

Module # 3—Seeing Space

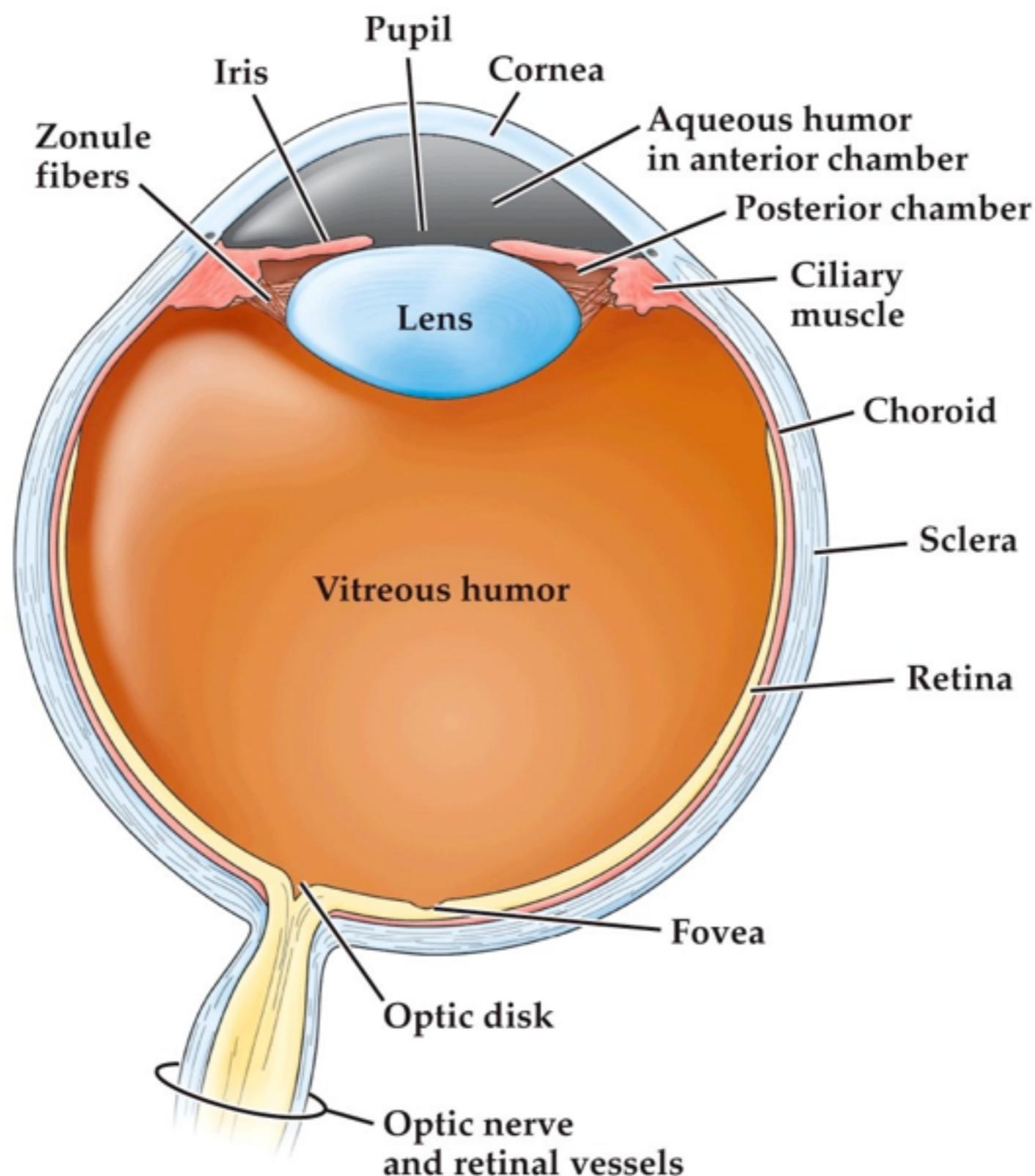
Visual Perception and the Brain

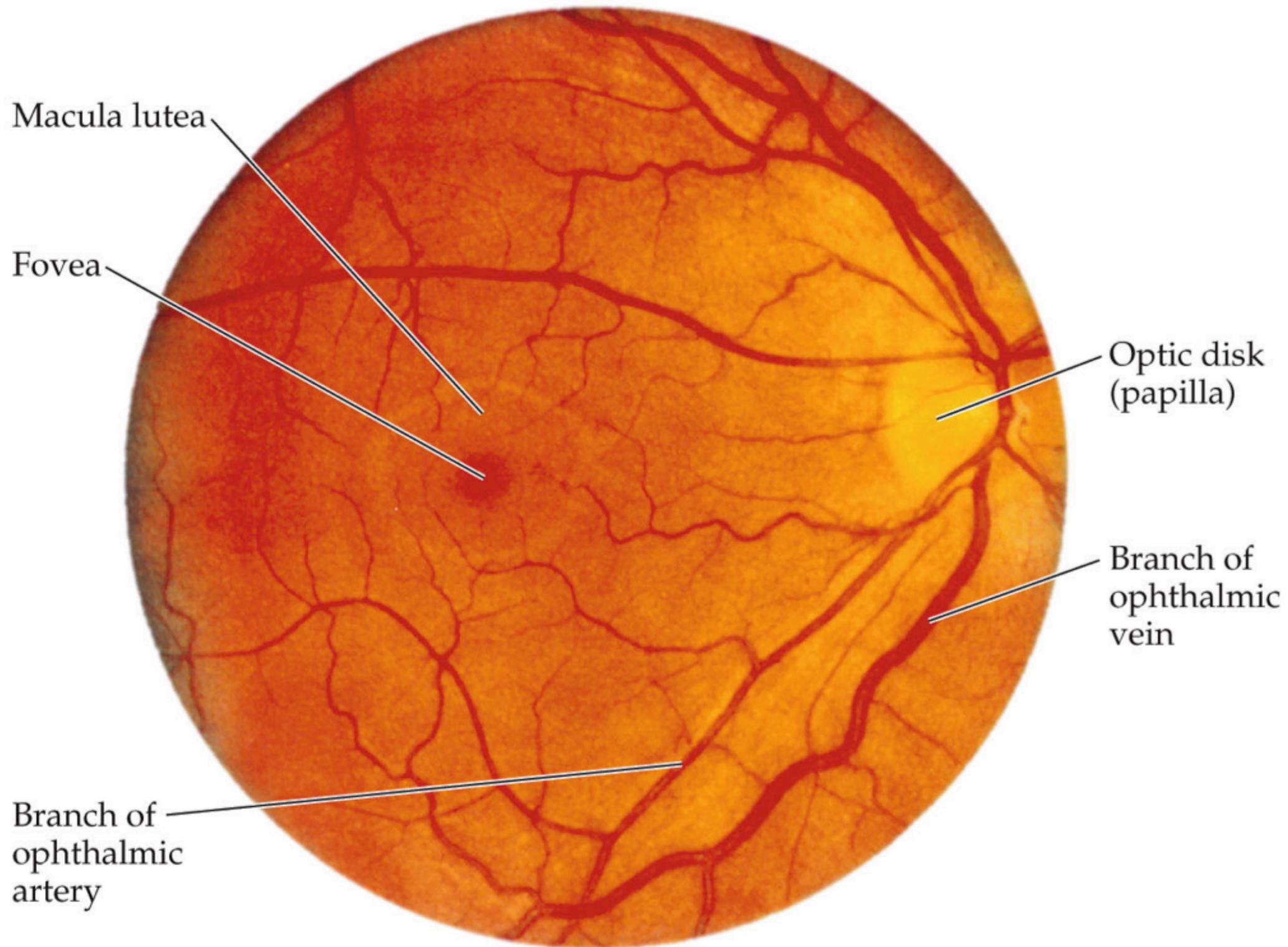


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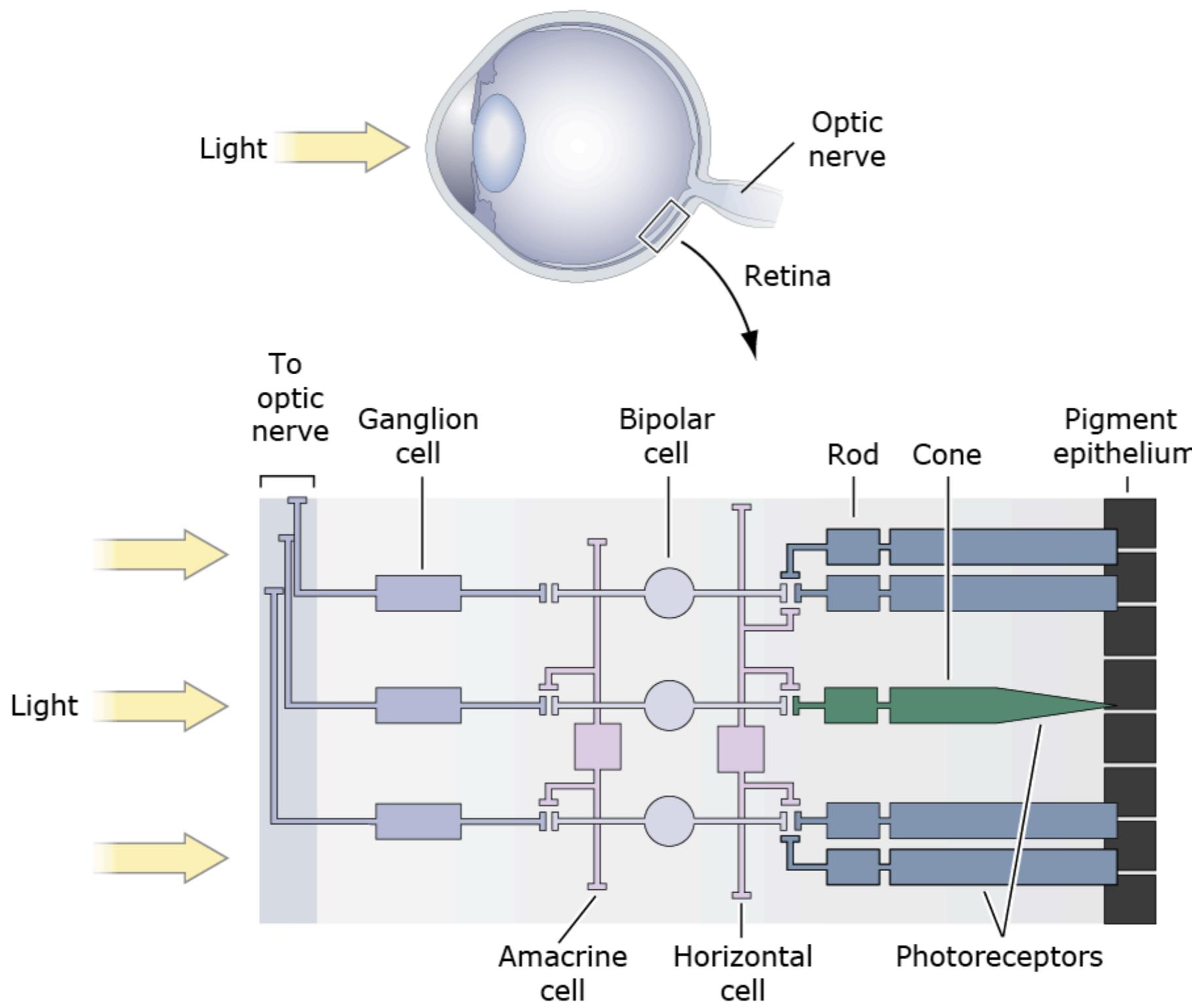
Topic 3. Organization of the Human Visual System

