

# Visual Perception and the Brain

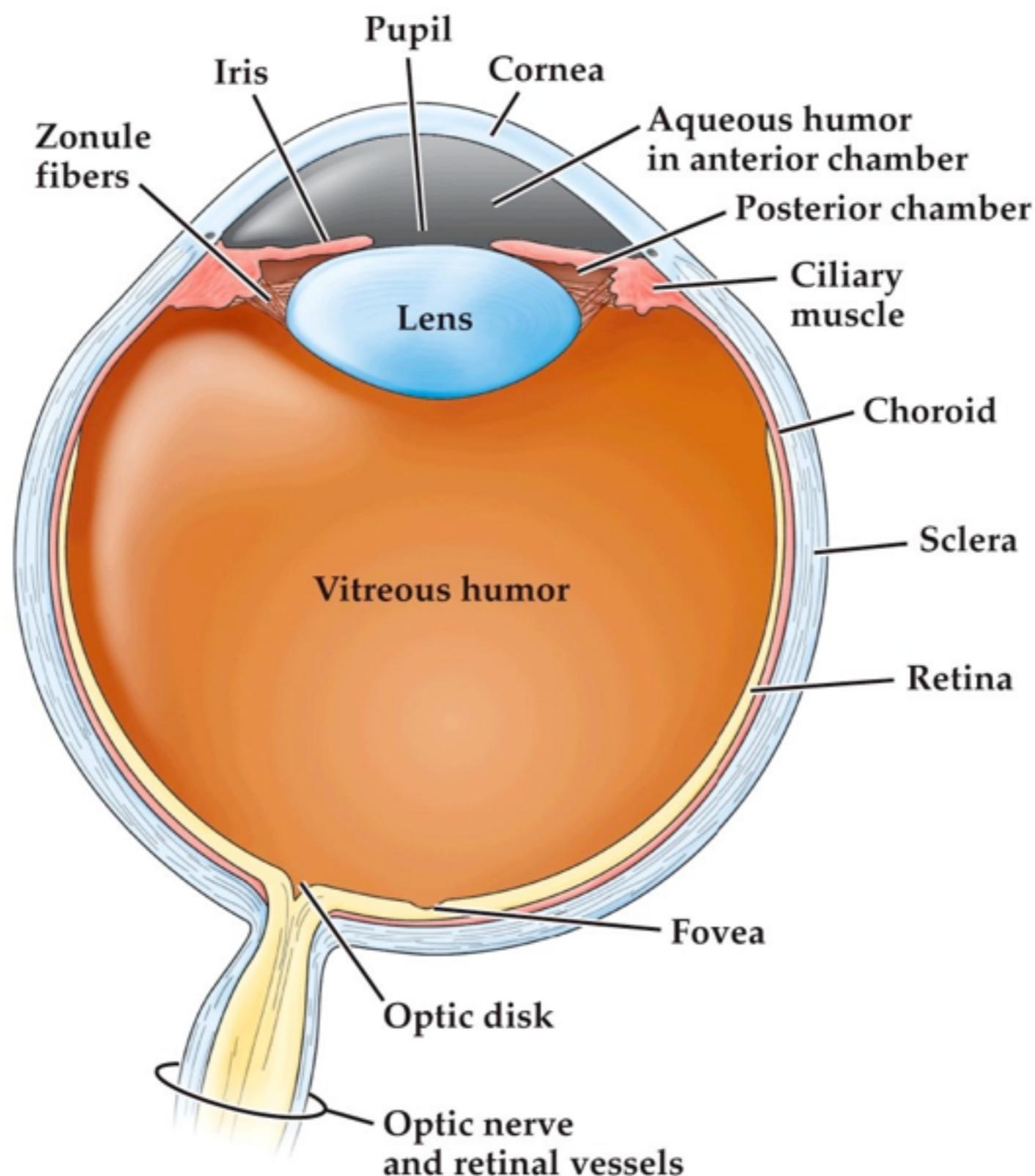
## **Module # 1 – Background**

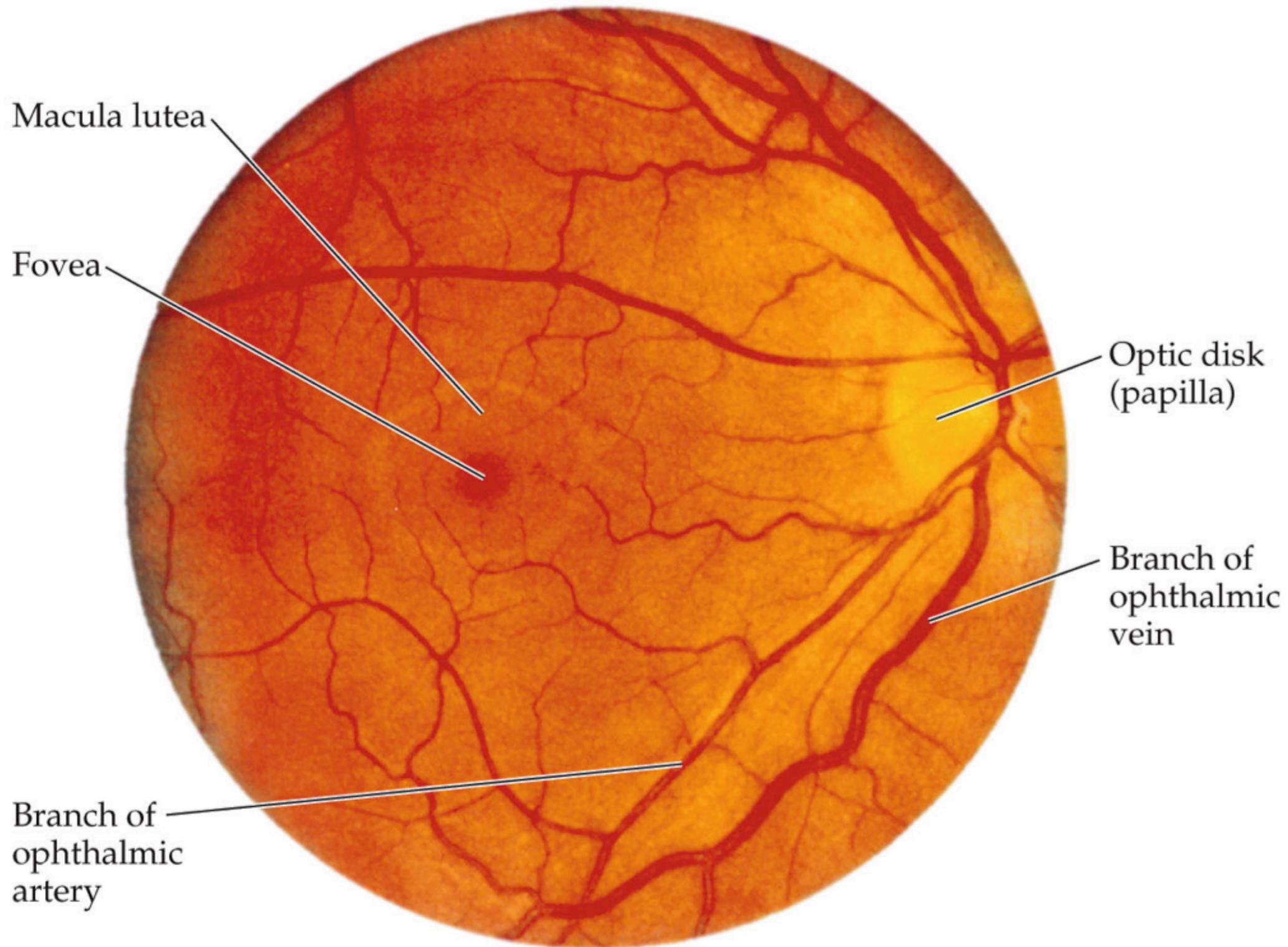


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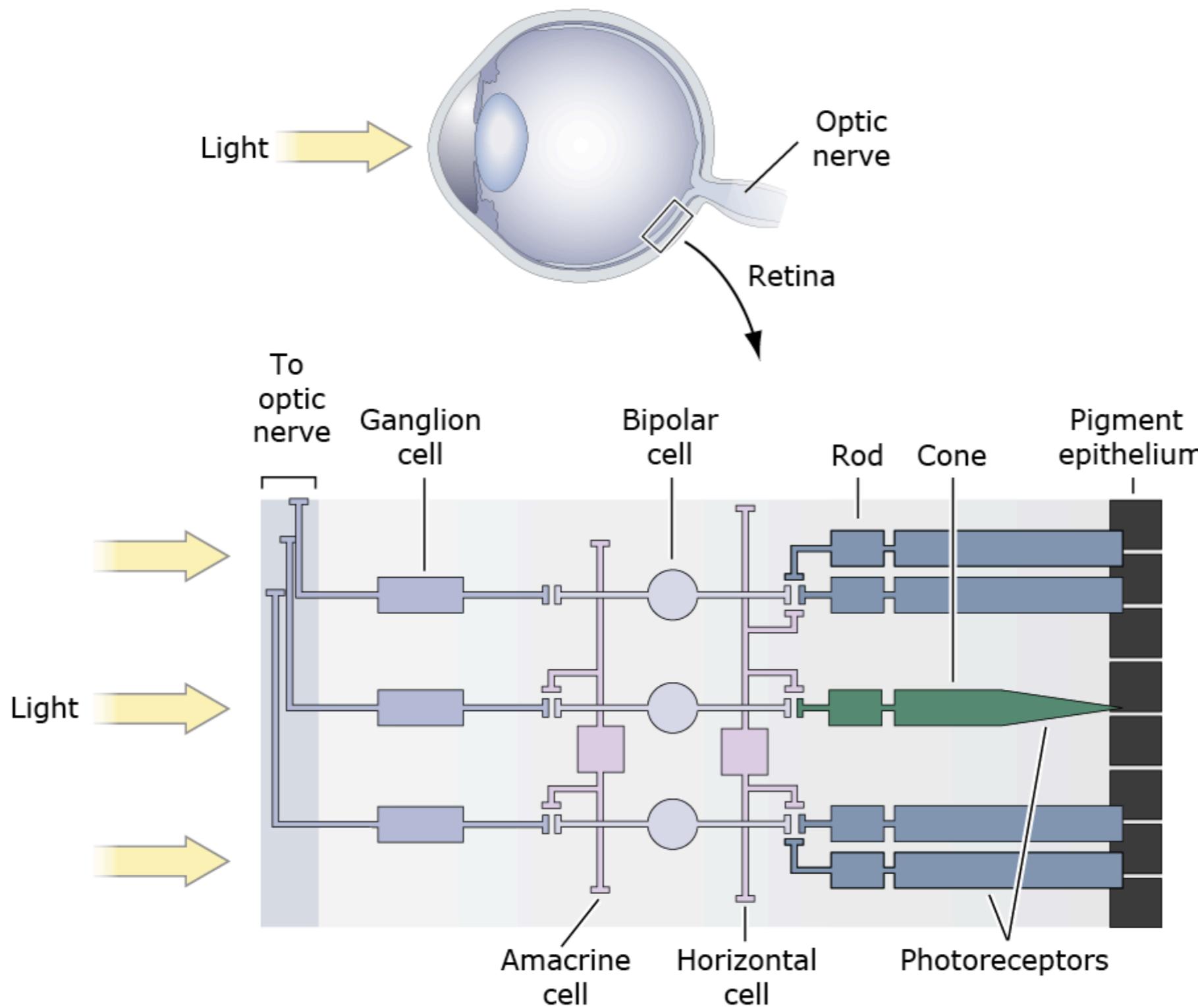
# Topic 3. Organization of the Human Visual System

