

The Autonomous Development of the Optic Cup

Surprisingly, a homogeneous embryonic stem cell population, when placed on a three-dimensional extracellular matrix in the presence of appropriate paracrine factors, can generate an optic vesicle that is remarkably similar to the vesicle in vivo. It will first create an ectodermal sphere, which then produces a “bud” with an inner and an outer wall. These interact such that the outer wall secretes Wnts and becomes characterized by the MITF transcription factor and melanin pigment. That is, it will become retinal pigmented epithelium. Simultaneously, the inner layer becomes specified as neural retina, characterized by transcription factors such as Six3 and Chx10. Moreover, this optic vesicle, without any external pressure, will invaginate to become an optic cup, and the inner portion will differentiate into a retina-like structure that contains each of the major types of retinal neurons, including the photoreceptors. This indicates that once cells are differentiated towards retinal progenitor fate, the neural retina and the retinal pigmented epithelium will segregate from one another (patterning), the folding will occur by intrinsic cell shape changes (morphogenesis), and the neural retina cells will differentiate into different neuronal types (differentiation) in the correct spatial arrangement (Eiraku et al. 2011; Sasai et al. 2012).

Literature Cited

Eiraku M, et al. (2011) Self-organizing optic-cup morphogenesis in three-dimensional culture. *Nature* 472: 51–56.

Sasai Y, Eiraku M, Suga H (2012) In vitro organogenesis in three dimensions: self-organising stem cells. *Development* 139: 4111–4121.

All the material on this website is protected by copyright. It may not be reproduced in any form without permission from the copyright holder.

© 2023 Oxford University Press |