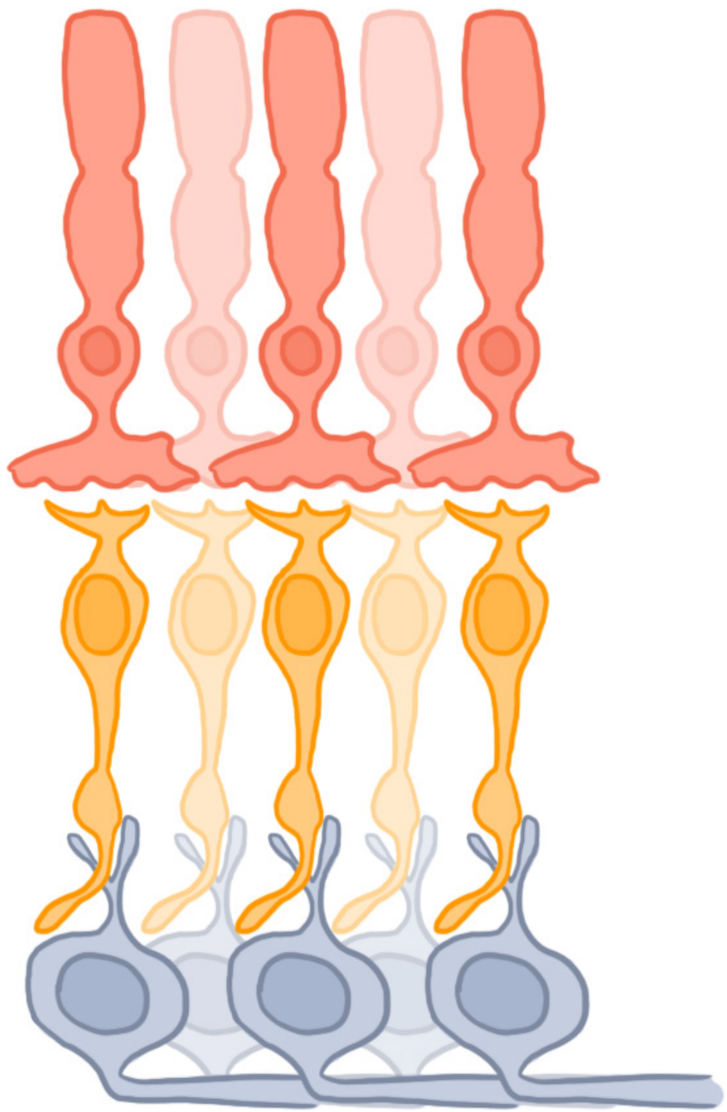
Receptive Fields



steven j. barnes

- Understand and explain what a visual receptive field is.
- Know the difference between an on-center ganglion cell and an off-center ganglion cell.

Learning Goals

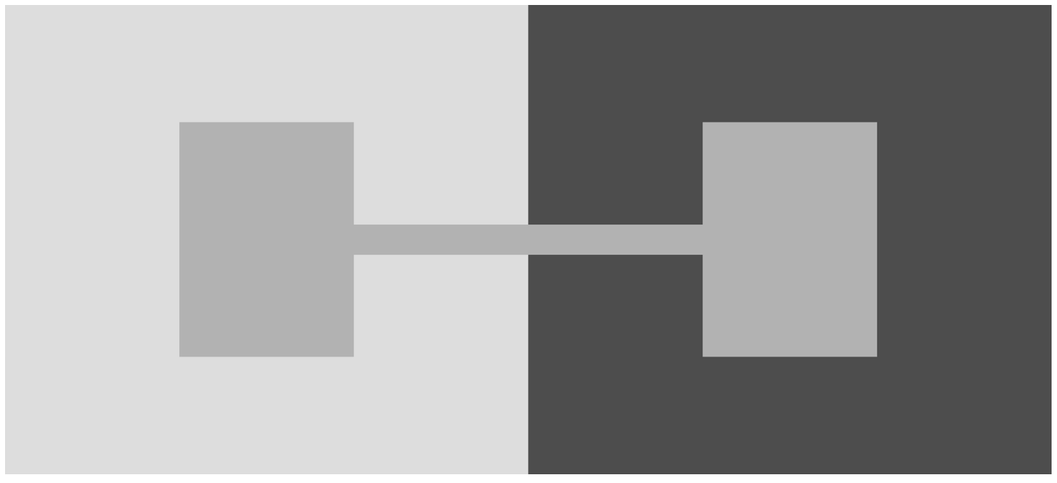
Our visual system detects differences in light intensity, not absolute amounts of light.

