Control of cell number during neural development

1. Controlling the number of precursor cells
2. Controlling the number of cell division before differentiation
3. Controlling the number of survival neurons
   - programmed cell death (late phase of development)
Progenitors cells of the nervous system arise from the neurectoderm.

Vertebrate-Dordal part of the ectoderm
Invertebrate-Ventral part of the ectoderm

Not all of the cells in the cluster become neuroblasts.
    Notch mutant (a neurogenic mutation) - produce too many neuroblasts.

**Cell-cell interactions define the number and pattern of neuroblasts.**

**Lateral Inhibition** (inhibitory cell-cell interaction)
    All cells in the cluster is competent to become a neuroblast.
    Laser ablation of Nb- An epidermoblast becomes a Nb.
Delta-Notch signal and the cell fate

Delta (Dl) from a neighbor cell

↓

Notch (N) activation

↓

Translocation of Suppressor of Hairless, Su(H), to the nucleus

↓

Expression of E(spl)-C

↓

Supression of Achaete-Scute complex (AS-C)

↓

Delta expression

↓

Dermoblast

Migration and Instructive signals for differentiation progenitor cells

- Glucocorticoid
  - Adrenal chromaffin cells
- FGF, NGF?
  - Sympathetic neurons
Birth and migration of neurons in the CNS

(A) Pial surface

(B) Radial glial process
Radially migrating cell
Non-radially migrating cell
Radial glial cell body

(C) Cortical plate
Intermediate zone
Ventricular zone
Leading process
Migrating neuron
Radial glial process
Trailing process

Neuroscience, Sinauer Assoc. p.392
Purves et. Al.
<table>
<thead>
<tr>
<th>Early stage</th>
<th>Late stage</th>
<th>Major derivatives in adult brain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Forebrain</td>
<td>1a. Telencephalon</td>
<td>Cerebral cortex, basal ganglia olfactory bulb</td>
</tr>
<tr>
<td></td>
<td>1b. Diencephalon</td>
<td>Thalamus, hypothalamus, retina optic nerves and tracts</td>
</tr>
<tr>
<td>3. Hindbrain</td>
<td>3a. Metencephalon</td>
<td>Pons, cerebellum</td>
</tr>
<tr>
<td></td>
<td>3b. Myelencephalon</td>
<td>Medulla</td>
</tr>
<tr>
<td>4. Spinal cord</td>
<td>4. Spinal cord</td>
<td>Spinal cord</td>
</tr>
</tbody>
</table>

**Diagram:**

A. Schematic representation of the embryo with labels for forebrain, midbrain, hindbrain, and spinal cord.

B. Diagram of the adult brain with labels for cerebral hemispheres, thalamus, hypothalamus, pons, medulla, and spinal cord.