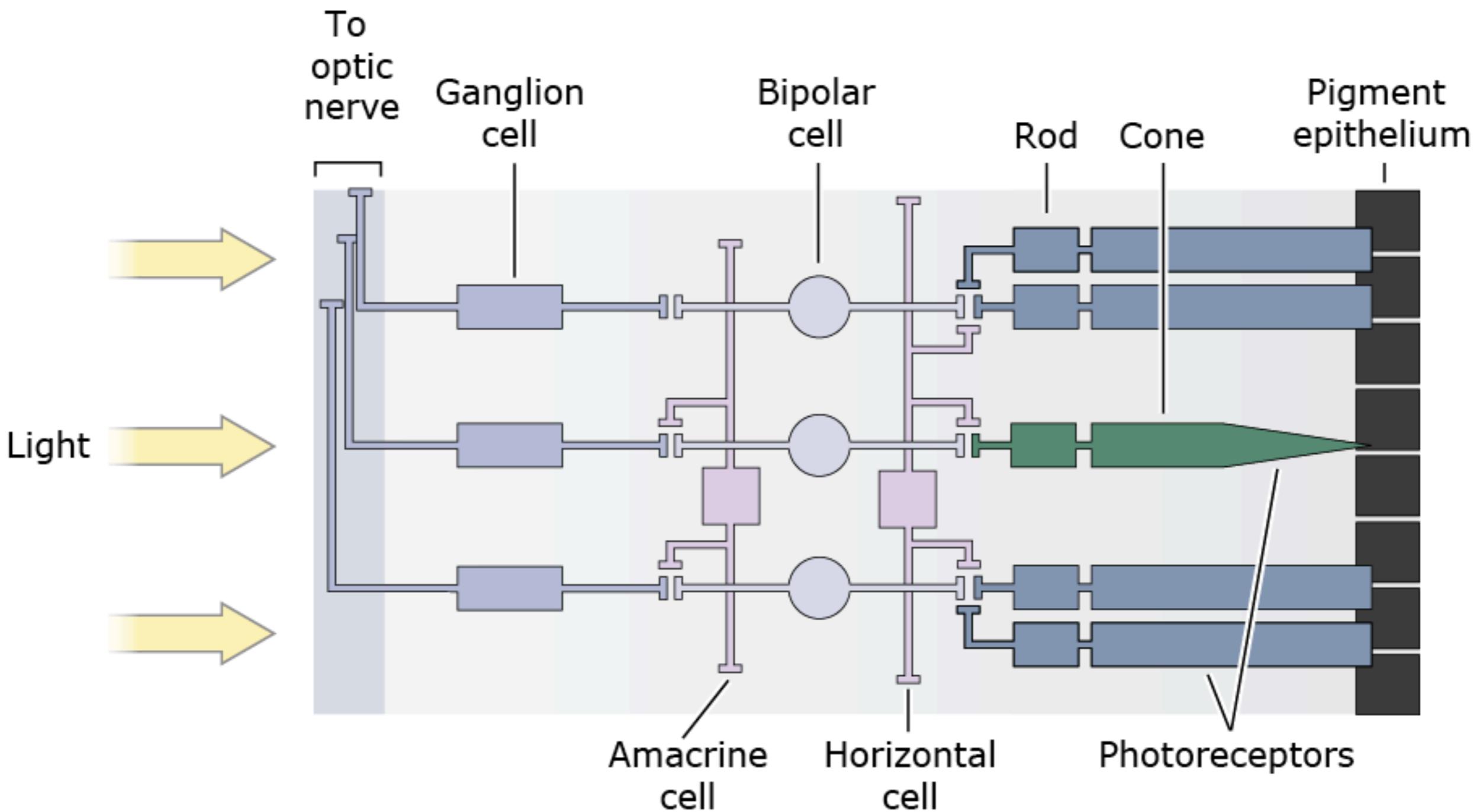
# Lesson 1. The Eye

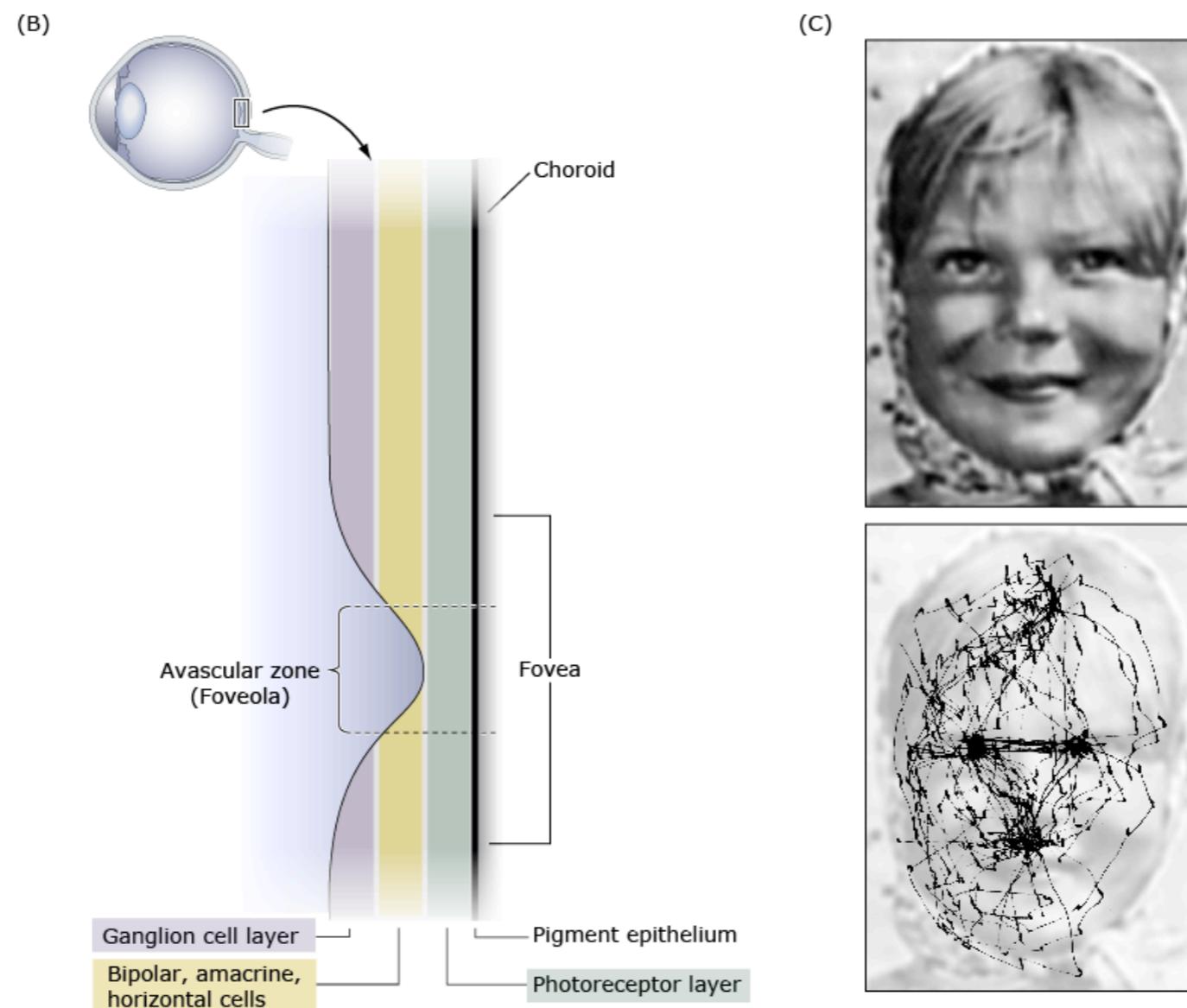
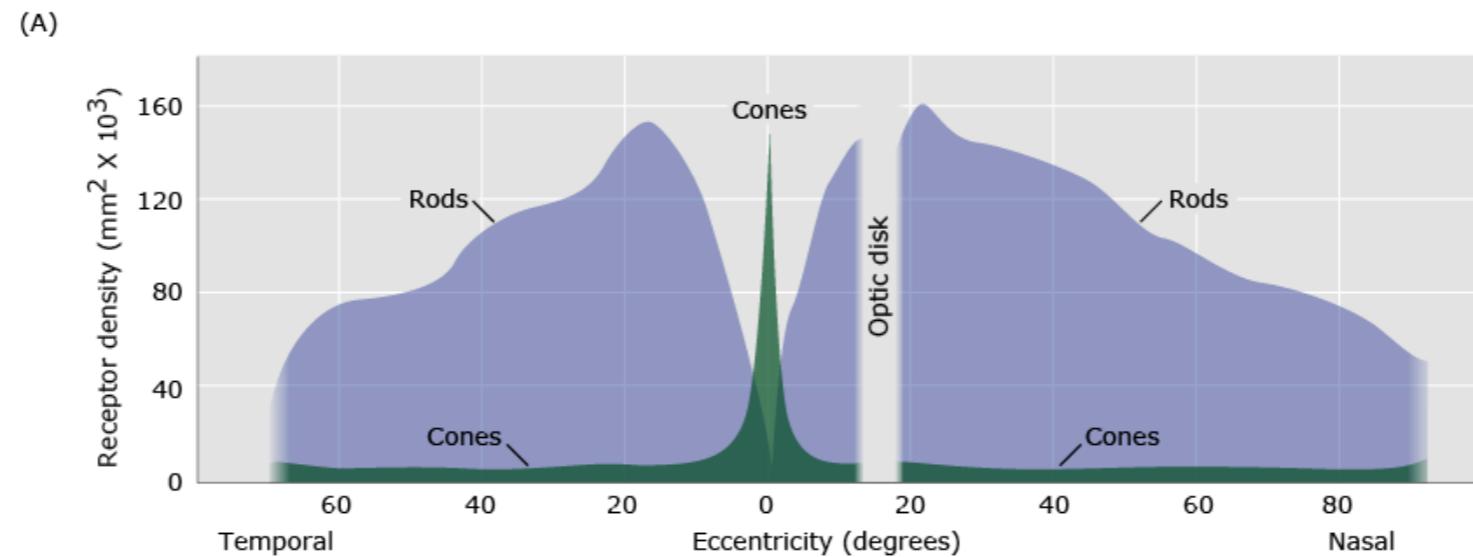




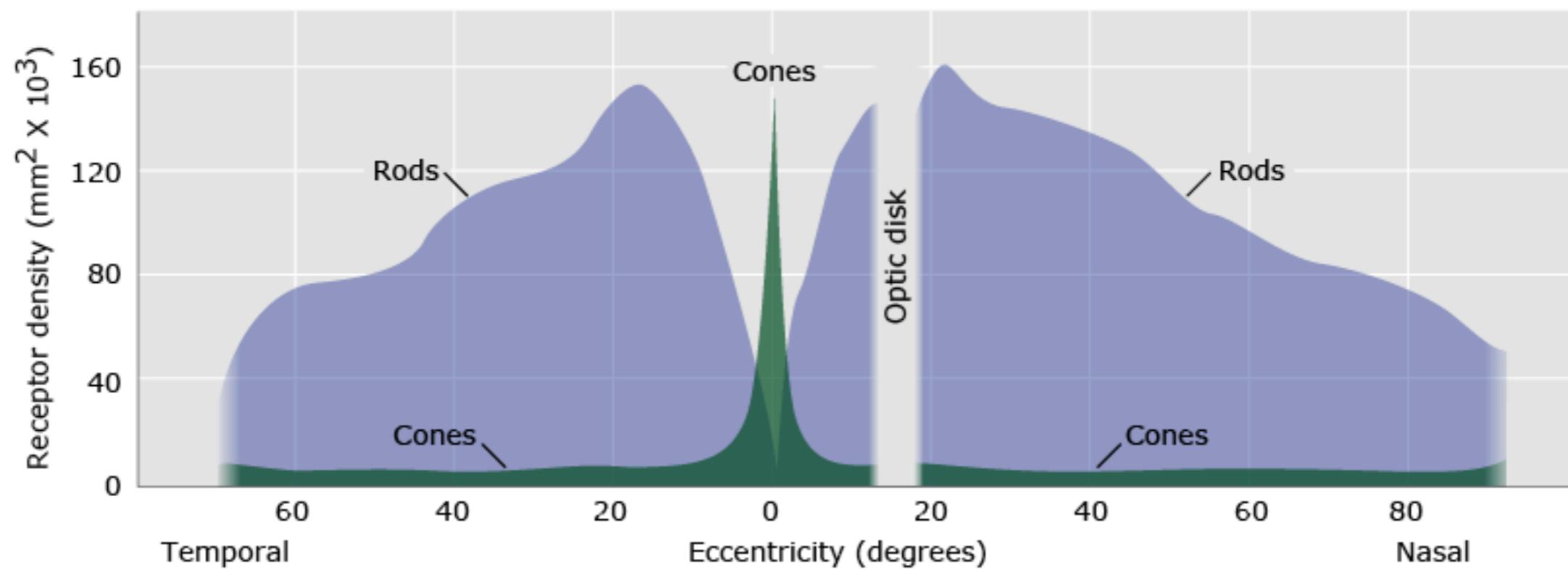
# Lesson 2. The Retina



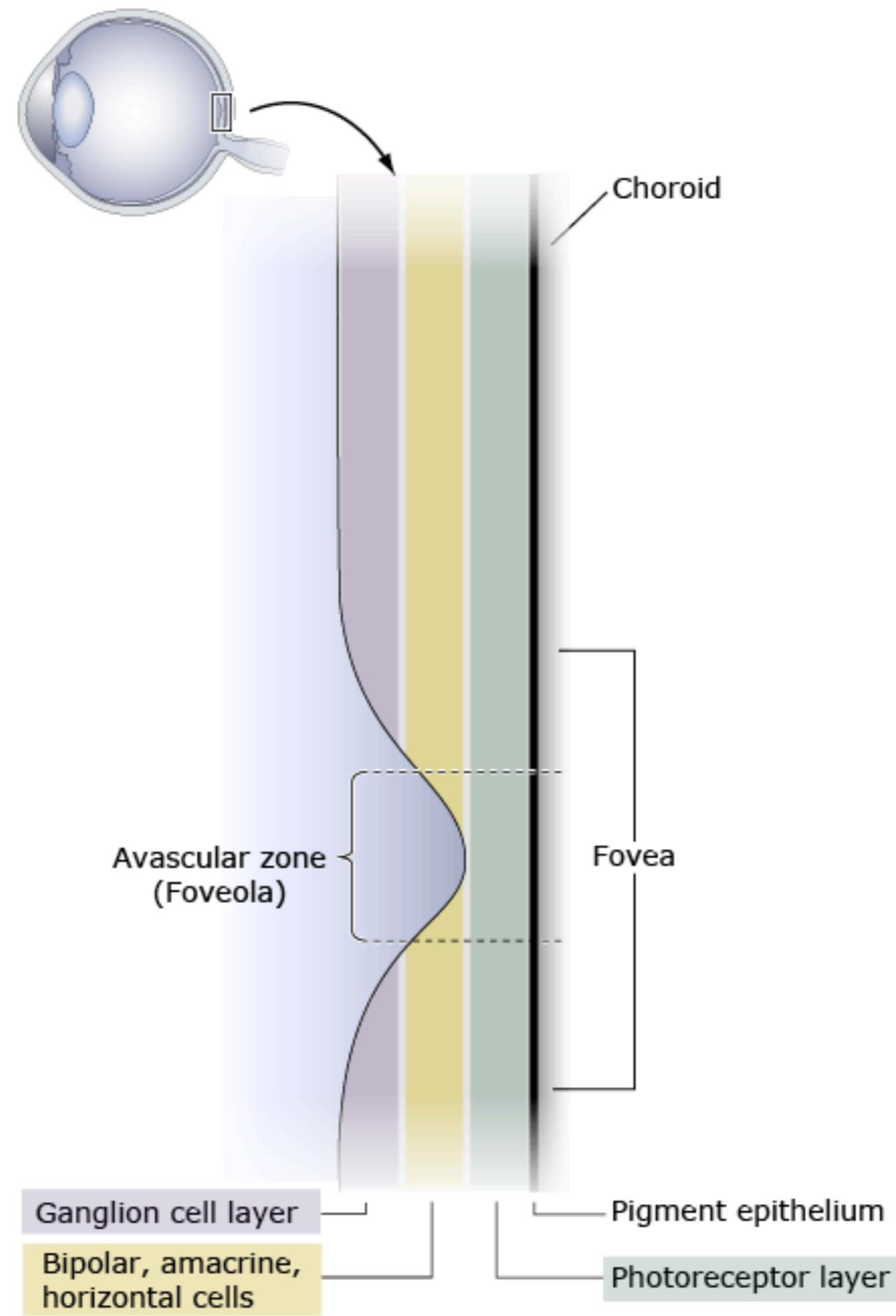




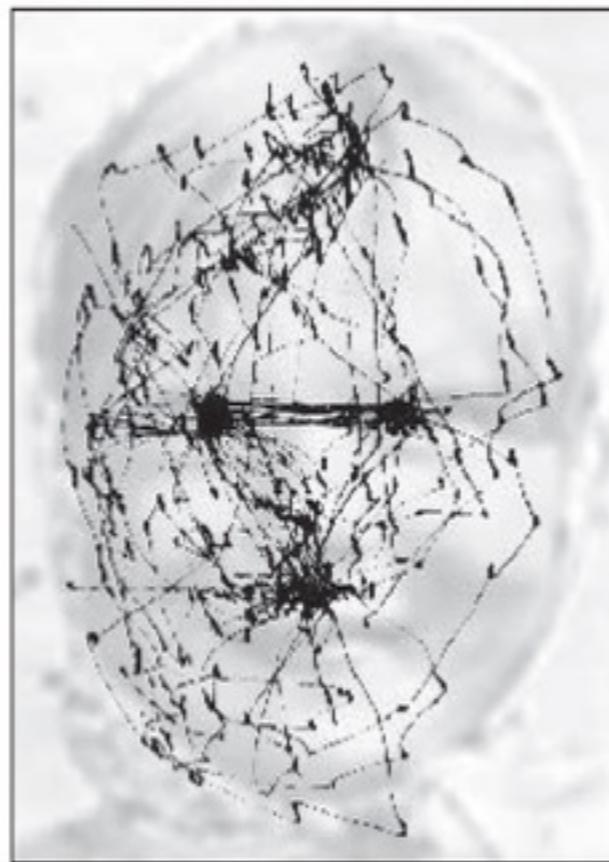
(A)

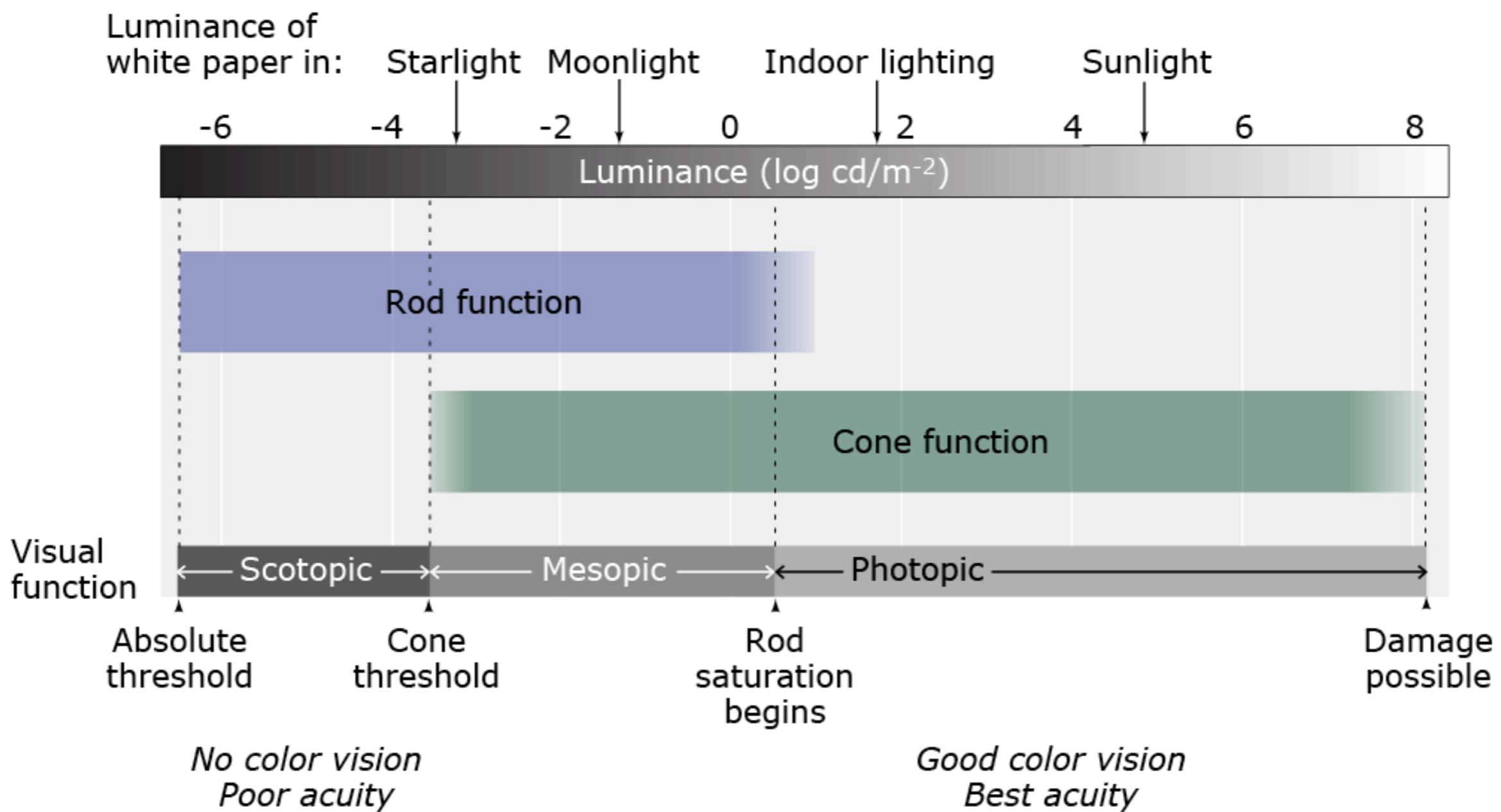


(B)



