Projection of visual information: retina ganglion cell project to the superior colliculus and the lateral geniculate nucleus in the thalamus - which later project to the primary visual cortex.

- Retinal ganglion cells project to the superior colliculi, patterned with molecular cue, creates retinotopic map.
    - EphA/EphrinA gradients:
        - High EphA receptor in temporal RGCs, low EphA receptor in nasal RGCs
        - High EphrinA ligand in posterior SC, low EpthrinA ligand in anterior RGC.
        - EphA/EphrinA repells collateral branches
        - Temporal RGC project to anterior SC, nasal RGC peoject to posterior RGC
    - EphB/EphrinB gradients:
        - High EphB receptor in ventral RCGs, low EphB receptor in dorsal RGCs
        - High EphrinB ligand in medial SC, low EphrinB ligand in lateral SC.
        - EphB/EphrinB attracts collateral branches
        - Dorsal RGC neurons project to lateral SC, ventral RGC neurons project to medial SC.
    - **Fluorescent tracing shows neurons gradually restrict their termination zone responding to molecular cue from P1 to P8. KO of EphrinA or EphA shows disruption in position of termination zone**

Retinal waves enables neuron refinement in the SC: 3 stages:

- Stage 1: Occurs before birth, slow infrequent waves
- Stage 2: Occurs from birth to around P10-12 days, slow infrequent acetylcholine signal originate from starburst amacrine cells. Responsible for L/R segregation
- Stage 3: Around P10 until eye opening (~P14), glutamate signalling from bipolar cells, fast waves. Responsible for ON/OFF segregation

Retinal wave segregation mechanism:

- Hebbian plasticity, neurons fire together wire together
- Neurons with different firing times loses connection over time.
- **Experiment inducing Ach receptor KO lead to less refined termination zone and retinotopic map.**

Orientation selectivity in the primary visual cortex

- Individual RGCs have a preferred orientation of edge, detection of such orientation results in the highest spiking pattern.
- Can develop without visual input, but selectivity is not as sharp
- Requires spontaneous activity (retinal waves) for refining. **TTX inhibition lead to decreased sensitivity.**
- Molecular cue is not yet discovered.

Movement direction selectivity

- Neurons respond to direction of movement differently, have a preferential direction with highest firing rate
- **In ferrets, with a lack of visual input direction selectivity still occur in the SC but not in the visual cortex. Can be rescued with restored vision before passing of critical period at around P45.**