Center-surround organization serves to emphasize areas of difference (contrast).

ON and OFF Channels

Our visual system detects differences in light intensity, not absolute amounts of light.

Center-surround organization serves to emphasize areas of difference (contrast).



ON and OFF Channels

Definition

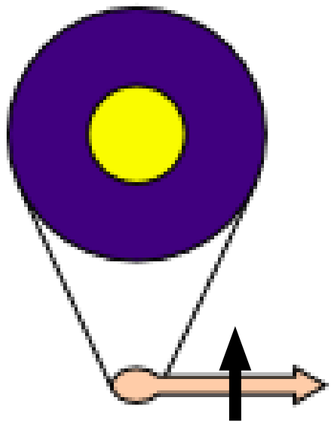
"The visual receptive field is the part of the retina in which a stimulus [, with a particular set of properties,] can cause the neuron to respond with a train of action potentials."

(adapted from Gilbert & Li, 2013)

Receptive Fields

Center-surround structure of ganglion receptive fields (RFs)

Light on center only

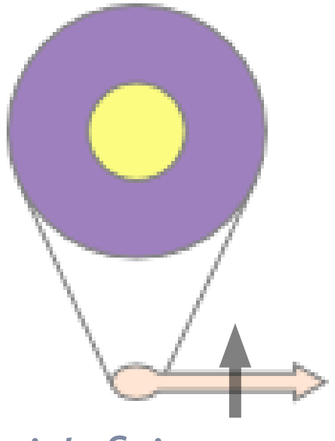


Cell increases it's firing rate.

ON Center Ganglion Cell

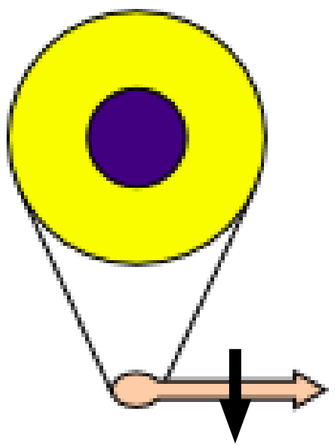
Center-surround structure of ganglion receptive fields (RFs)

Light on center only



Cell increases it's firing rate.

Light on surround only

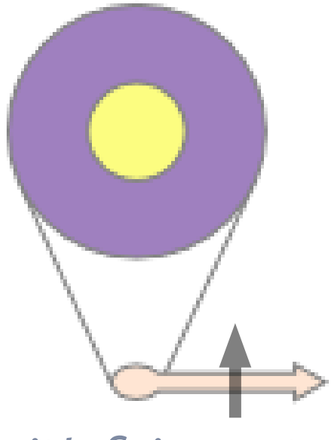


Cell decreases it's firing rate.

ON Center Ganglion Cell

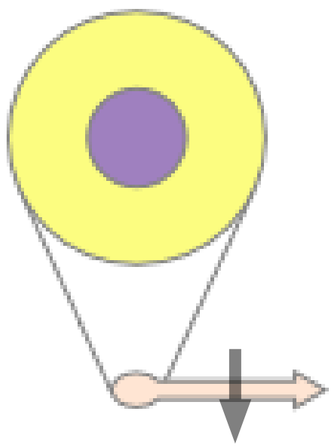
Center-surround structure of ganglion receptive fields (RFs)

Light on center only



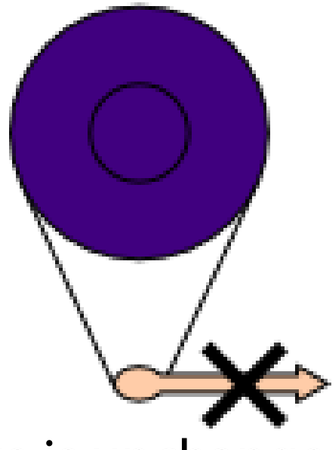
Cell increases it's firing rate.

Light on surround only



Cell decreases it's firing rate.