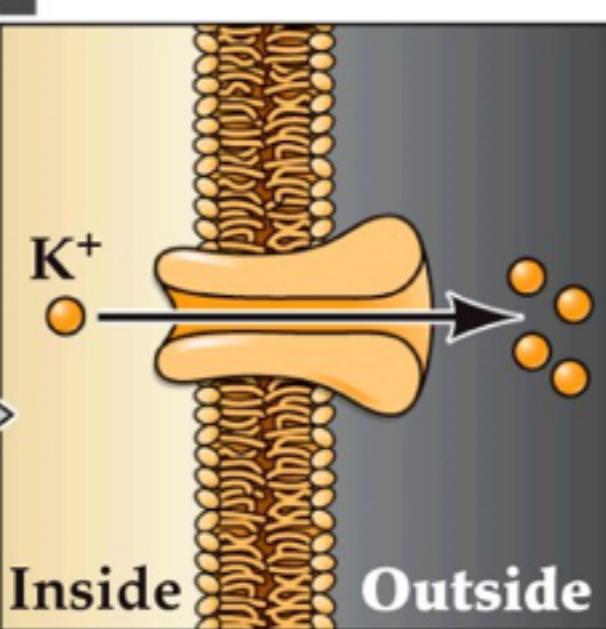
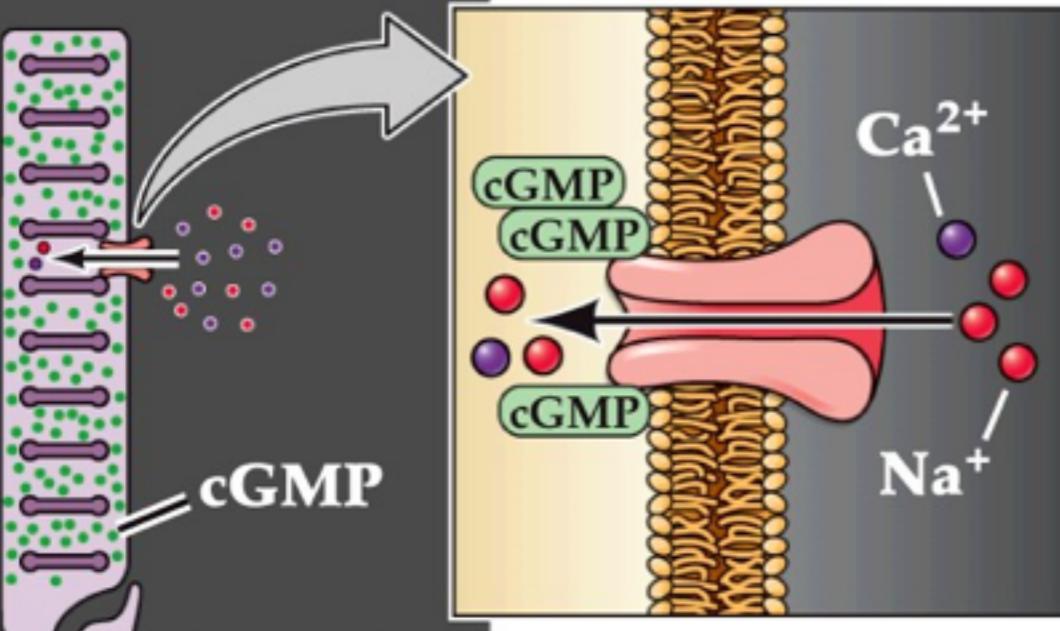
(C)





### (A) Dark

#### Rod outer segment

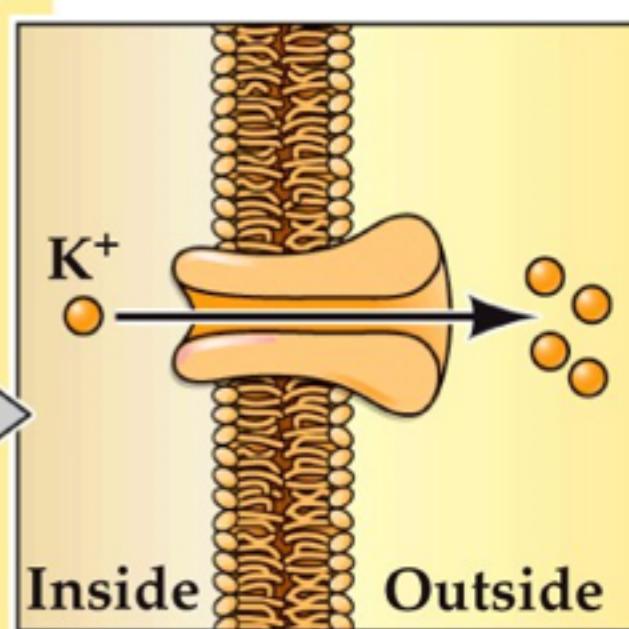
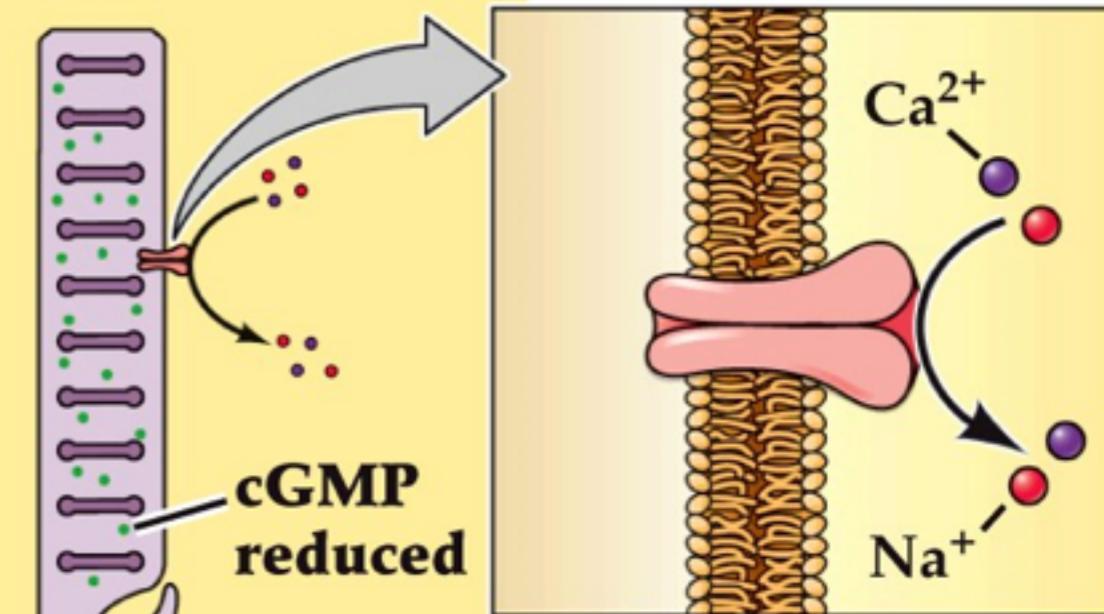


Rod inner segment

$\text{Na}^+$  influx,  
 $\text{K}^+$  efflux:  
Depolarization

### (B) Light

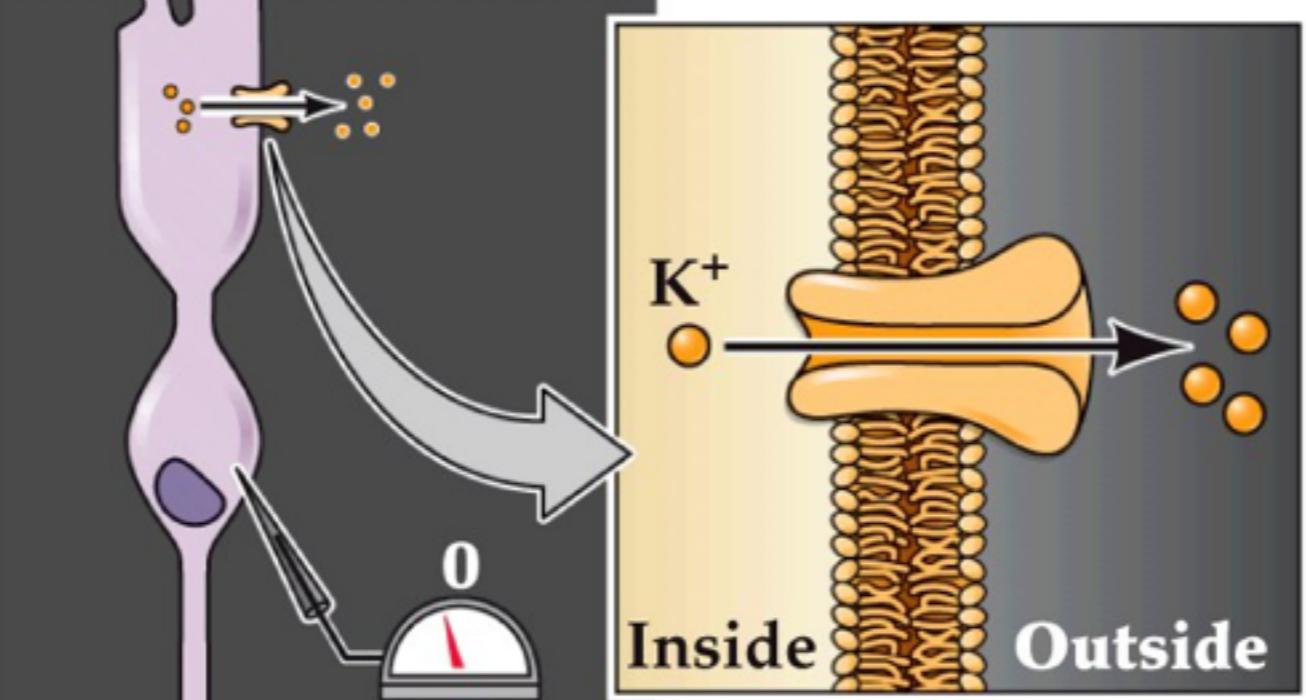
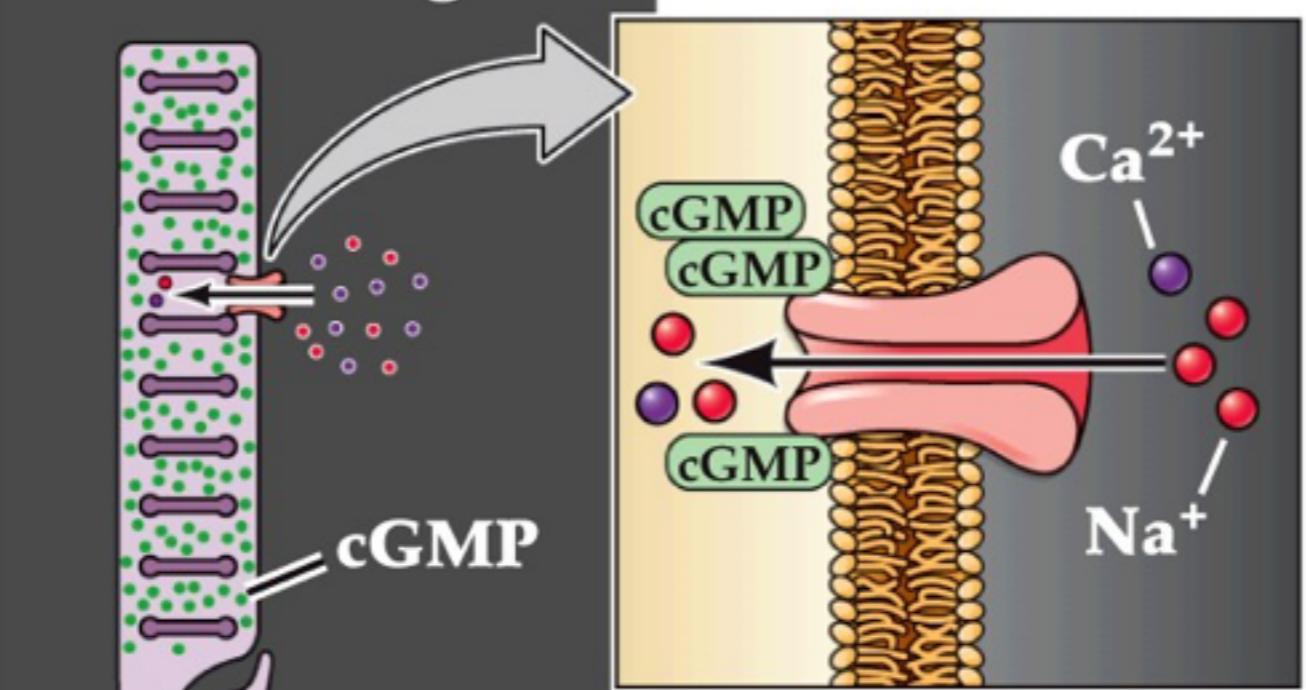
#### Rod outer segment



Rod inner segment

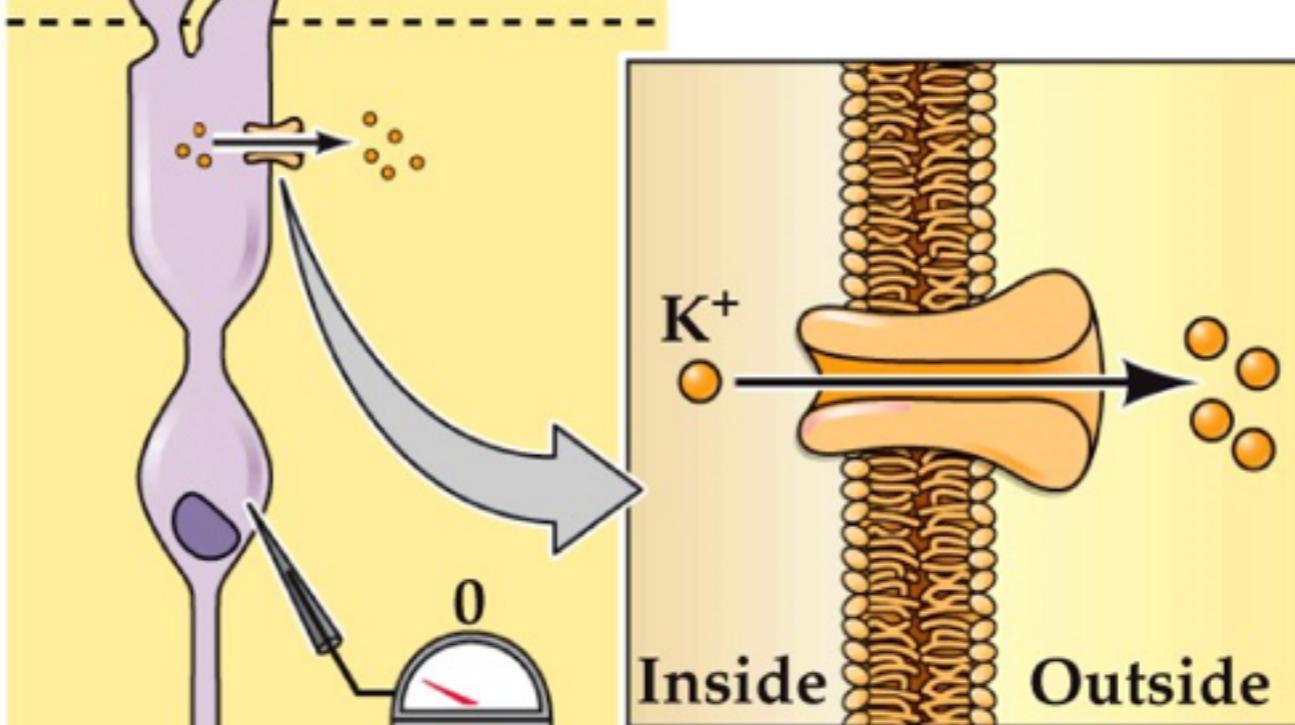
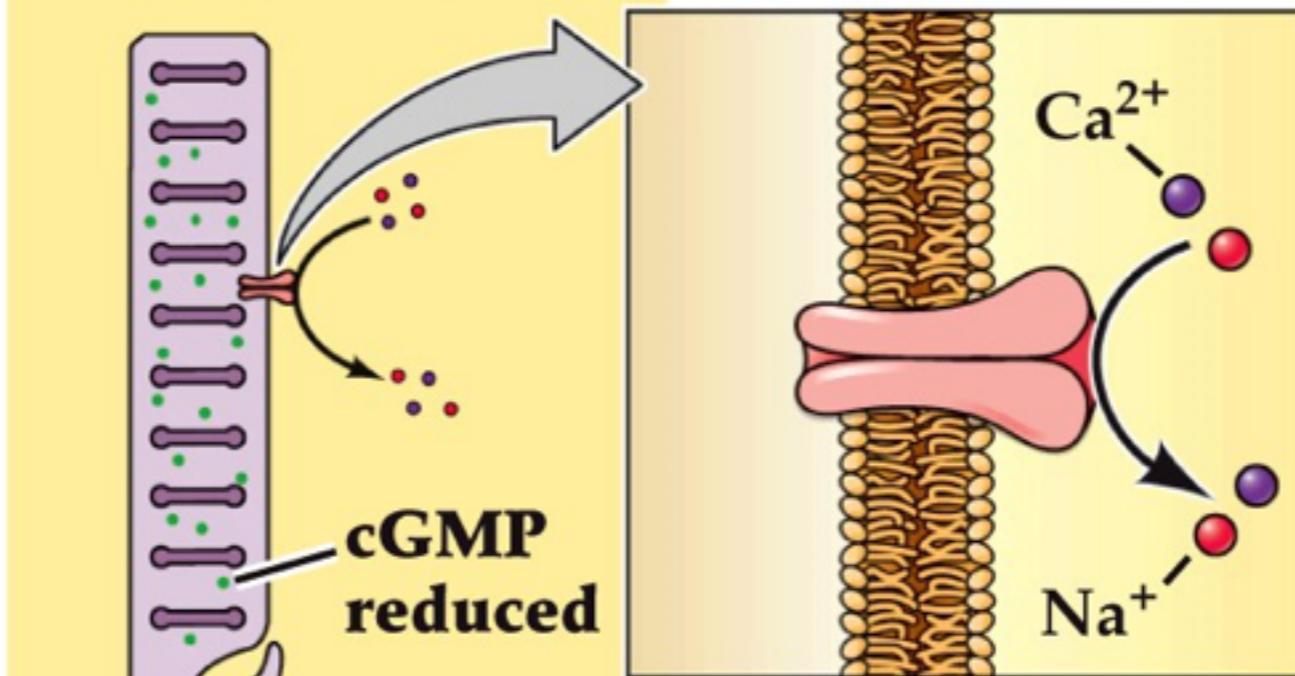
Reduced  $\text{Na}^+$  influx,  
 $\text{K}^+$  efflux:  
Hyperpolarization

