1. Specificity of neural computation and information loss always go hand in hand. One example of this is in the direction-selective ganglion cells, as when they are computing the specific direction of movement within the receptive field, a good amount of stimulus info is discarded. Another example of this property is found in the spatiotemporal receptive fields of bipolar cells when identifying texture motion. The circuit will encode the velocity of the object well, but it will discard information about the spatial layout of the moving pattern. The third example of this property is in rod bipolar cells, where the output of each rod photoreceptor is first thresholded before summation, and rod signals below the threshold are discarded (152).

2. The first strategy that the retina uses to reduce noise in processing is the method of temporal filtering - by enhancing the frequencies that primarily contain light signals and suppressing the others, the retina reduces noise in processing by highlighting the desired stimulus (152). The second strategy that the retina uses in reducing noise in processing is specialized cells detecting specific occurrences. An example of this second strategy is seen in the OMS cells, which only fire when objects move in a trajectory different from the original background. This cell type ignores the direction of motion and the image pattern, reducing noise. The third strategy that the retina uses in reducing noise processing is input from other sensory modalities, as demonstrated by the vestibulo-optic reflex pathway. The vestibulo-optic reflex pathway reduces the noise created by the viewer’s change in eye position or full-body position, yet heightening the desired stimulus - the motion from the scene.

3. Rectification is the conversion of an alternating current to a direct current. It’s computational function is to convert signals, once temporally filtered, into electric impulses that are eventually summed and processed by bipolar cells. This helps produce the bipolar cells’ nonlinear response. One example in which it performs important functions in the retina is in sensitivity to texture motion - due to rectification in synaptic transmission, only depolarized bipolar cells communicate to the ganglion cell. This causes transient firing of the ganglion cell in response to shifts of texture in a stimuli (153 Figure 2B). Another example in which it performs important functions in the retina is detection of approaching motion - due to nonlinear rectification of inputs from ON/OFF bipolar cells, amacrine cells, and gap junctions before integration by the ganglion cell, the retina can detect approaching motion.

4. One example of complex RGC’s that would appear to have classical center-surround responses, if static point stimulus was used, is RGC’s involved in detection of approaching motion. When an object moves laterally, excitation and inhibition balance
out, so the ganglion cell is silent. However, if a dark object is moving in a non-lateral manner, then the ganglion cells will become excited and experience no inhibition (154). Another example is RGC’s involved in anticipating motion. These RGC’s are only expected to fire when there is an actual stimulus, yet these RGC’s fire in response to anticipated motion. The receptive fields of these ganglion cells are extended in space. However, the firing of these ganglion cells are suppressed by the biphasic temporal receptive field and then by the dynamic gain control mechanism. The RGC is sensitive to first entry of the object into the RF, but then the response is shut down. The last example is RGC’s involved in detecting textured motion, which causes an increase of light intensity at certain points while decreasing light intensity at other points. The Y-cells that process this input by pooling inputs from smaller subregions in the receptive field. The Y-cell responds to moving textures regardless of direction or spatial pattern, as demonstrated by the spatiotemporal receptive fields of bipolar cells (152).

5. Studies of the visual system after exposure to a series of flashes serve as evidence that the retina computations contribute to making predictions about future sensory states based on past observations. After receiving a regular series of flashes, the activated visual neurons are entrained into a periodic response - if just one of the flashes is omitted, some neurons still generate a burst of activity equivalent to the burst of activity they would have if the flash still occurred. This omitted stimulus response is evidence that the retinal computations contribute to predicting future sensory states (155).

6. Presynaptic and postsynaptic inhibition differ in the time at which the inhibition occurs - the presynaptic inhibition occurs before a synapse while postsynaptic inhibition occurs after a synapse. Presynaptic inhibition means that calcium can’t enter the axon terminal and no neurotransmitter is released, while postsynaptic means that calcium enters the presynaptic neuron, and never opens the sodium channels, so no axon potential is fired. In retinal circuits, presynaptic inhibition occurs in computation of the Object Motion Sensitive (OMS) cells, where the inhibitory motion detector from the amacrine cells acts on bipolar cell terminals. Postsynaptic inhibition occurs in detecting approaching motion. When a dark object approaches laterally, the object’s leading edge causes excitation while the trailing edge causes inhibition. This inhibition must act postsynaptically at bipolar terminals, since signals from different parts of the object must be combined (154).

7. Certain visual computations are done as early as the retina because of survival reasons - we perform computations in the retina and undergo information loss because of the sheer volume of visual data our brain can receive. Other areas in the brain take time to process visual information, and the more material they have to process, the slower an animal’s response can be, thus making it more prone to harmful stimuli in it’s environment.