No light on center or surround

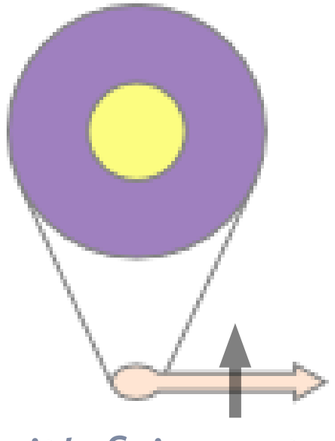


Cell firing rate is unchanged.

ON Center Ganglion Cell

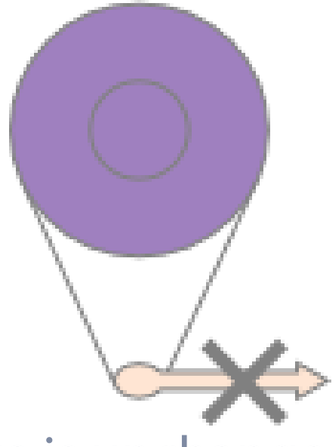
Center-surround structure of ganglion receptive fields (RFs)

Light on center only



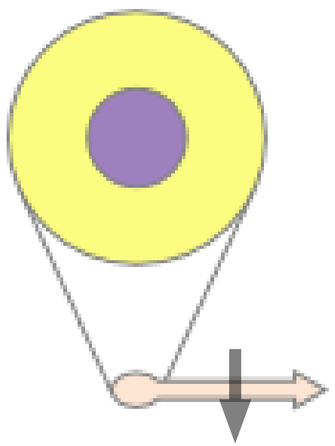
Cell increases it's firing rate.

No light on center or surround



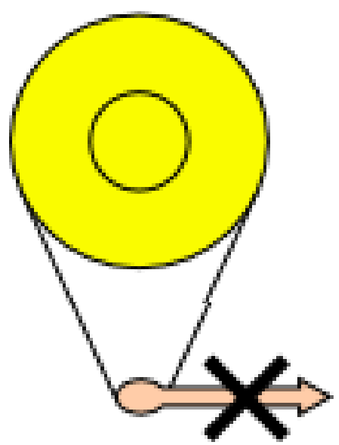
Cell firing rate is unchanged.

Light on surround only



Cell decreases it's firing rate.

Light on center and surround

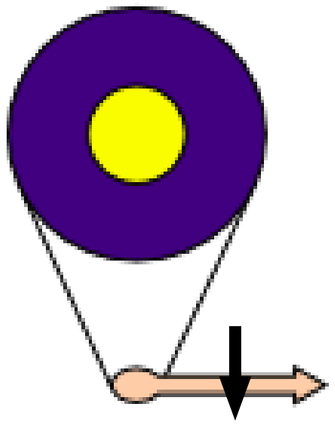


Cell firing rate is unchanged.

ON Center Ganglion Cell

Center-surround structure of ganglion receptive fields (RFs)

Light on center only

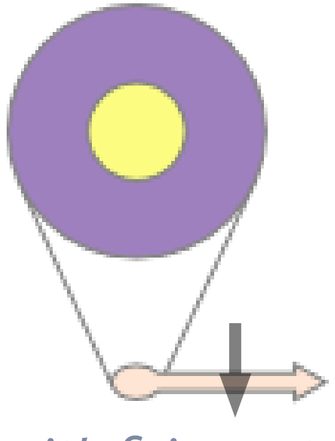


Cell decreases it’s firing rate.

OFF Center Ganglion Cell

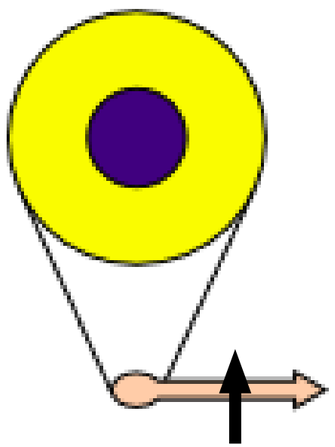
Center-surround structure of ganglion receptive fields (RFs)

Light on center only



Cell decreases it's firing rate.