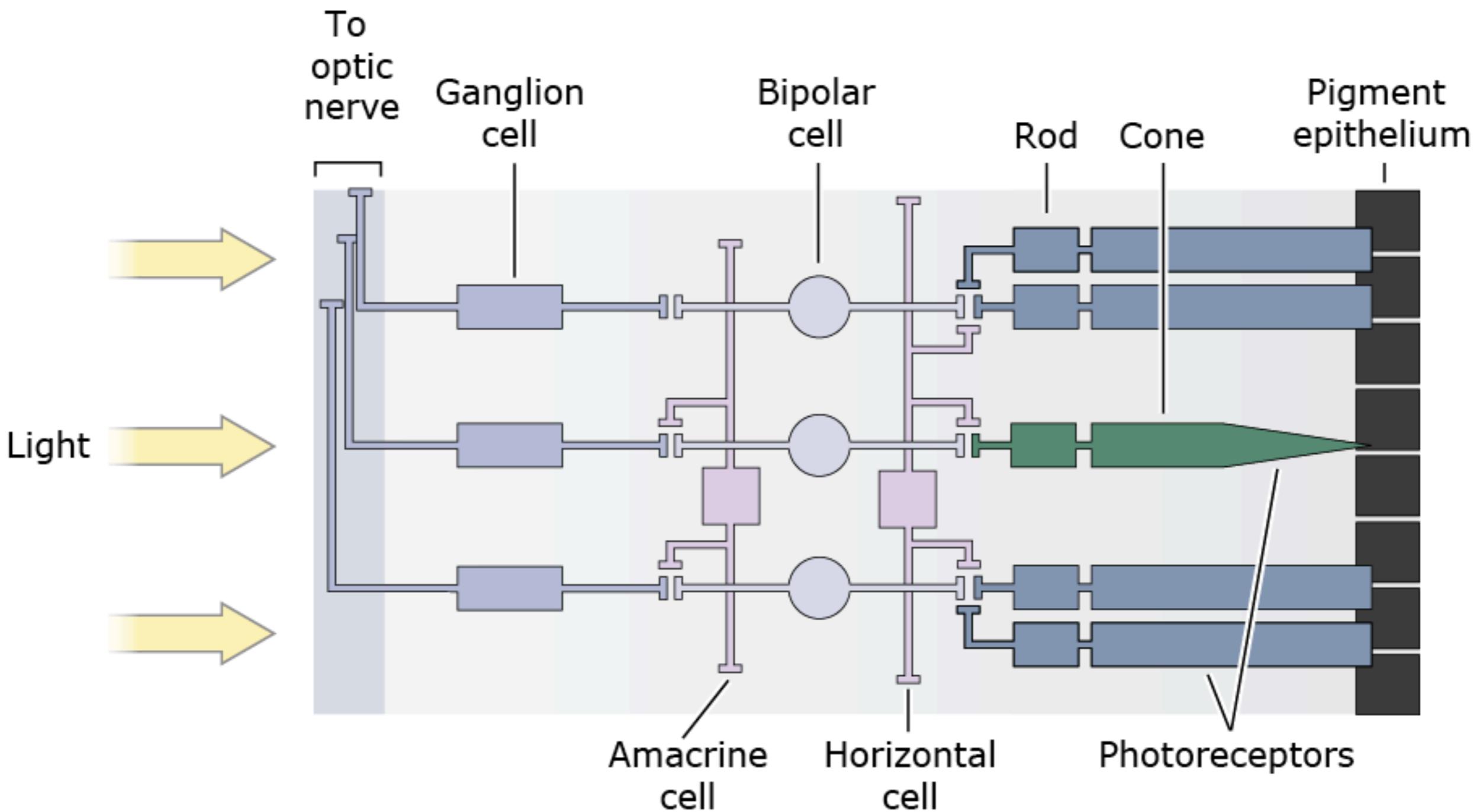
Lesson 1. The Eye

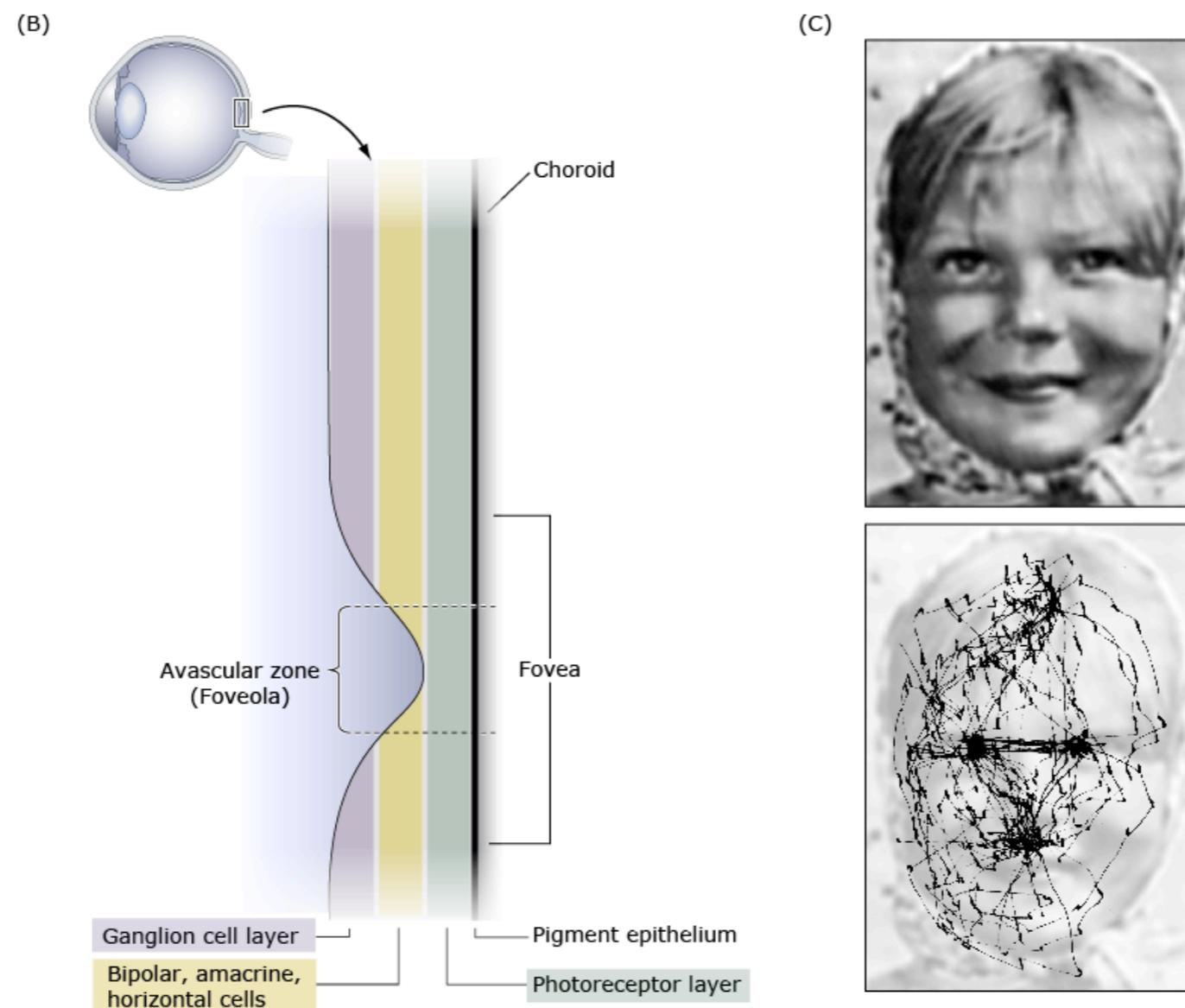
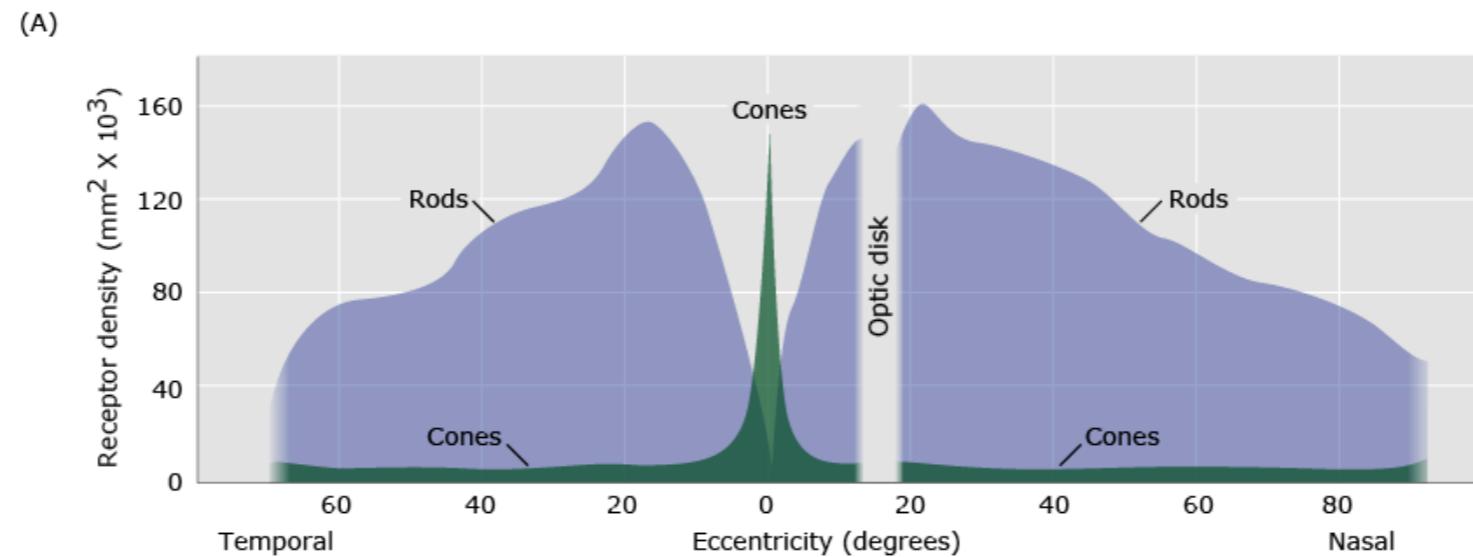




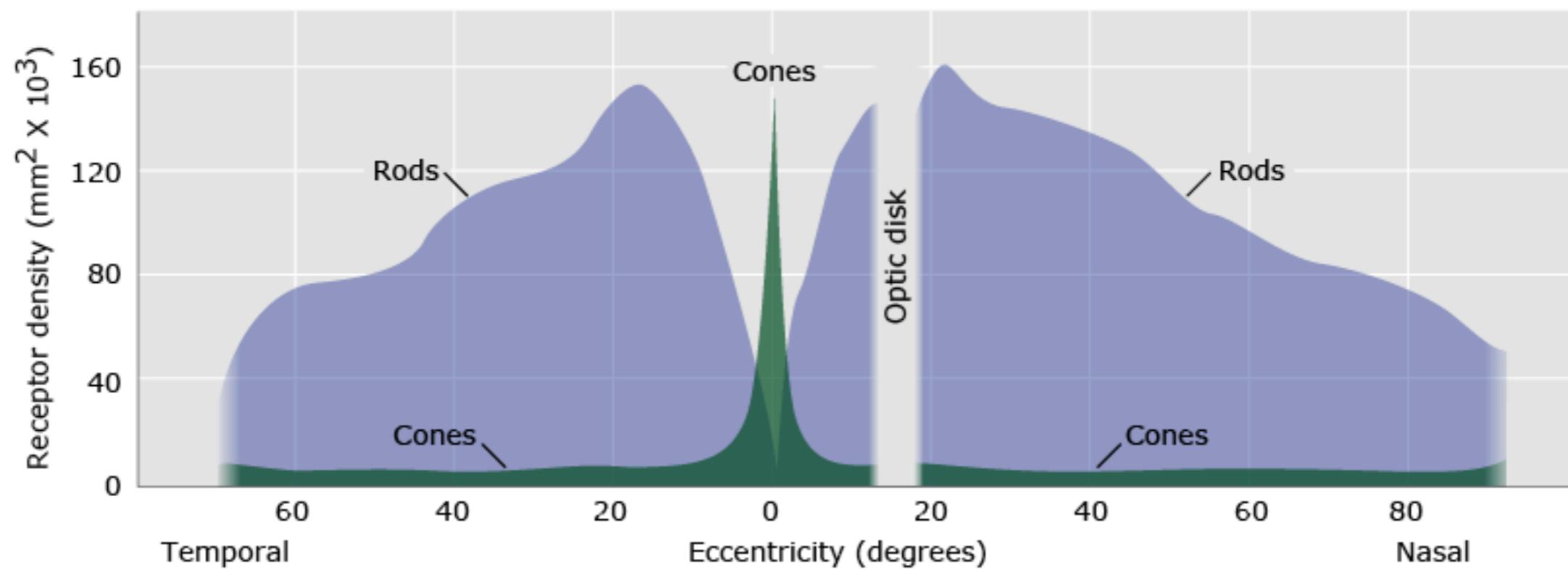
Lesson 2. The Retina



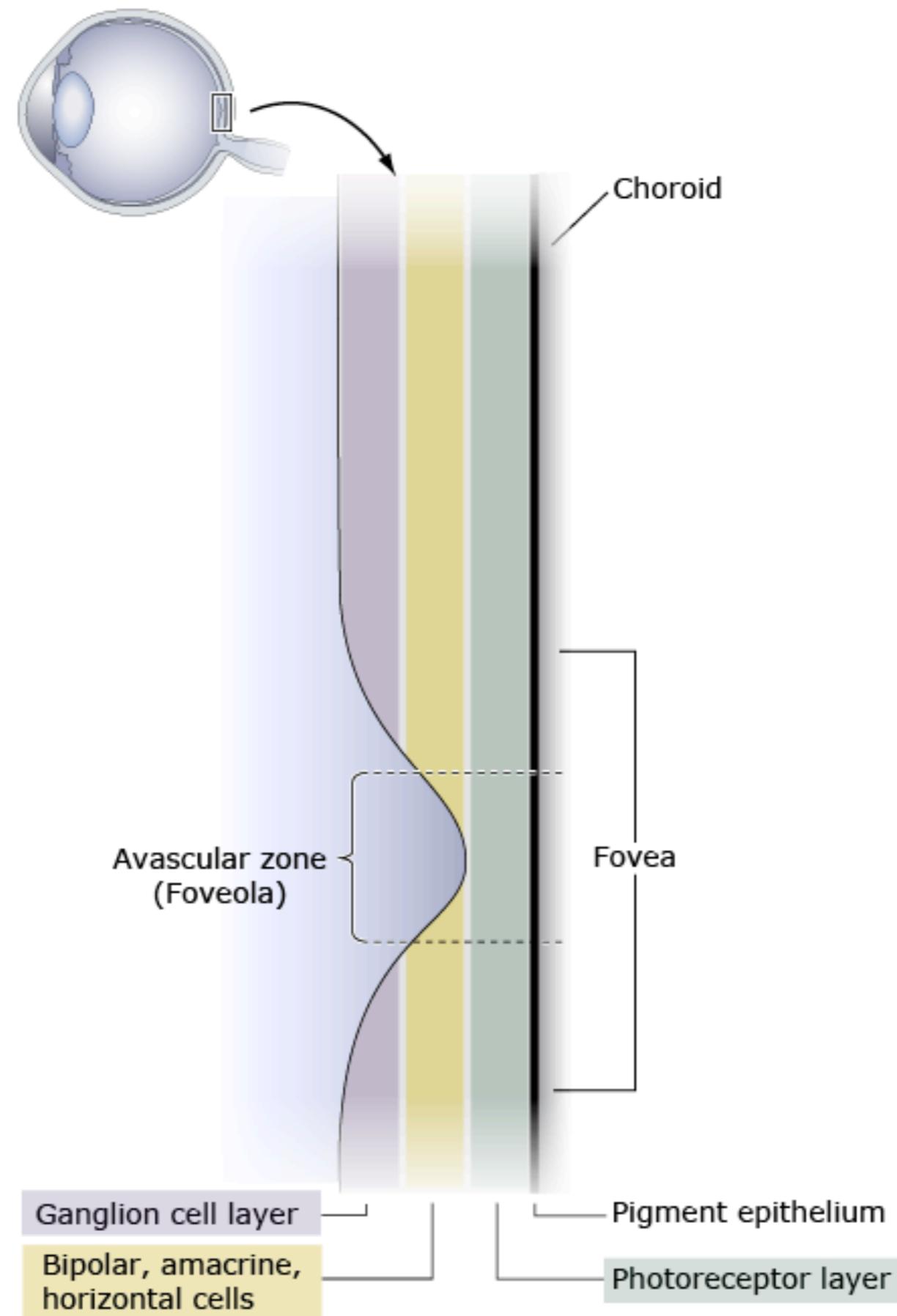




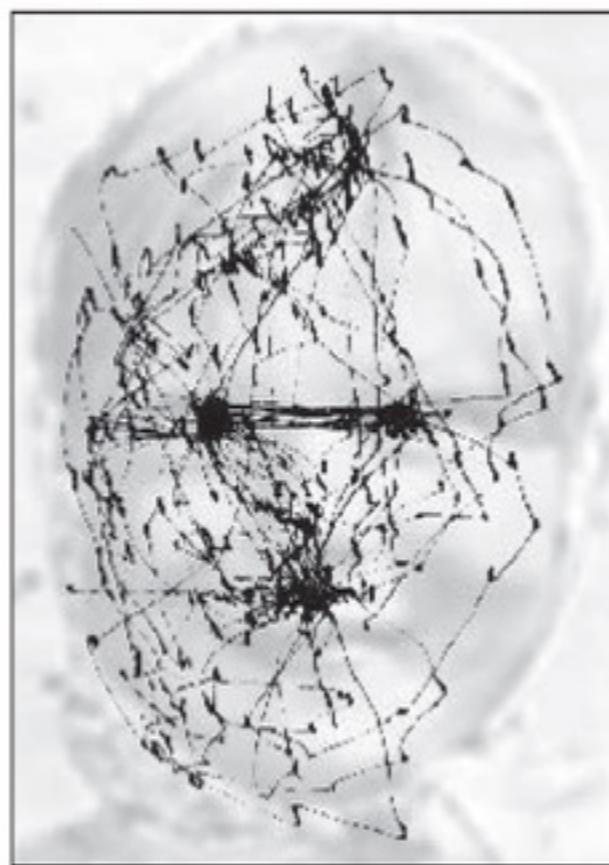
(A)

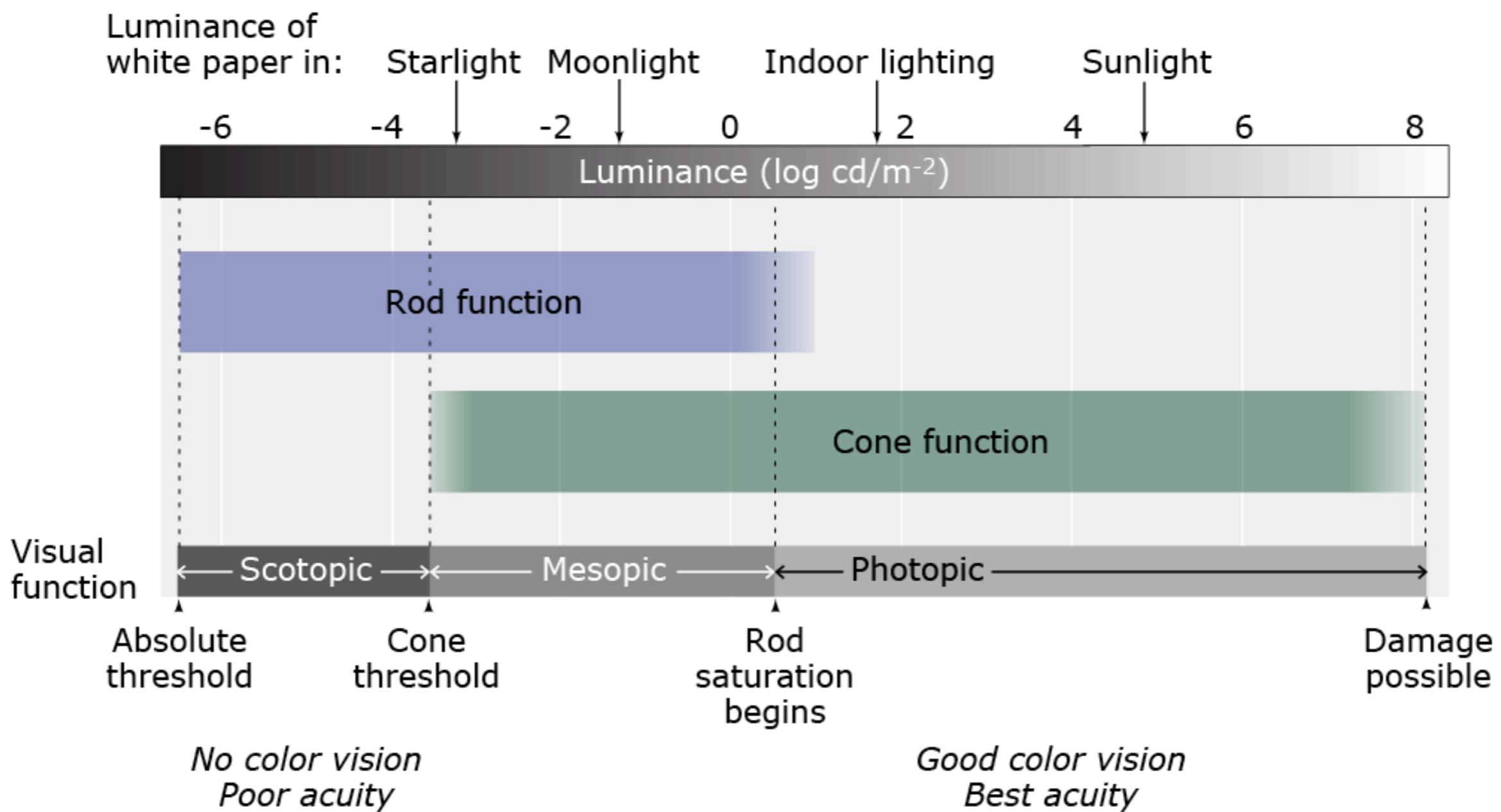


(B)



