Announcements

- **MP3** is due on Oct 22.

- **Exam 1** is coming soon: 10/21/2015 7-9 pm in SIEBL 1404
- New Preparation Material:
  Virtual Reality book by Steven LaValle: 2 chapters ready
  msl.cs.uiuc.edu/vr

- **Projects:** get started!
- Unity Tutorials: Wed Oct 14 6pm , Th Oct 15 6pm

VR is an Interdisciplinary Topic

- VR is **NOT** a purely CS topic.

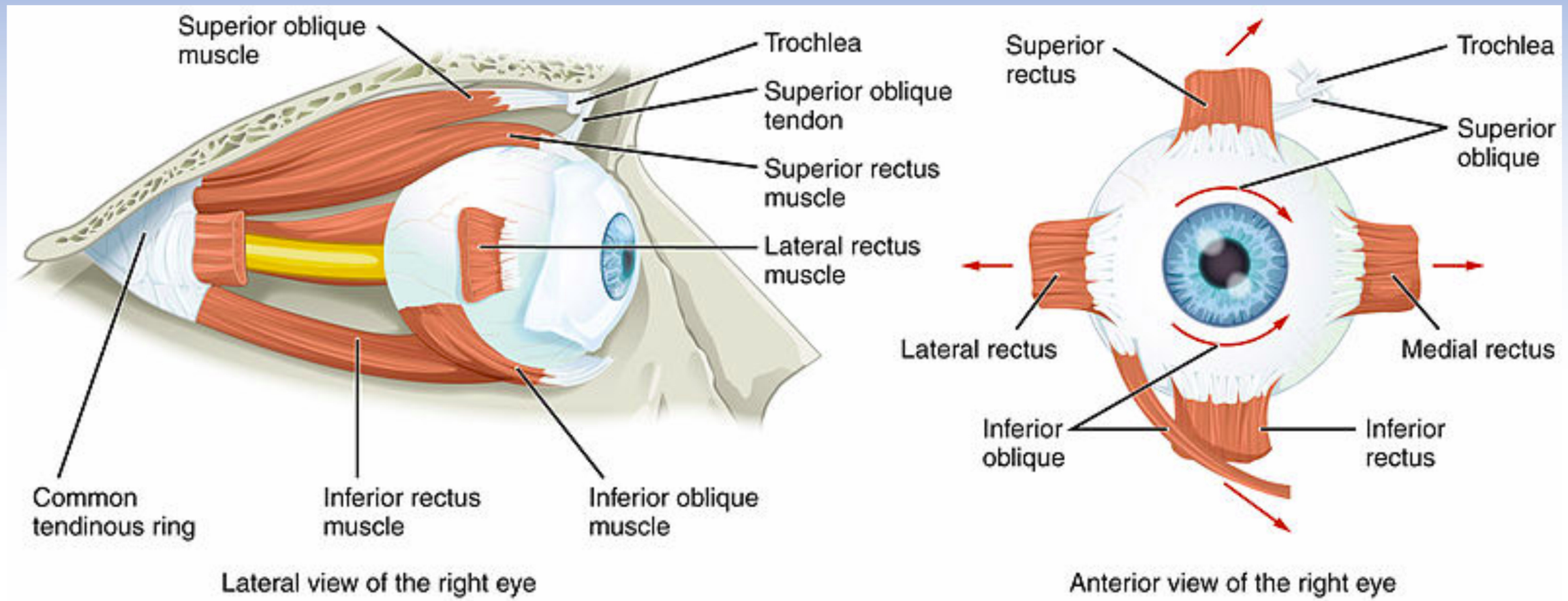
- If you work in a VR company, expect to work side by side with computer scientists, engineers, psychologists, optical engineers, optometrists, neuroscientists and artists.

- Most of the design questions in VR are open problems, almost everything is **unchartered territory**.

- Pick any field, you probably can make a difference there with VR.

- A great place to make impact and change the world.

