



Before you begin: This is a big topic, and big topics beget big slide-sets. There's a natural break just past the halfway mark (slide 228ish); I placed a *break time!* slide at that point to mark it.

Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*



# Q/A

## Retinal Anatomy and Histology



What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the

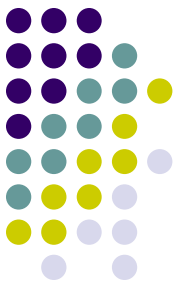
three words

# A

## Retinal Anatomy and Histology



*What is the difference between the retina and the **neurosensory** retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the **neurosensory** retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*

--?

--?

--?

# A

## Retinal Anatomy and Histology



*What is the difference between the retina and the **neurosensory** retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*

--Neurons

--Glial

--Vascular

## Q

## Retinal Anatomy and Histology



*What is the difference between the retina and the **neurosensory** retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they?*

--Neurons:

----?

----?

----?

----?

----?

--Glial

--Vascular

# A

## Retinal Anatomy and Histology



*What is the difference between the retina and the **neurosensory** retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

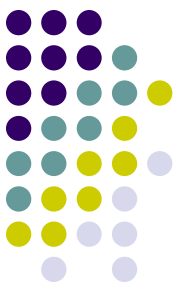
----Amacrine cells

----Horizontal cells

--Glial

--Vascular





# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the **neurosensory** retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

--Glial:

----?

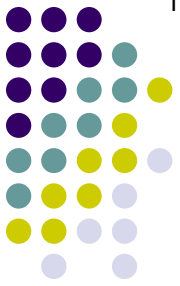
----?

----?

--Vascular

# A

## Retinal Anatomy and Histology



*What is the difference between the retina and the **neurosensory** retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

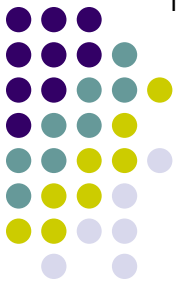
--Glial:

----Müller cells

----Astrocytes

----Microglia

--Vascular



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they?

There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

--Glial:

----Müller cells

----Astrocytes

----Microglia

--Vascular:

----?

----?

# A

## Retinal Anatomy and Histology



What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they?

*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

--Glial:

----Müller cells

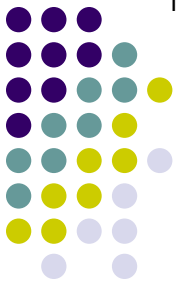
----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

----Pericytes



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

--Glial:

----*Müller cells?*

----*Astrocytes?*

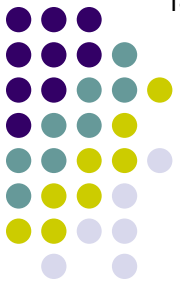
----*Microglia?*

*One of the glial cells is of particular note. Which one?*

--Vascular:

----Endothelial cells

----Pericytes



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

--Glial:

----**Müller cells**

----Astrocytes

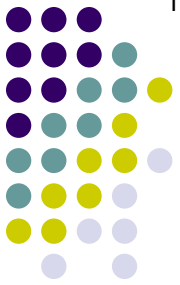
----Microglia

} *One of the glial cells is of particular note. Which one?*  
 Müller cells

--Vascular:

----Endothelial cells

----Pericytes



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

--Glial:

----**Müller cells**

----Astrocytes

----Microglia

} *One of the glial cells is of particular note. Which one?*  
 Müller cells

--Vascular:

----Endothelial cells

----Pericytes

*Why are Müller cells of particular note?*



*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

- Neurons:
  - Photoreceptors (PRs)
  - Bipolar cells
  - Ganglion cells
  - Amacrine cells
  - Horizontal cells

- Glial:
  - Müller cells**
  - Astrocytes
  - Microglia

} *One of the glial cells is of particular note. Which one?*  
} Müller cells

- Vascular:
  - Endothelial cells
  - Pericytes

*Why are Müller cells of particular note?*  
Because they form the three words of the retina



# A

## Retinal Anatomy and Histology



What is the difference between the retina and the neurosensory retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

- Photoreceptors (PRs)
- Bipolar cells
- Ganglion cells
- Amacrine cells
- Horizontal cells

--Glial:

----**Müller cells**

- Astrocytes
- Microglia



*One of the glial cells is of particular note. Which one?  
Müller cells*

--Vascular:

- Endothelial cells
- Pericytes

*Why are Müller cells of particular note?*

*Because they form the internal limiting membrane of the retina*



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

--Glial:

----**Müller cells**

----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

----Pericytes

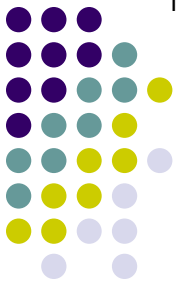
*One of the glial cells is of particular note. Which one?*

Müller cells

*Why are Müller cells of particular note?*

Because they form the internal limiting membrane of the retina

*Which specific aspect of Müller cells form the ILM?*



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

--Glial:

----**Müller cells**

----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

----Pericytes

*One of the glial cells is of particular note. Which one?*

Müller cells

*Why are Müller cells of particular note?*

Because they form the internal limiting membrane of the retina

*Which specific aspect of Müller cells form the ILM?*  
 Their foot processes



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

--Glial:

----**Müller cells**

----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

----Pericytes

One of the glial cells is  
Müller cells

What does the ILM attach to?

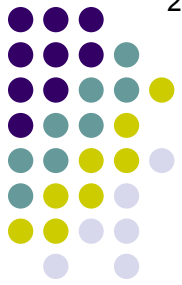
Why are Müller cells of particular note?

Because they form the **internal limiting membrane** of the retina

Which specific aspect of Müller cells form the ILM?  
Their foot processes

# A

## Retinal Anatomy and Histology



What is the difference between the retina and the neurosensory retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

- Photoreceptors (PRs)
- Bipolar cells
- Ganglion cells
- Amacrine cells
- Horizontal cells

--Glial:

- Müller cells**
- Astrocytes
- Microglia



One of the glial cells is Müller cells

What does the ILM attach to?  
The overlying cortical vitreous

--Vascular:

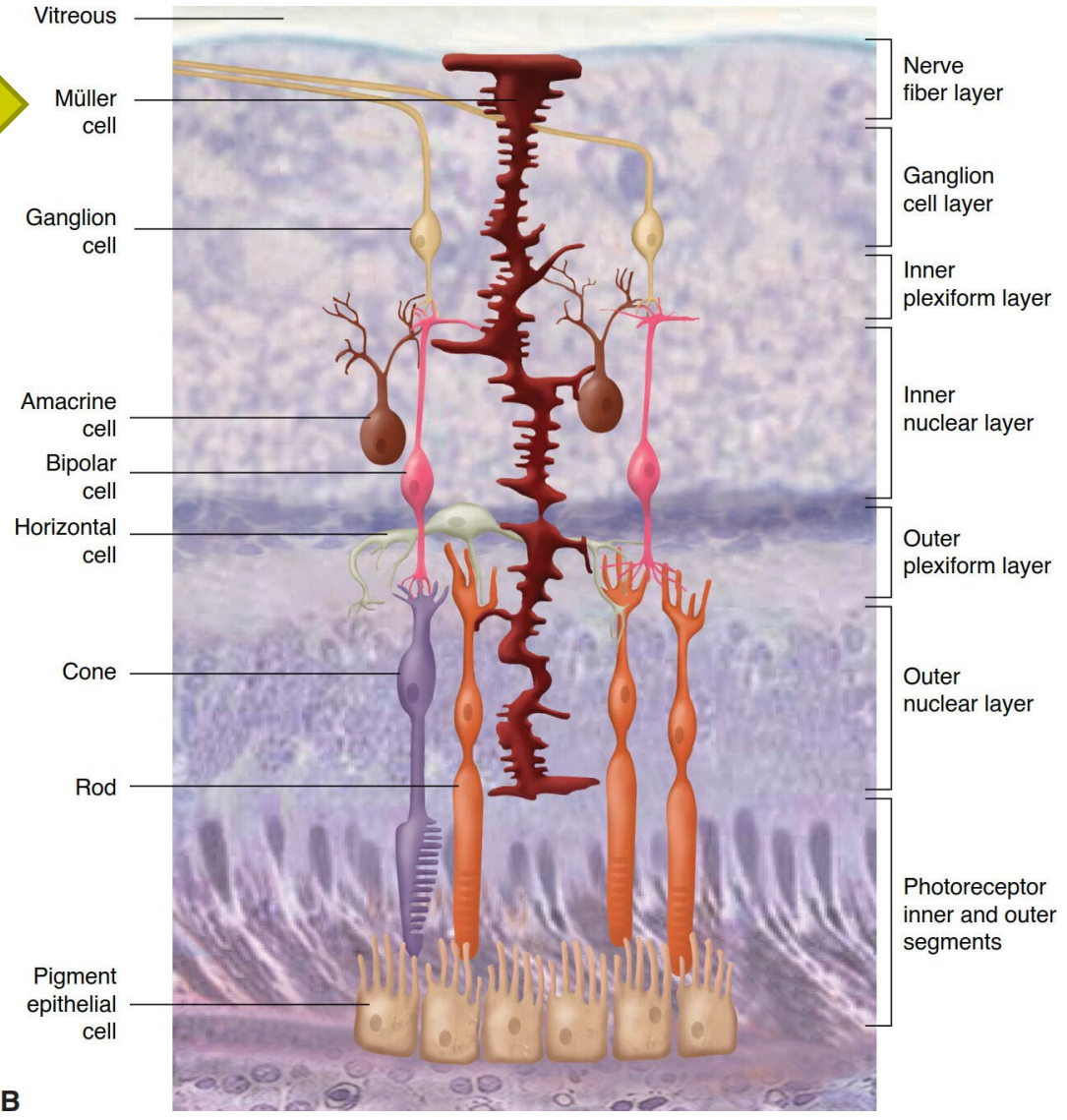
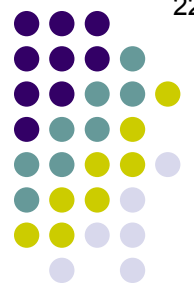
- Endothelial cells
- Pericytes

Why are Müller cells of particular note?