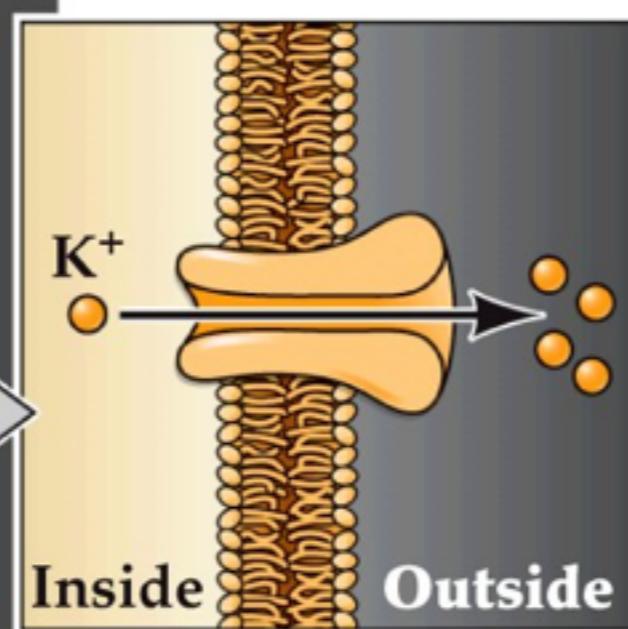
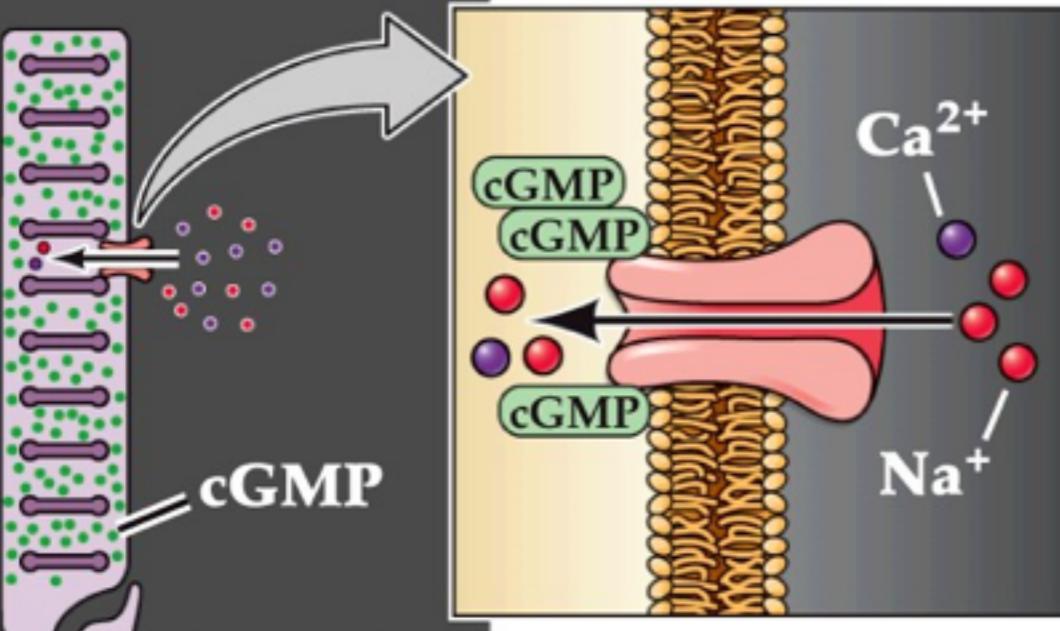
(C)





(A) Dark

Rod outer segment

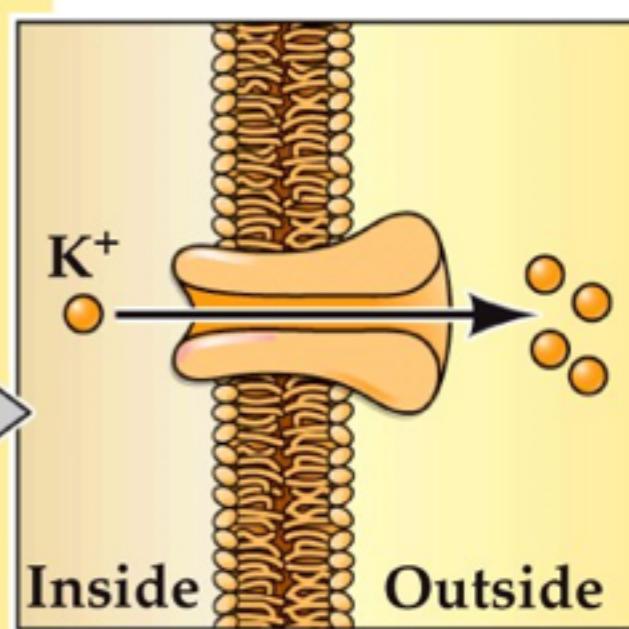
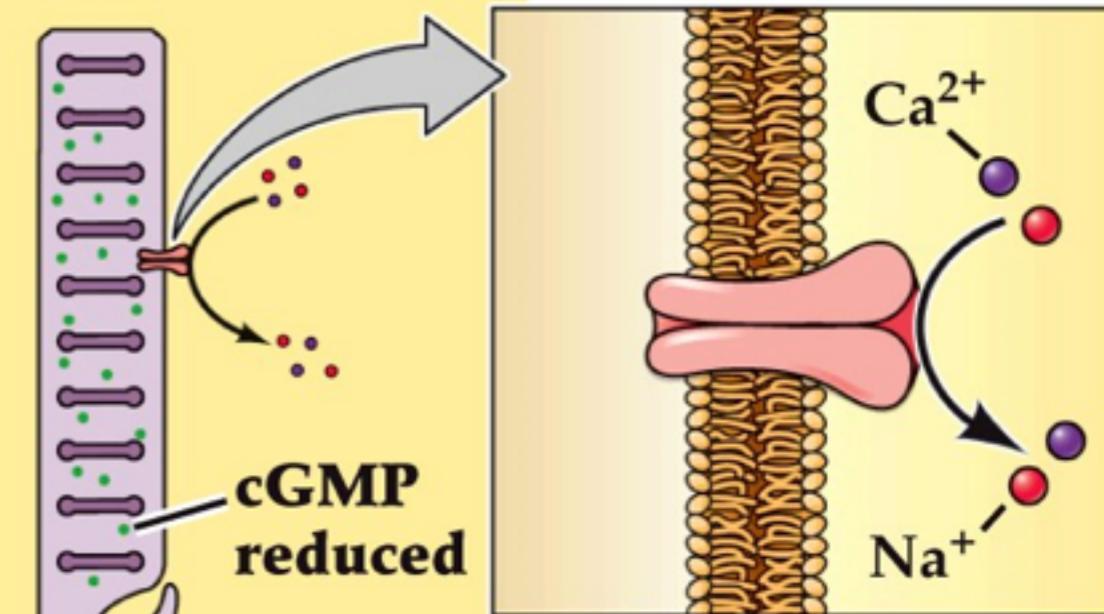


Rod inner segment

Na⁺ influx,
K⁺ efflux:
Depolarization

(B) Light

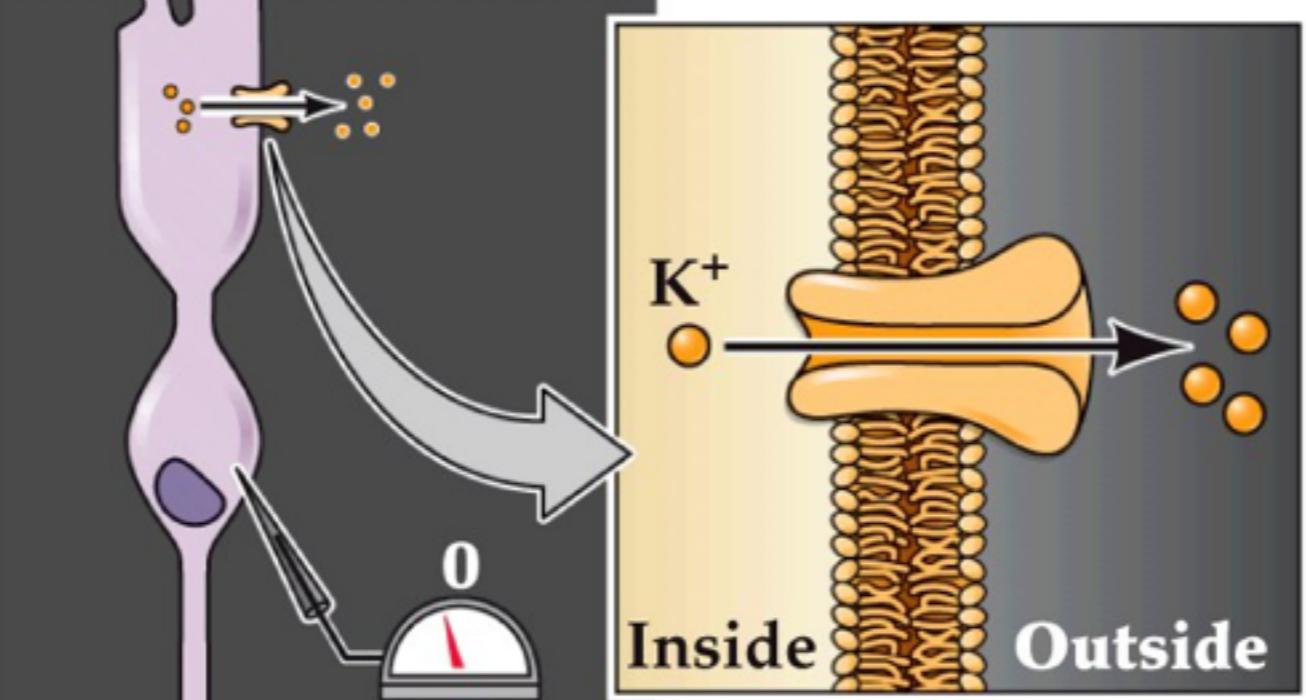
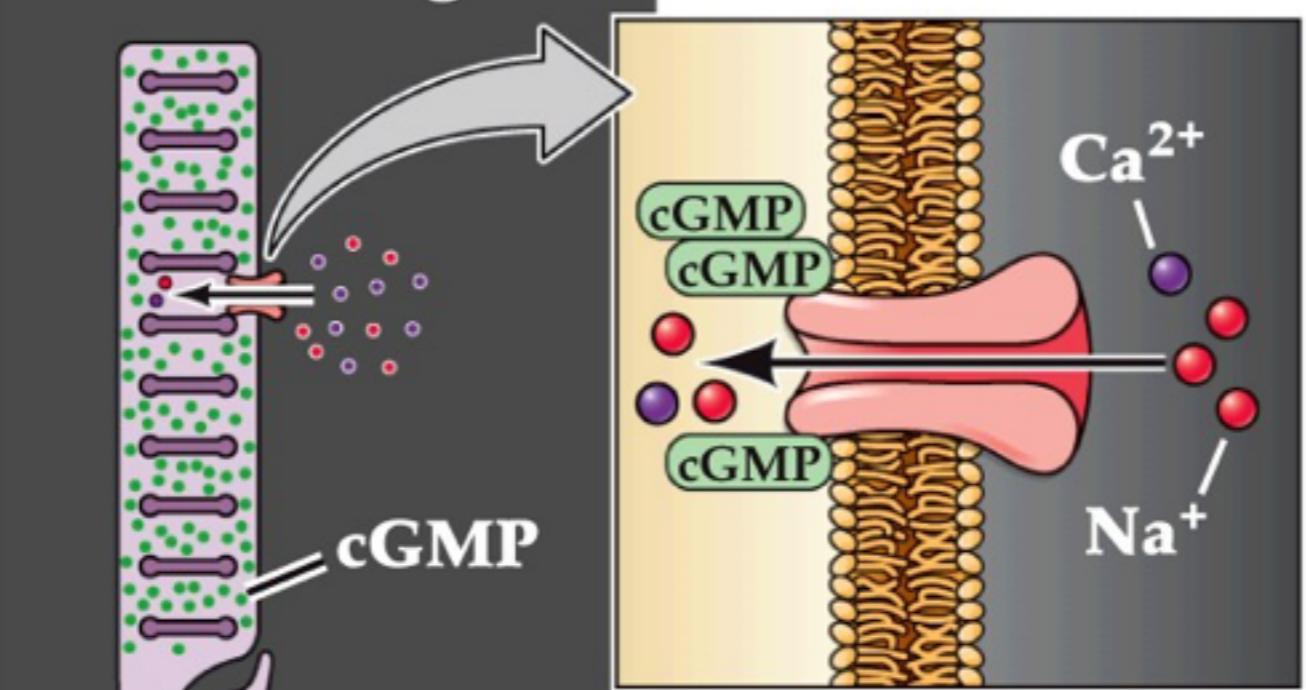
Rod outer segment



Rod inner segment

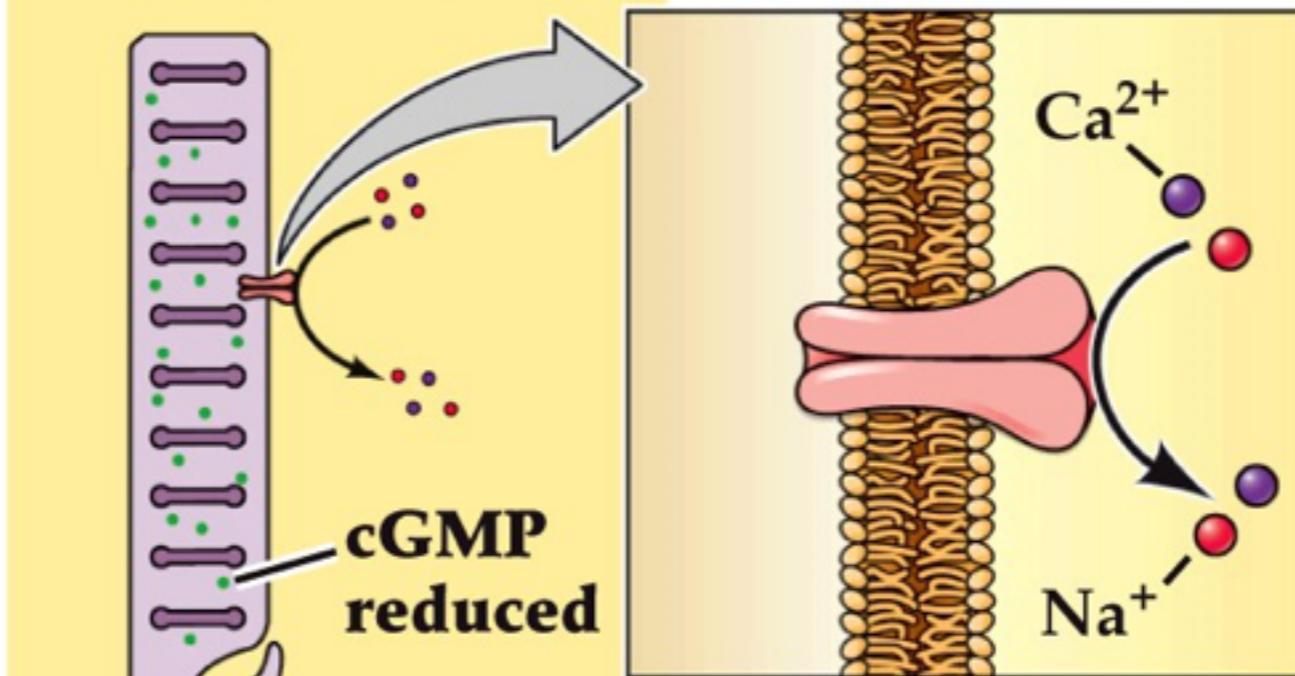
Reduced Na⁺ influx,
K⁺ efflux:
Hyperpolarization