Eye Muscles



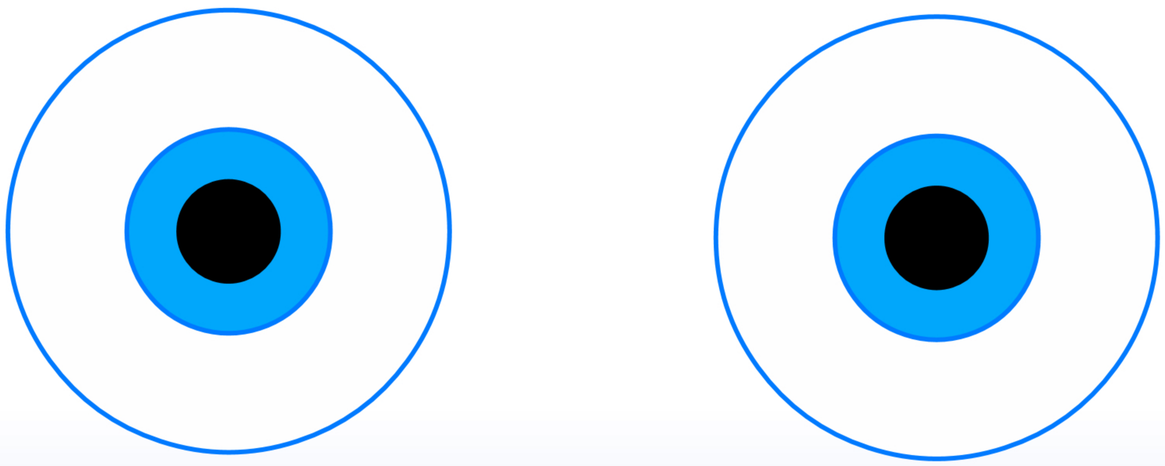
https://www.youtube.com/watch?v=u3BcgOIjbGA

https://www.youtube.com/watch?v=vd7OOJ7c1q4

https://www.youtube.com/watch?v=RsVf80YjdRI

Sanity Check: DOFs

https://www.youtube.com/watch?v=jrp8iPfvP4Y



Eye Motion Modes

	Conjugate	Disjunctive
Voluntary	Saccade Smooth pursuit	Convergence Divergence
Involuntary	Vestibulo-Ocular Optokinetic Microsaccades	

Strong coupling with neuroscience:

https://www.youtube.com/watch?v=kmPhBz1pfxc

Eye Motion Modes: Saccades

Saccades are rapid "jerks" motions

- last for < 45ms, 900°/s

- saccadic masking is transsaccadic masking

example of perceptual constancy

Examples:

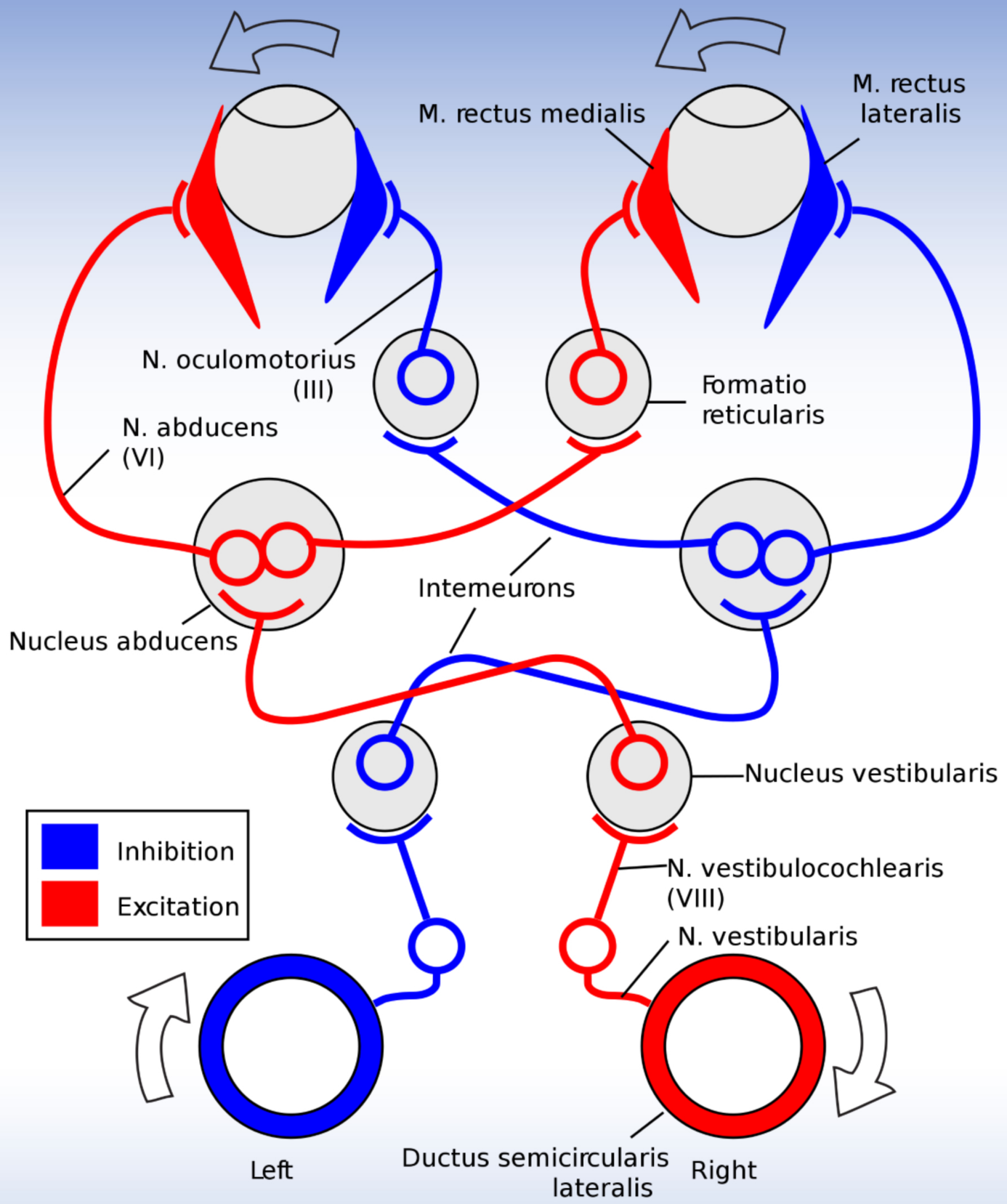
Eye Motion Modes: Smooth Pursuit

Smooth pursuit

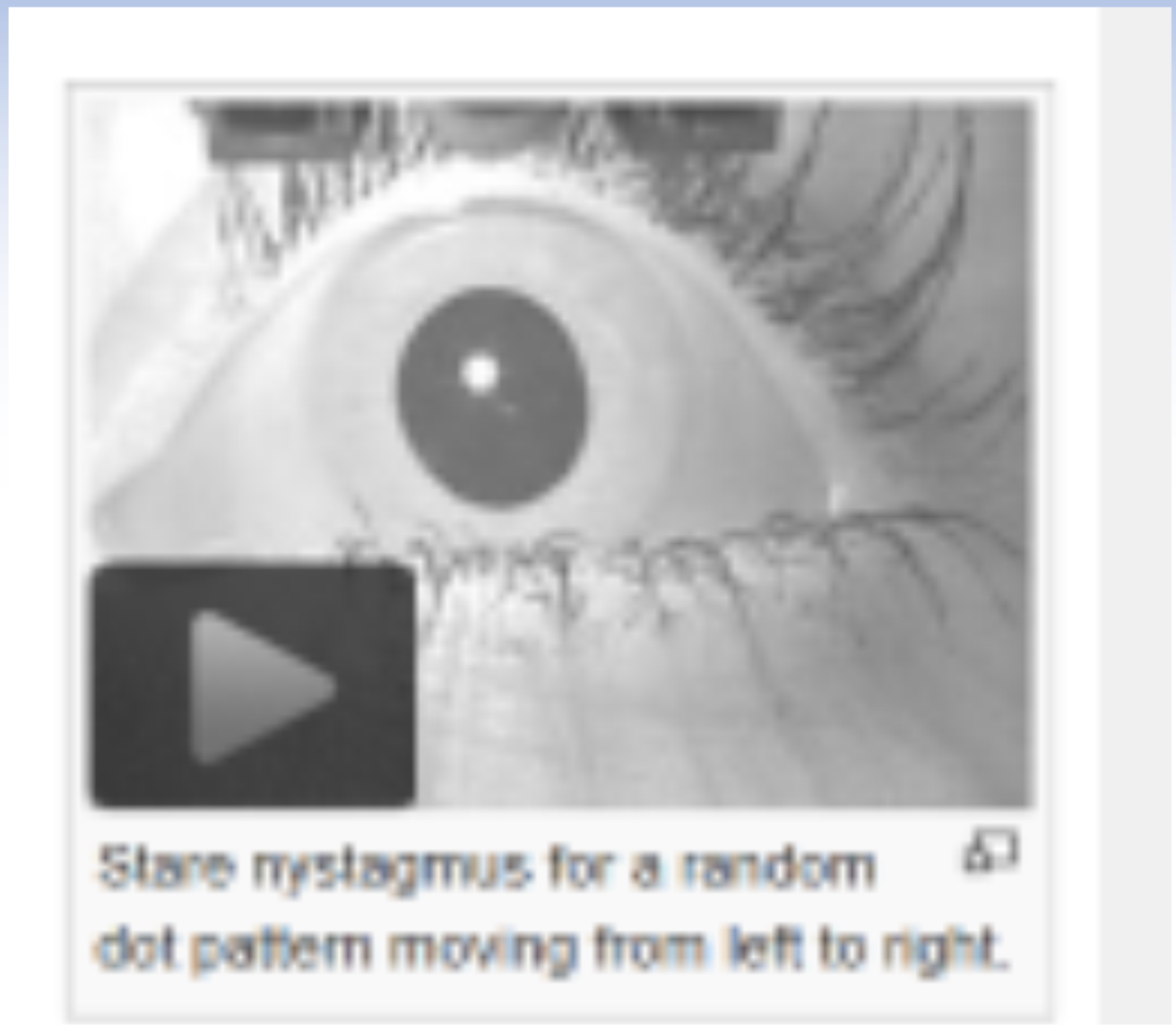
- Track a moving visual signal
- $< 30°/s$, otherwise saccades start