Light on surround only

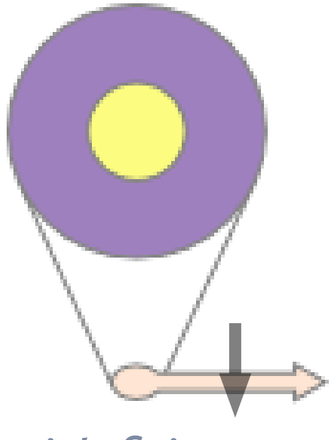


Cell increases it's firing rate.

OFF Center Ganglion Cell

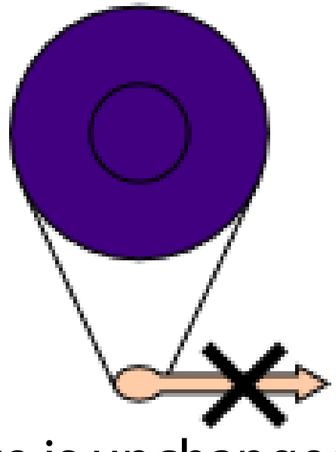
Center-surround structure of ganglion receptive fields (RFs)

Light on center only



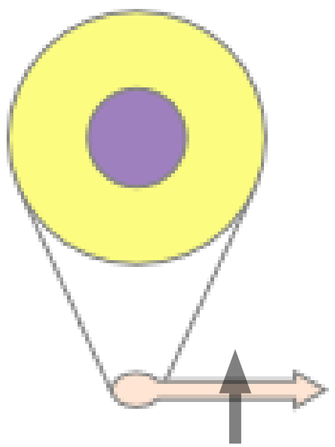
Cell decreases it's firing rate.

No light on center or surround



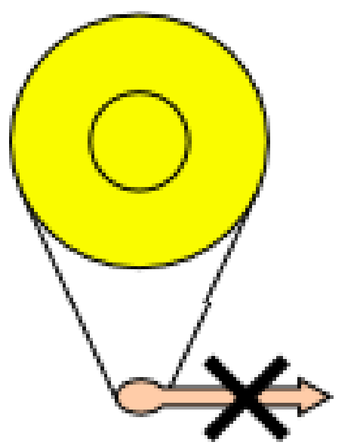
Cell firing rate is unchanged.

Light on surround only



Cell increases it's firing rate.