Rod outer segment

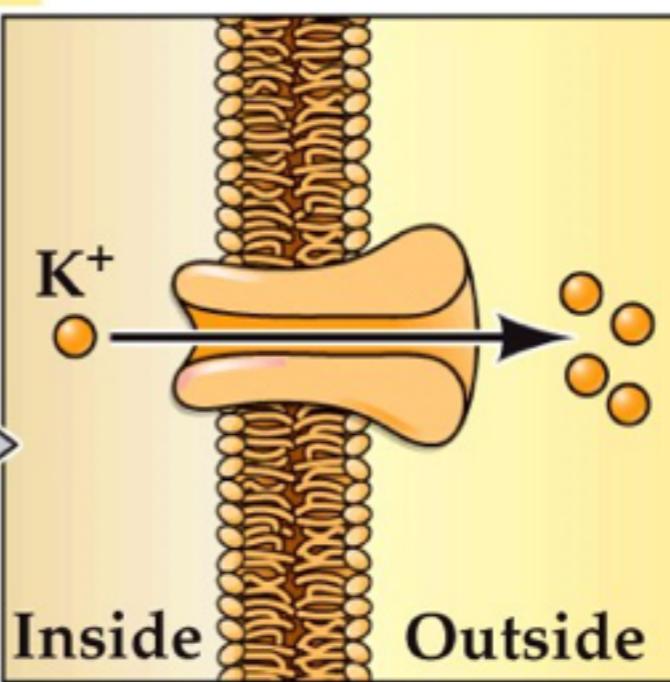


Na^+ influx,
 K^+ efflux:
Depolarization

Rod outer segment

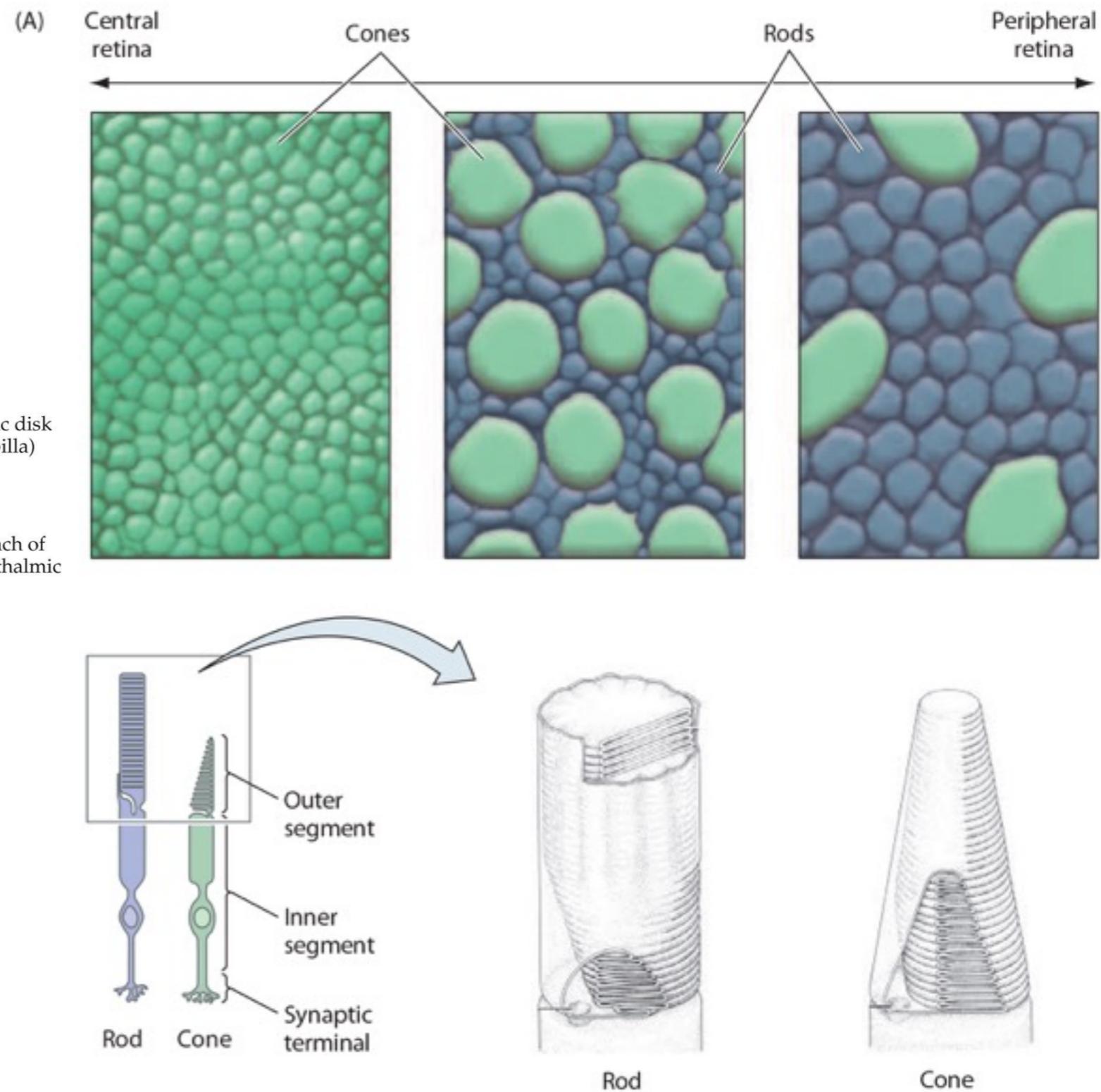
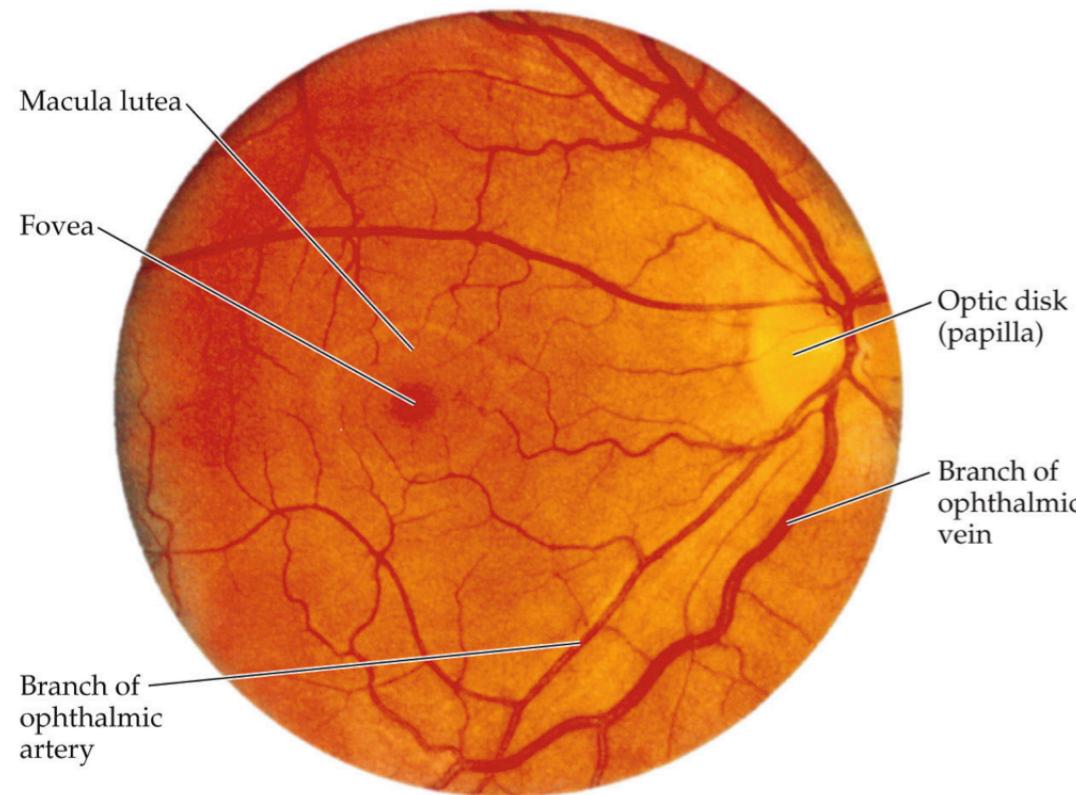


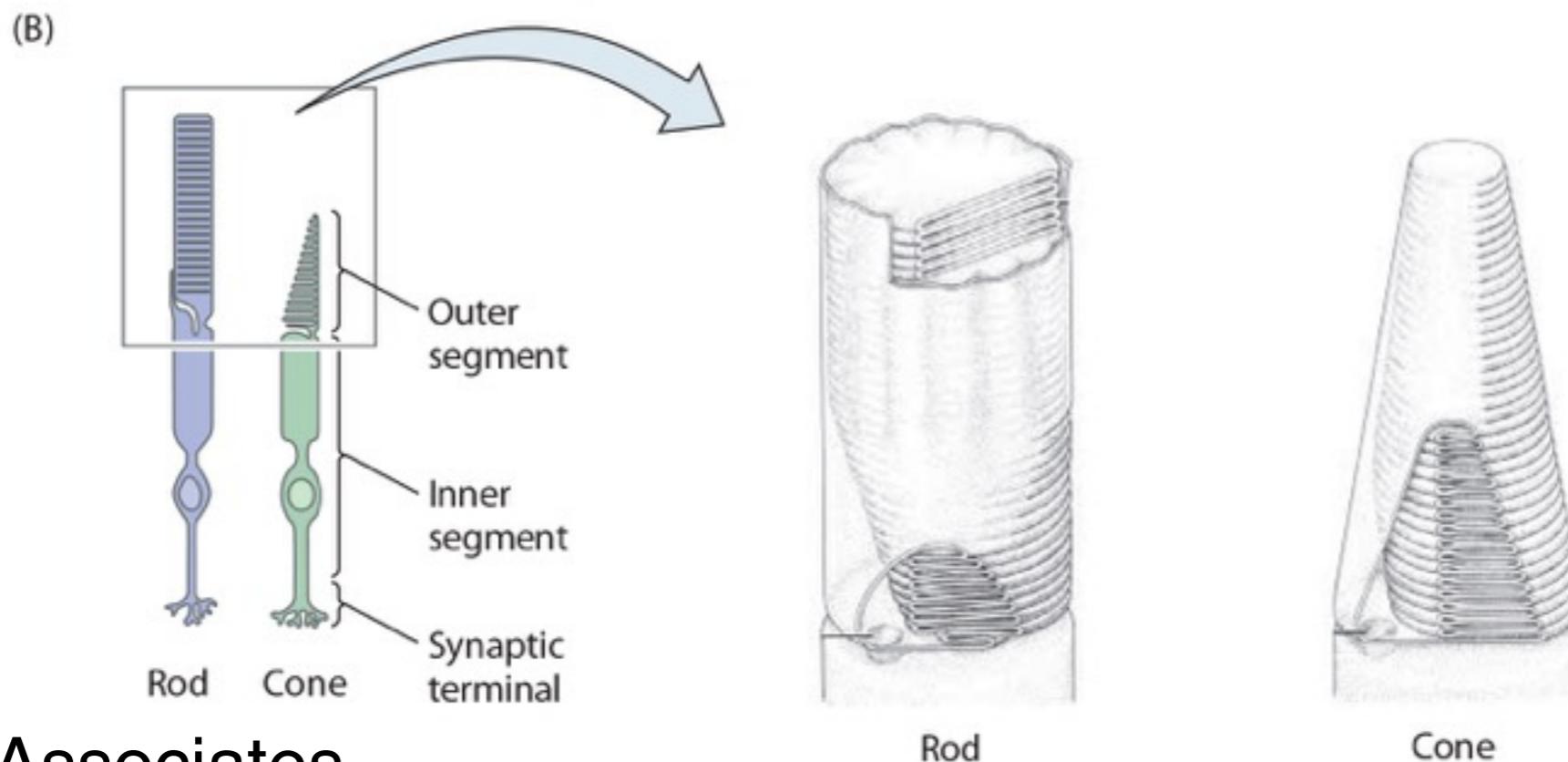
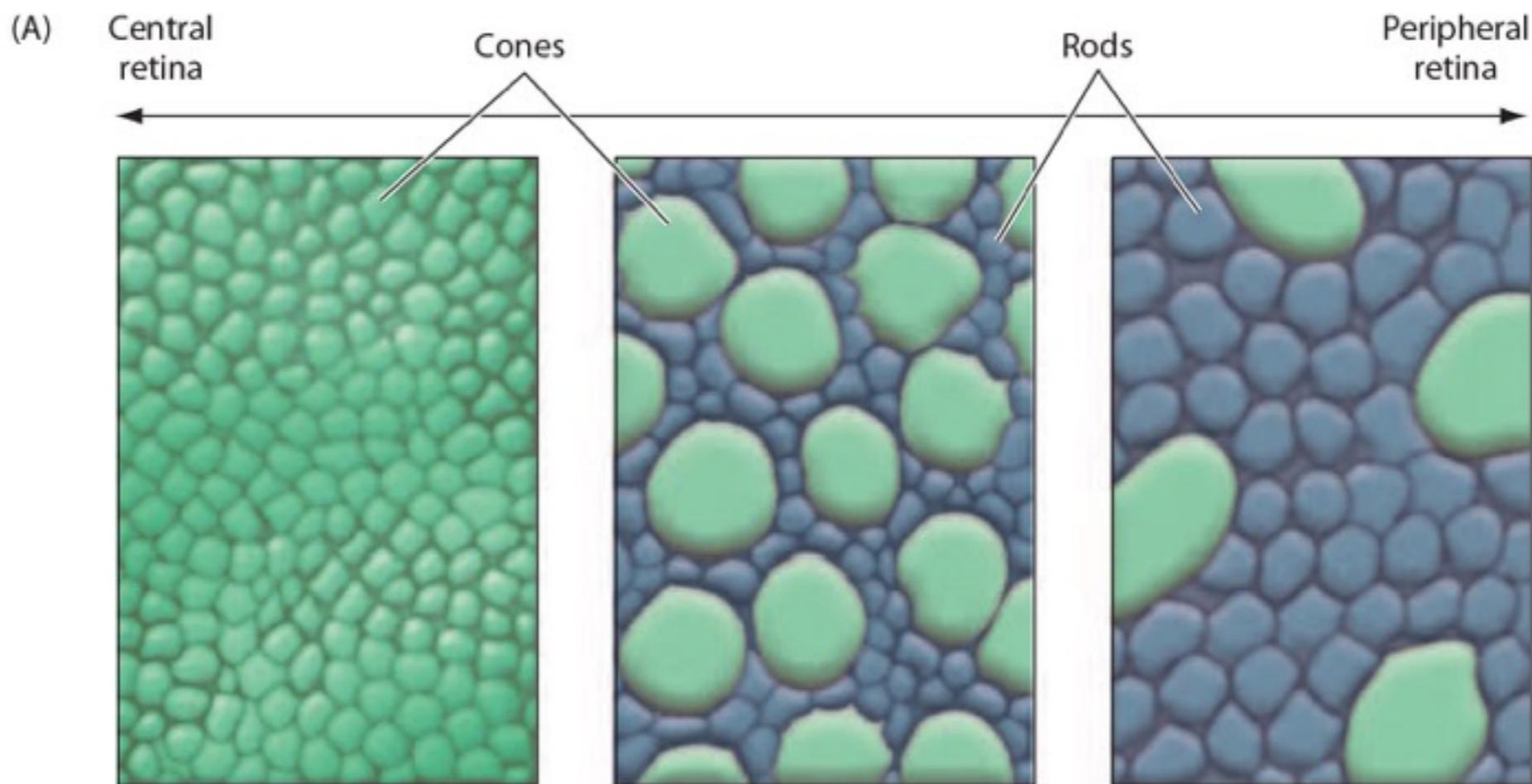
cGMP
reduced