## Rod outer segment

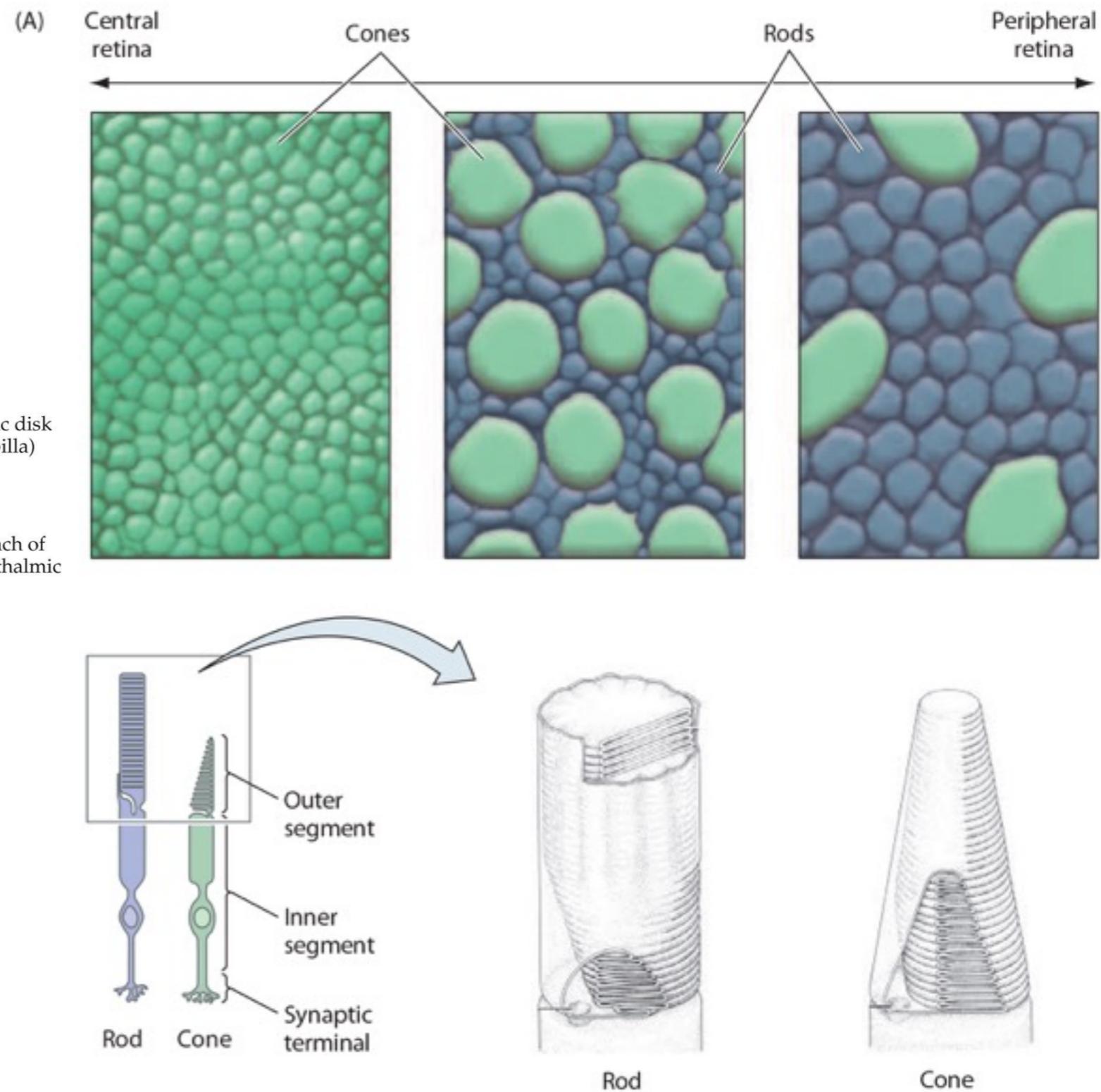
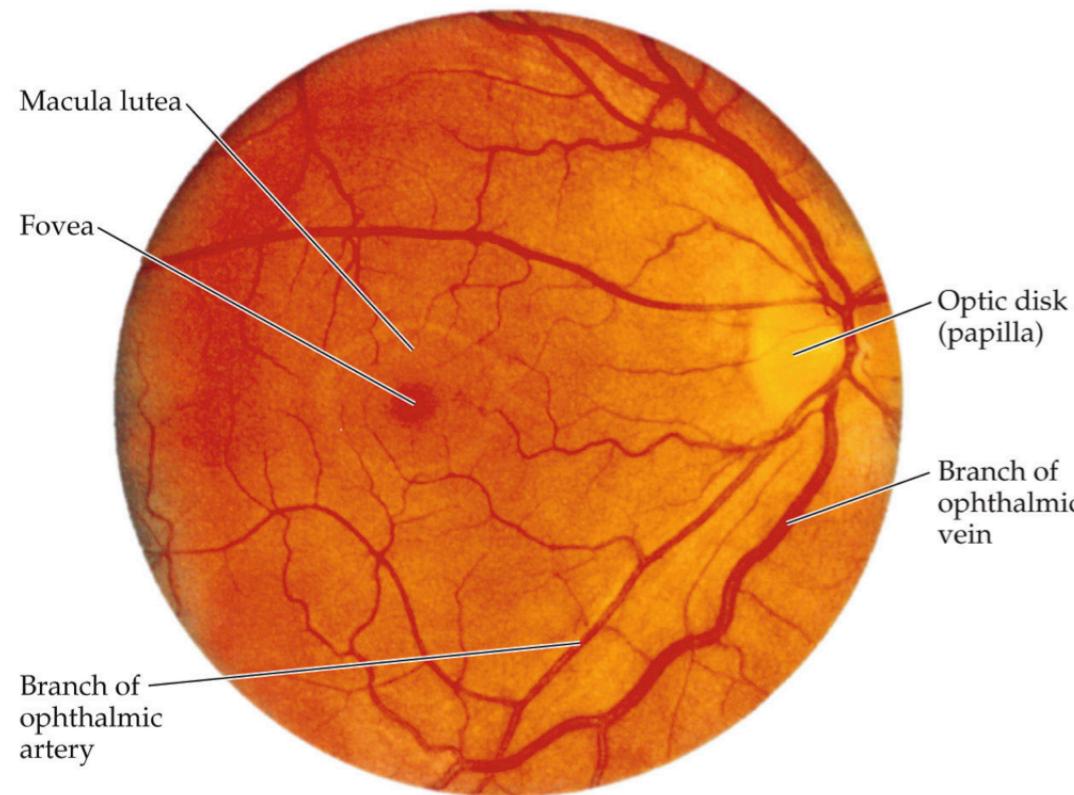


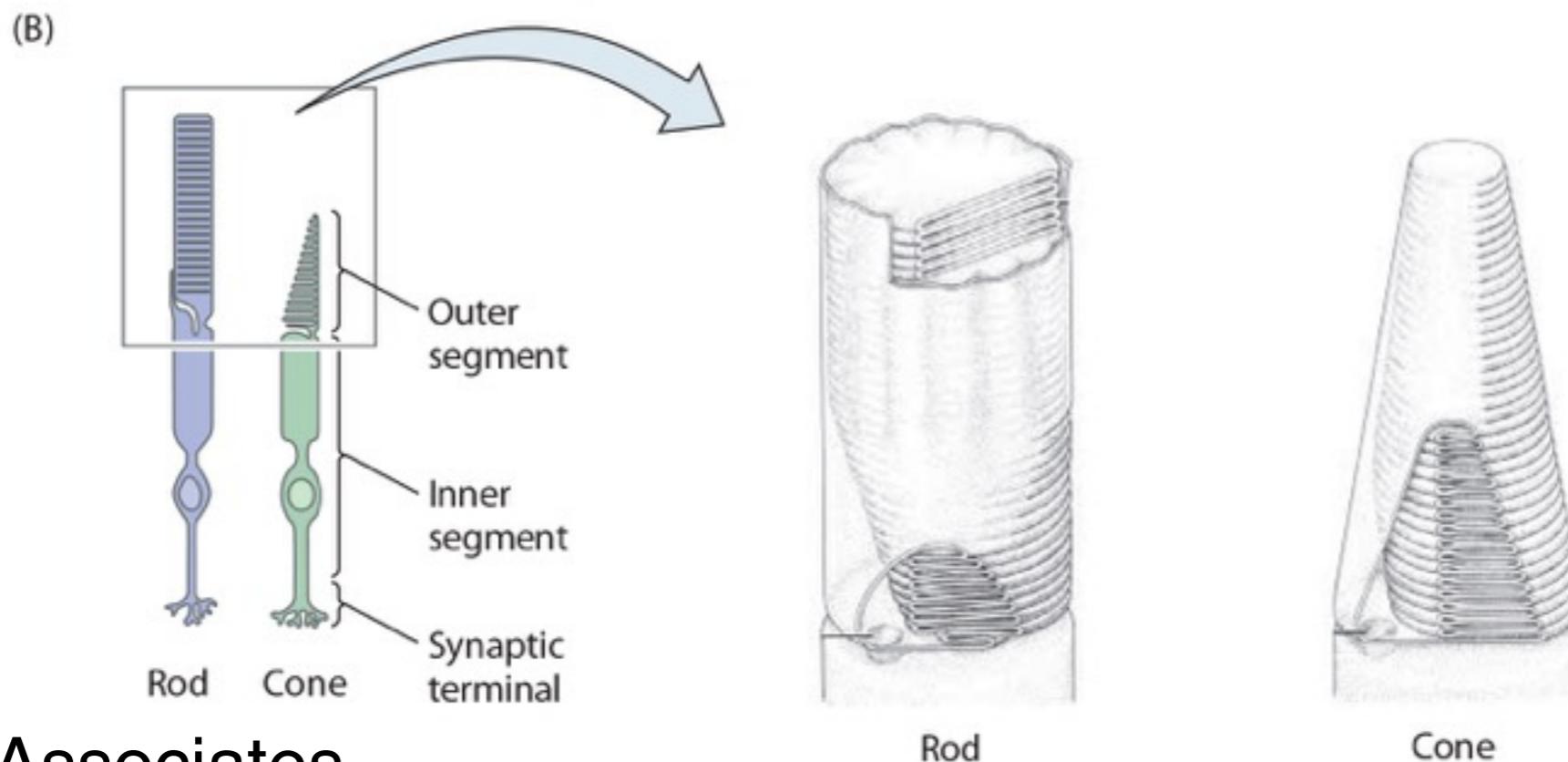
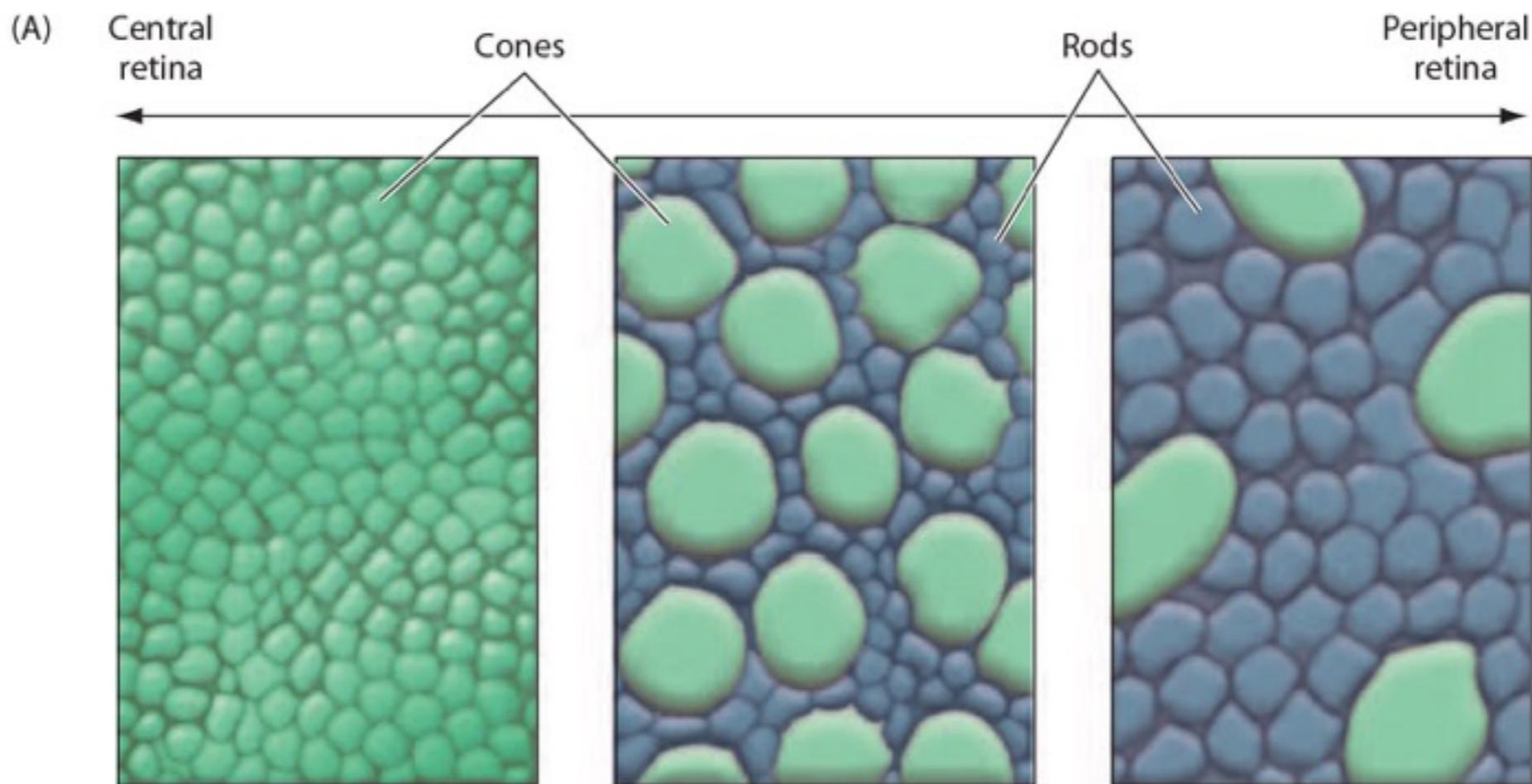
$\text{Na}^+$  influx,  
 $\text{K}^+$  efflux:  
Depolarization