Examples: tennis ball, soccer ball, toddler, slow car, train?

Eye Motion Modes: VOR



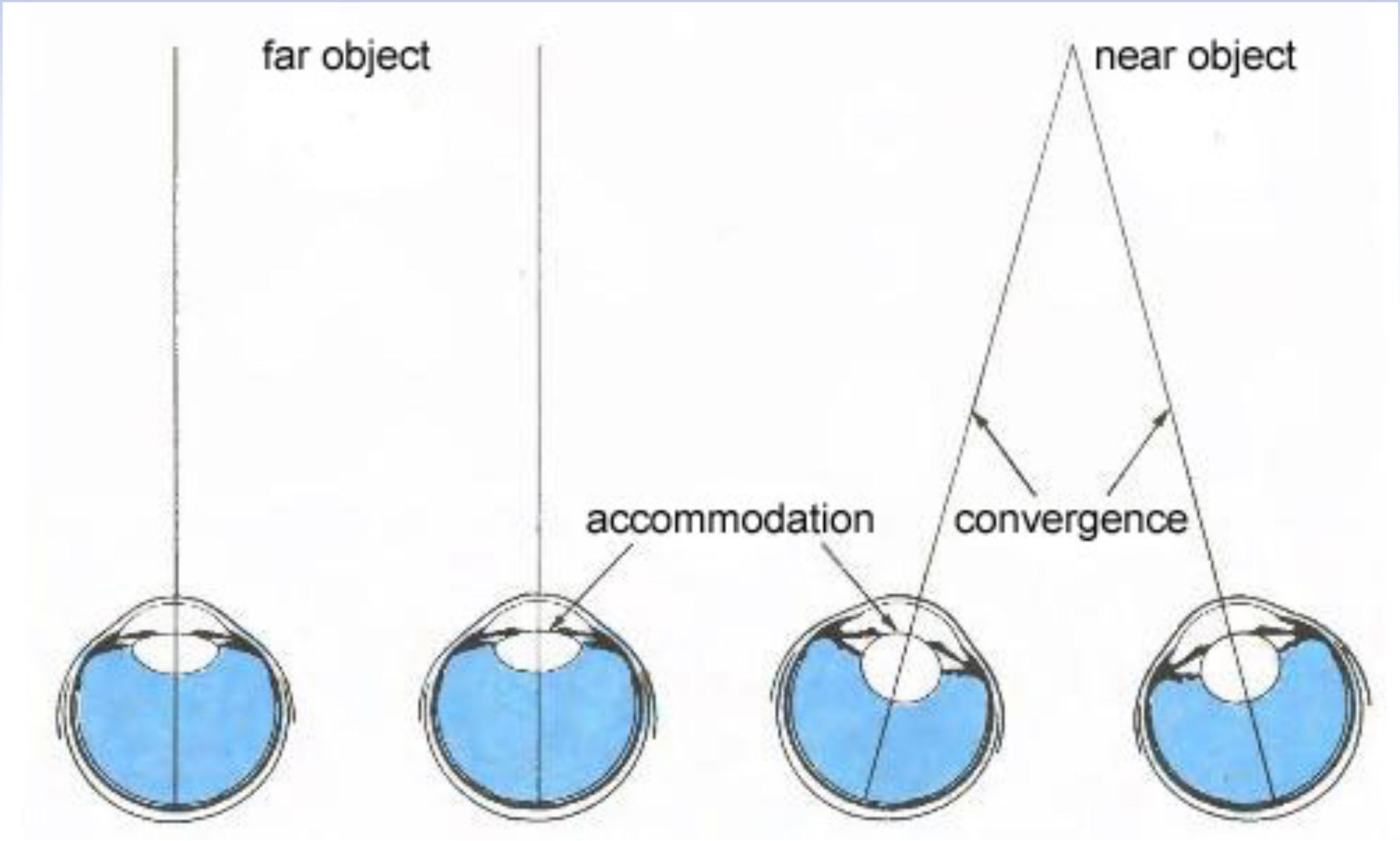