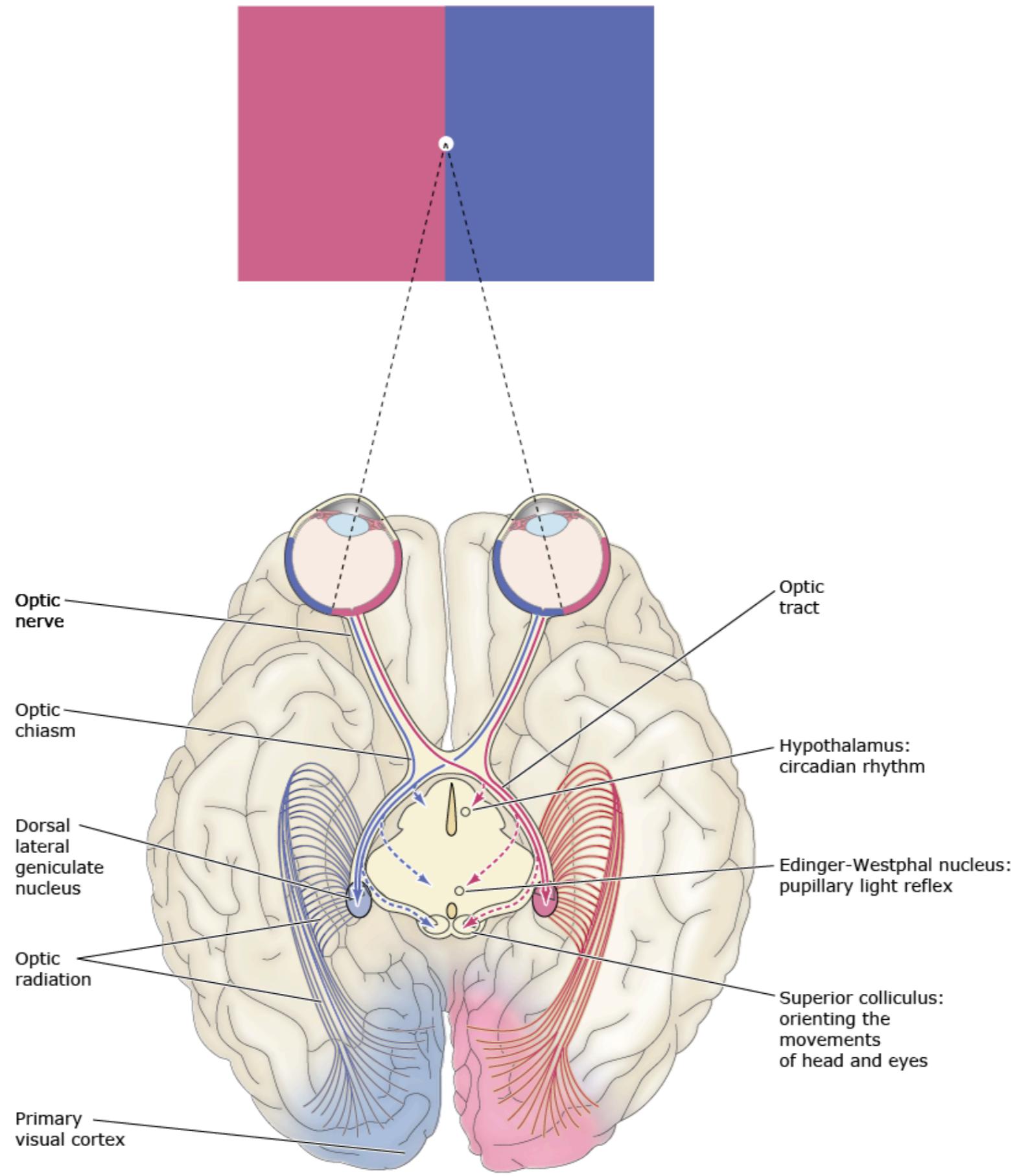
Rod inner
segment

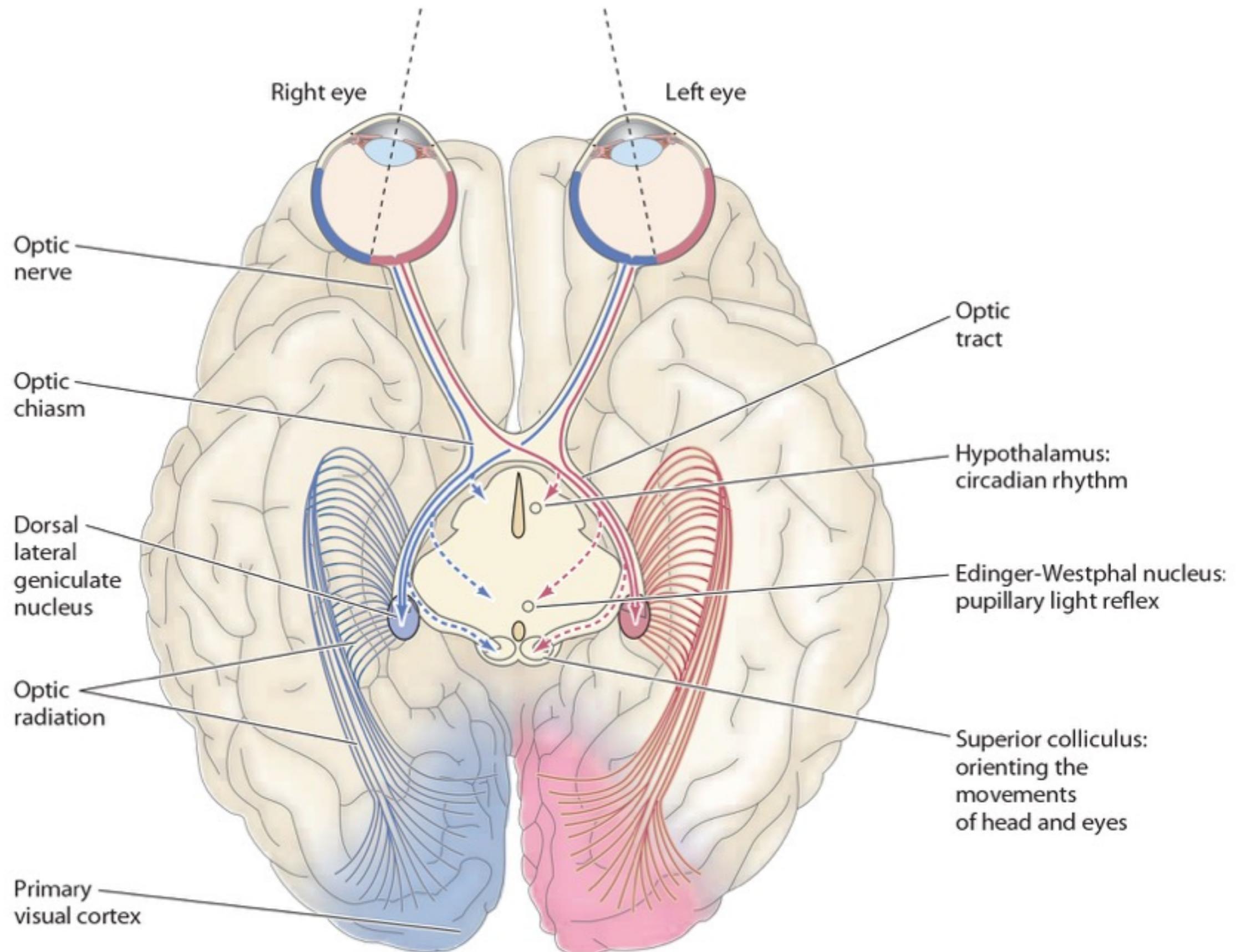
Reduced Na^+ influx,
 K^+ efflux:
Hyperpolarization



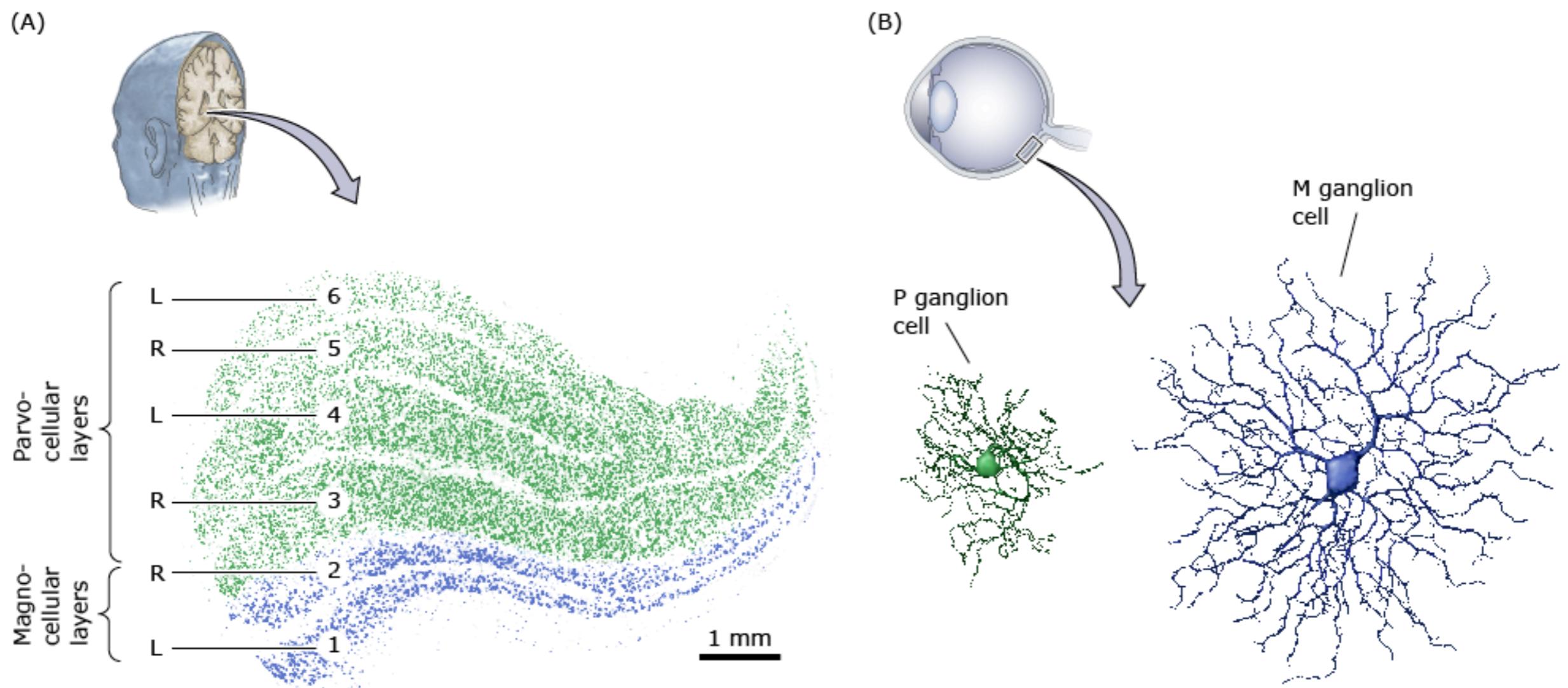


Lesson 3. The Primary Visual Pathway

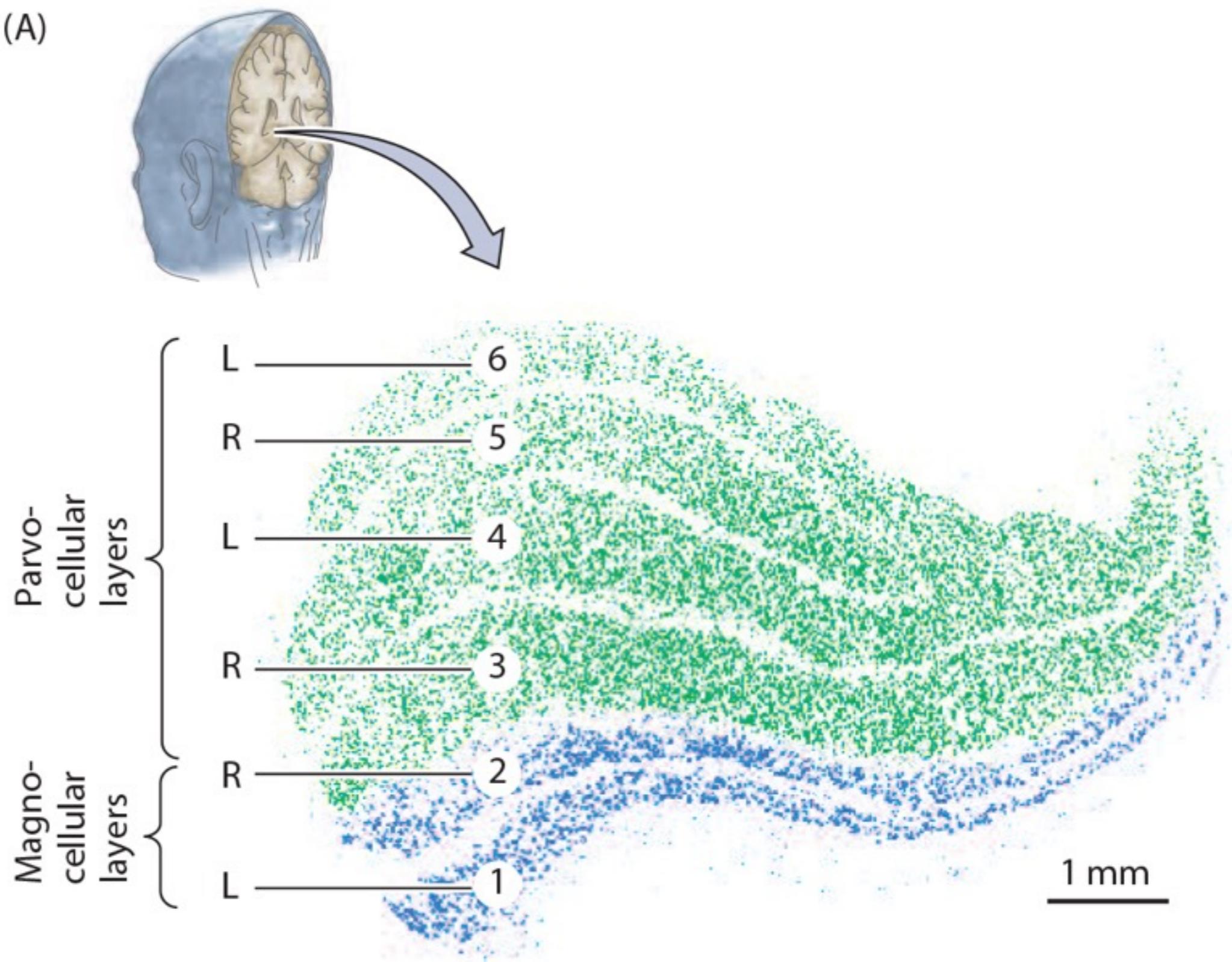




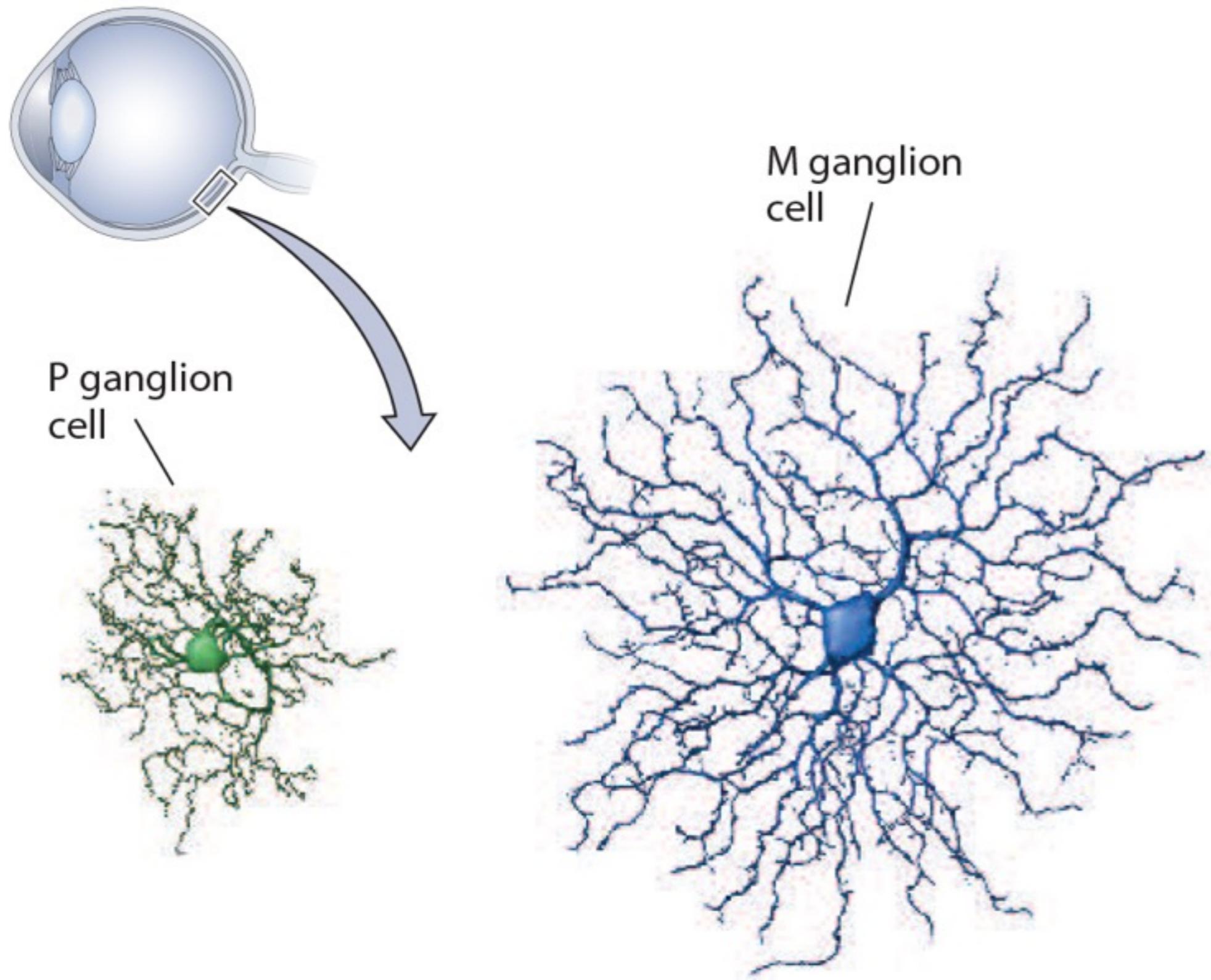
The Lateral Geniculate Nucleus in the Thalamus



(A)