Because they form the internal limiting membrane of the retina

Which specific aspect of Müller cells form the ILM?  
Their foot processes

# Retinal Anatomy and Histology



B

## Müller cells



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

### --Neurons:

- Photoreceptors (PRs)
- Bipolar cells
- Ganglion cells

----**Amacrine cells**

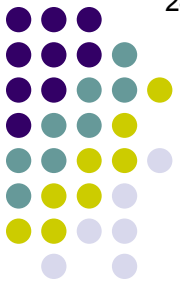
----**Horizontal cells**

*In two words, how would one describe/classify amacrine cells and horizontal cells?*

They are

### --Glial:

- Müller cells
- Astrocytes
- Microglia
- Vascular:
  - Endothelial cells
  - Pericytes



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

### --Neurons:

- Photoreceptors (PRs)
- Bipolar cells
- Ganglion cells

----**Amacrine cells**

----**Horizontal cells**

*In two words, how would one describe/classify amacrine cells and horizontal cells?*

They are inhibitory interneurons

### --Glial:

- Müller cells
  - Astrocytes
  - Microglia
- Vascular:
- Endothelial cells
  - Pericytes





# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

### --Neurons:

- Photoreceptors (PRs)
- Bipolar cells
- Ganglion cells

----Amacrine cells

----Horizontal cells

### --Glial:

- Müller cells
  - Astrocytes
  - Microglia
- Vascular:
- Endothelial cells
  - Pericytes

*In two words, how would one describe/classify amacrine cells and horizontal cells?*

They are inhibitory **interneurons**

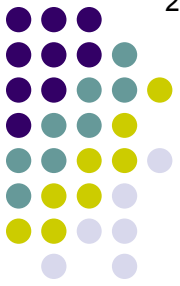
**'Interneurons'**—that word suggests amacrine cells and horizontal cells provide connections between other neural elements. With which neural elements are each associated?

--Horizontal cells interconnect...?

--Amacrine cells interconnect...

# A

## Retinal Anatomy and Histology



What is the difference between the retina and the neurosensory retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

### --Neurons:

- Photoreceptors (PRs)
- Bipolar cells
- Ganglion cells

----Amacrine cells

----Horizontal cells

### --Glial:

- Müller cells
  - Astrocytes
  - Microglia
- Vascular:
- Endothelial cells
  - Pericytes

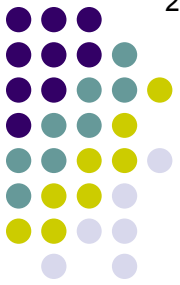
*In two words, how would one describe/classify amacrine cells and horizontal cells?*

They are inhibitory **interneurons**

**'Interneurons'**—that word suggests amacrine cells and horizontal cells provide connections between other neural elements. With which neural elements are each associated?

--Horizontal cells interconnect...PRs

--Amacrine cells interconnect...



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

### --Neurons:

- Photoreceptors (PRs)
- Bipolar cells
- Ganglion cells

----**Amacrine cells**

----**Horizontal cells**

### --Glial:

- Müller cells
  - Astrocytes
  - Microglia
- Vascular:
- Endothelial cells
  - Pericytes

*In two words, how would one describe/classify amacrine cells and horizontal cells?*

They are inhibitory **interneurons**

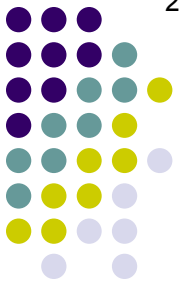
**'Interneurons'**—that word suggests amacrine cells and horizontal cells provide connections between other neural elements. With which neural elements are each associated?

--Horizontal cells interconnect...PRs

--Amacrine cells interconnect...?

# A

## Retinal Anatomy and Histology



What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

### --Neurons:

- Photoreceptors (PRs)
- Bipolar cells
- Ganglion cells

----**Amacrine cells**

----**Horizontal cells**

### --Glial:

- Müller cells
  - Astrocytes
  - Microglia
- Vascular:
- Endothelial cells
  - Pericytes

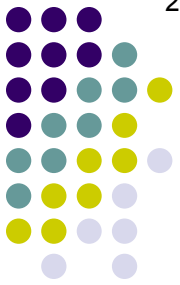
*In two words, how would one describe/classify amacrine cells and horizontal cells?*

They are inhibitory **interneurons**

**'Interneurons'**—that word suggests amacrine cells and horizontal cells provide connections between other neural elements. With which neural elements are each associated?

--Horizontal cells interconnect...PRs

--Amacrine cells interconnect...Bipolar cells, and ganglion cells



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to

*Noting that amacrine and horizontal cells are interconnectors dovetails nicely with a fundamental way you should think about the neural elements of the neurosensory retina.*

*No question yet—keep going*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

--Glial:

----Müller cells

----Astrocytes

----Microglia

--Vascular:

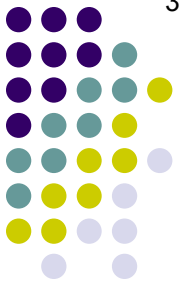
----Endothelial cells

----Pericytes

*'Interneurons'—that word suggests amacrine cells and horizontal cells provide connections between other neural elements. With which neural elements are each associated?*

--Horizontal cells interconnect...PRs

--Amacrine cells interconnect...Bipolar cells, and ganglion cells



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to

*Noting that amacrine and horizontal cells are interconnectors dovetails nicely with a fundamental way you should think about the neural elements of the neurosensory retina. Specifically, all of the neural elements can be conceptualized as belonging to one of two pathways—what are they?*

--Neurons:

----Photoreceptors (PRs)

?  
pathway

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

?  
pathway

--Glial:

----Müller cells

----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

----Pericytes

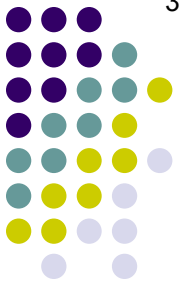
*'Interneurons'—that word suggests amacrine cells and horizontal cells provide connections between other neural elements. With which neural elements are each associated?*

--Horizontal cells interconnect...PRs

--Amacrine cells interconnect...Bipolar cells, and ganglion cells

# A

## Retinal Anatomy and Histology



What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to

*Noting that amacrine and horizontal cells are interconnectors dovetails nicely with a fundamental way you should think about the neural elements of the neurosensory retina. Specifically, all of the neural elements can be conceptualized as belonging to one of two pathways—what are they?*

The *vertical pathway* comprised of (in order) the PRs, bipolar cells, and ganglion cells; and the *horizontal pathway* comprised of amacrine and horizontal cells

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

*Vertical  
pathway*

*Horizontal  
pathway*

--Glial:

----Müller cells

----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

----Pericytes

*'Interneurons'—that word suggests amacrine cells and horizontal cells provide connections between other neural elements. With which neural elements are each associated?*

--Horizontal cells interconnect...PRs

--Amacrine cells interconnect...Bipolar cells, and ganglion cells



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina?

While often used interchangeably (including, on occasion, in this slide-set),

What does it mean to say the vertical pathway is, well, vertical?

...ory retina refers to  
...s nicely with a  
...neurosensory retina.  
Specifically, all of the neural elements can be conceptualized as belonging to one of two pathways—what are they?  
The **vertical pathway** comprised of (in order) the PRs, bipolar cells, and ganglion cells; and the horizontal pathway comprised of amacrine and horizontal cells

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

--Glial:

----Müller cells

----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

----Pericytes

Vertical  
pathway

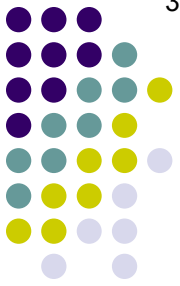
Horizontal  
pathway

'Interneurons'—that word suggests amacrine cells and horizontal cells provide connections between other neural elements. With which neural elements are each associated?

--Horizontal cells interconnect...PRs

--Amacrine cells interconnect...Bipolar cells, and ganglion cells





# A

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina?

While often used interchangeably (including, on occasion, in this slide-set),

**What does it mean to say the vertical pathway is, well, vertical?**

It means that this is the direct path that neural impulses take in getting out of the eye and to the visual cortex.

Specifically, all of the neural elements can be conceptualized as belonging to one of two pathways—what are they?

The **vertical pathway** comprised of (in order) the PRs, bipolar cells, and ganglion cells; and the **horizontal pathway** comprised of amacrine and horizontal cells

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

--Glial:

----Müller cells

----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

----Pericytes

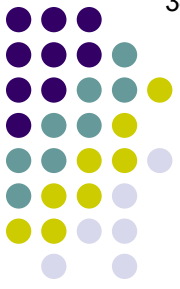
**Vertical  
pathway**

*Horizontal  
pathway*

'Interneurons'—that word suggests amacrine cells and horizontal cells provide connections between other neural elements. With which neural elements are each associated?

--Horizontal cells interconnect...PRs

--Amacrine cells interconnect...Bipolar cells, and ganglion cells



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina?

While often used interchangeably (including, on occasion, in this slide-set),

**What does it mean to say the vertical pathway is, well, vertical?**

It means that this is the direct path that neural impulses take in getting out of the eye and to the visual cortex. In contrast, the horizontal pathway conducts impulses from one area of the retina to another.

Specifically, all of the neural elements can be conceptualized as belonging to one of two pathways—what are they?