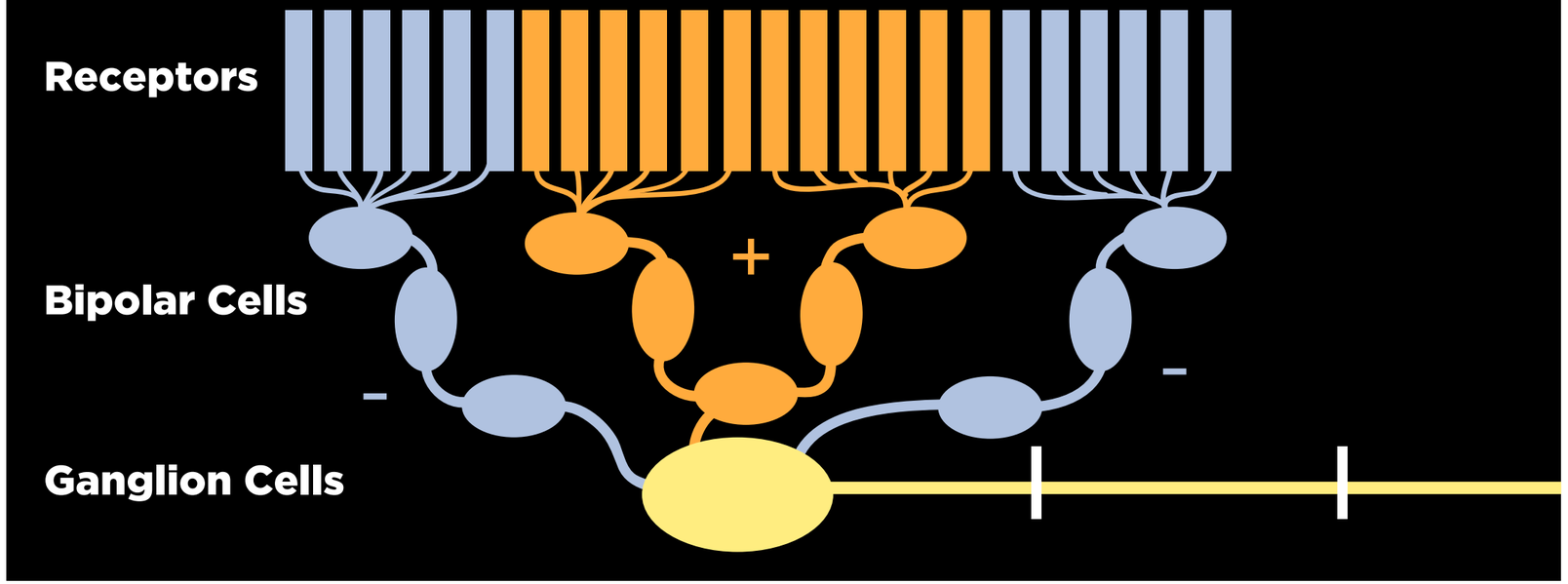
Light on center and surround



Cell firing rate is unchanged.