Eye Motion Modes: Optokinetics



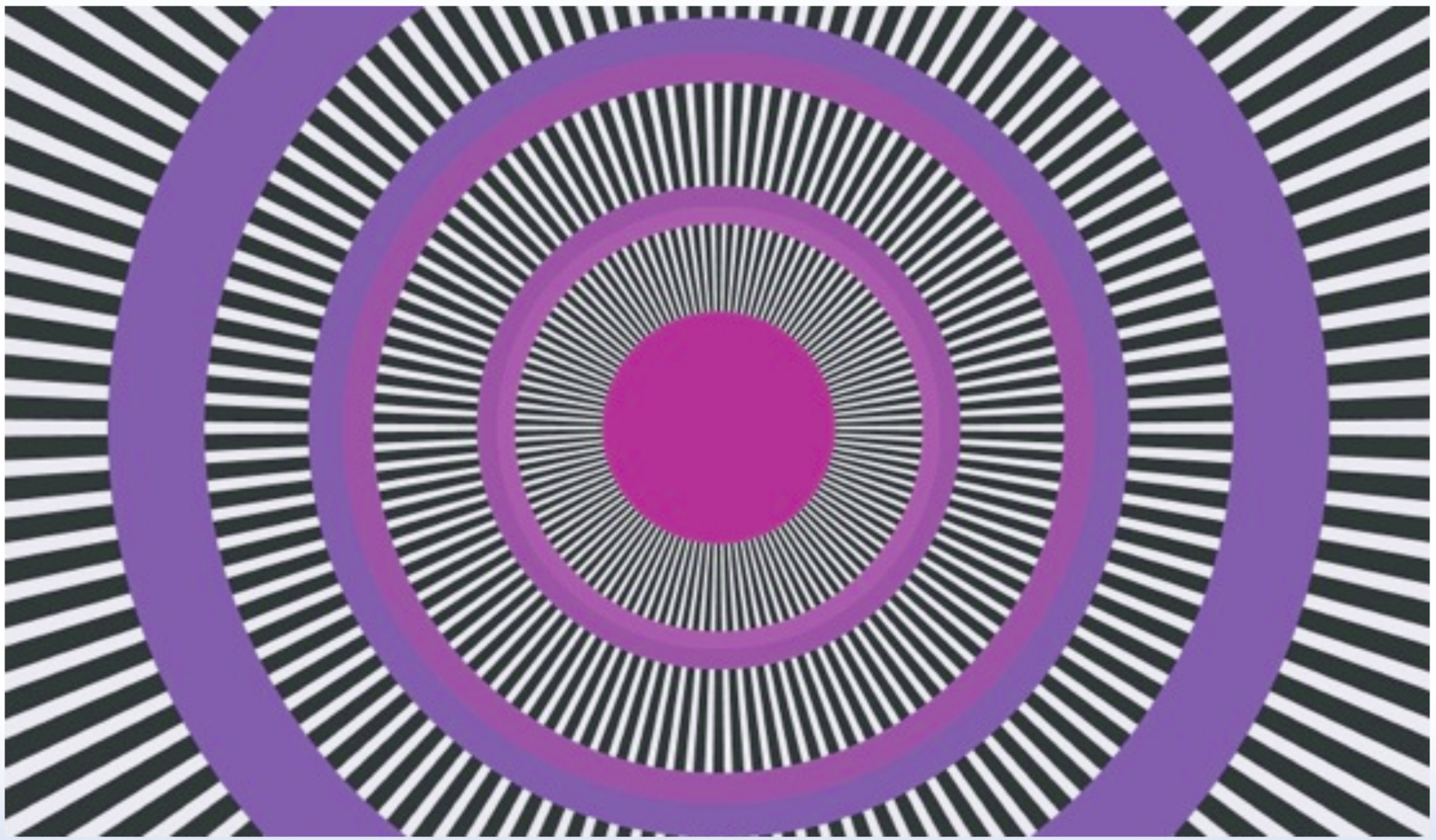
https://en.wikipedia.org/wiki/Optokinetic_reflex