The **vertical pathway** comprised of (in order) the PRs, bipolar cells, and ganglion cells; and the **horizontal pathway** comprised of amacrine and horizontal cells

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

----Ganglion cells

----Amacrine cells

----Horizontal cells

*Vertical  
pathway*

*Horizontal  
pathway*

--Glial:

----Müller cells

----Astrocytes

----Microglia

--Vascular:

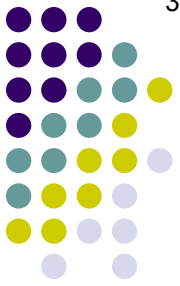
----Endothelial cells

----Pericytes

'Interneurons'—that word suggests amacrine cells and horizontal cells provide connections between other neural elements. With which neural elements are each associated?

--Horizontal cells interconnect...PRs

--Amacrine cells interconnect...Bipolar cells, and ganglion cells



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

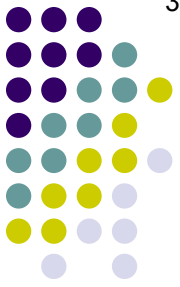
----Photoreceptors (PRs)

-----Disposer cells

*Let's drill down on the PRs. In just a few words, what absolutely fundamental role do PRs play in the vision process?*

## A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

-----Disposer cells

*Let's drill down on the PRs. In just a few words, what absolutely fundamental role do PRs play in the vision process?*

They convert light energy into electrical (neural) impulses, ie, **phototransduction**



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----**Photoreceptors (PRs)**

Disorder cells

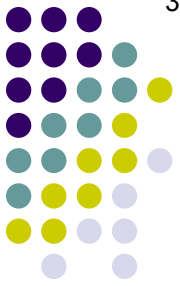
*Let's drill down on the PRs. In just a few words, what absolutely fundamental role do PRs play in the vision process?*

They convert light energy into electrical (neural) impulses, ie, **phototransduction**

*There are two basic PR types—what are they?*

# A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----**Photoreceptors (PRs)**

Displer cells

*Let's drill down on the PRs. In just a few words, what absolutely fundamental role do PRs play in the vision process?*

They convert light energy into electrical (neural) impulses, ie, **phototransduction**

*There are two basic PR types—what are they?*

Rods and cones



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

Displer cells

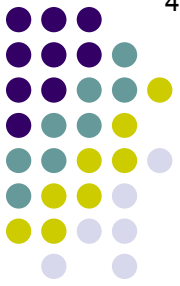
*Let's drill down on the PRs. In just a few words, what absolutely fundamental role do PRs play in the vision process?*

They convert light energy into electrical (neural) impulses, ie, **phototransduction**

*There are two basic PR*

*What is the origin-story for the names 'rod' and 'cone'?*

**Rods and cones**



*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

Displer cells

*Let's drill down on the PRs. In just a few words, what absolutely fundamental role do PRs play in the vision process?*

They convert light energy into electrical (neural) impulses, ie, **phototransduction**

*There are two basic PR*

**Rods and cones**

*What is the origin-story for the names 'rod' and 'cone'?*

They're named for the shape of their

two words





# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

Displer cells

*Let's drill down on the PRs. In just a few words, what absolutely fundamental role do PRs play in the vision process?*

They convert light energy into electrical (neural) impulses, ie, **phototransduction**

*There are two basic PR*

**Rods and cones**

*What is the origin-story for the names 'rod' and 'cone'?*

They're named for the shape of their outer segments



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

Displer cells

*Let's drill down on the PRs. In just a few words, what absolutely fundamental role do PRs play in the vision process?*

They convert light energy into electrical (neural) impulses, ie, **phototransduction**

*There are two basic PR*

**Rods and cones**

*What is the origin-story for the names 'rod' and 'cone'?*

They're named for the shape of their outer segments—cone outer segs are conical, whereas rod outer segs are rodical (j/k, that's not a word)



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----**Photoreceptors (PRs)**

Disorder cells

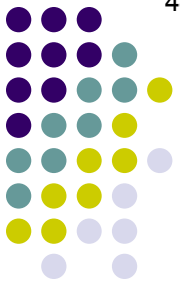
*Let's drill down on the PRs. In just a few words, what absolutely fundamental role do PRs play in the vision process?*

They convert light energy into electrical (neural) impulses, ie, **phototransduction**

*There are two basic PR types—what are they?*

Rods and cones

*How many rods and how many cones reside in the average human retina?*



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----**Photoreceptors (PRs)**

-----Disposer cells

*Let's drill down on the PRs. In just a few words, what absolutely fundamental role do PRs play in the vision process?*

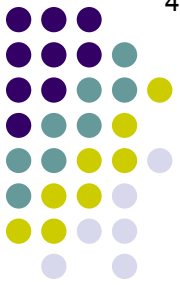
They convert light energy into electrical (neural) impulses, ie, **phototransduction**

*There are two basic PR types—what are they?*

Rods and cones

*How many rods and how many cones reside in the average human retina?*

Ballpark it at 100-125M rods, and 6-7M cones



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----**Photoreceptors (PRs)**

-----Bipolar cells

*Let's drill down on the PRs. In just a few words, what absolutely fundamental role do PRs play in the vision process?*

They convert light energy into electrical (neural) impulses, ie, **phototransduction**

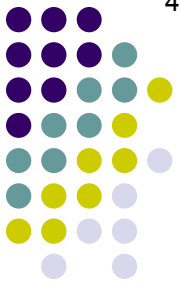
*There are two basic PR types—what are they?*

Rods and cones

*How many rods and how many cones reside in the average human retina?*

Ballpark it at 100-125M rods, and 6-7M cones

*Rods and cones differ in many ways, but which difference is probably the most fundamental?*



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

Displer cells

*Let's drill down on the PRs. In just a few words, what absolutely fundamental role do PRs play in the vision process?*

They convert light energy into electrical (neural) impulses, ie, **phototransduction**

*There are two basic PR types—what are they?*

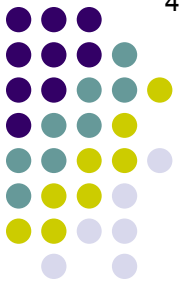
Rods and cones

*How many rods and how many cones reside in the average human retina?*

Ballpark it at 100-125M rods, and 6-7M cones

*Rods and cones differ in many ways, but which difference is probably the most fundamental?*

Cones provide color vision, whereas rods provide monochromatic vision



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

*With regard to color vision: How many different sorts of cones are there?*

*What fundamental role do PRs play*

*transduction*

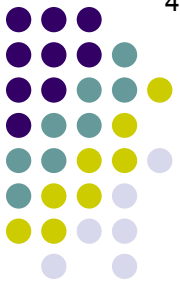
*retina?*

*What part of the rod and cone, and what part of the cone*

*Rods and cones differ in many ways, but which difference is probably the most fundamental?*

*Cones provide color vision, whereas rods provide monochromatic vision*

**Cones provide color vision**



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

*With regard to color vision: How many different sorts of cones are there?*

Three

*What fundamental role do PRs play*

*in transduction*

*in the retina?*

*Rods and cones differ in many ways, but which difference is probably the most fundamental?*

*Cones provide color vision, whereas rods provide monochromatic vision*

**Cones provide color vision**





# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

*With regard to color vision: How many different sorts of cones are there?*

Three

*How do these three subpopulations differ from one another?*

*What fundamental role do PRs play*

*in vision?*

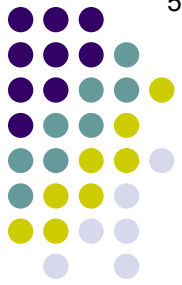
*What is the difference between the retina and the neurosensory retina?*

*Rods and cones differ in many ways, but which difference is probably the most fundamental?*

**Cones provide color vision**, whereas rods provide monochromatic vision

# A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

**--Neurons:**

*With regard to color vision: How many different sorts of cones are there?*

Three

*How do these three subpopulations differ from one another?*

In terms of the wavelength of light to which they are most responsive

*What fundamental role do PRs play*

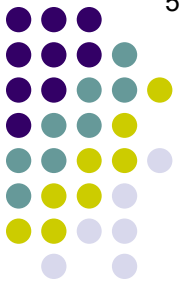
*in transduction*

*in the retina?*

*Rods and cones differ in many ways, but which difference is probably the most fundamental?*

*Rods provide monochromatic vision, whereas rods provide monochromatic vision*

**Cones provide color vision**



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

With regard to color vision: How many different sorts of cones are there?

Three

How do these three subpopulations differ from one another?

In terms of the wavelength of light to which they are most responsive

What are the three wavelengths?

--?

--?

--?

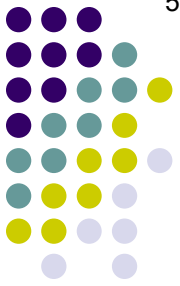
mental role do PRs play

nsduction

ina?

Rods and cones differ in many ways, but which difference is probably the most fundamental?

**Cones provide color vision**, whereas rods provide monochromatic vision



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

**--Neurons:**

*With regard to color vision: How many different sorts of cones are there?*

Three

*How do these three subpopulations differ from one another?*

In terms of the wavelength of light to which they are most responsive

*What are the three wavelengths?*

--Short (S cones)

--Medium (M cones)

--Long (L cones)

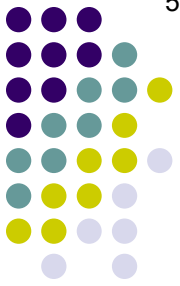
*What fundamental role do PRs play*

*in transduction*

*of the retina?*

*Rods and cones differ in many ways, but which difference is probably the most fundamental?*

**Cones provide color vision**, whereas rods provide monochromatic vision



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

**--Neurons:**

*With regard to color vision: How many different sorts of cones are there?*

Three

*How do these three subpopulations differ from one another?*

In terms of the wavelength of light to which they are most responsive

*What are the three wavelengths? Short, medium and long? Why not just say blue, green and red?*

**--Short (S cones)**

**--Medium (M cones)**

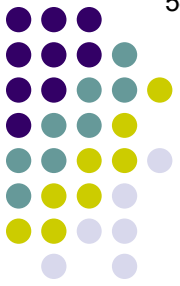
**--Long (L cones)**

*What fundamental role do PRs play*

*in transduction*

*Rods and cones differ in many ways, but which difference is probably the most fundamental?*

**Cones provide color vision**, whereas rods provide monochromatic vision



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

With regard to color vision: How many different sorts of cones are there?