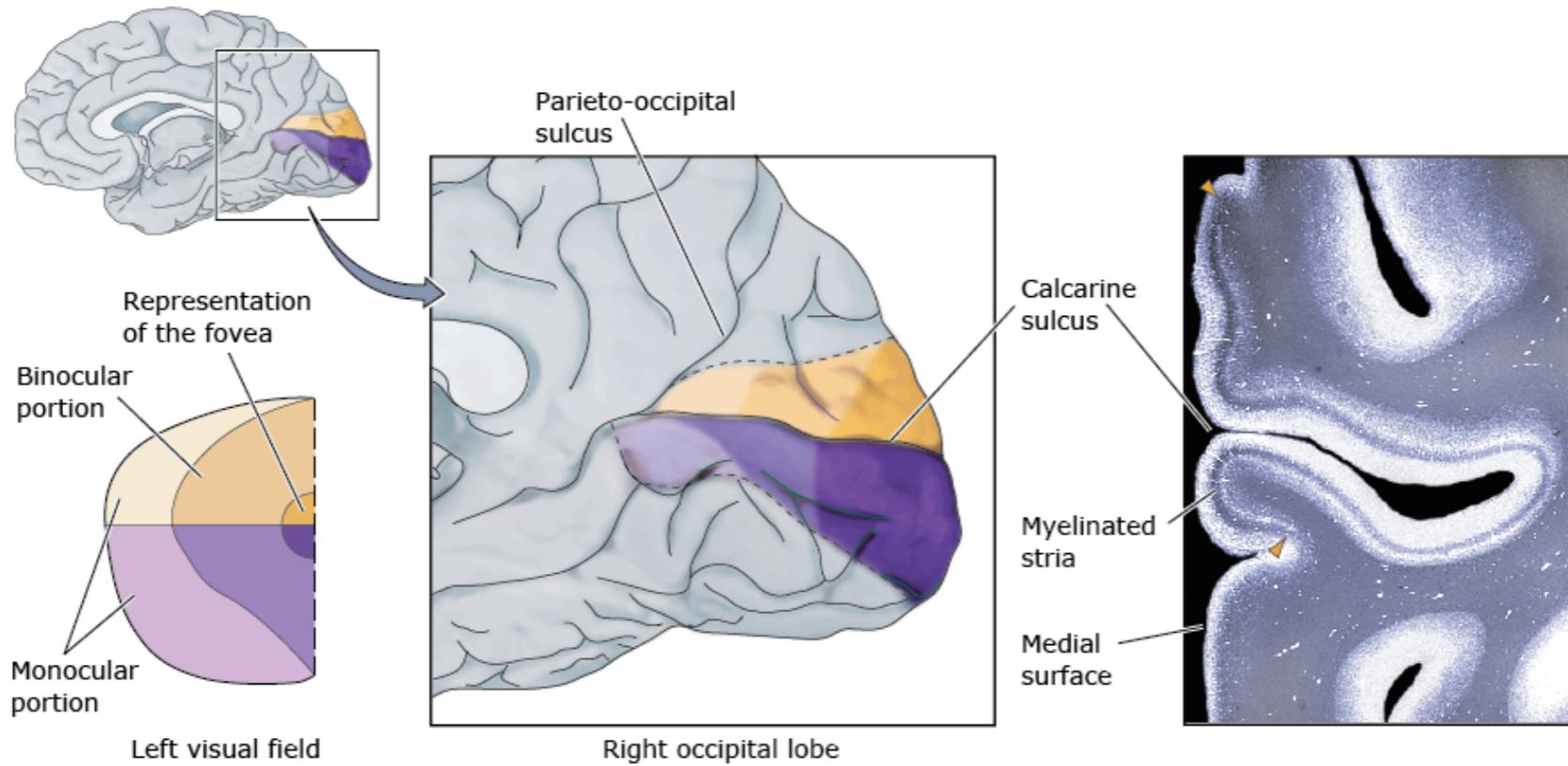
(B)



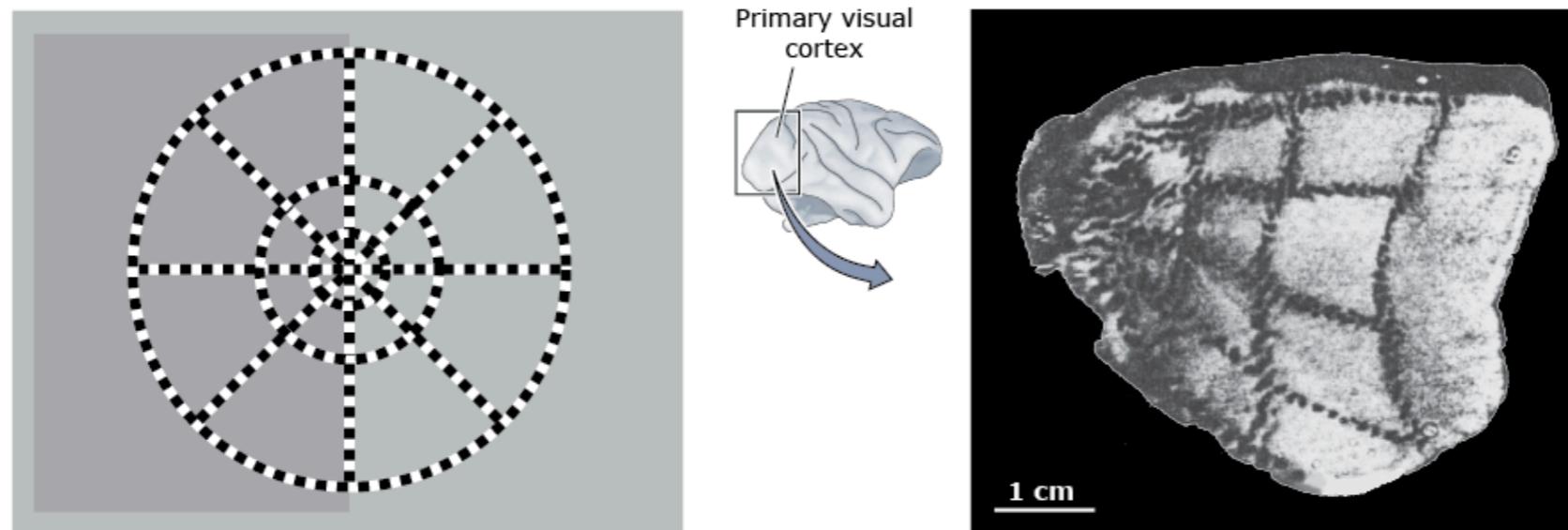
Lesson 4. The Visual Cortex

The Primary Visual Area (V1) in the Occipital Cortex

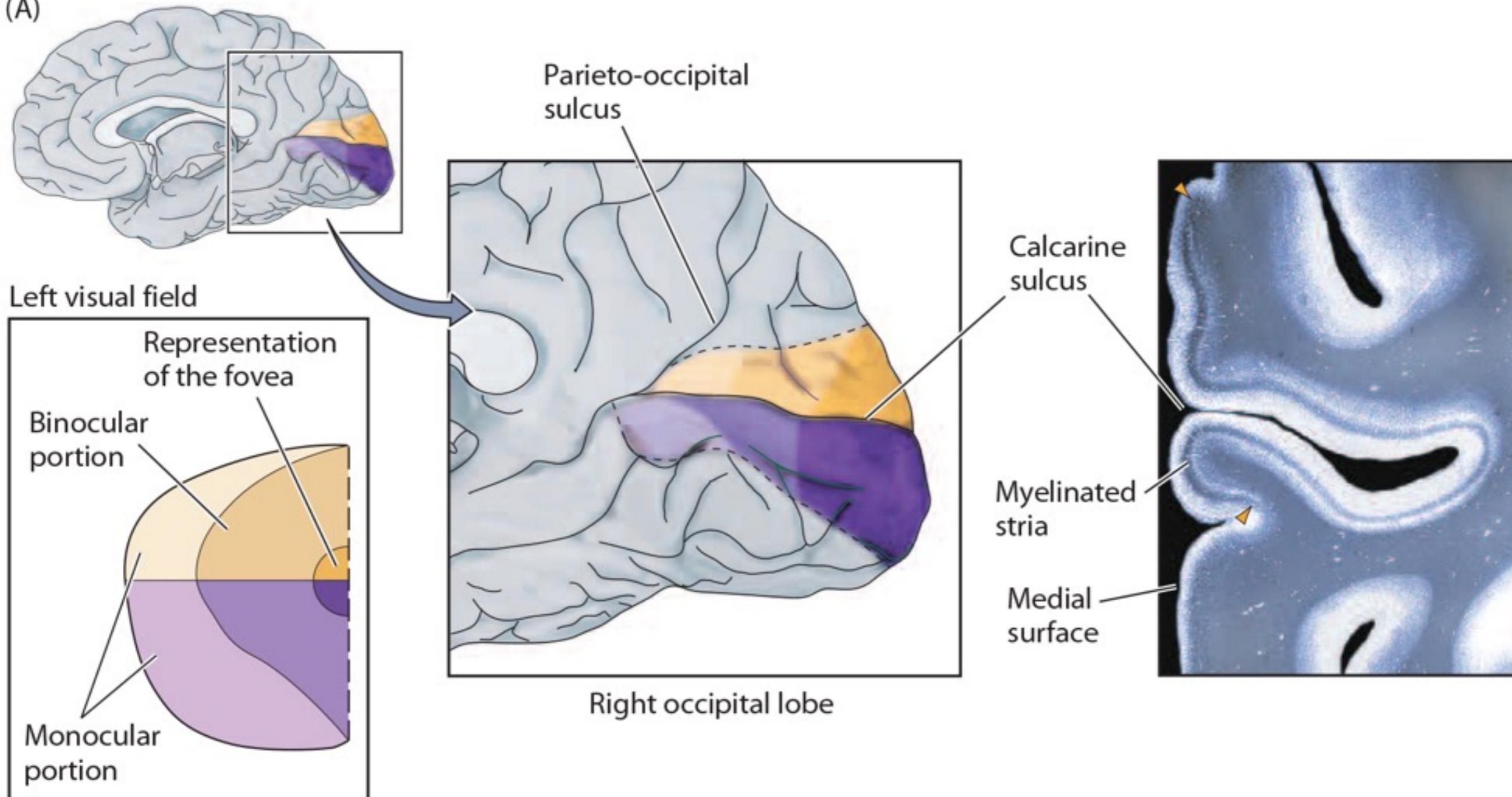
(A)



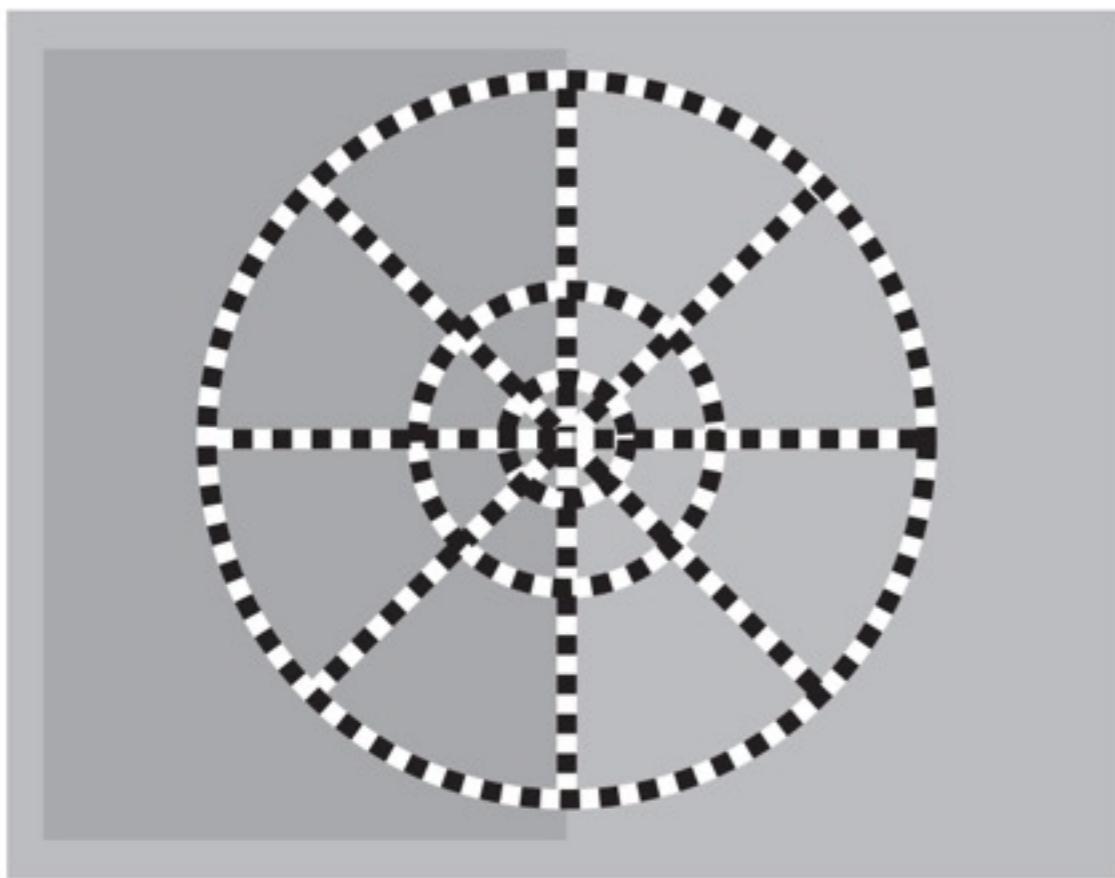
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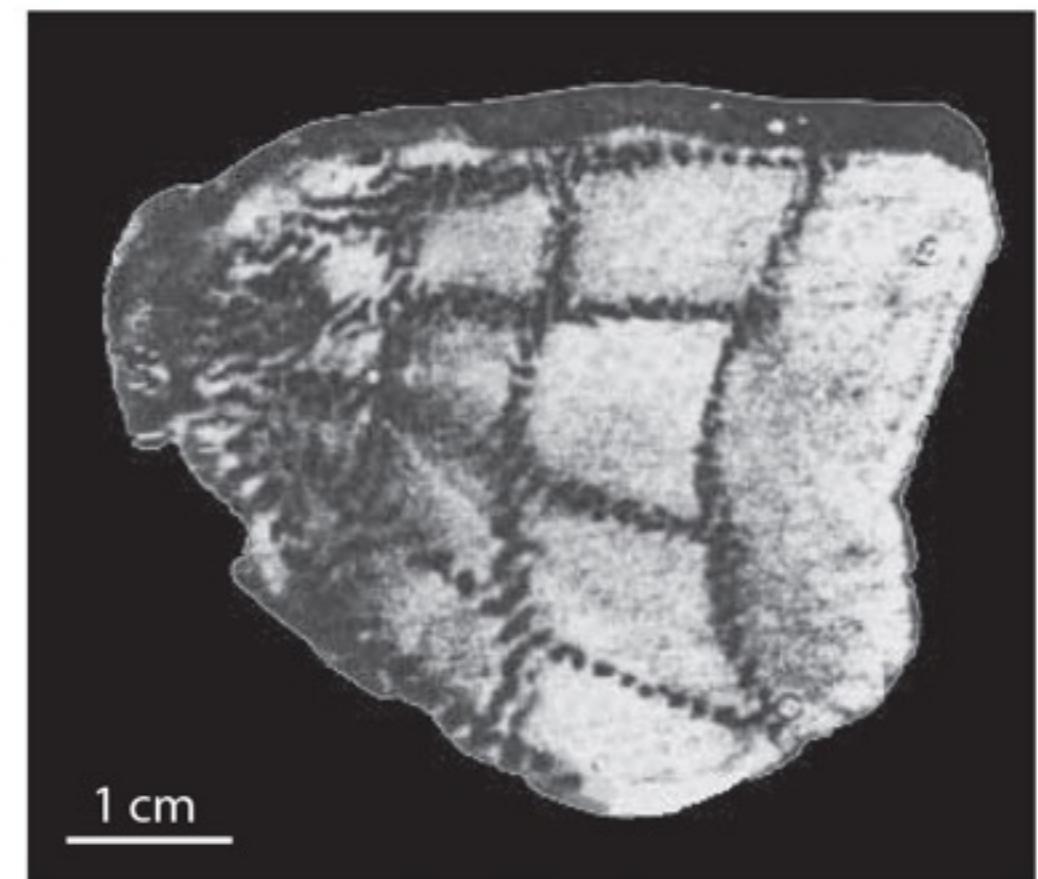
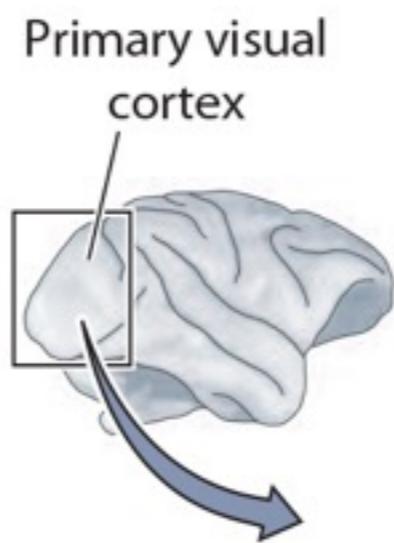
(A)



(B)