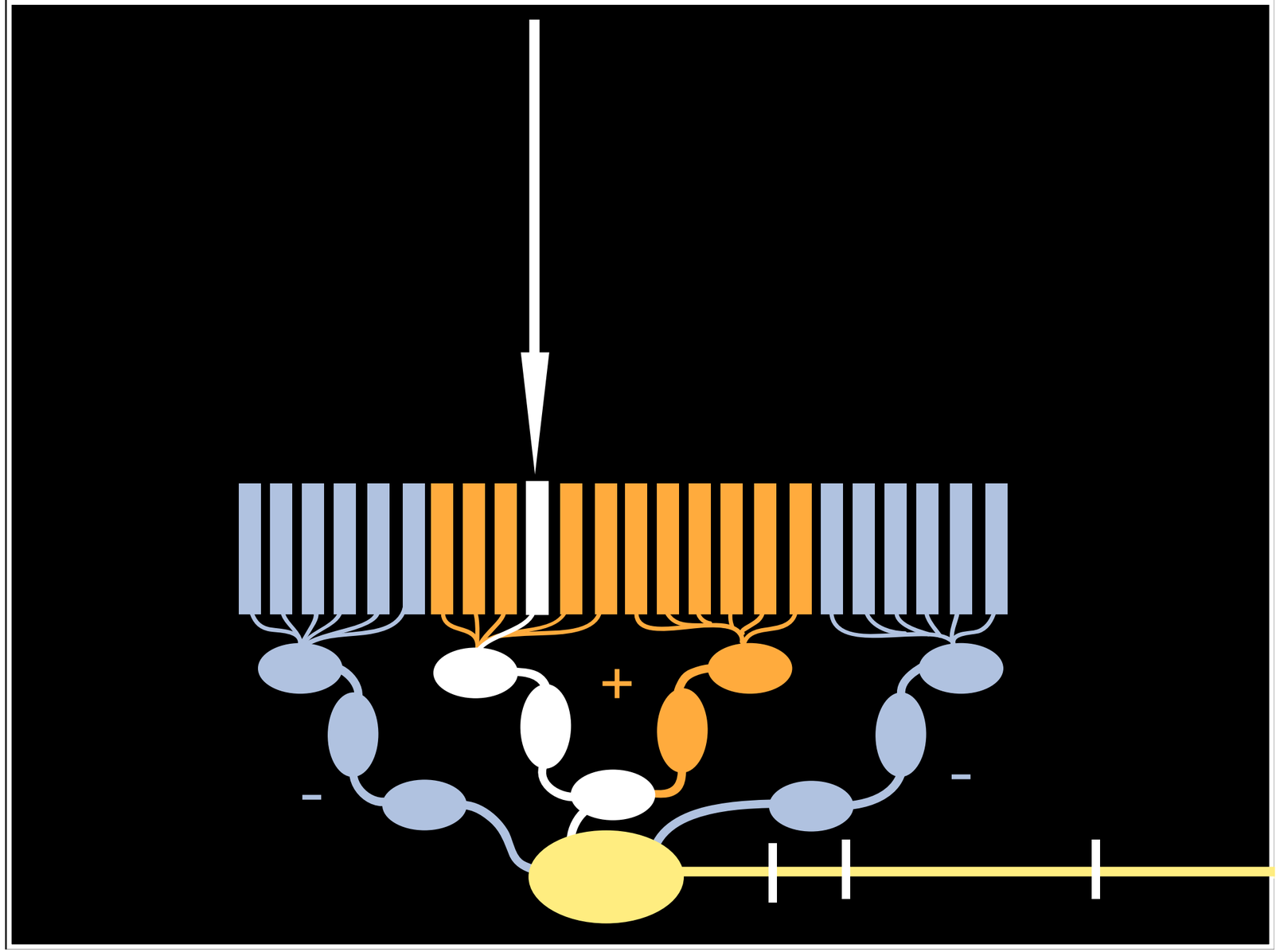
OFF Center Ganglion Cell

Orange are excitatory inputs into the receptive field.
Blue are the inhibitory inputs into the receptive field



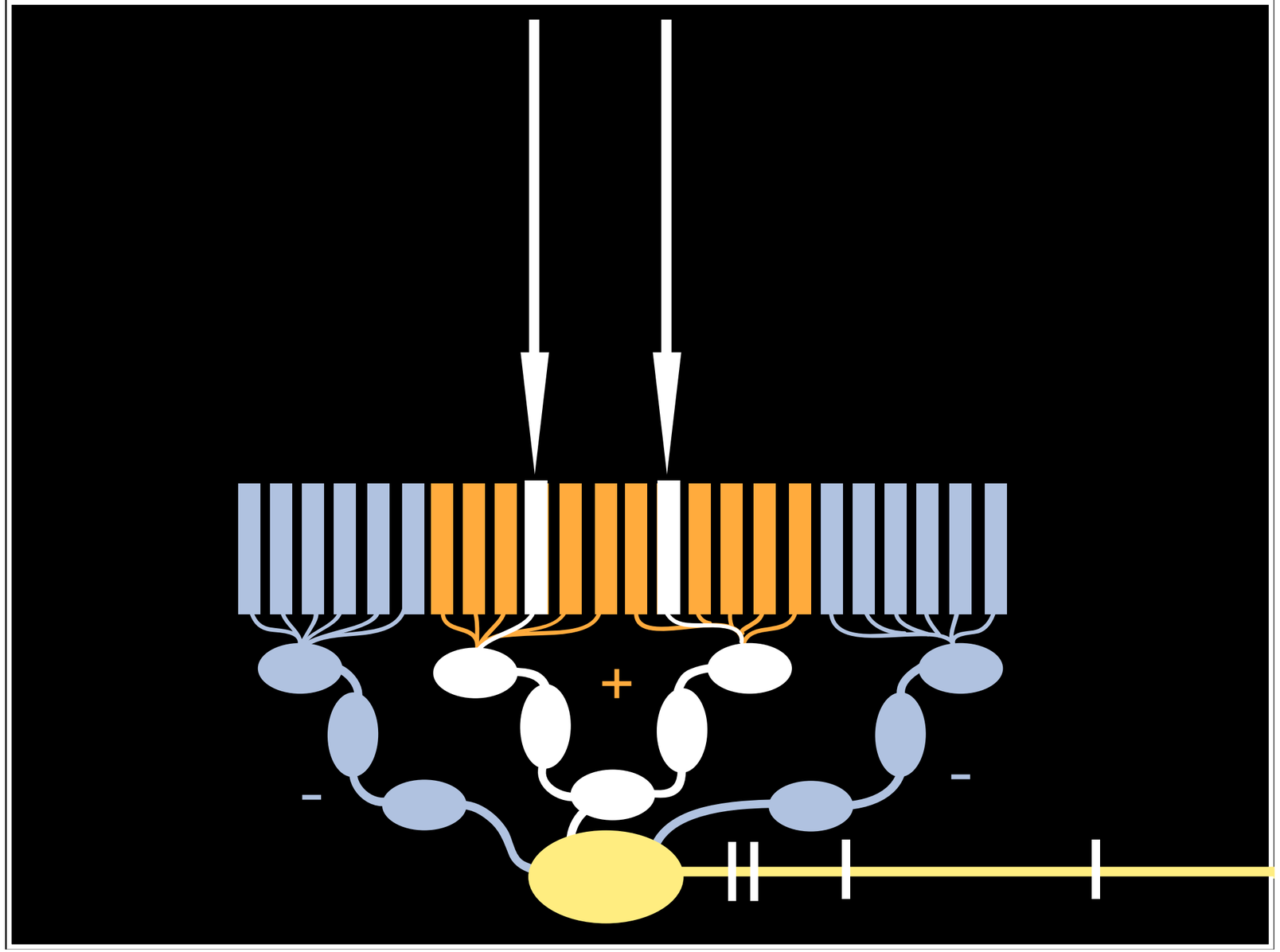
Adapted from a demo developed by John H. Krantz

