

Heteroplastic Transplantation of Halves of Girdle Rudiment in *Amblystoma*.

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In heteroplastic transplantations of the eye, Harrison¹ found that when the lens came from the donor species and the retina from the host species, each part exerted an influence on the other's growth. In order to see if a mosaic system would react in a similar way when the rudiment contained tissue from the two species, halves of the girdle rudiment were transplanted between *Amblystoma punctatum* and *A. tigrinum*. Reciprocal transplants of dorsal, ventral, anterior and posterior halves of the girdle rudiment were made. Except in a few cases killed for the study of intermediate stages, all animals were raised until the *tigrinum* of the pair had a fully formed fourth digit, usually 70 to 80 days after operation.

The limbs and girdles, both normal and operated, were prepared by a modified van Wihje method for the staining of cartilage, and after the muscles had been carefully removed, were mounted in damar. It was found that at 80 days there are well marked differences between the normal girdles of the two species. The *punctatum* girdle is smaller, has undergone considerably more chondrification than that of the *tigrinum*, has a rounded coracoid and a short, stout scapula which passes gradually into the broader suprascapula. The *tigrinum* girdle is larger, having its coracoid shaped more like a plow, and having a very long, slender scapula at the top of which is a much broader suprascapula.

The specificity of the transplanted tissue was shown by the fact that there was no regulation of form due to transplantation into the girdle region of the host species. The portion of the operated girdle that had come from the donor could easily be recognized. The procoracoid and the muscles attached to the operated girdles were so variable that they could not be studied.

In the dorsal half transplantations, which included the rudiments of the free limb, scapula and suprascapula, these parts were always of the donor species. Under optimum conditions, the transplanted limbs grew to the same size upon the host species as their control limbs did upon the donor species. The growth in size of the limbs is due to factors intrinsic to the graft. Cell counts showed hypoplasia of the spinal ganglia supplying the grafted limb in the case

of a *tigrinum* bearing a *punctatum* limb. In the reverse combination, a *punctatum* bearing a *tigrinum* limb, there was hyperplasia of the ganglion cells. The effect upon the ganglia of *A. punctatum* was relatively greater than upon those of *A. tigrinum*, as was expected from the size of the limbs.

In the ventral half transplantations, which include the rudiments of the coracoid and procoracoid, the free limb, scapula and suprascapula are always of the host species. This is the only series in which complicating factors are not introduced by the presence of either a larger or smaller limb than normally would be present. It shows that the transplanted tissue from the donor species has no effect upon that part of the girdle supplied by the host species, for the scapula and suprascapula in all cases are of a size normal to the host. This series indicates that the tissue which has the potentialities of forming girdle material is more extensive than has hitherto been supposed.

In the transplantations of the anterior and posterior halves, the dividing line being taken as the projection of the fourth-fifth somite boundary, many of the limbs are compound; tissue from both species is present in the limb at the same time and capable of morphological identification. This is especially striking in the digits and carpus. In single limbs which contain tissue from both species, if the grafted tissue formed the anterior half, the anterior digits are of the donor species and the posterior digits are of the host species. If the posterior half of the rudiment was transplanted, the posterior digits are of the donor species and the anterior ones are of the host species. This shows that the tissue which is determined to form the digits is localized in the limb disc in an antero-posterior direction, the material for the first digit lying most anteriorly. With a few exceptions, the carpal elements are similarly affected. That is, a hand having the first two digits composed of *tigrinum* tissue will have carpales 1 and 2 and the radiale enlarged, while a hand having the first two digits composed of *punctatum* tissue will have carpales 1 and 2 and the radiale reduced.

The girdles of the posterior half series were very little or not at all affected by the operation, making it probable that there is little or no girdle-forming material posterior to the fourth-fifth somite boundary.

¹ Harrison, Ross G., *Anat. Rec.*, 1925, **xxi**, 299.