Neurobiology I
Axon Guidance
Why guidance is important?
Axon Guidance

Ability of the growing axon to navigate its way through the complex landscape of the developing embryo to its correct target tissue and establish synaptic communication with it.
Pioneer axon navigation

Bentley and Caudy, 1983
• Growing axons are able to recognize various molecules on the surfaces of other axons and cells, and to use these molecules as cues to navigate the sometimes circuitous pathways to their particular destinations.

• Also respond to diffusible molecules such as morphogens.

• They respond to same cues differently during different developmental stages, thus giving different outputs.

Hibbard, 1965
Specialized, motile tips of axons which sense directional signals (cues) in the environment and guide the axon to its targets
Guidance cues: Molecular signals that act as landmarks and are sensed by the receptors on the (Guidance Receptors) growth cone and interpreted as attractive or repulsive

Attractive: growth cone moves towards it
Repulsive: growth cone moves away from it
Chemoattraction at the CNS midline

The Vertebrate Midline

CN: Commisural Neuron; FP: Floor Plate
• Attraction to midline: due to activation of DCC by netrins.

• Crossing and moving from the midline:
  1. Upregulation of Robo expression and repulsion by Slit
  2. Loss of netrin responsiveness if DCC is
Cytoskeletal remodeling in guidance

- Contact Attractant
- Net Cytoskeletal Drive Across the Leading Edge
- Growth Cone
- Axon
- Filopodia
- Lamellipodia

Actin; Microtubules
Mechanical tension and axonal outgrowth
Thank You!
Dickson and Gilestro, 2006.