Three

How do these three subpopulations differ from one another?

In terms of the wavelength of light to which they are most responsive

What are the three wavelengths?

--Short (S cones)

--Medium (M cones)

--Long (L cones)

Short, medium and long? Why not just say **blue**, **green** and **red**?

We used to. However, we now realize that perceived color does not stand in a 1:1 relationship with stimulation of a particular type of cone. Rather, cones are cross-connected into receptive fields, and work in a coordinated fashion to recognize contrasting levels of the color-pairs **red-green**, and **blue-yellow**.

Rods and cones differ in many ways, but which difference is probably the most fundamental?

**Cones provide color vision**, whereas rods provide monochromatic vision



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

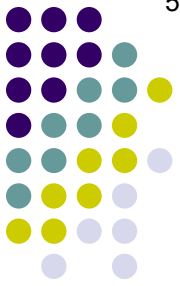
*The neurosensory retina contains three classes of cells—what are they?  
There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

*Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?*

----Pericytes



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

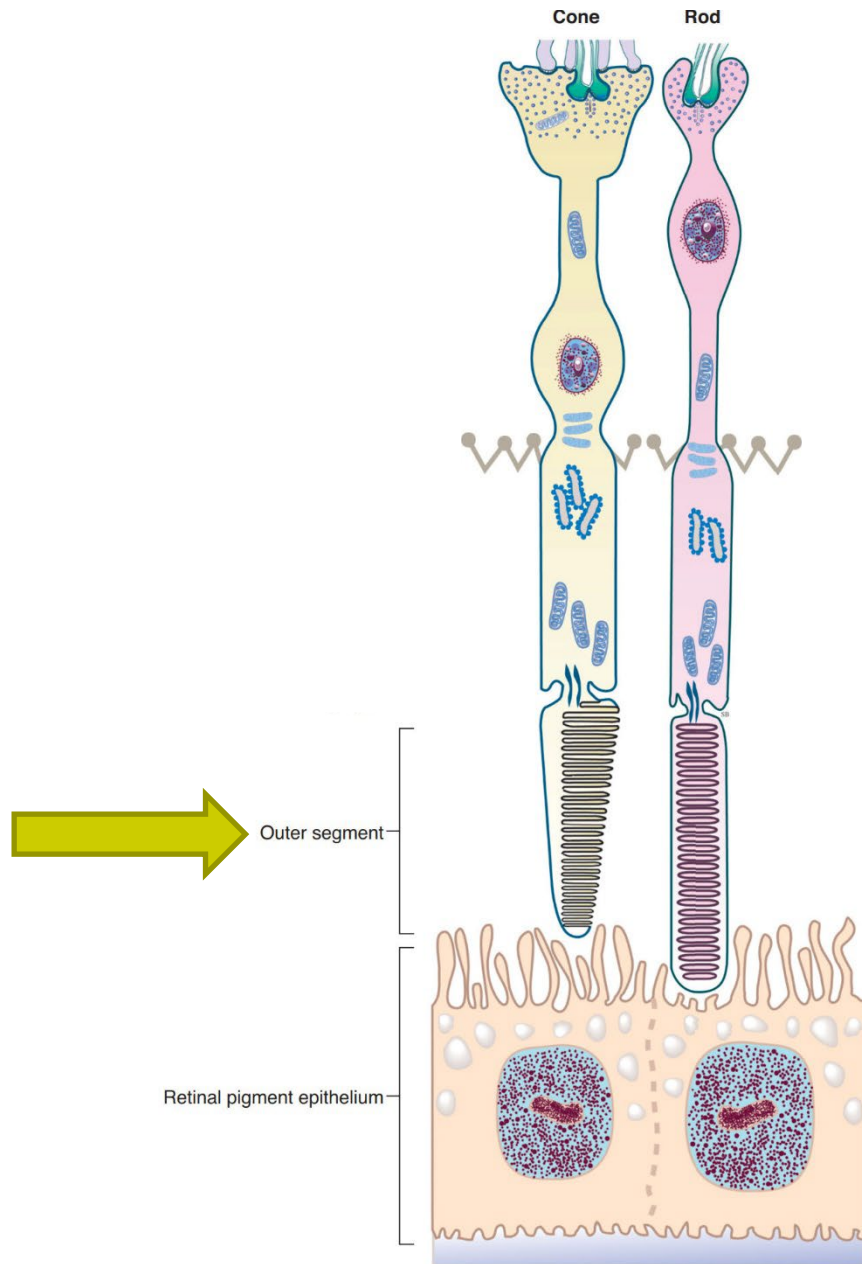
----Photoreceptors (PRs)

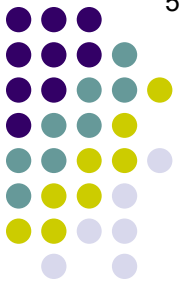
*Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?*  
 The outer segment. As mentioned, the outer segs of rods and cones are rod-shaped and conical, respectively.

----Pericytes



# Retinal Anatomy and Histology





# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

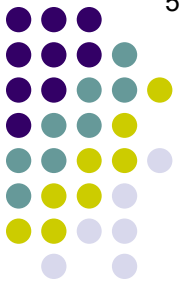
*In this context, what does the word 'outer' intend to convey?*

*Let's talk PR morphology.  
 The outer segment. As r*

**outer segment.**

*one?  
 spective.*

----Pericytes



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

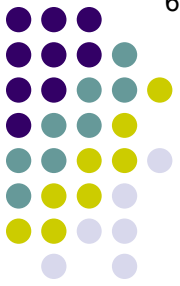
----Photoreceptors (PRs)

Let's talk PR morphology.  
The **outer segment**. As r

*In this context, what does the word 'outer' intend to convey?*  
As is almost always the case with regards to eye anatomy, *outer* means 'closer to the eye wall' (the correct implication being that the term *inner* means 'closer to the center of the globe')

one?  
spectively.

----Pericytes



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

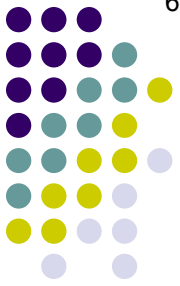
--Neurons:

----Photoreceptors (PRs)

*Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?*  
 The outer segment. As mentioned, the outer segs of rods and cones are rod-shaped and conical, respectively.

*What is the dominant morphologic feature of a PR outer seg?*

----Pericytes



*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

*Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?*  
The outer segment. As mentioned, the outer segs of rods and cones are rod-shaped and conical, respectively.

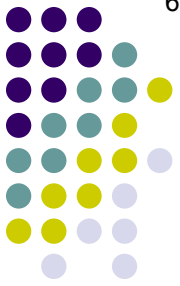
*What is the dominant morphologic feature of a PR outer seg?*

The outer segs contain the PR's

----Pericytes

## A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

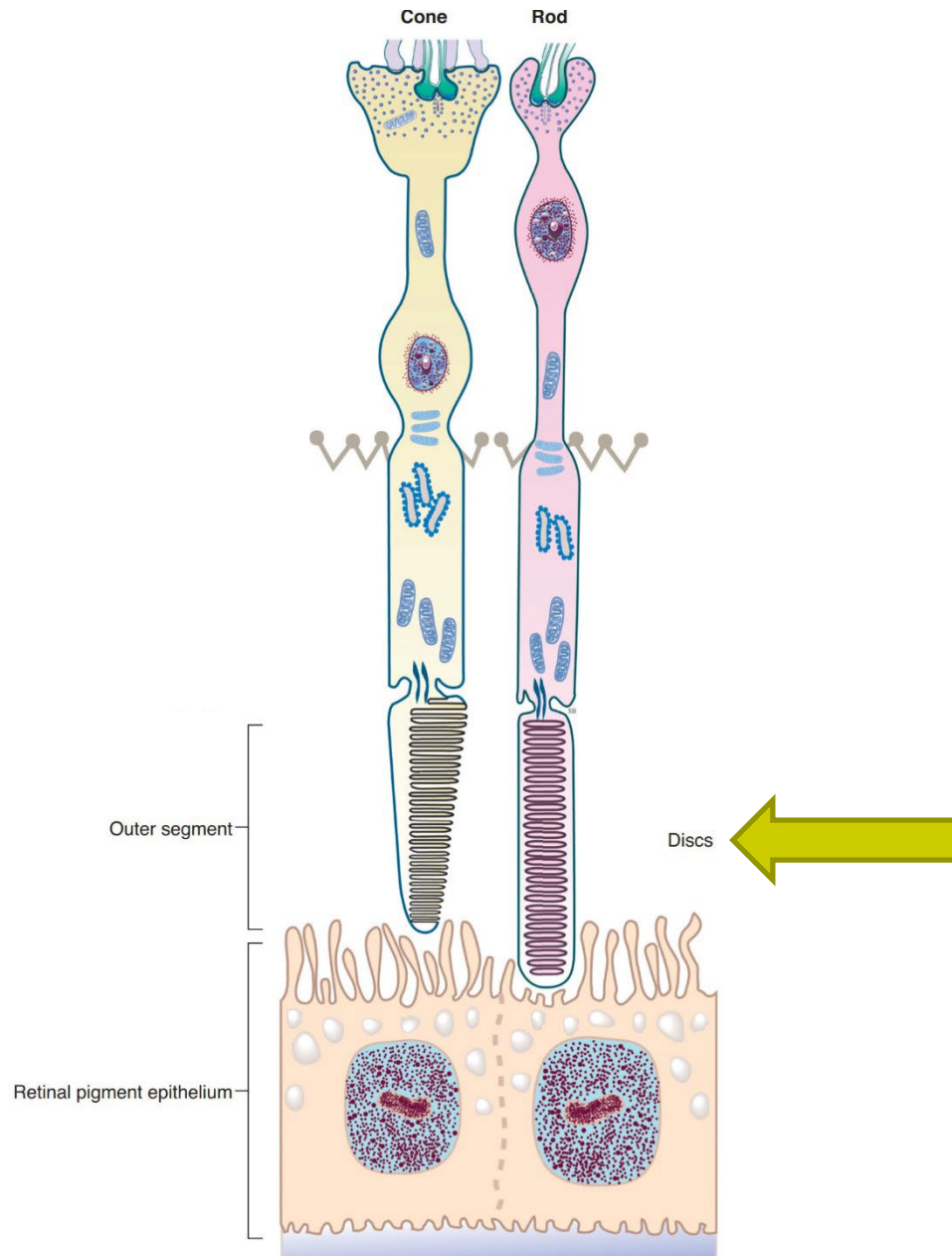
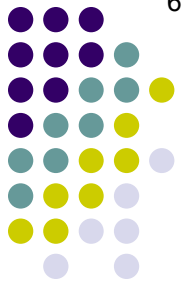
----Photoreceptors (PRs)

