Forebrain morphogenesis

rat  E11  E13  E15
human  3-4w  7-8w
Sources of neurons in the cerebral cortex
(a) mouse  
(b) human  
(c) human 1  
(d) human 2
Protomap model

Rakic, P.

Protocortex model

O’Leary, D.D.
Signaling centers in the neocortex

Signaling molecules (patterning centers)
- FGF8 (ANR, CoP)
- Wnts, BMPs (hem)
- Shh (MGE)

Graded gene expression in VZ
(a) Graded patterns of gene expression

Emx2

Pax6

(b) Expected shifts of area identities in loss-of-function mutants

(c) Area organization of neocortex

Wild type

Emx2 mutant

Pax6 mutant

Current Opinion in Neurobiology
Patterning the neocortex

Signaling molecules (patterning centers)
- FGF8 (ANR, CoP)
- Wnts, BMPs (hem)
- Shh (MGE)

Graded gene expression in VZ

CP
VZ

Graded gene expression in VZ and CP

Intrinsic mechanisms

Pax6  Emx2
Patterning the neocortex
Patterning the neocortex
(A) Duck-billed platypus

(B) Star-nosed mole