ON Center Ganglion Cell



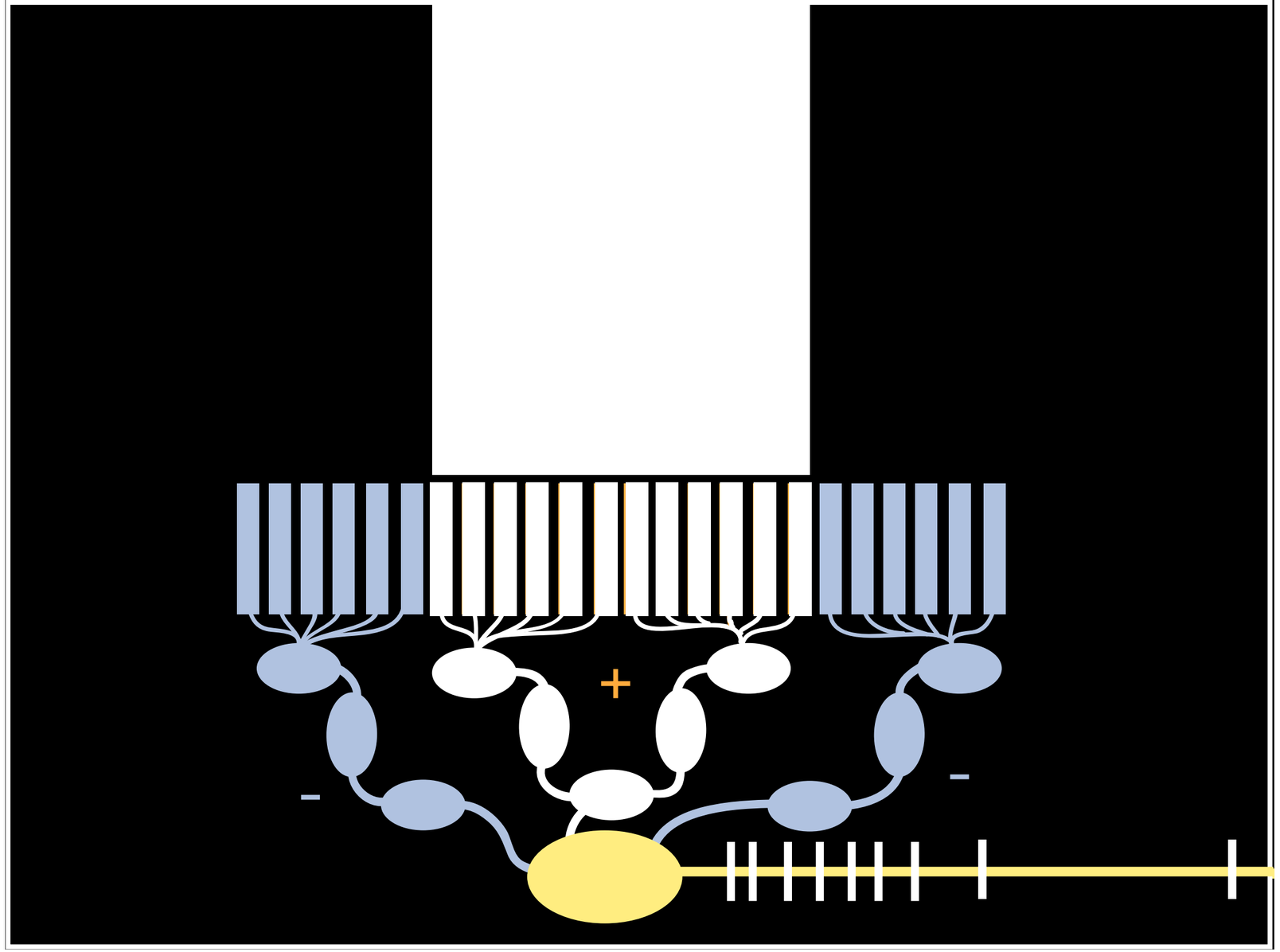
Increases # of action potentials.