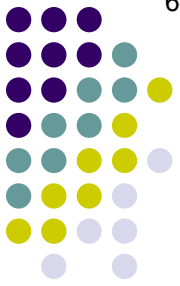
*Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?*  
The outer segment. As mentioned, the outer segs of rods and cones are rod-shaped and conical, respectively.

*What is the dominant morphologic feature of a PR outer seg?*  
The outer segs contain the PR's discs

----Pericytes

# Retinal Anatomy and Histology





# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

*What role do the discs play in the vision process?*

*mentioned—which one?  
 ed and conical, respectively.*

*What is the dominant morphologic feature of a PR outer seg?*

The outer segs contain the PR's **discs**

----Pericytes



# Q/A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

*What role do the discs play in the vision process?*

The disc membranes contain the protein [redacted], which is the substance that reacts to the incoming light and kicks off the process of phototransduction

*What is the dominant morphologic feature of a PR outer seg?*

The outer segs contain the PR's **discs**

*mentioned—which one?  
ed and conical, respectively.*

----Pericytes



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

*What role do the discs play in the vision process?*

The disc membranes contain the protein **rhodopsin**, which is the substance that reacts to the incoming light and kicks off the process of phototransduction

*What is the dominant morphologic feature of a PR outer seg?*

The outer segs contain the PR's

**discs**

*mentioned—which one?  
 ed and conical, respectively.*

----Pericytes



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

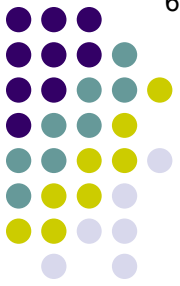
----Photoreceptors (PRs)

*Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?*  
 The outer segment. As mentioned, the outer segs of rods and cones are rod-shaped and conical, respectively.

*What is the dominant morphologic feature of a PR outer seg?*  
 The outer segs contain the PR's discs

*How many discs are contained within a PR outer seg?*

----Pericytes



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

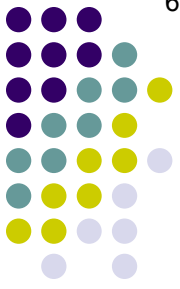
----Photoreceptors (PRs)

*Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?*  
 The outer segment. As mentioned, the outer segs of rods and cones are rod-shaped and conical, respectively.

*What is the dominant morphologic feature of a PR outer seg?*  
 The outer segs contain the PR's discs

*How many discs are contained within a PR outer seg?*  
 About 1000/rod (BCSC didn't give a number for cones)

----Pericytes



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

*Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?*  
 The outer segment. As mentioned, the outer segs of rods and cones are rod-shaped and conical, respectively.

*What is the dominant morphologic feature of a PR outer seg?*  
 The outer segs contain the PR's discs

*How many discs are contained within a PR outer seg?*  
 About 1000/rod (BCSC didn't give a number for cones)

*After a disc's phototransduction ability is spent, what happens to it?*

----Pericytes

## A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

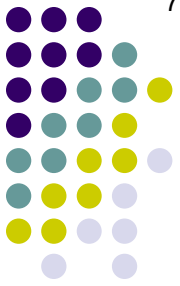
*Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?*  
 The outer segment. As mentioned, the outer segs of rods and cones are rod-shaped and conical, respectively.

*What is the dominant morphologic feature of a PR outer seg?*  
 The outer segs contain the PR's discs

*How many discs are contained within a PR outer seg?*  
 About 1000/rod (BCSC didn't give a number for cones)

*After a disc's phototransduction ability is spent, what happens to it?*  
 It is 'shed' by the PR, and gobbled up by adjacent RPE cells

----Pericytes



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

*Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?*

The outer segments are adjacent to the RPE cells, respectively. *How 'adjacent' are the adjacent RPE cells?*

*What is the...*

The outer segments...

*How many...*

About 100...

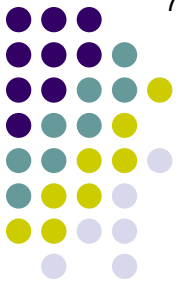
*After a disc's phototransduction ability is spent, what happens to it?*

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes

# Q/A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

*Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?*

The outer segments are located in the outer retina, and the inner segments are located in the inner retina, respectively.

**How 'adjacent' are the adjacent RPE cells?**

Really adjacent. As in, the **apical v basal** aspects of the PRs interdigitate intimately with the highly convoluted **apical v basal** aspects of the RPE

*What is the difference between the outer and inner segments?*

The outer segments

*How many*

About 100

*After a disc's phototransduction ability is spent, what happens to it?*

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes





# A

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The neurosensory retina contains three classes of cells—what are they?  
There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?

The outer segments are adjacent to the RPE, and the inner segments are adjacent to the inner limiting membrane, respectively.

How 'adjacent' are the adjacent RPE cells?

Really adjacent. As in, the apical aspects of the PRs interdigitate intimately with the highly convoluted apical aspects of the RPE

What is the RPE?

The outer limiting membrane

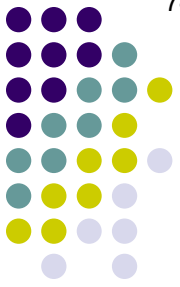
How many RPE cells?

About 100

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by adjacent RPE cells

----Pericytes



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Ne So, the PRs and RPE cells are oriented apex-to-apex? How did that come about?

----P

Let's talk PR

The outer segments are how adjacent are the adjacent RPE cells?

Really adjacent. As in, the apical aspects of the PRs interdigitate intimately with the highly convoluted apical aspects of the RPE

What is the

The outer

How many

About 100

which one?

respectively.

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Ne So, the PRs and RPE cells are oriented apex-to-apex? How did that come about?  
 ----P It came about for the same reason the ciliary body has two epithelial layers which are likewise oriented apex-to-apex: **Embryology**.

Let's talk PR

The outer segments of adjacent PRs are adjacent. How adjacent are the adjacent RPE cells?

Really adjacent. As in, the apical aspects of the PRs interdigitate intimately with the highly convoluted apical aspects of the RPE

What is the

The outer

How many

About 100

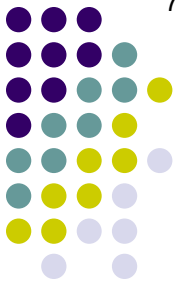
Which one?

respectively.

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The neurosensory retina contains three classes of cells—what are they?  
There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Ne So, the PRs and RPE cells are oriented apex-to-apex? How did that come about?

----P It came about for the same reason the ciliary body has two epithelial layers which are likewise oriented apex-to-apex: **Embryology**. If you have no idea what I'm talking about, you need to review slide-set FELT21 sometime soon!

Let's talk PR

The outer segments of adjacent PRs are oriented in opposite directions.

Really adjacent. As in, the apical aspects of the PRs interdigitate intimately with the highly convoluted apical aspects of the RPE

What is the

The outer

How many

About 100

Which one?

respectively.

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?

The outer segments are located in the **outer nuclear layer** and the inner segments are located in the **outer plexiform layer**, respectively.

**How 'adjacent' are the adjacent RPE cells?**

Really adjacent. As in, the apical aspects of the PRs interdigitate intimately with the highly convoluted apical aspects of the RPE

What is the **interdigitation**?

The outer segments

**Interdigitate**—does that mean the PRs and RPE cells are attached to one another?

How many

About 100

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

Let's talk PR morphology. PRs have several portions, one of which we've already mentioned—which one?

The outer segments are adjacent to the RPE, and the inner segments are adjacent to the inner limiting membrane, respectively.

**How 'adjacent' are the adjacent RPE cells?**

Really adjacent. As in, the apical aspects of the PRs interdigitate intimately with the highly convoluted apical aspects of the RPE

What is the relationship between the PRs and the RPE?

The outer segments

**Interdigitate—does that mean the PRs and RPE cells are attached to one another?**

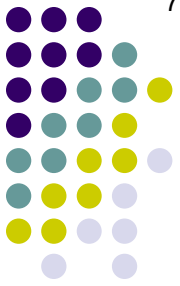
How many? Negatory good buddy, and this is a really important factoid to have on hand—there

About 100 are no direct connections between the PRs and the RPE

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

Let's talk about **Why is this fact so important?**

The outer

mentioned—which one?

respectively.