### Rod outer segment

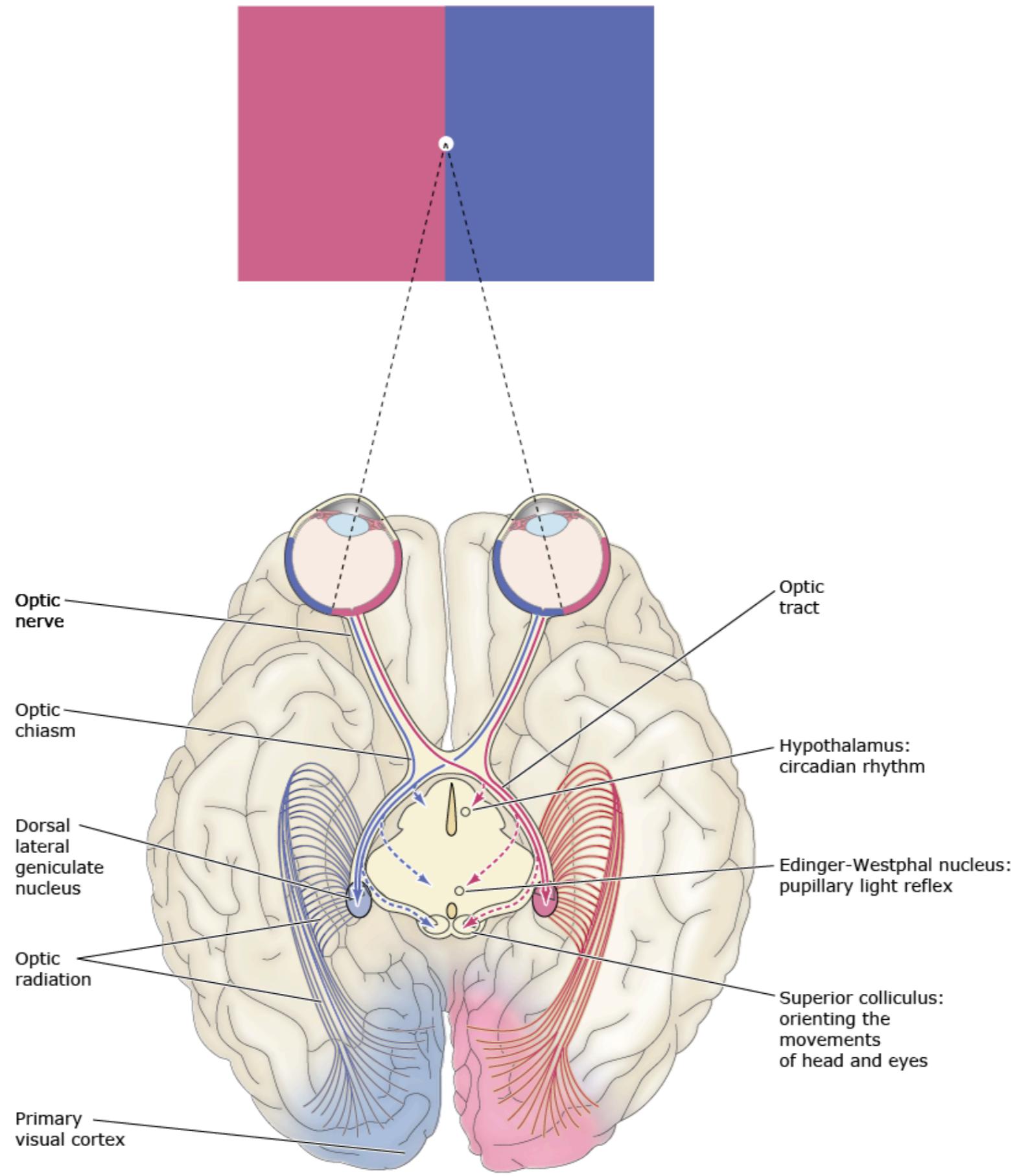


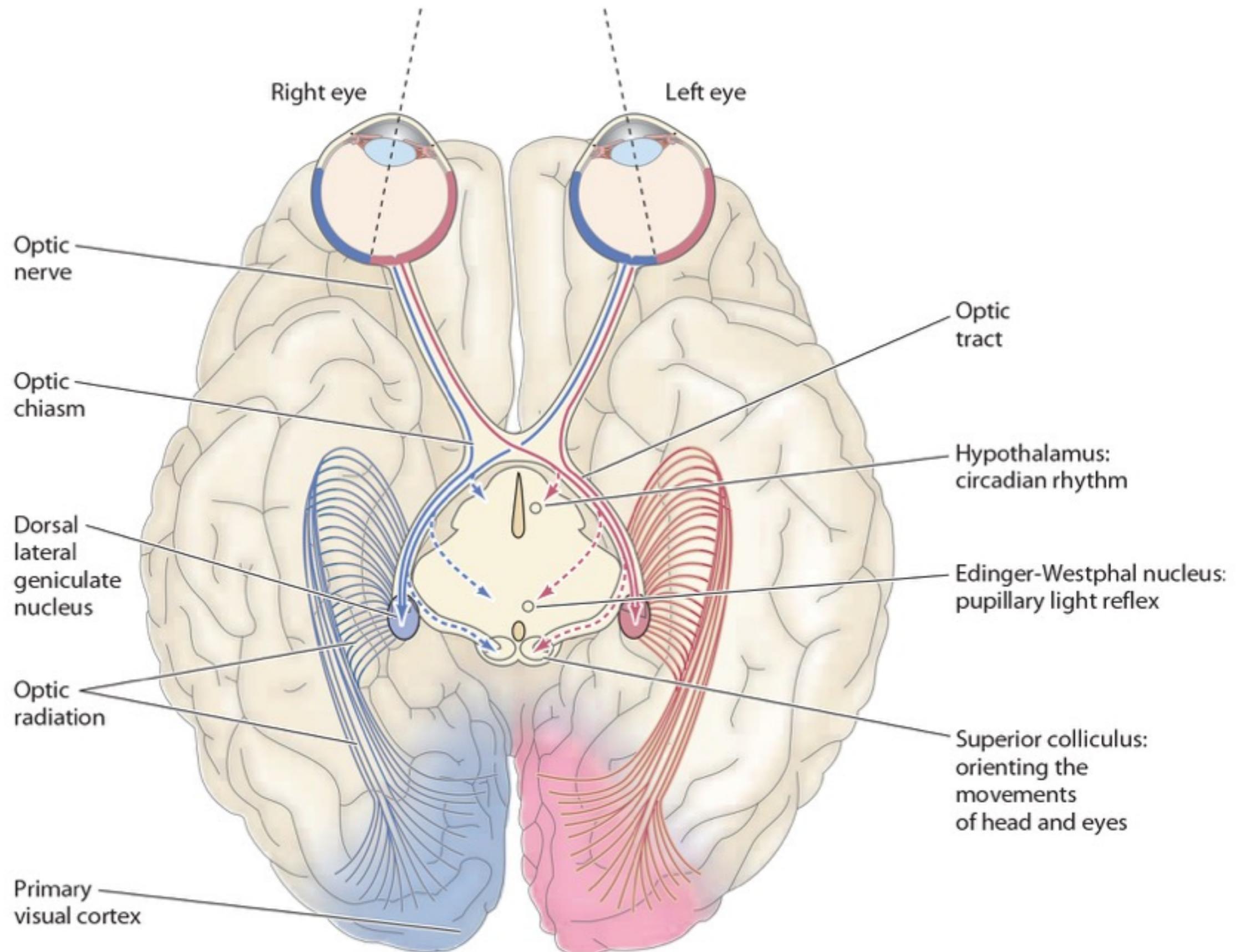
Reduced  $Na^+$  influx,  
 $K^+$  efflux:  
Hyperpolarization



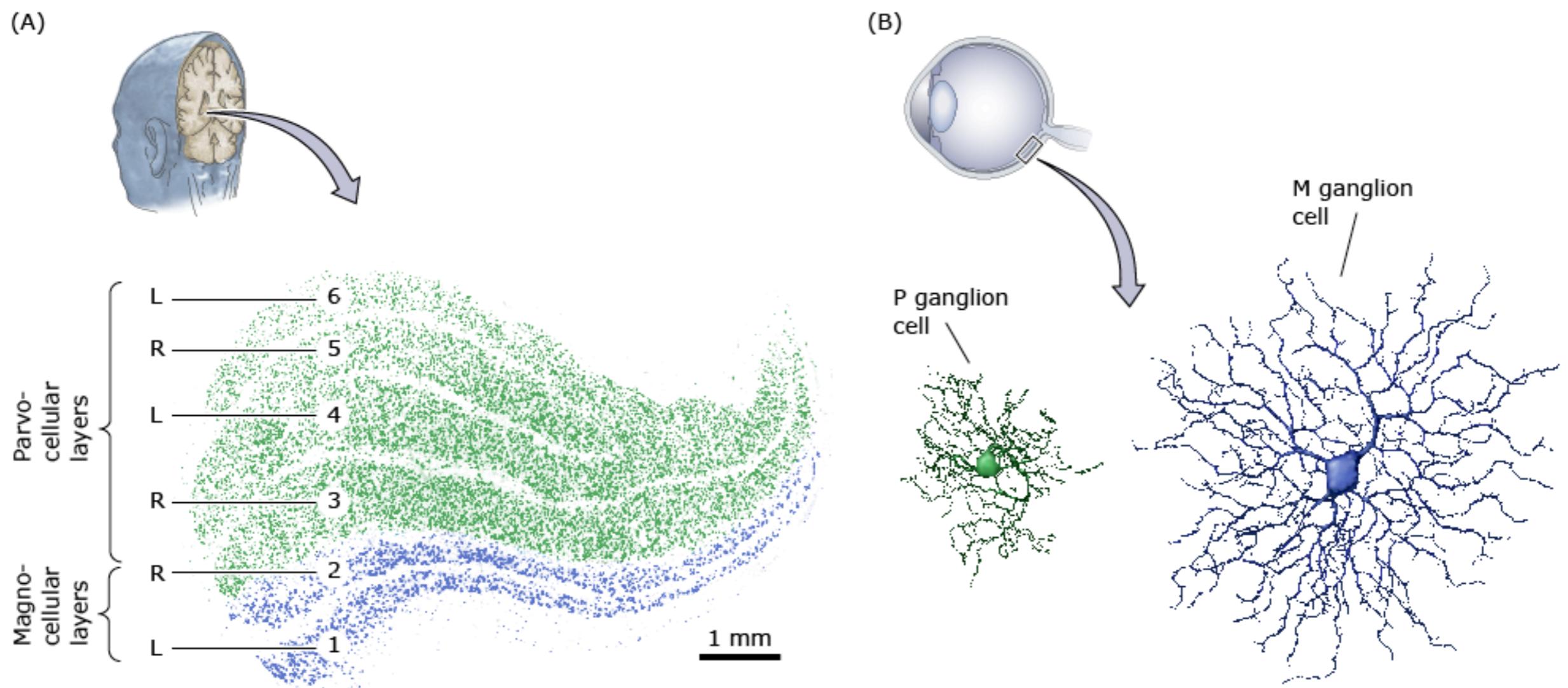


# Lesson 3. The Primary Visual Pathway

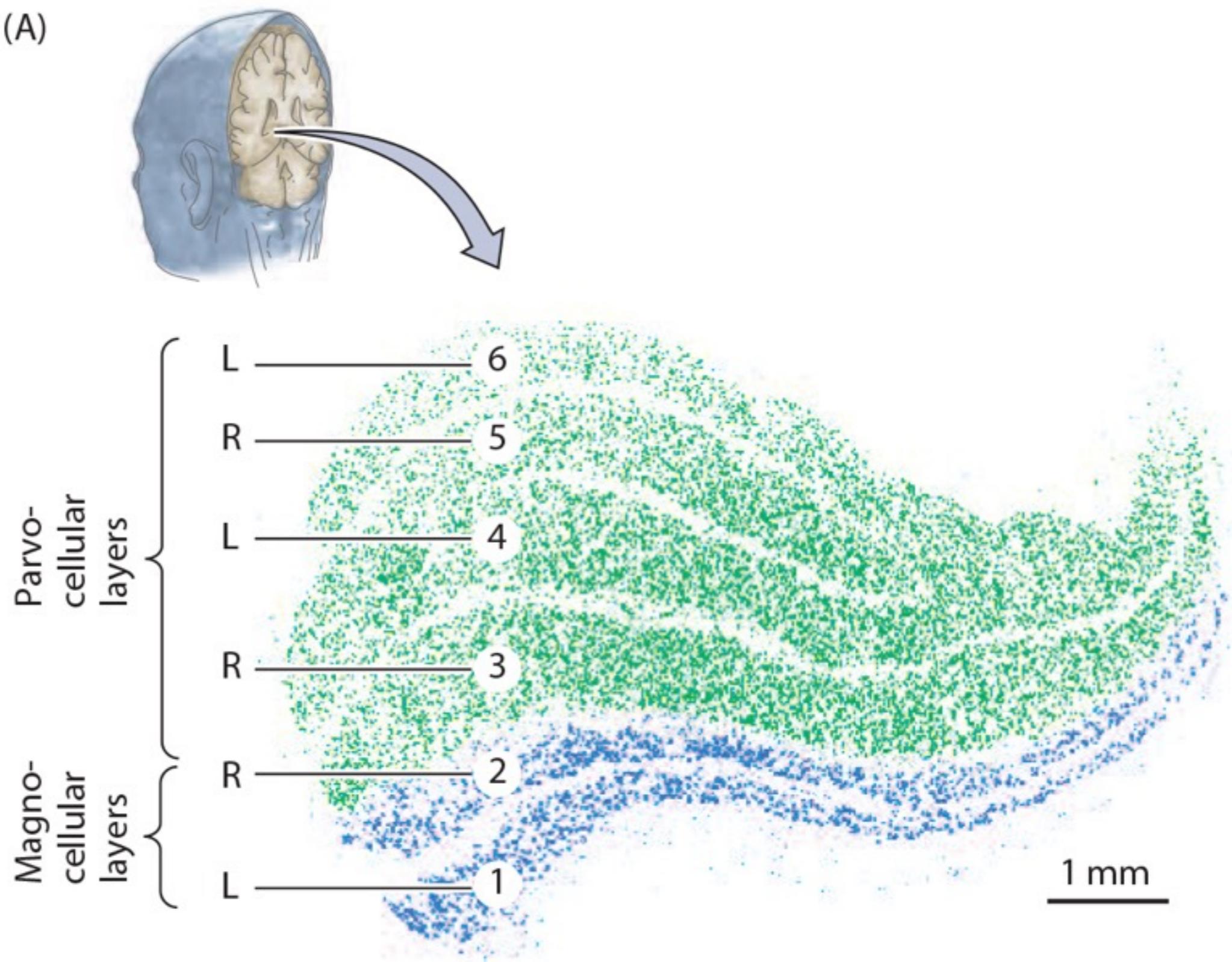




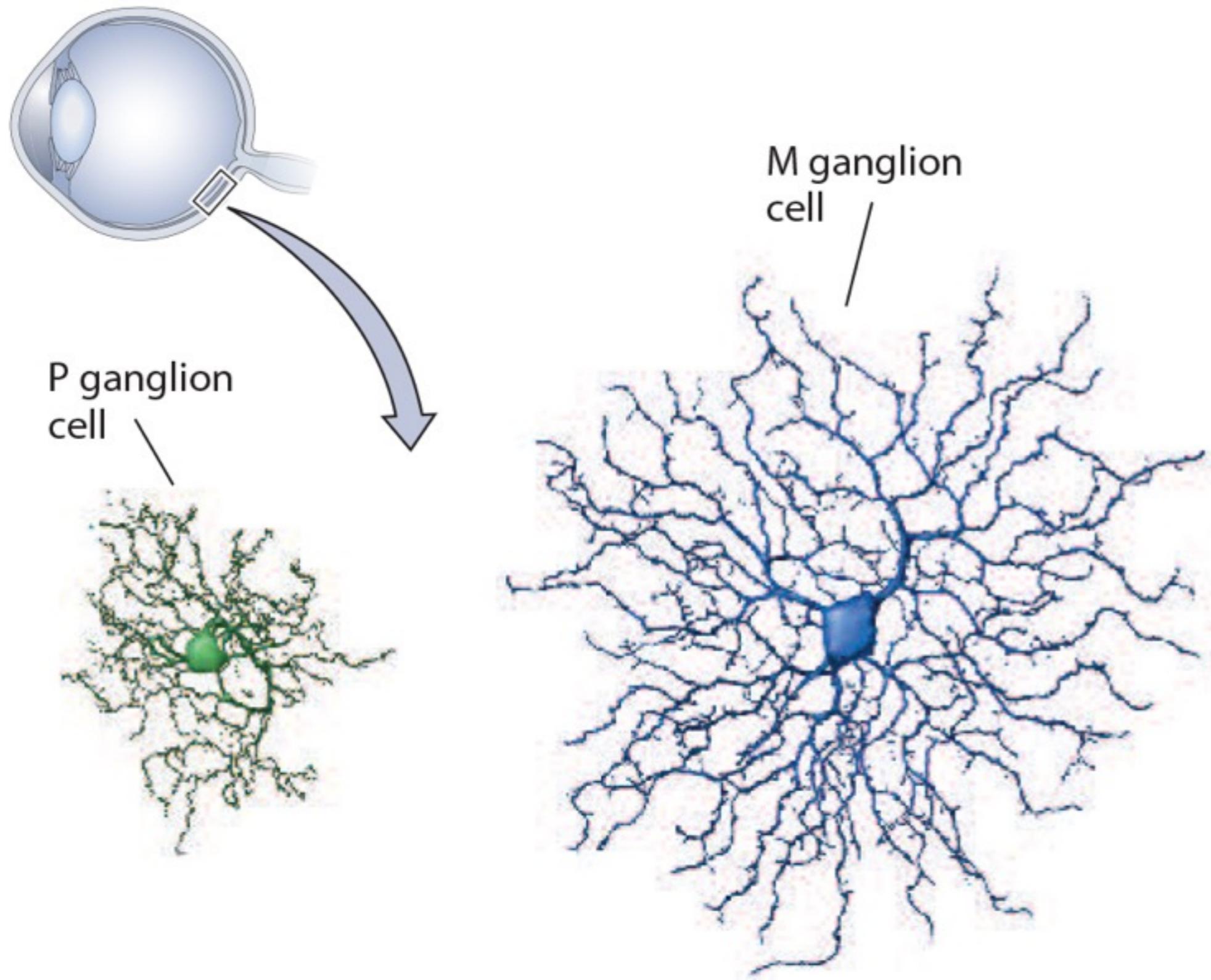
# The Lateral Geniculate Nucleus in the Thalamus



