Roger Sperry’s Classic Experiment (1940’s)

Frog behavior:
Dangle a lure frog will grab it with its tongue.

Roger Sperry’s Classic Experiment (1940’s)

Frog visual system

retina
optic tectum

Frog visual system
Eye Rotated 180°
How do neurons know where to go???
Roger Sperry (1963)

Chemoaffinity Hypothesis:
Postsynaptic surface has chemical tags that direct the neuron to its proper location

In vitro experiments

retina  tectum
It does not account for...

- targets transplanted to novel positions sometimes innervate the incorrect target.
- Some axons follow the same circuitous route to their target in every member of a species, rather than growing directly to the target.
- Not enough genes to account for a different chemical tag for every neuron to reach its proper location.

Blue Print Hypothesis...

- The undeveloped nervous system contains specific chemical or mechanical trails that growing axons follow to their destinations.

Experiment: Pioneer axons in fish destroyed, subsequent axons of the same nerve never made it to their target.
Chick Spinal Cord: Muscle Innervation

Topographic Gradient Hypothesis

retina  tectum
If one lesions 1/2 the retina & nerve...

The remaining ones systematically project over the *entire* tectum.
If one lesions 1/2 the tectum & nerve cut...

The retinal ganglion cells projected systematically over the remaining half tectum.

Diffuse pattern of synaptic contact

Early stages of development
Focused pattern of synaptic contact

After synapse rearrangement has occurred
What happens when...

Mechanisms of neural reorganization...
The case of Tom and Philip...