What is the

The outer

ely with the

How many

About 100

**Interdigitate—does that mean the PRs and RPE cells are attached to one another?**

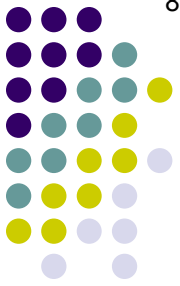
**Negative good buddy, and this is a really important factoid to have on hand—there**

**are no direct connections between the PRs and the RPE**

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

Let's talk about the space between the PRs and RPE. Why is this fact so important?

The outer nuclear layer is the space between the PRs and RPE. Because it means a potential space exists between the PRs and RPE

mentioned—which one?

respectively.

ely with the

What is the

The outer

interdigitate—does that mean the PRs and RPE cells are attached to one another?

How many? Negatory good buddy, and this is a really important factoid to have on hand—there

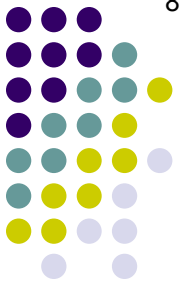
About 100 are **no direct connections between the PRs and the RPE**

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes





# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

Let's talk about the space between the PRs and RPE. Why is this fact so important?

The outer space between the PRs and RPE. Because it means a potential space exists between the PRs and RPE

mentioned—which one?

respectively.

ely with the

What is the clinical relevance of this space? Is this potential space of clinical relevance?

The outer

interdigitate—does not mean the PRs and RPE cells are attached to one another?

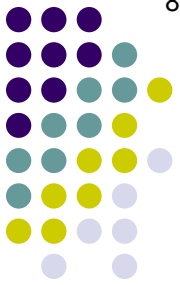
How many negative good buddies, and this is a really important factoid to have on hand—there

About 100 are **no direct connections between the PRs and the RPE**

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes



What is the difference between the retina and the neurosensory retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

Let's talk about the space between the PRs and RPE. Why is this fact so important?

The outer space between the PRs and RPE is important because it means a potential space exists between the PRs and RPE.

What is the clinical relevance of this space? Is this potential space of clinical relevance?

The outer space between the PRs and RPE is indeed clinically relevant. This space is the one that opens up in a **two words**.

Interdigitate—does not mean the PRs and RPE cells are attached to one another?

How many negative good buddies are there? Negatively good buddy, and this is a really important factoid to have on hand—there

About 100 **are no direct connections between the PRs and the RPE**

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

Let's talk about the space between the PRs and RPE. Why is this fact so important?

The outer space between the PRs and RPE. Because it means a potential space exists between the PRs and RPE.

What is the clinical relevance of this space? Is this potential space of clinical relevance?

The outer space between the PRs and RPE. Indeed it is. This space is the one that opens up in a retinal detachment.

How many connections are there between the PRs and RPE? Interodigitate—does not mean the PRs and RPE cells are attached to one another?

How many connections are there between the PRs and RPE? Negatory good buddy, and this is a really important factoid to have on hand—there

About 100 connections. **There are no direct connections between the PRs and the RPE**

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by adjacent RPE cells

----Pericytes



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

What are the three classes/mechanisms of retinal detachment?

--?

--?

--?

Indeed it is. This space is the one that opens up in a **retinal detachment**.

Interdigitate—does not mean the PRs and RPE cells are attached to one another?

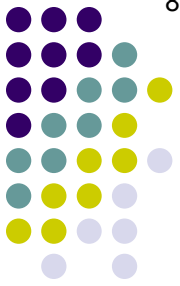
Negative good buddy, and this is a really important factoid to have on hand—there

**are no direct connections between the PRs and the RPE**

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes



What is the difference between the retina and the neurosensory retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

What are the three classes/mechanisms of retinal detachment?

--Rhegmatogenous (= 2ndry to a two words)

--Tractional

--Serous

Indeed it is. This space is the one that opens up in a **retinal detachment**.

Interdigitate—does not mean the PRs and RPE cells are attached to one another?

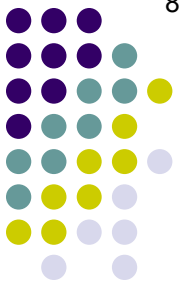
Negative good buddy, and this is a really important factoid to have on hand—there

are **no direct connections between the PRs and the RPE**

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The *neurosensory retina* contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?

--Neurons:

----Photoreceptors (PRs)

What are the three classes/mechanisms of retinal detachment?

- Rhegmatogenous (= 2ndry to a retinal break )
- Tractional
- Serous

Indeed it is. This space is the one that opens up in a **retinal detachment**.

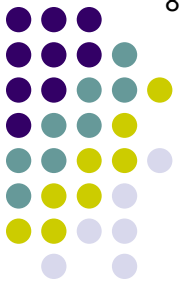
Interdigitate—does not mean the PRs and RPE cells are attached to one another?

Negative good buddy, and this is a really important factoid to have on hand—there **are no direct connections between the PRs and the RPE**

After a disc's phototransduction ability is spent, what happens to it?

It is 'shed' by the PR, and gobbled up by **adjacent RPE cells**

----Pericytes



## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

The neurosensory retina contains three classes of cells—what are they?  
There are five types of neural elements—what are they? What are the

**For more on retinal detachment, see slide-set R35**

### ----Photoreceptors (PRs)

Let's talk about retinal detachment. Why is this fact important? Because it may be the most common cause of blindness. What are the three classes/mechanisms of retinal detachment? --Rhegmatogenous (= 2ndry to a retinal break ) --Tractional --Serous. Shed— which one? respectively.

The outer layer of the retina is attached to the inner layer of the RPE with the interdigitation of the photoreceptor outer segments and the RPE cells. Indeed it is. This space is the one that opens up in a retinal detachment. Interdigitate— does this mean the PRs and RPE cells are attached to one another? Negative good buddy, and this is a really important factor to have on hand—there are no direct connections between the PRs and the RPE.

How many photoreceptors are there? About 100 million. After a disc's phototransduction ability is spent, what happens to it? It is 'shed' by the PR, and gobbled up by adjacent RPE cells.

### ----Pericytes



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
There are five types of neural elements—what are they? What are the  
three types of glial cells? The two vascular cell types?*

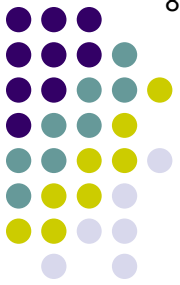
--Neurons:

----Photoreceptors (PRs)

-----Disposer cells

*Continuing our look at PR morphology...What portion is next to the outer segment?*





# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

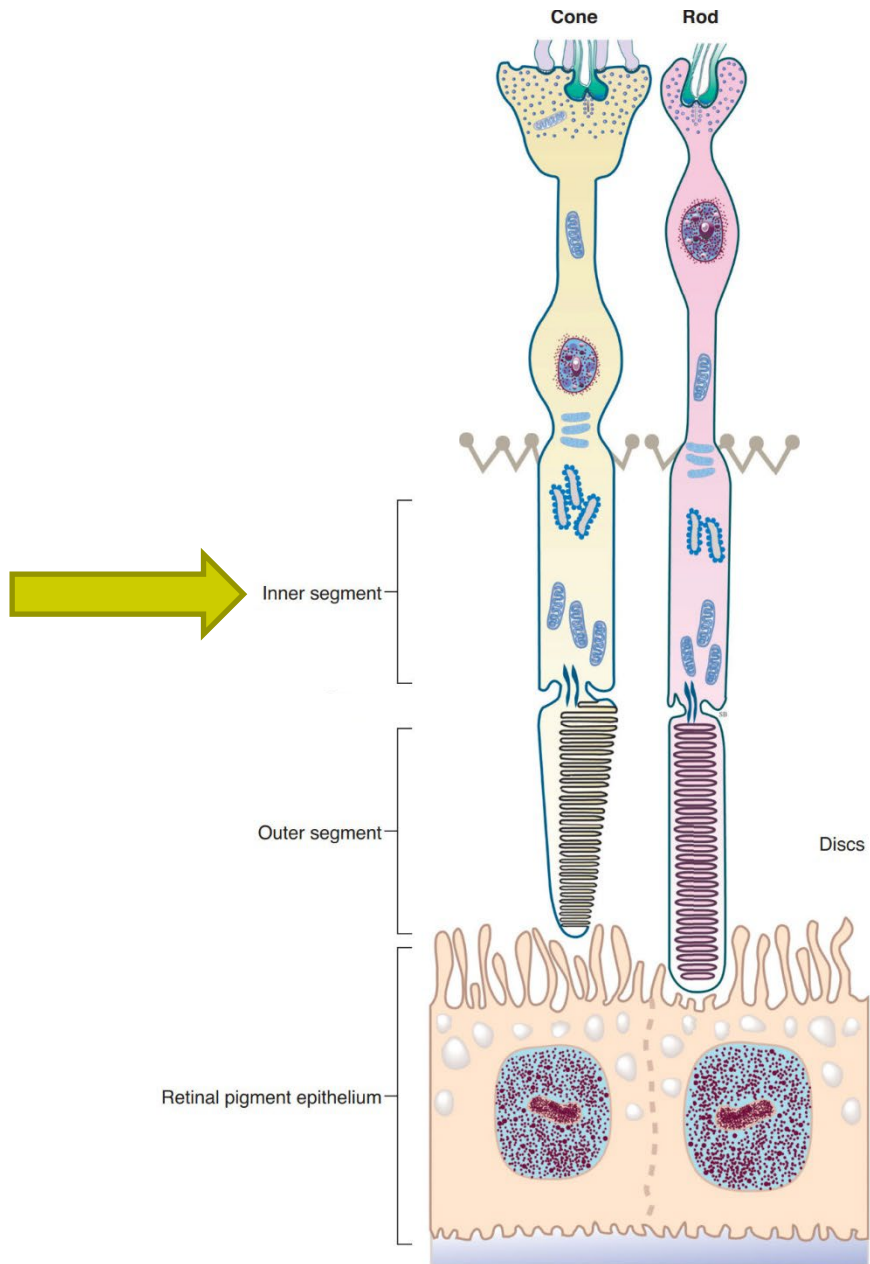
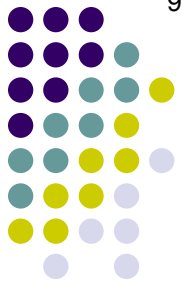
--Neurons:

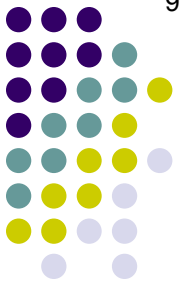
----Photoreceptors (PRs)

-----Disposer cells

*Continuing our look at PR morphology...What portion is next to the outer segment?  
 The inner segment*

# Retinal Anatomy and Histology





# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

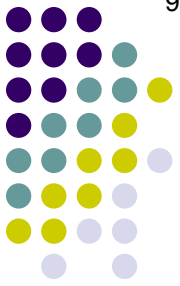
--Neurons:

----Photoreceptors (PRs)

-----Disposer cells

*Continuing our look at PR morphology...What portion is next to the outer segment?*  
 The inner segment

*The inner and outer segments are connected by a specific sort of structure—what is it?*



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

-----Disposer cells

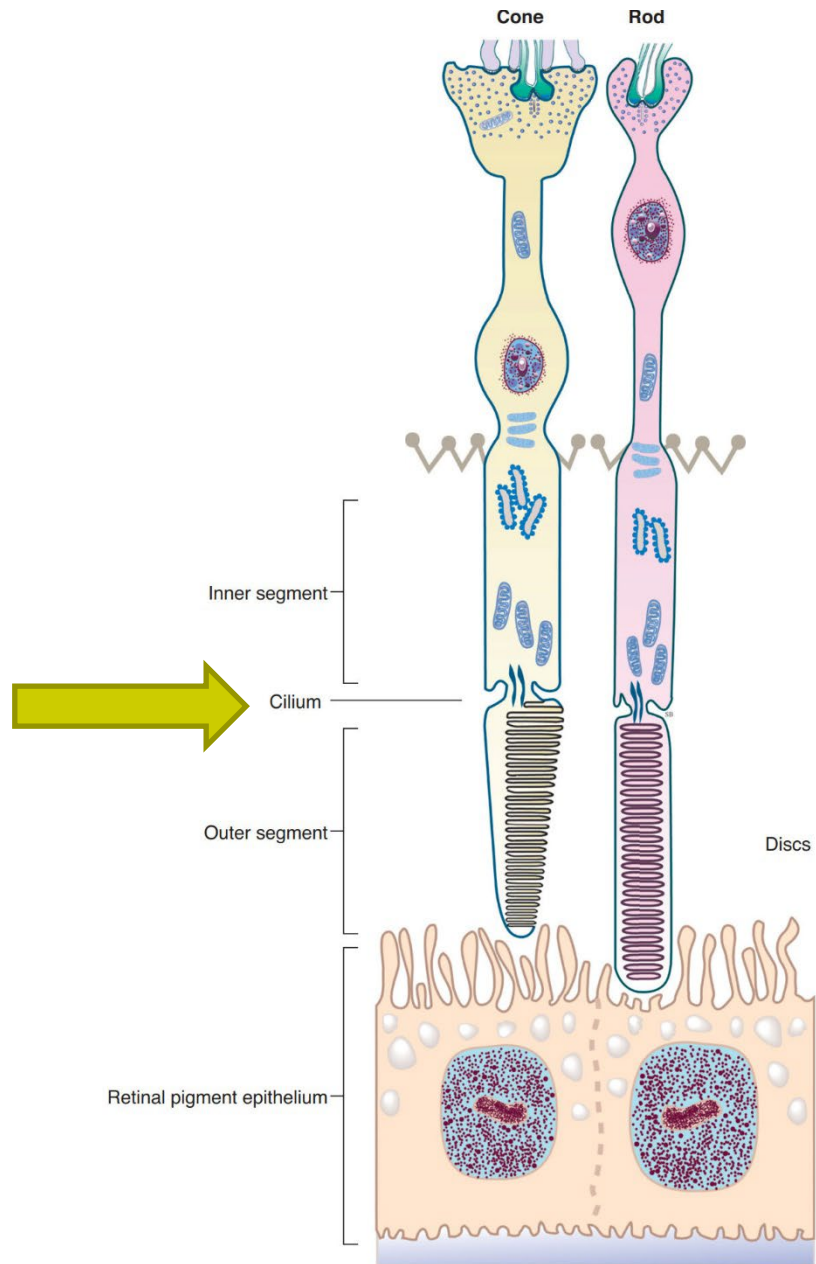
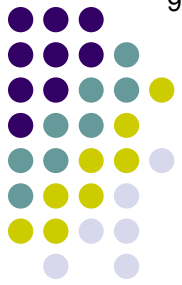
*Continuing our look at PR morphology...What portion is next to the outer segment?*

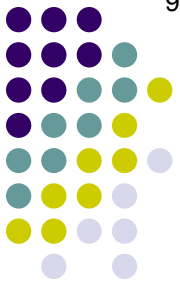
The inner segment

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A cilium

# Retinal Anatomy and Histology





# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

Disks

*Continuing our look at PR morphology...What portion is next to the outer segment?*  
 The inner segment

*The inner and outer segments are connected by a specific sort of structure—what is it?*

**cilium**

*So does this cilia allow the outer segments to wiggle about?*



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

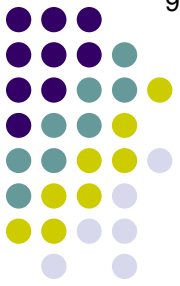
Disks

*Continuing our look at PR morphology...What portion is next to the outer segment?*  
 The inner segment

*The inner and outer segments are connected by a specific sort of structure—what is it?*

**cilium**

*So does this cilia allow the outer segments to wiggle about?*  
 No—it's a **nonmotile** cilia, not a motile one



Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina? While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to

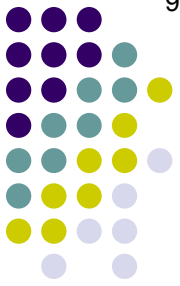
Um, OK, so there's a tiny, nonmotile cilium connecting the inner and outer segments. Why are we sidebarring about what seems like a trivial anatomic point?

The inner and outer segments are connected by a specific sort of structure—what is it?

A **cilium**

So does this cilia allow the outer segments to wiggle about?  
No—it's a **nonmotile** cilia, not a motile one





# A

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina?  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to

*Um, OK, so there's a tiny, nonmotile cilium connecting the inner and outer segments.*

*Why are we sidebarring about what seems like a trivial anatomic point?*

It's because disorders affecting the integrity of such cilia have enormous consequences for PR/retinal health and visual function—and such disorders exist

*The inner and outer segments are connected by a specific sort of structure—what is it?*

**cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to

*Um, OK, so there's a tiny, nonmotile cilium connecting the inner and outer segments.*

*Why are we sidebarring about what seems like a trivial anatomic point?*

It's because disorders affecting the integrity of such cilia have enormous consequences for PR/retinal health and visual function—and such disorders exist

*What is the general term for a disorder stemming (ahem) from defects of cilia?*

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to

*Um, OK, so there's a tiny, nonmotile cilium connecting the inner and outer segments.*

*Why are we sidebarring about what seems like a trivial anatomic point?*

It's because disorders affecting the integrity of such cilia have enormous consequences for PR/retinal health and visual function—and such disorders exist

*What is the general term for a disorder stemming (ahem) from defects of cilia?*

A **ciliopathy**

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to

*Um, OK, so there's a tiny, nonmotile cilium connecting the inner and outer segments.*

*Why are we sidebarring about what seems like a trivial anatomic point?*

It's because disorders affecting the integrity of such cilia have enormous consequences for PR/retinal health and visual function—and such disorders exist

*What is the general term for a disorder stemming (ahem) from defects of cilia?*

A **ciliopathy**

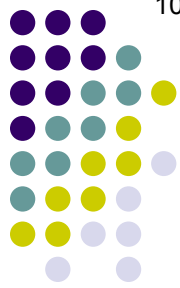
*Ciliopathies affecting cilia such as those that connect inner/outer segs have devastating effects on two other organs as well—what are they?*

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to

*Um, OK, so there's a tiny, nonmotile cilium connecting the inner and outer segments.*

*Why are we sidebarring about what seems like a trivial anatomic point?*

It's because disorders affecting the integrity of such cilia have enormous consequences for PR/retinal health and visual function—and such disorders exist

*What is the general term for a disorder stemming (ahem) from defects of cilia?*

A **ciliopathy**

*Ciliopathies affecting cilia such as those that connect inner/outer segs have devastating effects on two other organs as well—what are they?*

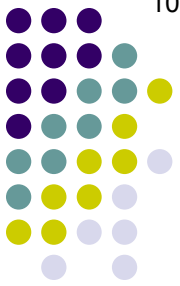
The kidney and the brain

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina?  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to

*In terms of retinal function and appearance, how does a ciliopathy present?*

--In terms of function: ?

--In terms of fundus appearance

*What is the general term for a disorder stemming (ahem) from defects of cilia?*

A **ciliopathy**

*Ciliopathies affecting cilia such as those that connect inner/outer segs have devastating effects on two other organs as well—what are they?*

The kidney and the brain

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina?  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to

*In terms of retinal function and appearance, how does a ciliopathy present?*

- In terms of function: With progressive loss of visual field and visual acuity resulting in blindness
- In terms of fundus appearance

*What is the general term for a disorder stemming (ahem) from defects of cilia?*

A **ciliopathy**

*Ciliopathies affecting cilia such as those that connect inner/outer segs have devastating effects on two other organs as well—what are they?*

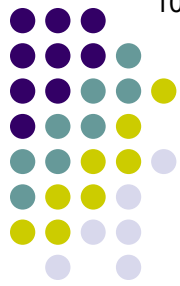
The kidney and the brain

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina?  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to

*In terms of retinal function and appearance, how does a ciliopathy present?*

- In terms of function: With progressive loss of visual field and visual acuity resulting in blindness
- In terms of fundus appearance: ?