(A)



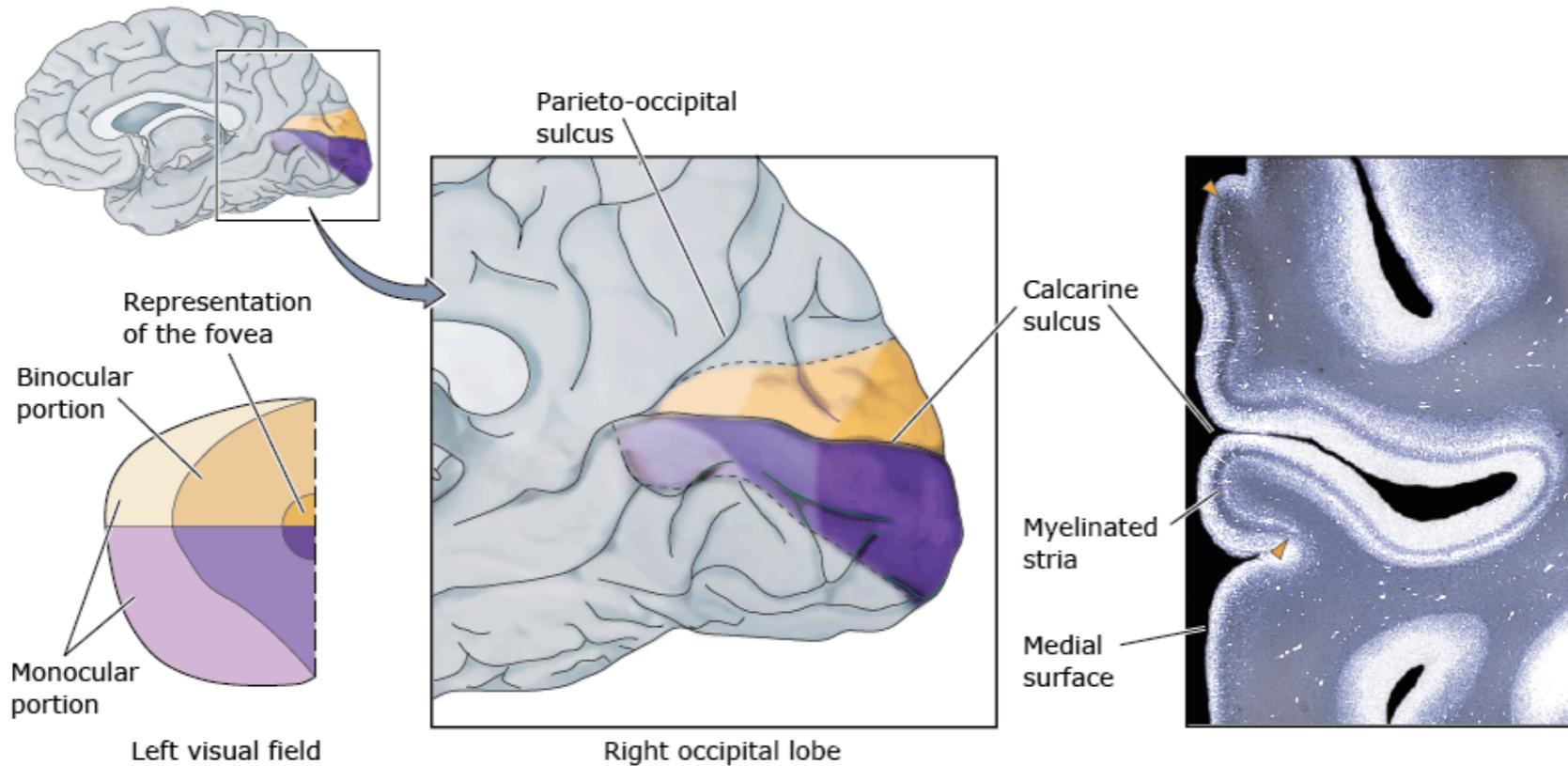
(B)



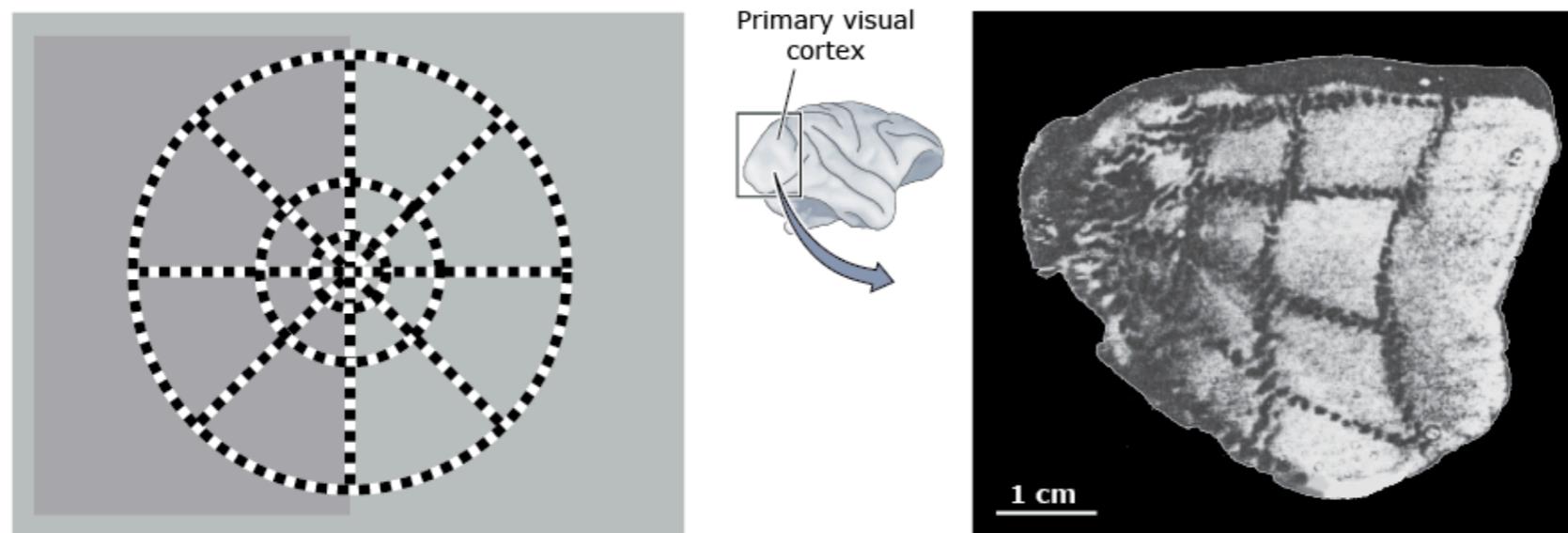
# Lesson 4. The Visual Cortex

# The Primary Visual Area (V1) in the Occipital Lobe

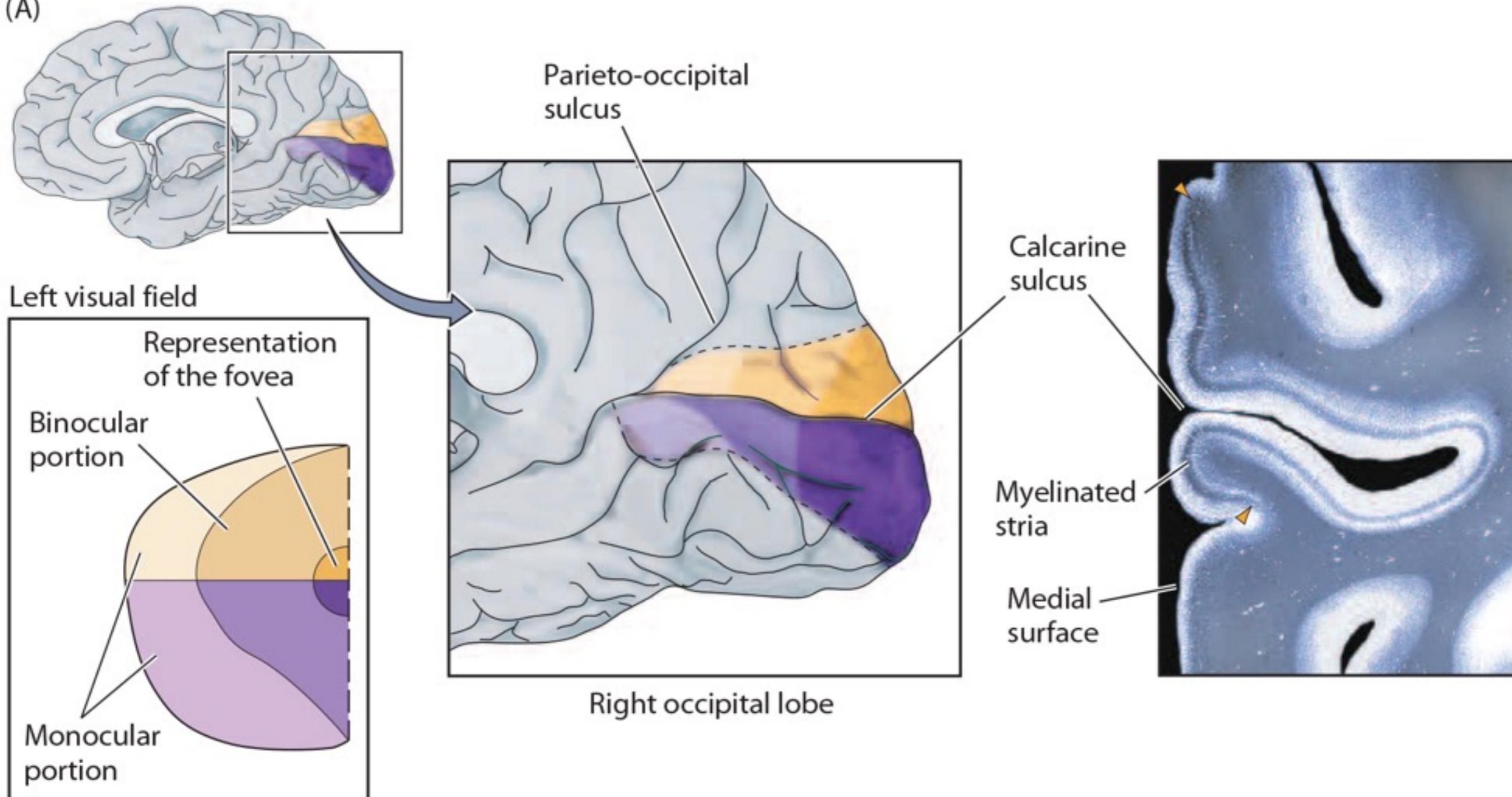
(A)



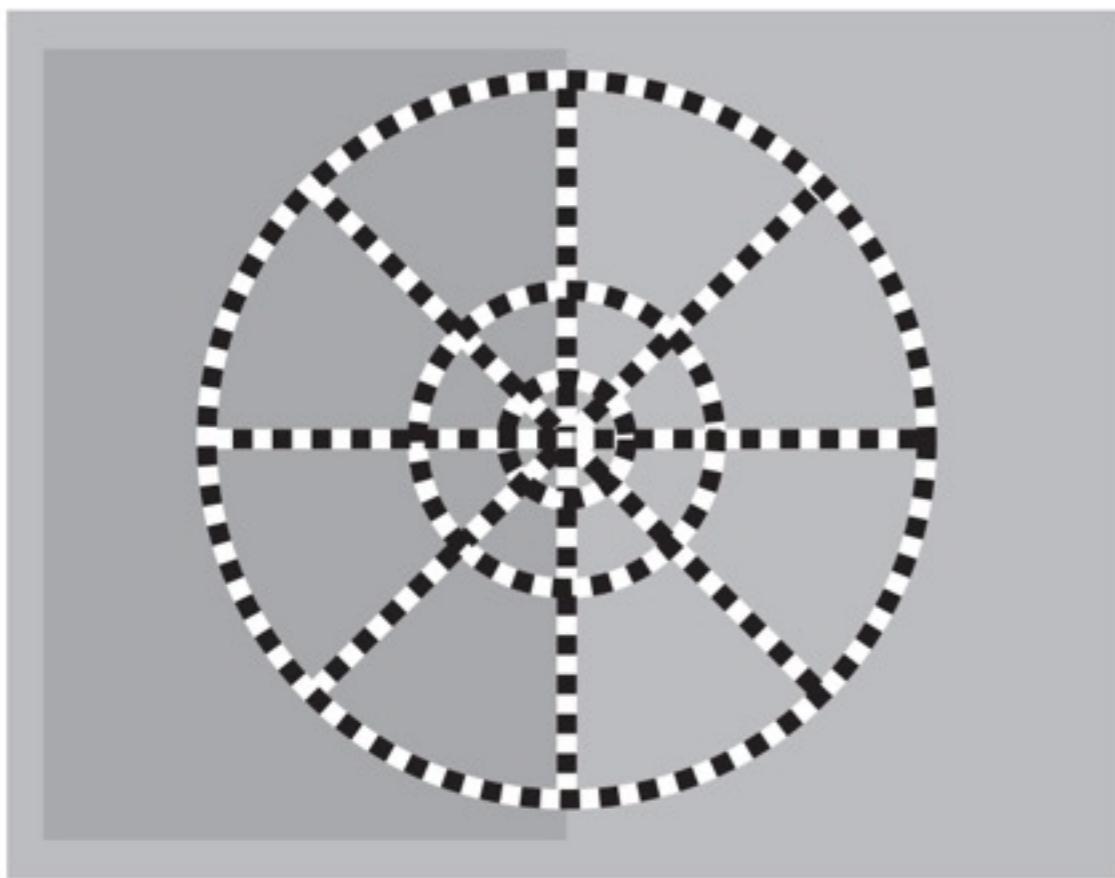
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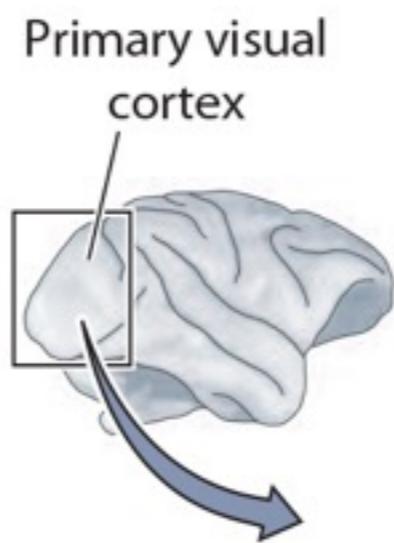
(A)



