

Developmental Neurobiology 9.18/9.181
Sample Questions

In Fig 1, dissociated stage-9 animal cap cells (a) or intact caps (b) were incubated for 4hrs with or without the Bmp-4 protein. In the absence of the added factor, dispersed cells expressed the neural marker NCAM after reaggregation and culture, but not the epidermal marker keratin (a, lane 2). In contrast, in the presence of even low Bmp-4 doses, NCAM expression was suppressed and the dispersed cells expressed keratin. In intact caps, keratin but not NCAM were expressed irrespective of the added factor.

1. In the absence of external signals, the fate of dispersed animal cap cells is to become:
 - a. Epidermis
 - b. Neural tissue
 - c. Mesoderm
 - d. Anterior endoderm

2. This experiment suggests that the endogenous source of BMP-4 for ectodermal differentiation is:
 - a. Vegetal pole cells
 - b. Mesoderm
 - c. Animal cap cells
 - d. Dorsal Mesoderm

3. Noggin and chordin expressed by the Spemann organizer function to:
 - a. Induce anterior mesoderm
 - b. Bind BMP and allow neuralization
 - c. Bind BMP and prevent induction of a neural fate
 - d. Bind each other and induce a neural fate

Figure 2 shows a scheme of rhombomere transplantation experiments.

4. In the experiment described by a-e you would expect the transplanted segment to:
 - a. Develop an r2 fate, but maintain its inverted dorsal/ventral axis
 - b. Maintain an r4 fate, but correct its inverted dorsal/ventral axis
 - c. Develop an r2 fate and correct its inverted dorsal/ventral axis
 - d. Maintain an r4 fate and an inverted dorsal/ventral axis

5. List at least 2 criteria, by which you could assess the r2/r4 and dorsal/ventral fates of the transplanted segment in this experiment.

In Figure 3, ectopic expression of Shh in chick midbrain is used to demonstrate its effects on brain development. Match each of the following conclusions with a panel or panels in this figure.

6. Shh misexpression on one side of the midbrain results in an expansion of the entire arcuate pattern of the ventral midbrain, while maintaining the relative positions of the arcuate territories: _____ and _____

7. Shh misexpression stimulates cell proliferation: _____

8. Endogenous Shh expression is restricted to the ventral midline: _____

9. Figure 4 plots the distribution of mitotic cleavage orientations during cortical neurogenesis. This figure indicates that

- a. Early in neurogenesis most divisions are vertical, while later the majority becomes horizontal
- b. Most early divisions as well as late divisions are asymmetric
- c. At birth approximately half the divisions give rise to additional progenitors
- d. Asymmetric divisions continue to increase after birth generating more and more neurons that migrate into the cortical plate.