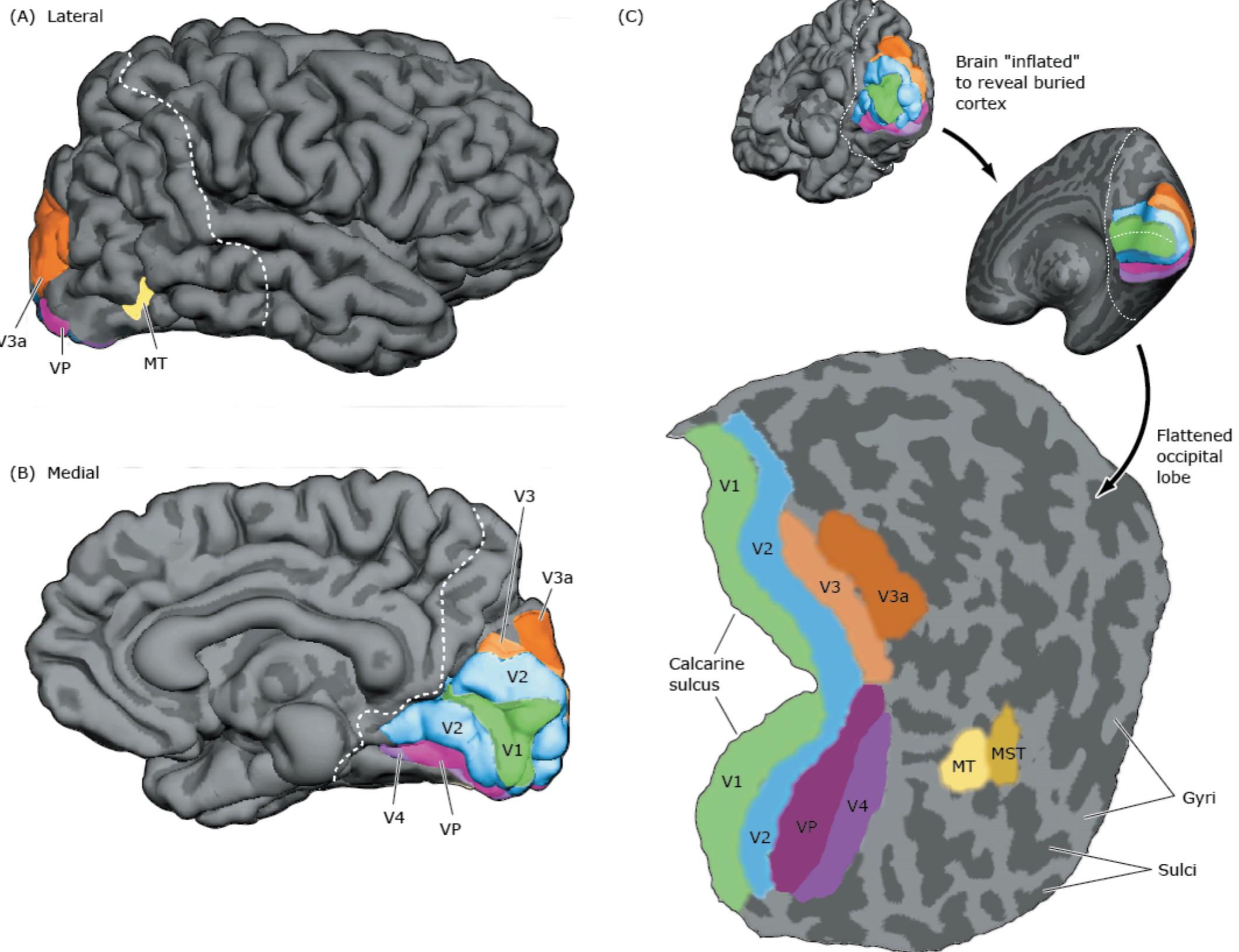


Stimulus

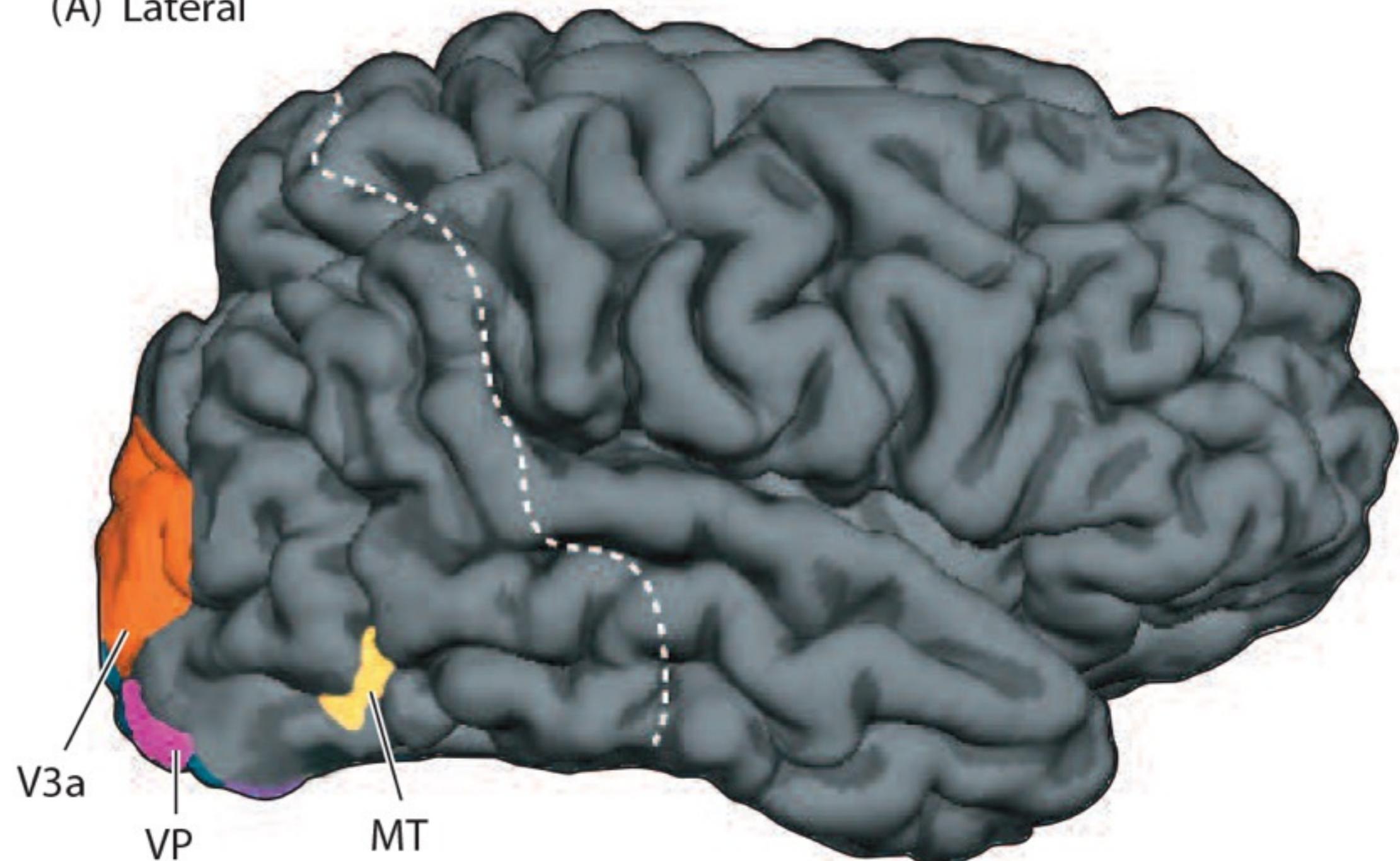


Cortical activation

Higher Order Visual Areas



(A) Lateral

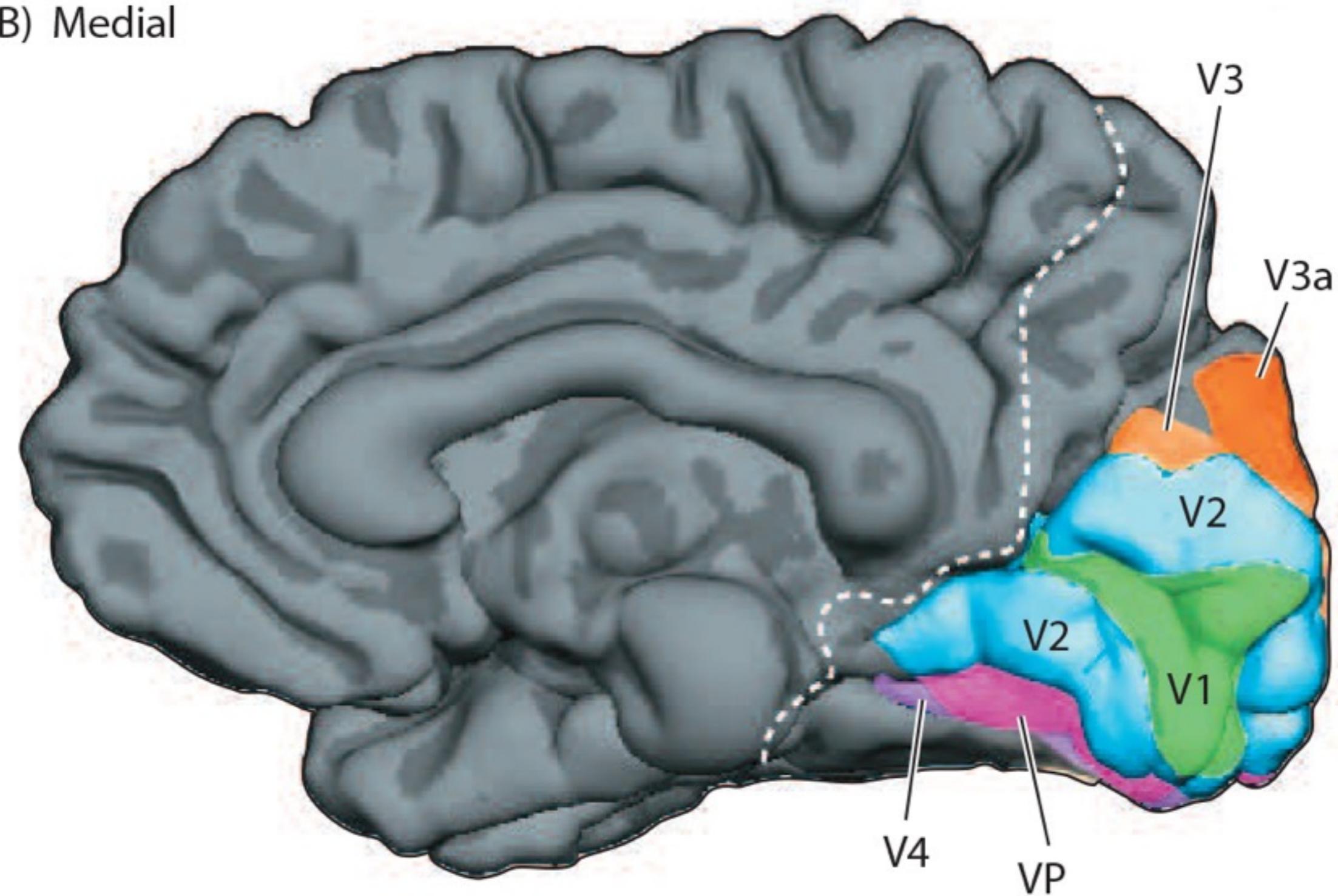


V3a

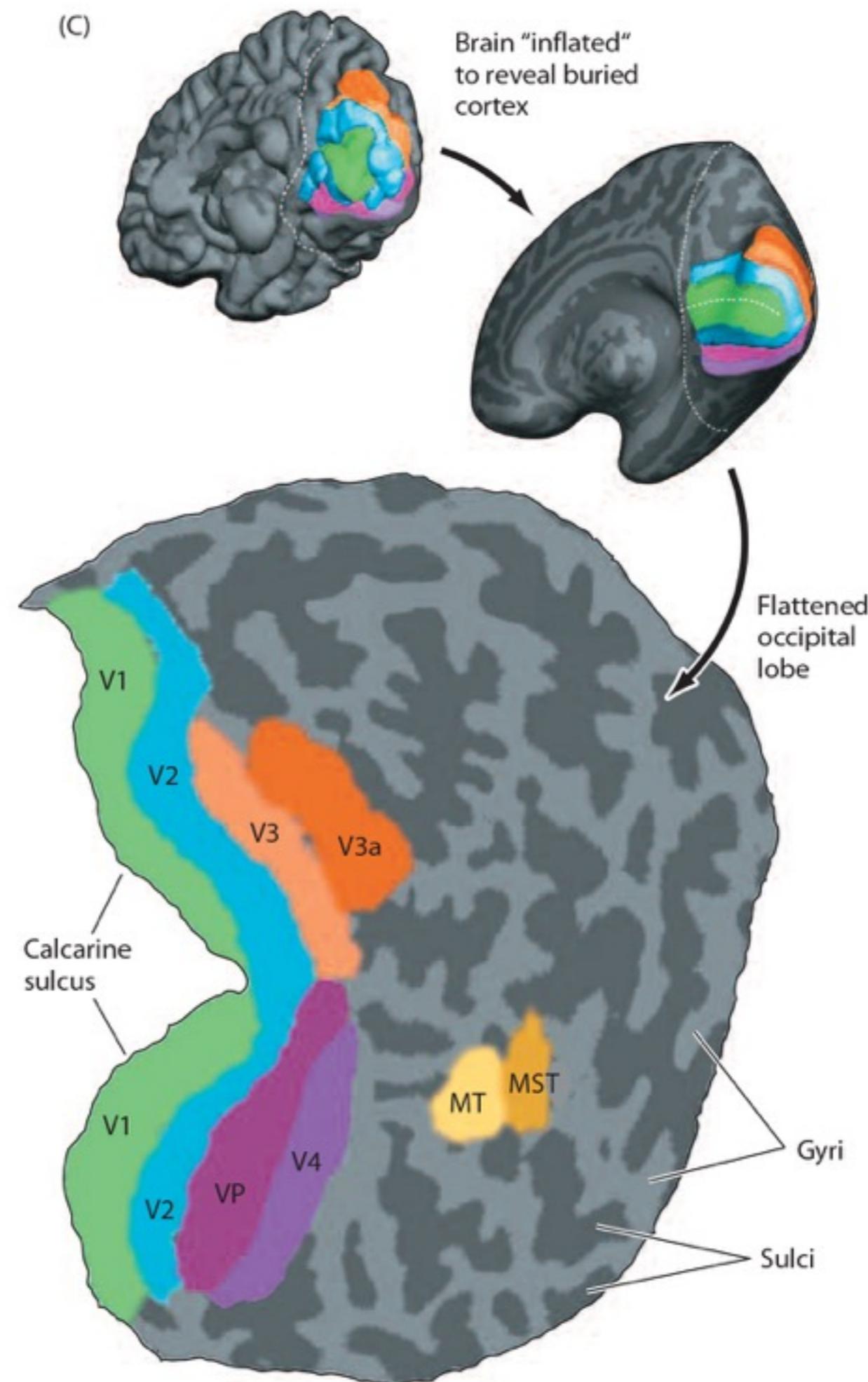
VP

MT

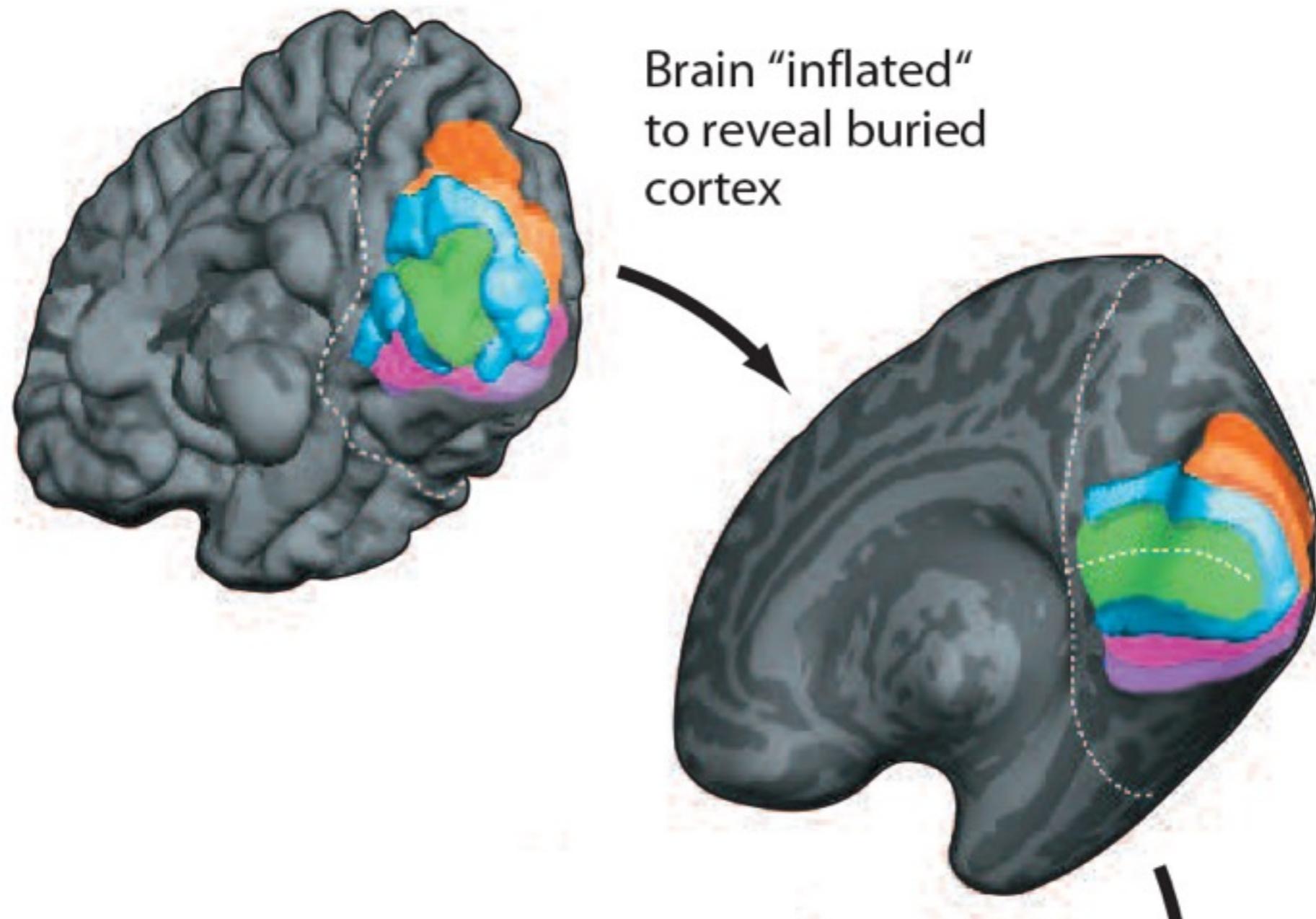
(B) Medial

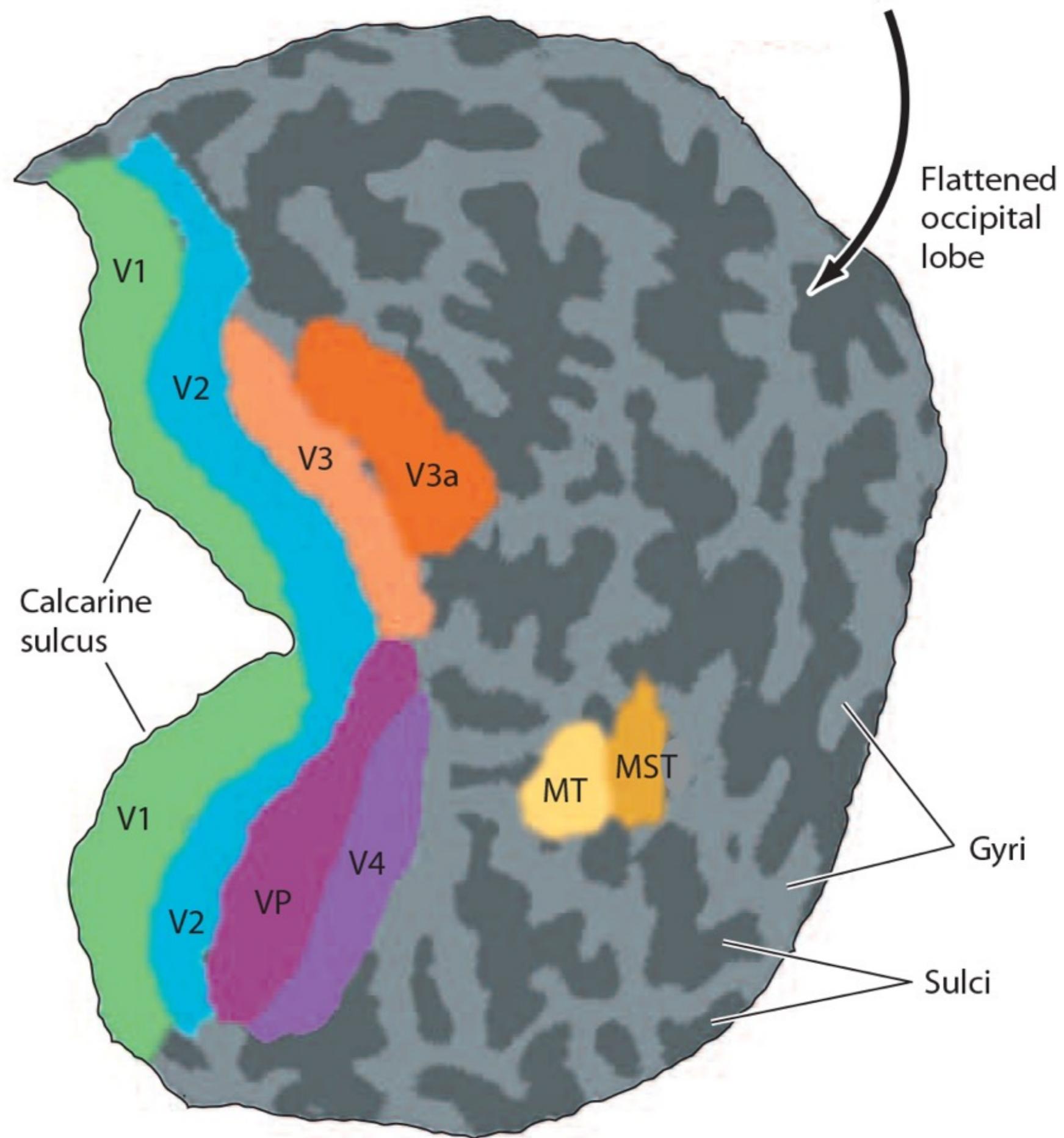