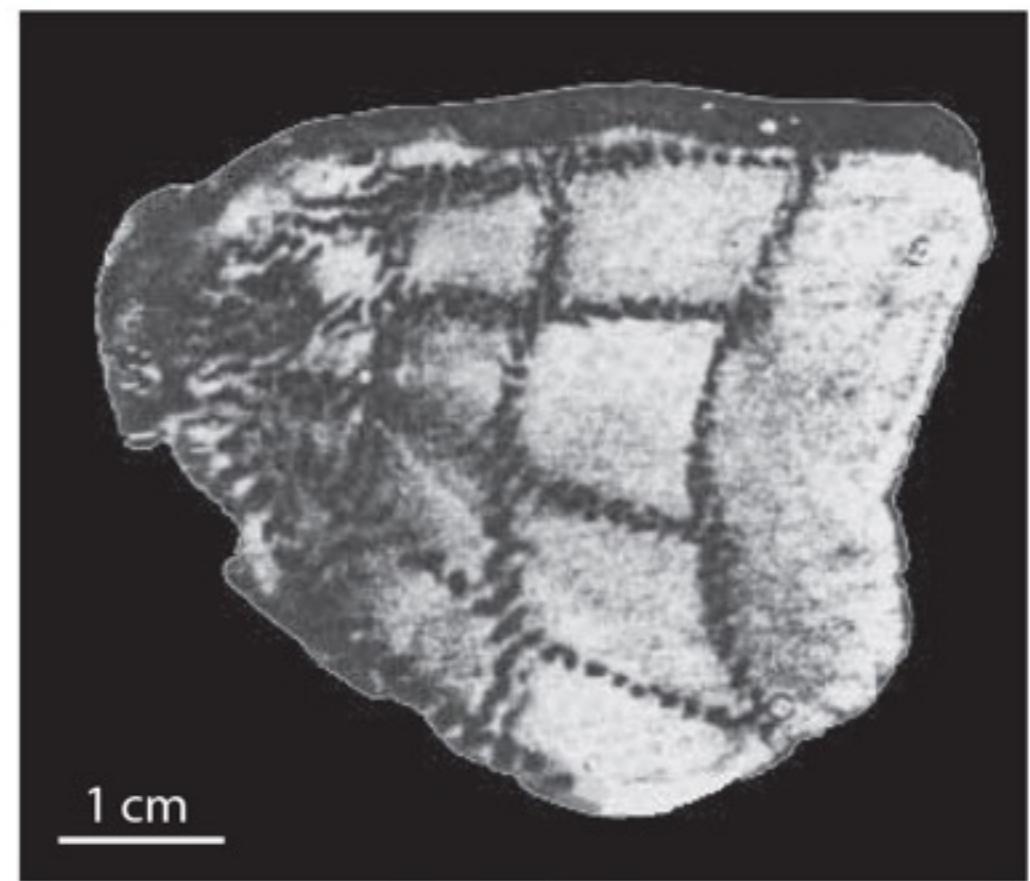
(B)