https://www.youtube.com/watch?v=wj8ZEr6HVPk

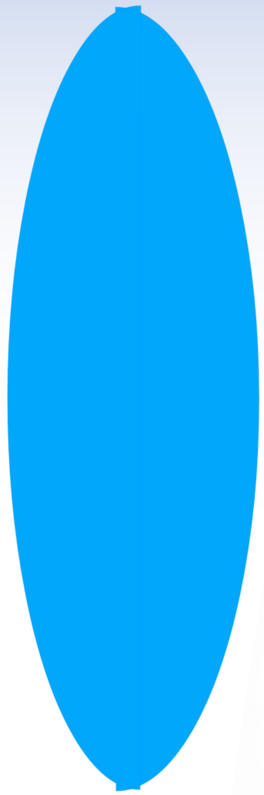
Eye Motion Modes: Convergence/Divergence

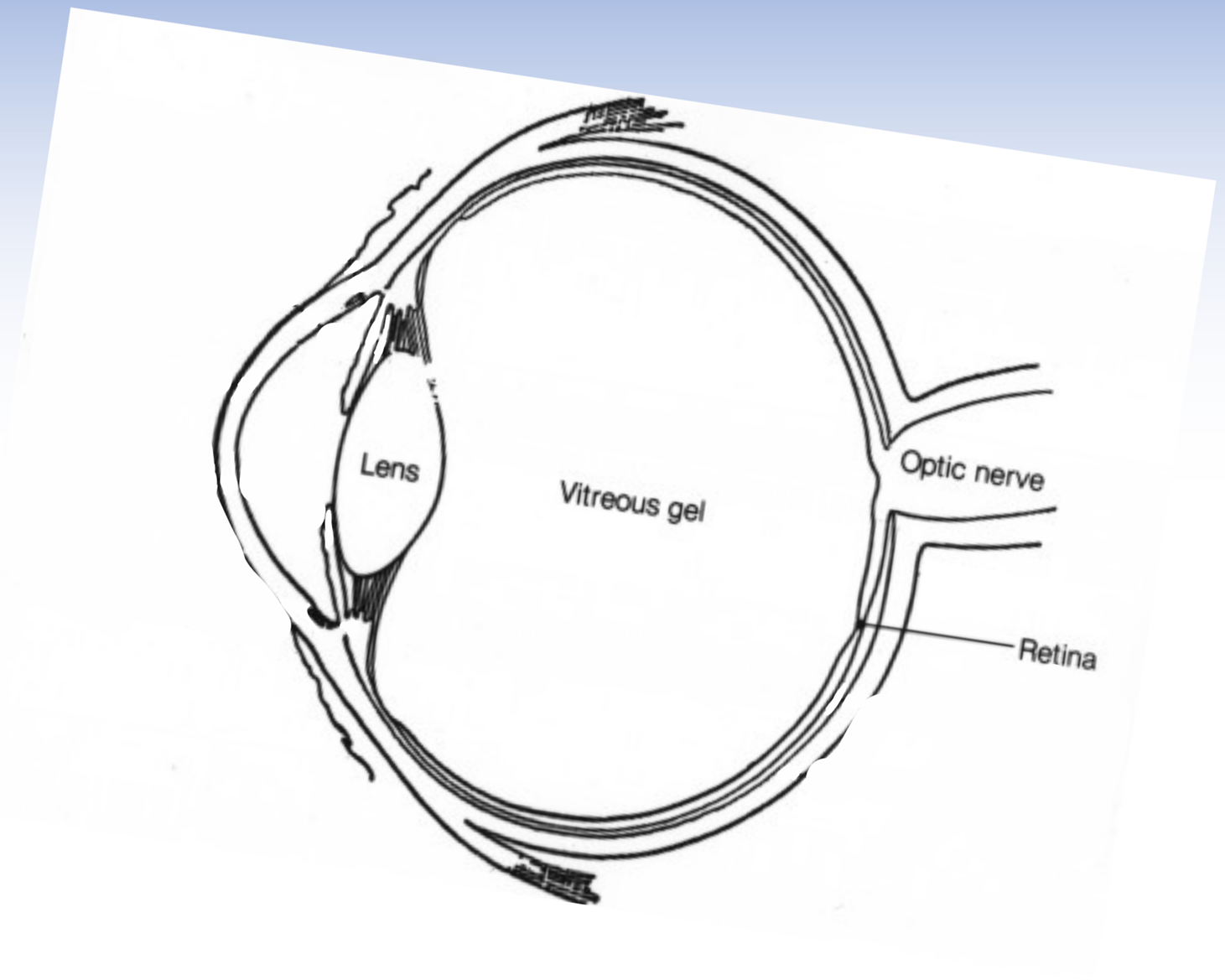


Eye Motion Modes: Microsaccades



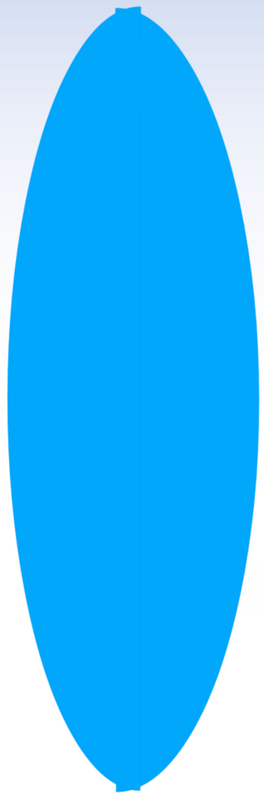
Eye Motion and VR: 1. Lens Aberrations

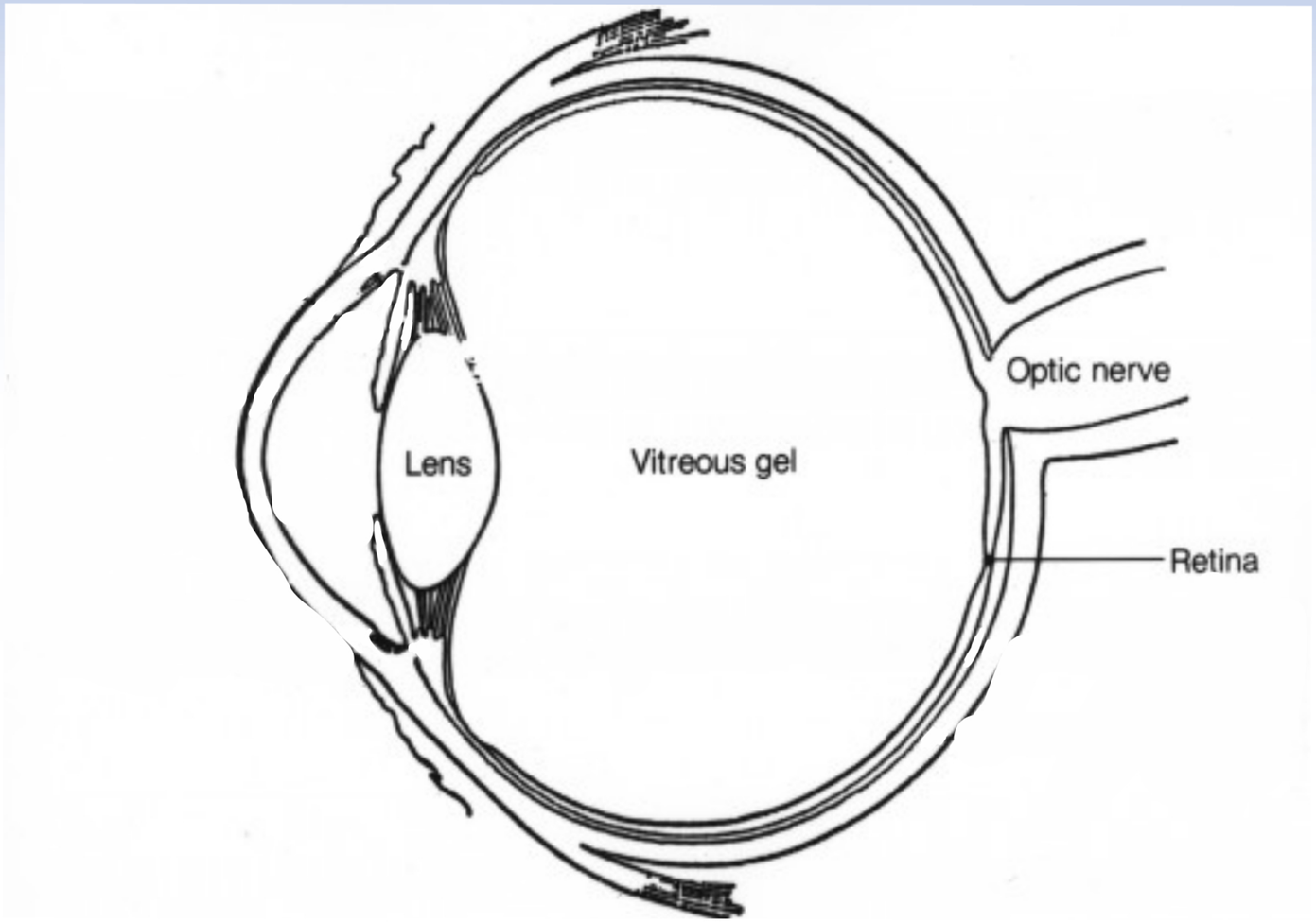




