THE EYELESS MUTANT AXOLOTL:

STUDIES CONCERNED WITH THE HYPOTHALAMUS

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Recent studies of the eyeless mutant axolotl (Ambystoma mexicanum) have looked at this mutation's effect upon the hypothalamus (Eagleson and Malacinski, 1986). Eyeless axolotls are sterile, and studies by Van Deusen (1973) indicated that the mutant e gene affects a restricted region of the anterior medullary plate neuroectoderm. Further studies (Eagleson and Malacinski, 1986) indicated that only the anterior hypothalamus is affected by the eyeless condition. These studies looked at neurosecretory neurons and neurons immunoreactive to luteinizing-releasing hormone (irLHRH). The irLHRH neurons of the anterior hypothalamus in eyeless mutants are less prominent and their tracts are disrupted and absent, whereas the caudal hypothalamus is less affected (Eagleson and Malacinski, 1986). The disruption in the anterior hypothalamus must be the major link that controls normal release of gonadotropins necessary for fertility. Immunoreactive-LHRH tracts have been detected in the caudal hypothalamus (Eagleson and Malacinski, 1986; Williams, 1984).

I have been involved in a number of studies following the development of the hypothalamus in amphibians (Eagleson et. al, 1986). The presumptive hypothalamus (see Figure 1) can be subdivided into two areas. The prospective caudal hypothalamus of amphibians remains within the neural plate throughout neurulation. During the final stages of neurulation and

braintube formation, this rectangular shaped tissue migrates forward but remains localized within the neural plate. It becomes situated between but posterior to the eye-forming regions. The presumptive anterior hypothalamic area is more forward in stage 15 embryonic neural plates (Schrekenberg and Jacobson, 1975). During stages 18/19 this presumptive anterior hypothalamic tissue occupies the most anterior and ventral portion of the ventral ridge (VNR). The VNR tissue's lateral aspects form a portion of the eye. The stage 19 anterior VNR tissue of amphibians also forms a portion of the anterior pituitary (Eagleson et. al, 1986). The preoptic irLHRH area most affected by the e gene should be localized within this presumptive anterior hypothalamic area (Eagleson and Malacinski, 1986).

My laboratory has recently begun a number of studies to investigate if the sterile condition is restricted to this stage 18/19 VNR tissue. These studies have involved bilateral tissue grafts between eyeless and eyed stage 19 siblings. The VNR was exchanged between 75 pairs of embryos. These grafts did not affect the incidence of eyelessness, and larvae have been and will continue to be assessed with regard to gonad development. Preliminary assessments of these larvae seem to indicate that the defect for sterility is endogenous to the e/e neuroectoderm; but organisms must be allowed to develop further in order to make a proper conclusion.

Other studies in my laboratory (Cawley, 1986; Ziegenhorn, 1986) have also looked at the determination of the pituitary,

hypothalamus, and eye. These studies indicate that the eye is fully determined by stage 18^{+} /19 in the axolotl. VNR and prospective eye tissue is capable of differentiation into hypothalamus and eye when cultured in vitro or autotransplanted to the tail region. These results should be taken into account when one is interpreting transplantation experiments.

Figure 1: Development of the presumptive hypothalamic areas in amphibians.

Stage 18^{+} Stage 19 Stage 19^{+}/ 20

▨ - Caudal Hypothalamus (presumptive)

▪ - Anterior Hypothalamus (presumptive)

These areas were determined by vital-dye marking experiments. (See Eagleson et. al, 1986 for further details).

Literature Cited

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