

however, affords a chance to study the movements of the limb on the one side and to compare it with the normal movements of the eye upon the opposite side. So far in the course of experimentation only one limb has been secured which has shown perfect development in this location. This limb likewise showed movements of the whole limb which corresponded to the movements of the normal eye. The limb did not show movements of its component parts.

The experiments show that when the limb disc is transplanted to regions anterior to its normal location, functional connections can be effected through cranial nerves or through fiber outgrowths direct from the nervous system. Cranial nerve components which under ordinary conditions are associated with the somatic motor, special visceral (splanchnic) motor and sensory regions are capable of producing reactions within an extremity normally supplied by general motor and sensory elements. When such reactions are obtained they are coordinate with the reactions in groups supplied by the same innervation.

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### Transplantations of Tissues in Fetal Rats.

J. S. NICHOLAS.

*From the Osborn Zoological Laboratory, Yale University.*

Transplantations have been used in order to determine the amount of differentiation which may take place in fetal mammalian structures and also to study the changes which may occur in such tissues following their transplantation to strange environments.

The method of procedure in operations upon the mammalian fetus has been described previously.<sup>1</sup> It is necessary to use fetuses of the earliest possible stage of development in order to secure the tissues in the least differentiated stages. This is difficult in the albino rat fetus because of the absence of anatomical landmarks which will assist the operator in localizing the tissue which it is desired to remove from the embryo. In order to secure an anatomical landmark a cross was made between albino and hooded stock. This cross gave both albino and hooded fetuses in the same litter, oft-times within the same uterine horn. Pigment develops in the eye of the hooded rat at about the tenth day of gestation age. Unless some

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<sup>1</sup> Nicholas, J. S., *Anat. Rec.*, 1925, xxxi, 385.

factor is used for orientation so much handling is necessary that the damage to the tissues precludes any chance of a successful experiment.

Two series of transplantations were performed: (1) transplantations of the *globus oculi* and (2) transplantations of the forelimb.

The *globus oculi* was removed from one animal of a litter and transplanted to various regions of a second fetus. A pigmented globus was used as the graft, the host being albino. In this way an accurate check and a simple method of localizing the transplant in the host were obtained. The eye was transplanted under the skin over the abdomen, within the abdominal cavity and under the skin of the thorax. Of these locations, the flank over the abdomen gave the greatest number of successful cases, the abdominal cavity next and the thoracic subcutaneous region the lowest.

Growth of the eye was secured in a relatively small percentage of the total number of experiments. Many of the eyes were so badly injured during the operations that successful results could hardly be expected. When the tissues are injured in this way, the eye acts as a foreign body and the host tissues give a typical foreign body reaction.<sup>2</sup> Where optimum conditions were secured at the time of transplantation, the graft was well vascularized and the tissues grew. The final increase in the size of the eye could be measured by comparing the ratio of the measurements of the graft and the normal eye of the host. In such cases, the transplant grew to 75% of its normal volume.

In the second series of experiments, the transplantation of the forelimb was attempted. This operation cannot be conducted with the same degree of certainty that obtains in the preceding series. The tissues are extremely fragile and must be handled with extreme delicacy, all cuts being made with a thin glass pipette in which the tissues are handled during their transplantation. In the light of the experiments with the eye, the region of transplantation was the skin of the flank over the abdomen.

Two successful transplantations were secured from 40 experiments. In one case, the limb was transplanted on the eleventh day, in the other on the thirteenth day of the gestation period. Both limbs showed relatively little differentiation beyond that at the time of transplantation. Vascularization was irregular and much less abundant than in the eye transplants. Some cartilage was formed and the skin layers were decidedly thickened over the transplant. All the remaining cases showed either complete resorption of the graft or else its loss by tearing during parturition.

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<sup>2</sup> Nicholas, J. S., *Anat. Rec.*, 1929, xlii, 58.