Stimulus

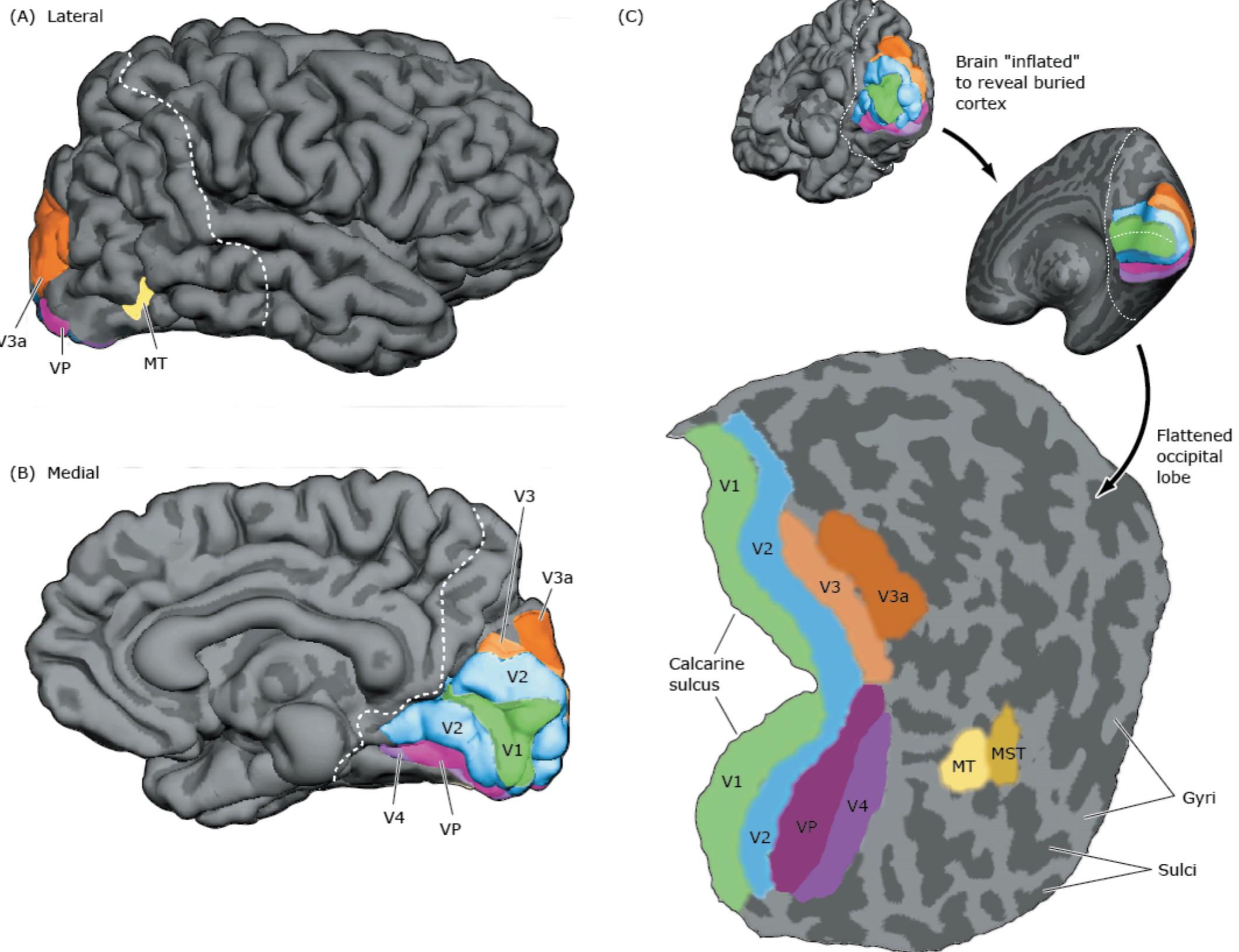


Primary visual cortex

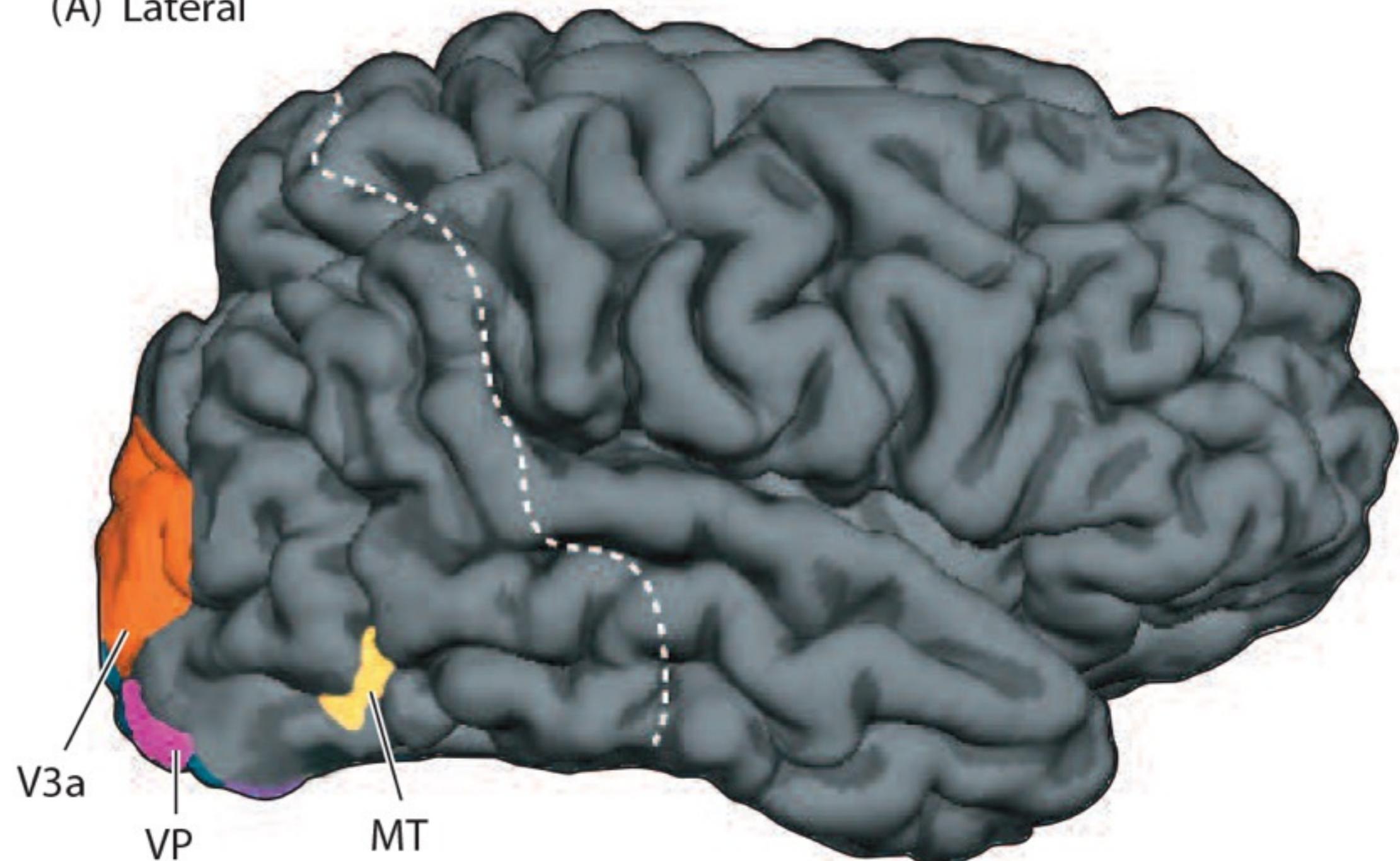


Cortical activation

# Higher Order Visual Areas



(A) Lateral

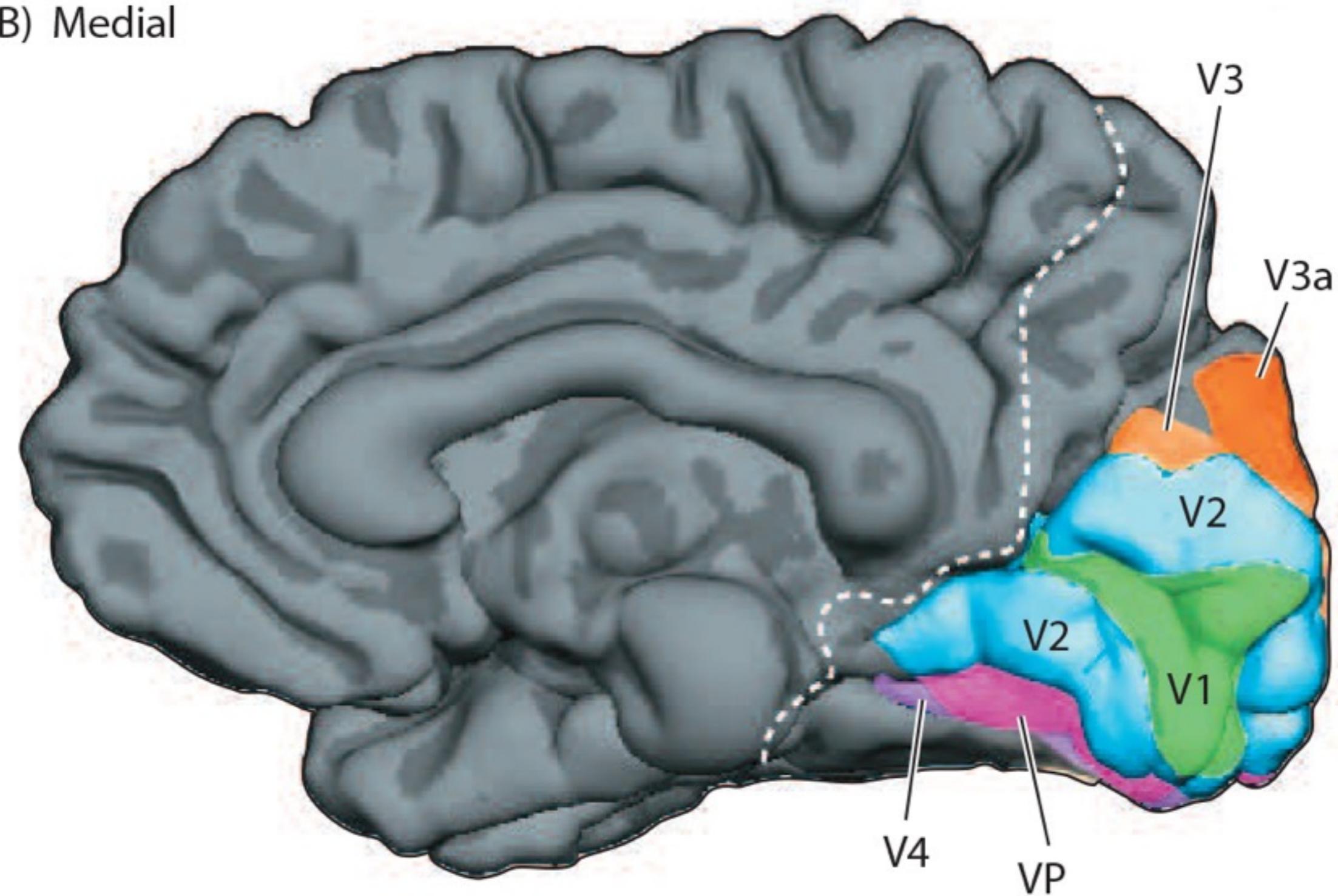


V3a

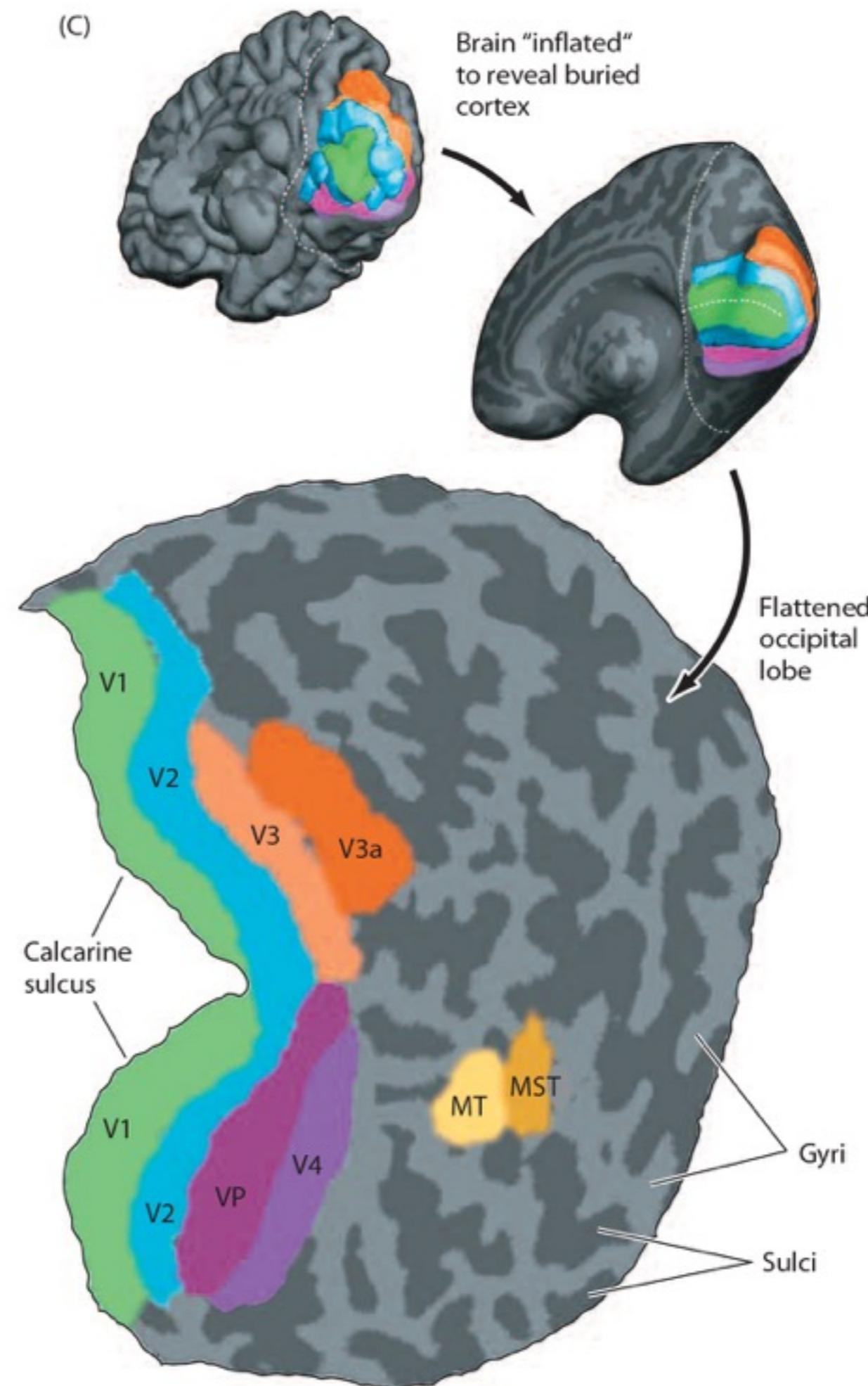
VP

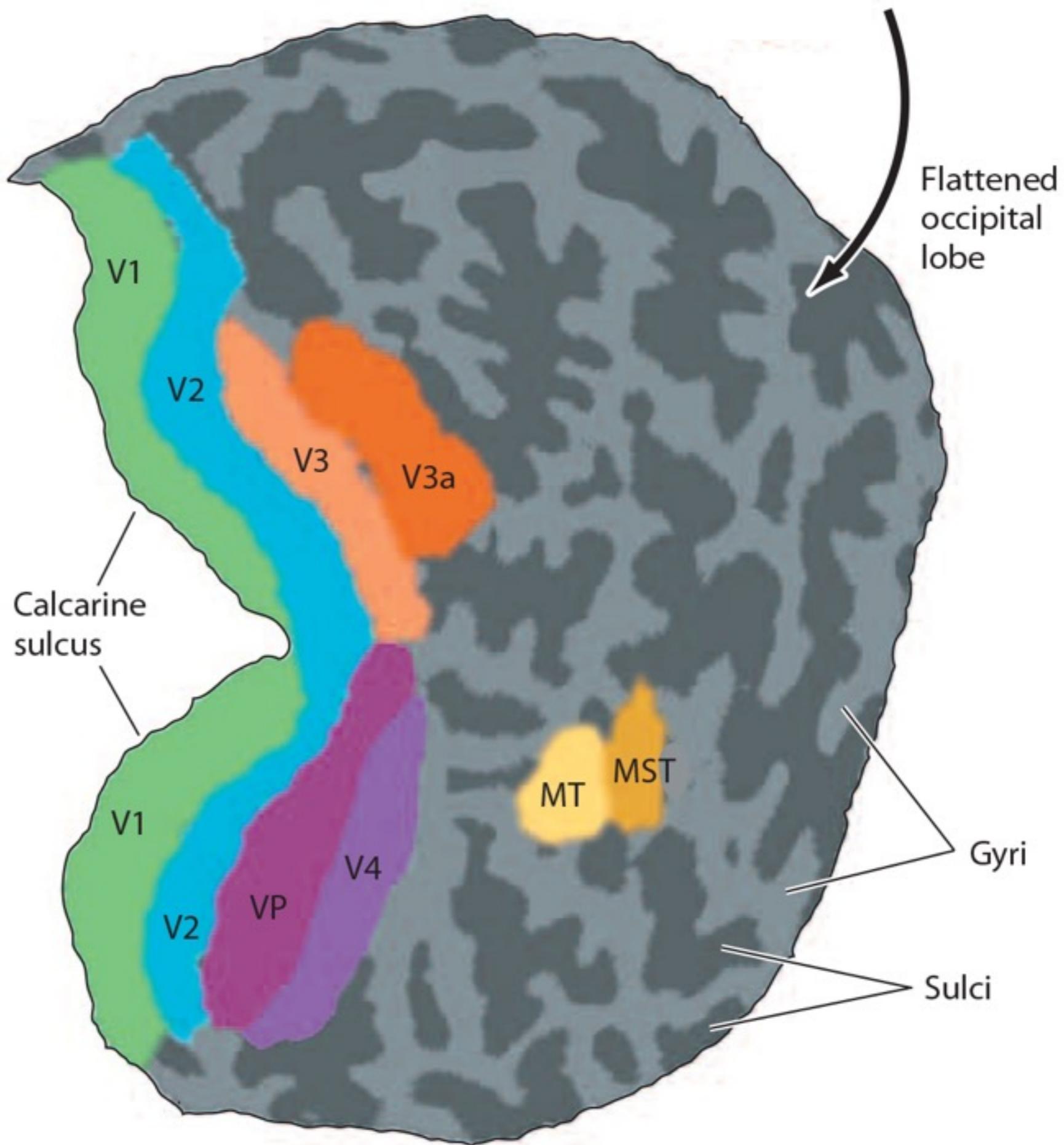
MT

(B) Medial



(C)

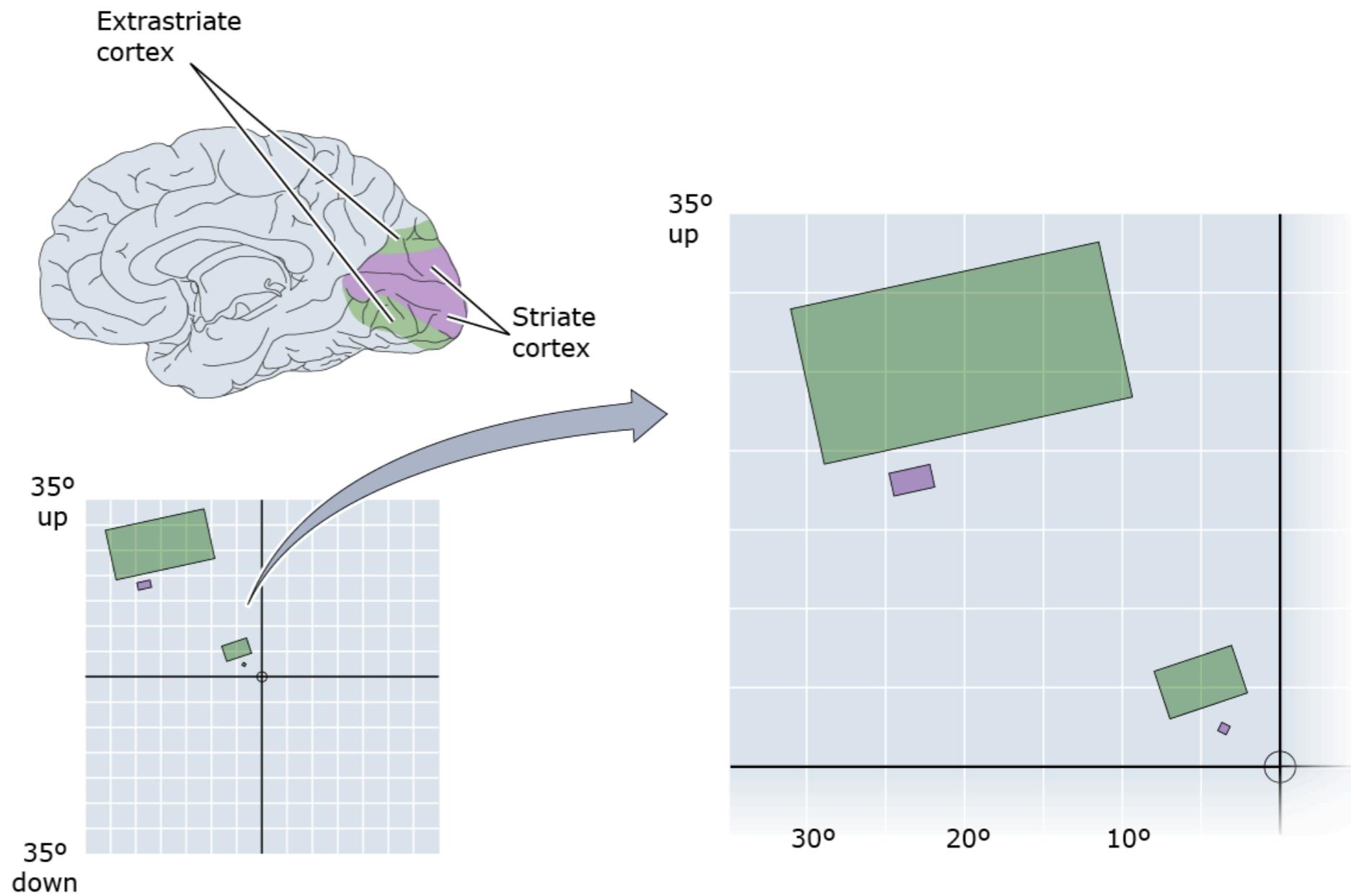


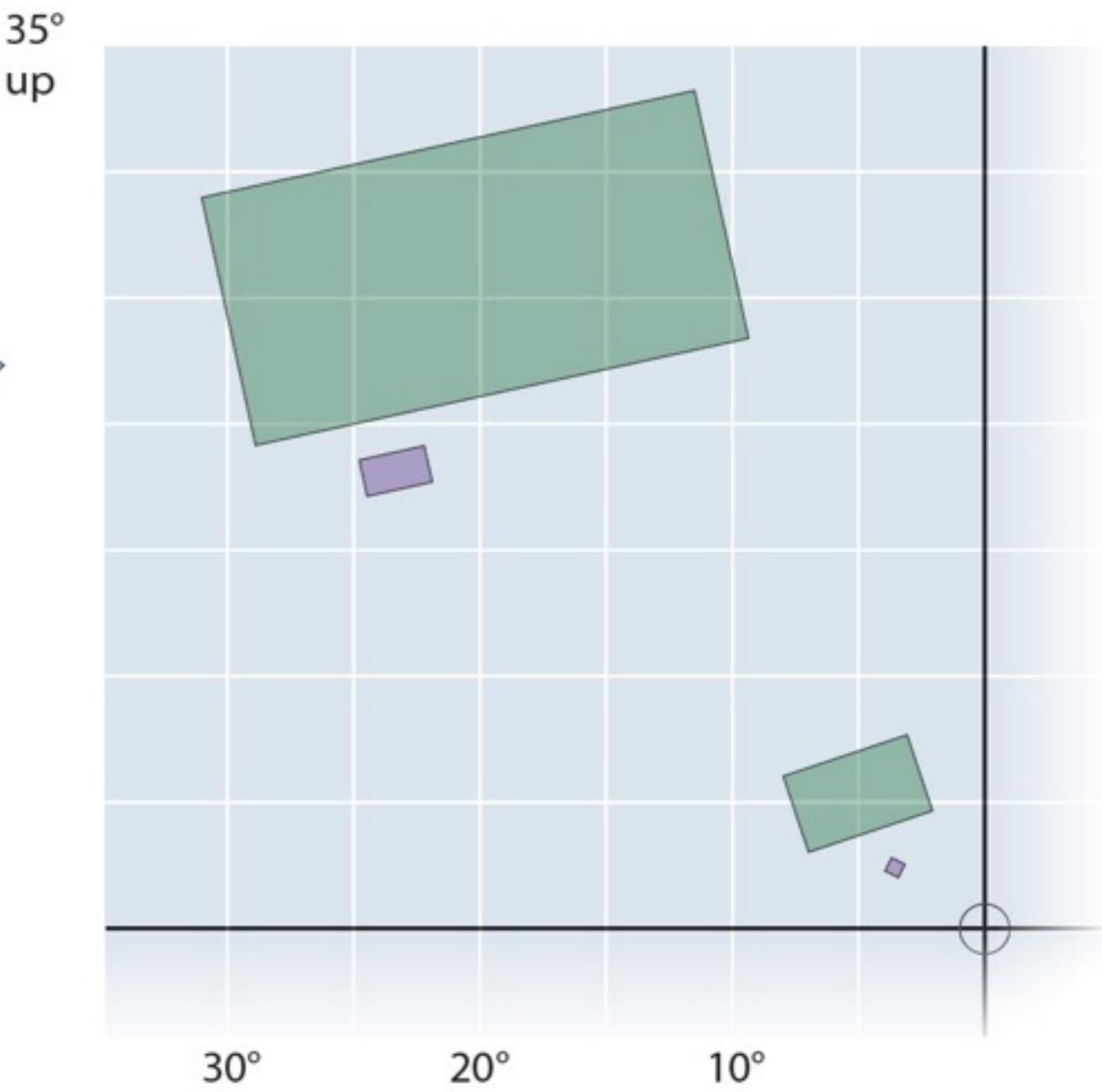
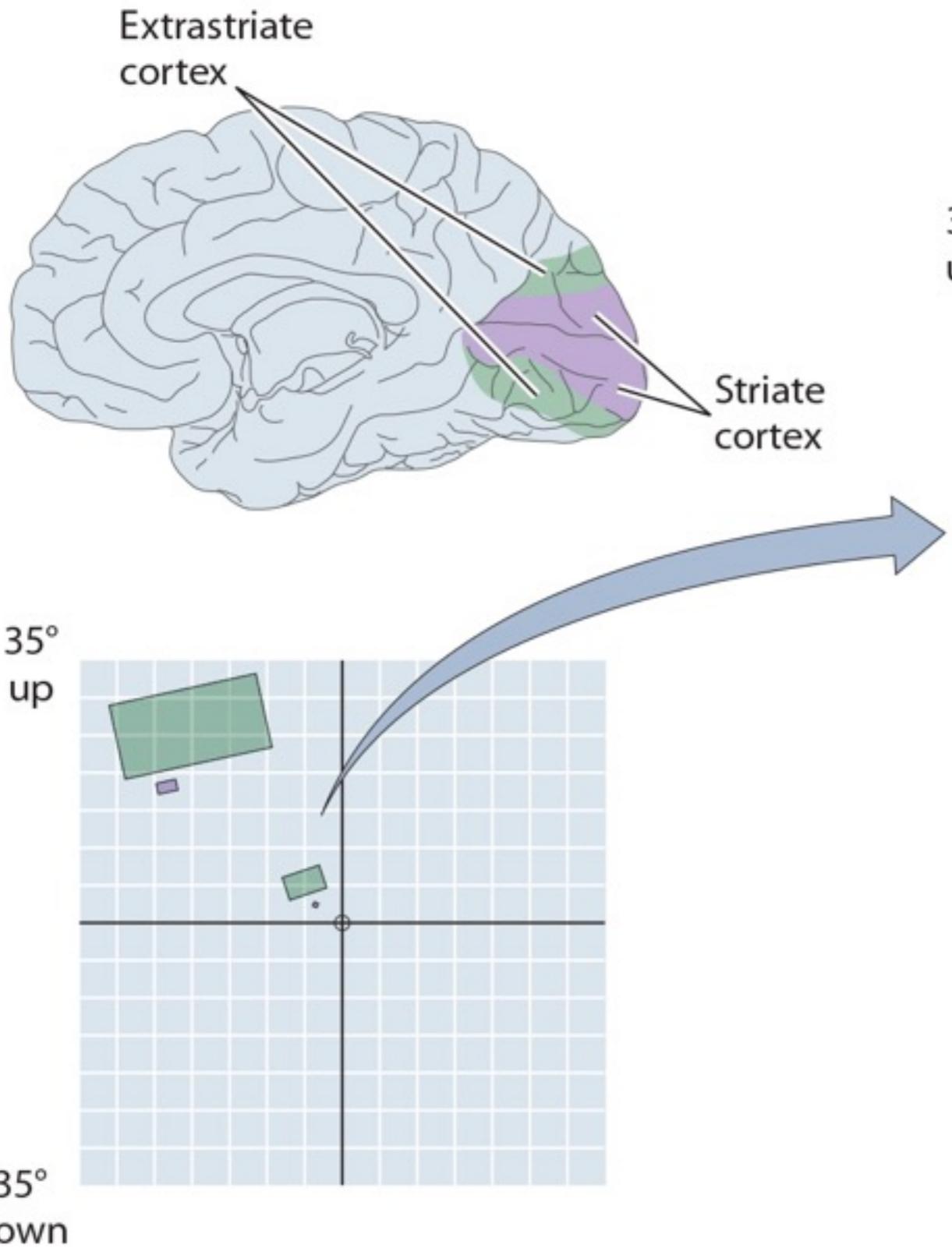


# Lesson 5. The Concept of Receptive Fields



Stephen Kuffler  
David Hubel  
Torsten Wiesel





# Summary of the Main Points

- For the purposes of this course the organization of the visual system concerns the primary visual pathway
- Its main elements are the eye and retina, the lateral geniculate nucleus in the thalamus, and the visual cortex in the occipital lobe, V1 in particular
- The pathway begins as a hierarchy that unravels in the extra striate cortex
- A guiding principle is the concept of the receptive field, which is not entirely straightforward

# Credits

Dale Purves et al, *Neuroscience*, 5th edition, 2012

- Eye anatomy, pg. 230
- Inner surface of retina, pg. 233

Dale Purves, R. Beau Lotto. *Why We See What We Do Redux*,  
Sinauer Associates Inc. 2011:

- Elements of retina, pg. 204
- Retinal eccentricity, pg. 208
- Luminance levels, pg. 206

Photoreceptor changes, Dale Purves et al, *Neuroscience*, 5th  
edition, 2012, pg. 240

# Credits

Dale Purves, R. Beau Lotto. *Why We See What We Do Redux*,  
Sinauer Associates Inc. 2011:

- Human retina, pg. 204
- Rods and cones, pg. 205
- Primary visual pathway, pg. 210
- Lateral geniculate nucleus in the thalamus, pg. 212
- Primary visual cortex, pg. 214
- Higher order visual areas, pg. 216-217

Stephen Kuffler, David Hubel, Torsten Wiesel, McMahan, U. J.  
*Steve: Remembrances of Stephen W. Kuffler*, Sunderland, MA:  
Sinauer Associates, 1990

- Visual receptive fields, Dale Purves, R. Beau Lotto. *Why We See What We Do Redux*, Sinauer Associates Inc. 2011, pg. 218