ON Center Ganglion Cell



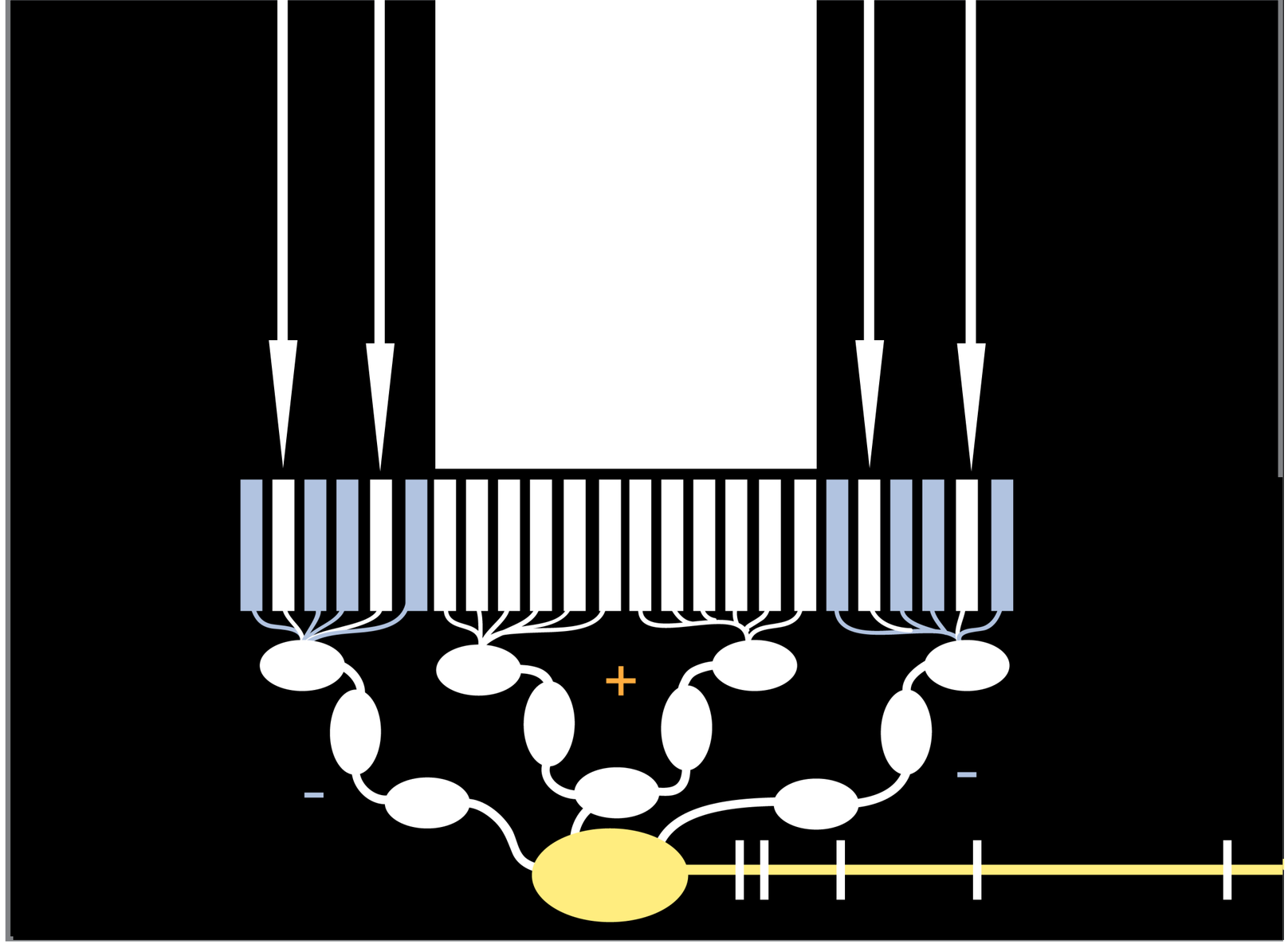
Further increases # of action potentials

ON Center Ganglion Cell



Huge increase in # of action potentials

ON Center Ganglion Cell



Decreases # of action potentials

ON Center Ganglion Cell