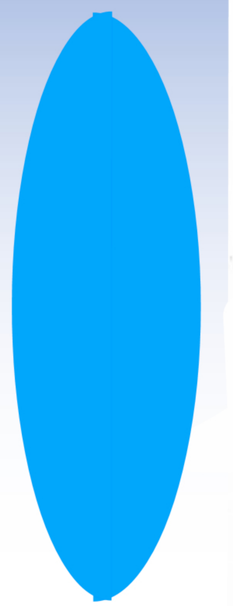
- focus
- optical distortion

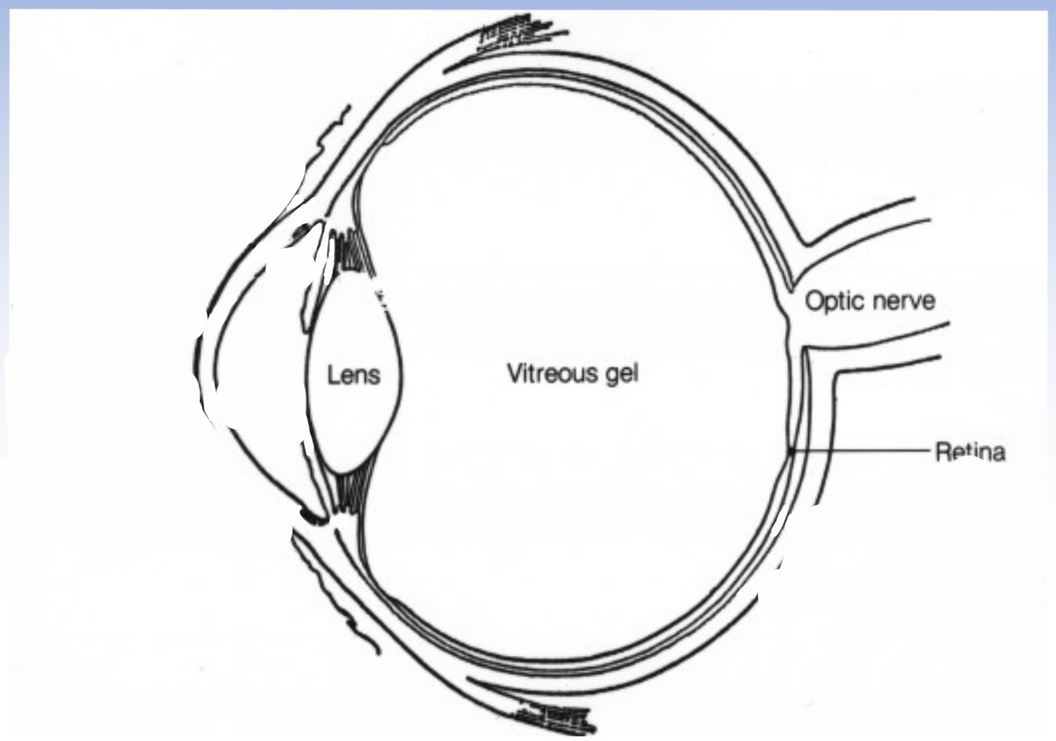
Eye Motion and VR: 2. VOR Gain Adaptation





Eye Motion and VR: 3. Interaction with Photoreceptors





1. Pixels on the display switch their color/intensity at some non-zero rate.
2. There is RGB sub pixel structure.
3. Frames might be off (black) at particular times.
4. Asynchronous (line-by-line) display scan out.
5. Photoreceptors are slow to respond. It takes them about 0.1-0.2 seconds to respond.
6. All of the eye movements shift the image on the retina.

Eye Motion and VR: 4. Vergence