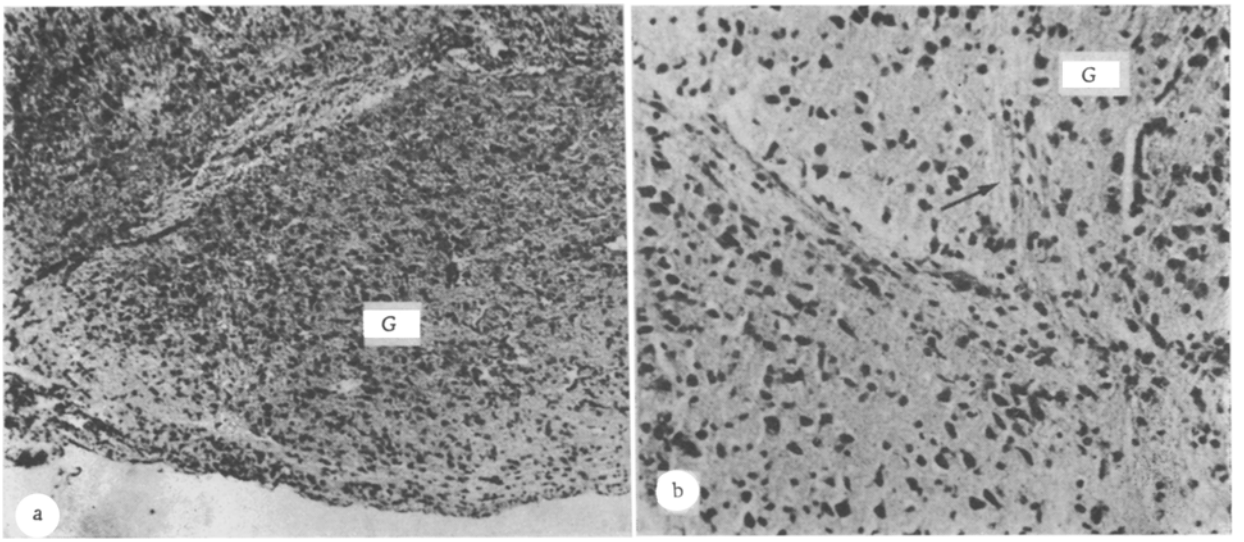

Fig. 3. Possibility of re-establishment of connections between graft and recipient's brain: a) absence of capsule over a wide area between graft and recipient's brain. 80 ×; b) Growth of fibers from recipient's brain into graft. Nissl's stain. 100 ×. G) Graft.

the end of the experiment. The increase in the number of binucleolar neurons was particularly marked in the recipient's cerebral hemisphere on the side of the operation.

An increase in the number of binucleolar cells is considered in the literature to be indirect evidence of metabolically active DNA [6]. In tissue culture an increase in the number of nucleoli in the cell is associated with intensification of their proliferative activity [5]. Some investigators [4] have shown that the increase in the number of nucleoli in rat brain neurons is based on activation of ribosomal RNA synthesis, an indicator of the intensity of intracellular hyperplastic processes. Metabolic activity of the plastic apparatus of neurons [2] also was confirmed by the presence of varied numbers of normochromic and hyperchromic neurons in the recipient's brain (Fig. 2b).

Investigators have associated the positive clinical effect of brain transplantation to the establishment of connections between the graft and the recipient's brain [7, 8]. In most cases I observed the development of a well-defined glio-fibrous capsule between the graft and the recipient's brain; in these cases there were no signs of ingrowth of fibers on the graft into the recipient's brain. In some observations the capsule was absent between the graft and the recipient's brain in several places (Fig. 3a) or it was very thin. Under these circumstances, the impression was created that ingrowth of fibers takes place between the graft and the brain (Fig. 3b).

After transplantation of neocortical fragments into the parietal region of the brain in young rabbits stimulation of repair processes was observed in the recipient's brain. Evidence of this is given by the sharp increase in the number of binucleolar neurons in the hemisphere on the side of the operation and the trend of the change in the number of hyperchromic and normochromic nerve cells. Regeneration of the nerve tissue of the brain at the tissue level is manifested as proliferation of neuroglial cells. Sometimes, if the glio-fibrous capsule is poorly developed or is absent in a small area, some ingrowth of fibers may perhaps take place between the graft and the recipient's brain.

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