(C)



(C)

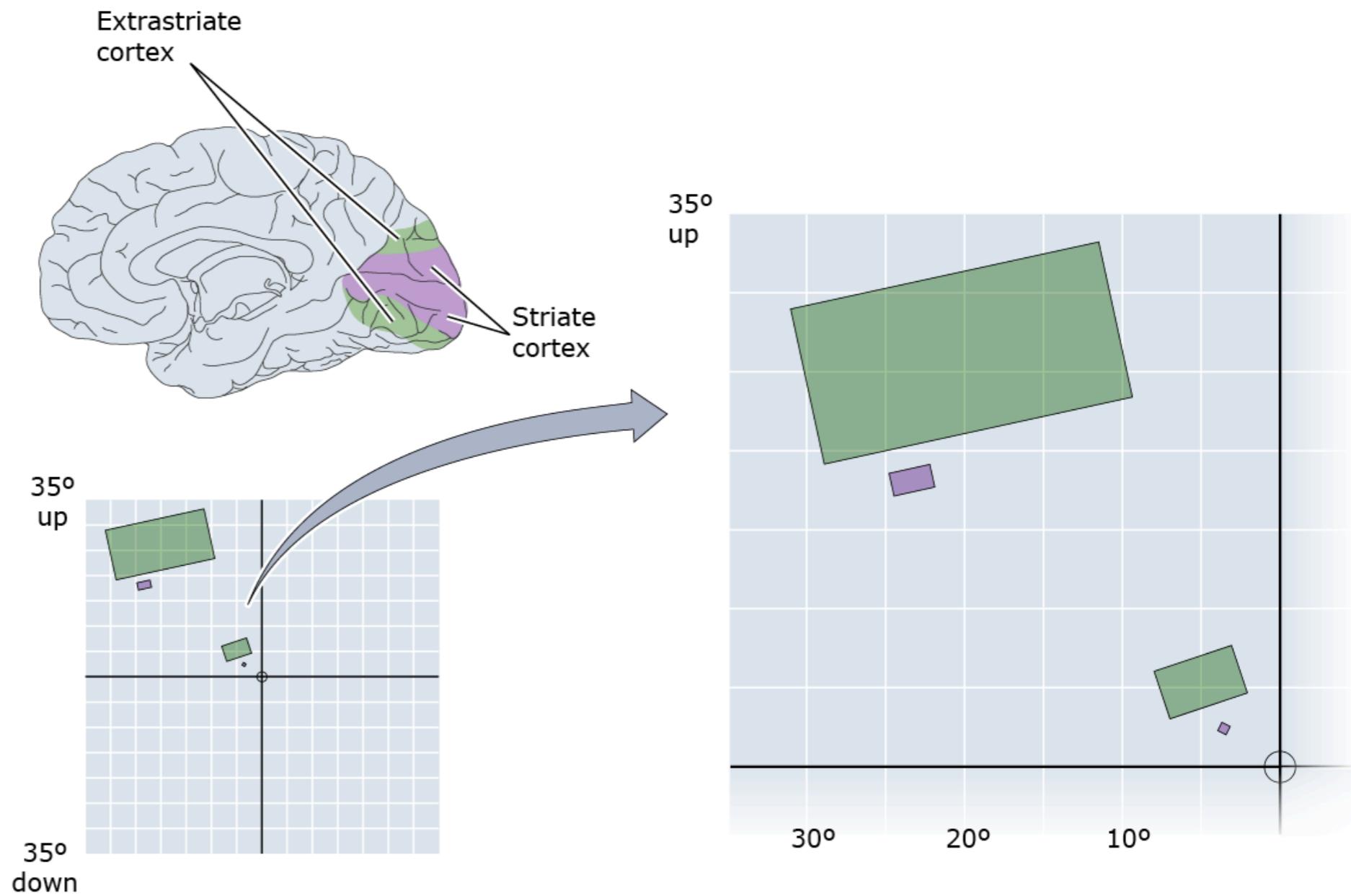


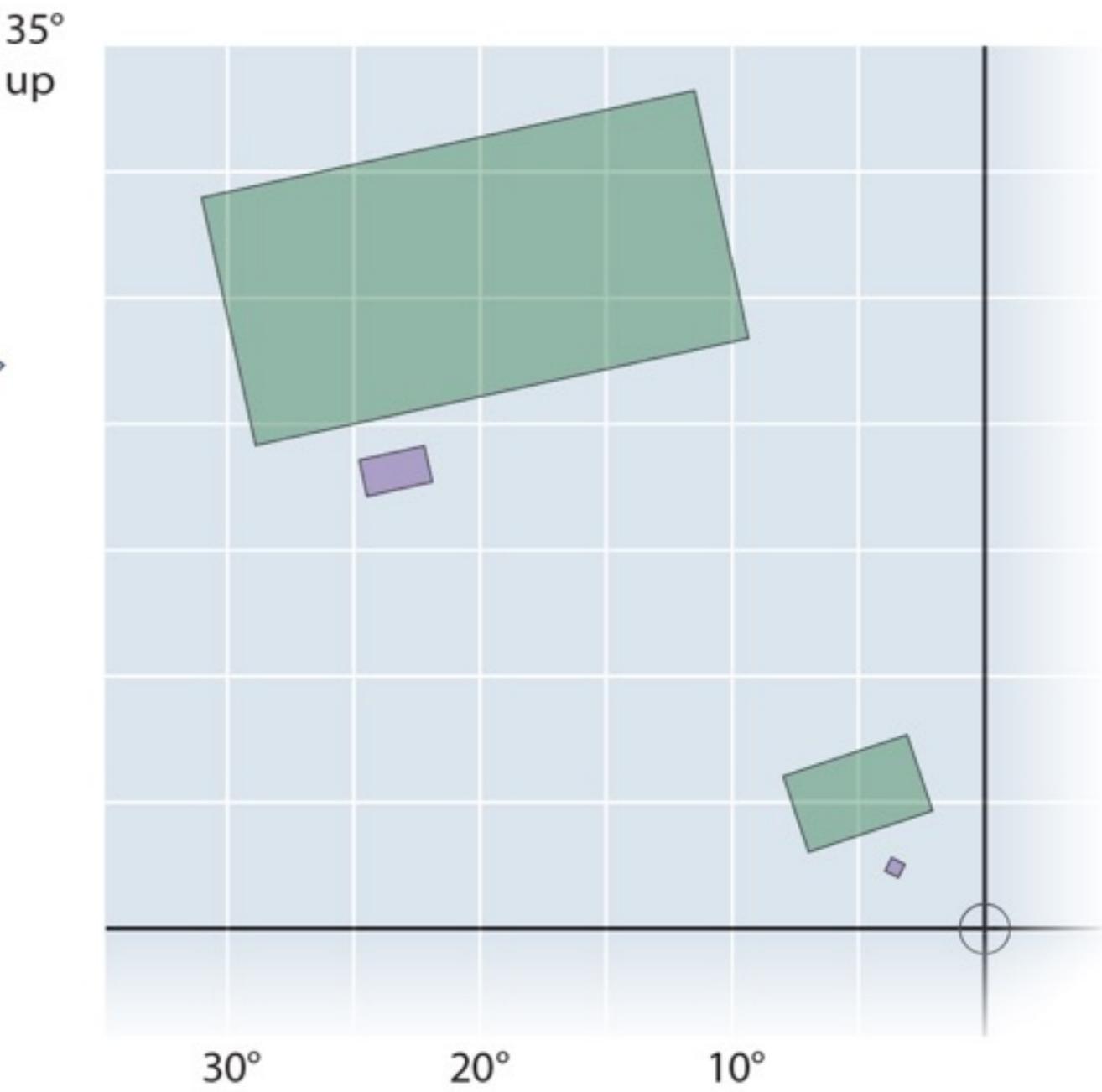
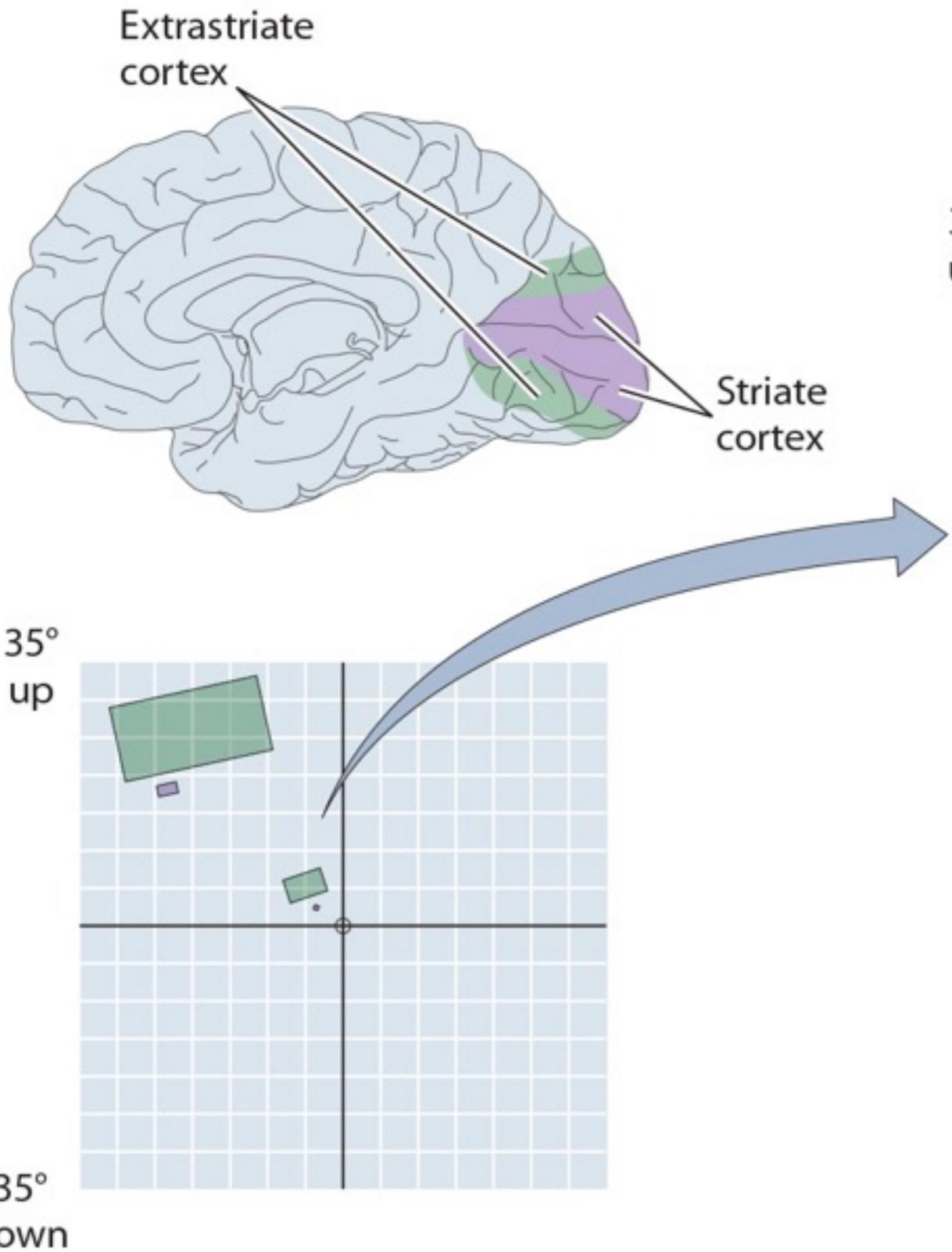


Lesson 5. The Concept of Receptive Fields



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, but it also has problems

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