*What is the general term for a disorder stemming (ahem) from defects of cilia?*

A **ciliopathy**

*Ciliopathies affecting cilia such as those that connect inner/outer segs have devastating effects on two other organs as well—what are they?*

The kidney and the brain

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one





# A

## Retinal Anatomy and Histology

What is the difference between the retina and the **neurosensory** retina?  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to

*In terms of retinal function and appearance, how does a ciliopathy present?*

- In terms of function: With progressive loss of visual field and visual acuity resulting in blindness
- In terms of fundus appearance: With atrophy of the NS retina and RPE, along with scattering of RPE pigment (often in a 'spiculated' pattern)

*What is the general term for a disorder stemming (ahem) from defects of cilia?*

A **ciliopathy**

*Ciliopathies affecting cilia such as those that connect inner/outer segs have devastating effects on two other organs as well—what are they?*

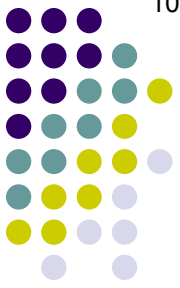
The kidney and the brain

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



Q

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?  
 Wh *Hmm... Visual field and acuity loss, along with retinal/RPE atrophy* (slide-set),  
 the *and pigment spiculation—why does that sound so familiar?* *ina* refers to

In terms of

--In terms of function: With progressive loss of visual field and visual acuity resulting in blindness  
 --In terms of fundus appearance: With atrophy of the NS retina and RPE, along with scattering of RPE pigment (often in a 'spiculated' pattern)

What is the general term for a disorder stemming (ahem) from defects of cilia?

A **ciliopathy**

Ciliopathies affecting cilia such as those that connect inner/outer segs have devastating effects on two other organs as well—what are they?

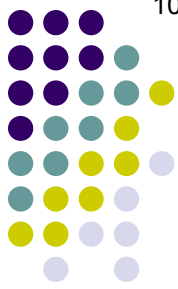
The kidney and the brain

The inner and outer segments are connected by a specific sort of structure—what is it?

A **cilium**

So does this cilia allow the outer segments to wiggle about?

No—it's a **nonmotile** cilia, not a motile one



What is the difference between the retina and the neurosensory retina?  
Wh *Hmm... Visual field and acuity loss, along with retinal/RPE atrophy* (slide-set),  
the *and pigment spiculation—why does that sound so familiar?* *ina* refers to

Because it's a spot-on description of **two words** . *refer* to

*In terms of*

--In terms of function: With progressive loss of visual field and visual acuity resulting in blindness  
--In terms of fundus appearance: With atrophy of the NS retina and RPE, along with scattering of RPE pigment (often in a 'spiculated' pattern)

*What is the general term for a disorder stemming (ahem) from defects of cilia?*

A **ciliopathy**

*Ciliopathies affecting cilia such as those that connect inner/outer segs have devastating effects on two other organs as well—what are they?*

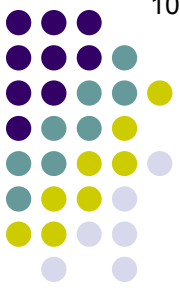
The kidney and the brain

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?

Wh *Hmm... Visual field and acuity loss, along with retinal/RPE atrophy* (slide-set),  
 the *and pigment spiculation—why does that sound so familiar?* *ina* refers to

the *Because it's a spot-on description of* **retinitis pigmentosa (RP)** . *refer to*

*In terms of*

--In terms of function: With progressive loss of visual field and visual acuity resulting in blindness

--In terms of fundus appearance: With atrophy of the NS retina and RPE, along with scattering of RPE pigment (often in a 'spiculated' pattern)

*What is the general term for a disorder stemming (ahem) from defects of cilia?*

A **ciliopathy**

*Ciliopathies affecting cilia such as those that connect inner/outer segs have devastating effects on two other organs as well—what are they?*

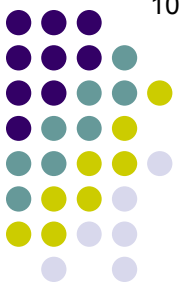
The kidney and the brain

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?

Wh *Hmm... Visual field and acuity loss, along with retinal/RPE atrophy* (slide-set),  
the *and pigment spiculation—why does that sound so familiar?* *ina* refers to

the *Because it's a spot-on description of retinitis pigmentosa (RP)* .  *refers to*

*In terms of* The ciliopathies are in the DDX for an RP-like fundus.

--In terms of function: With progressive loss of visual field and visual acuity resulting in blindness

--In terms of fundus appearance: With atrophy of the NS retina and RPE, along with scattering of RPE pigment (often in a 'spiculated' pattern)

*What is the general term for a disorder stemming (ahem) from defects of cilia?*

A **ciliopathy**

*Ciliopathies affecting cilia such as those that connect inner/outer segs have devastating effects on two other organs as well—what are they?*

The kidney and the brain

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



Q

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?

Wh *Hmm... Visual field and acuity loss, along with retinal/RPE atrophy* (slide-set),  
the *and pigment spiculation—why does that sound so familiar?* *ina* refers to

the *Because it's a spot-on description of retinitis pigmentosa (RP)* .  *refers to*

*In terms of* The ciliopathies are in the DDX for an RP-like fundus.

--In terms of function: With progressive loss of visual field and visual acuity resulting in blindness

--In terms of fundus appearance: With atrophy of the NS retina and RPE along with scattering of RPE pigment (often

*What are the four ciliopathies addressed in the BCSC?*

--?

--?

--?

--?

*What is the gene*

A **ciliopathy**

*Ciliopathies affect*

*effects on two other organs as well—what are they?*

The kidney and the brain

*devastating*

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?

Wh *Hmm... Visual field and acuity loss, along with retinal/RPE atrophy* (slide-set),  
the *and pigment spiculation—why does that sound so familiar?* *ina* refers to

the *Because it's a spot-on description of retinitis pigmentosa (RP)* .  *refers to*

*In terms of* The ciliopathies are in the DDX for an RP-like fundus.

--In terms of function: With progressive loss of visual field and visual acuity resulting in blindness

--In terms of fundus appearance: With atrophy of the NS retina and RPE along with scattering of RPE pigment (often

*What are the four ciliopathies addressed in the BCSC?*

- Joubert syndrome
- Alström syndrome
- Bardet-Biedl syndrome
- Senior-Løken syndrome

*What is the gene*

A **ciliopathy**

*Ciliopathies affect*

*effects on two other organs as well—what are they?*

The kidney and the brain

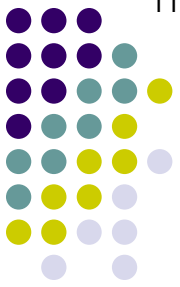
*devastating*

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?

Wh *Hmm... Visual field and acuity loss, along with retinal/RPE atrophy* (slide-set),  
the *and pigment spiculation—why does that sound so familiar?* *ina* refers to

the *Because it's a spot-on description of retinitis pigmentosa (RP)* .  *refers to*

*In terms of* The ciliopathies are in the DDX for an RP-like fundus.

--In terms of function: With progressive loss of visual field and visual acuity resulting in blindness

--In terms of fundus appearance: With atrophy of the NS retina and RPE along with scattering of RPE pigment (often) *What are the four ciliopathies addressed in the BCSC?*

--Joubert syndrome

--Alström syndrome

--Bardet-Biedl syndrome

--Senior-Løken syndrome

*Got a mnemonic for remembering the ciliopathies?*

*What is the gene*

A **ciliopathy**

*Ciliopathies affect*

*effects on two other organs as well—what are they?*

The kidney and the brain

*devastating*

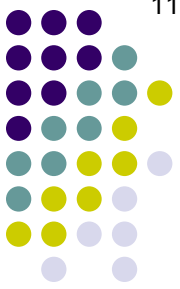
*The inner and outer segments are connected by a specific sort of structure—what is it?*

A **cilium**

*So does this cilia allow the outer segments to wiggle about?*

No—it's a **nonmotile** cilia, not a motile one





# A

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?

Wh *Hmm... Visual field and acuity loss, along with retinal/RPE atrophy* (slide-set),  
the *and pigment spiculation—why does that sound so familiar?* *ina* refers to

the *Because it's a spot-on description of retinitis pigmentosa (RP)* .  *refers to*

*In terms of* The ciliopathies are in the DDX for an RP-like fundus.

--In terms of function: With progressive loss of visual field and visual acuity resulting in blindness

--In terms of fundus appearance: With atrophy of the NS retina and RPE along with scattering of RPE pigment (often) *What are the four ciliopathies addressed in the BCSC?*

- J**oubert syndrome
- A**lström syndrome
- B**ardet-Biedl syndrome
- S**enior-Løken syndrome

*Got a mnemonic for remembering the ciliopathies?*  
**JABS**. Imagine a cilia as it **jabs** someone in the eye

*What is the gene*  
**A ciliopathy**

*Ciliopathies affect* *devastating*  
*effects on two other organs as well—what are they?*  
The kidney and the brain

*The inner and outer segments are connected by a specific sort of structure—what is it?*

**A cilium**

*So does this cilia allow the outer segments to wiggle about?*  
No—it's a **nonmotile** cilia, not a motile one



# Q

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?

Wh *Hmm... Visual field and acuity loss, along with retinal/RPE atrophy* (slide-set),  
the *and pigment spiculation—why does that sound so familiar?* *ina* refers to

the *Because it's a spot-on description of retinitis pigmentosa (RP)* .  *refers to*

*In terms of* The ciliopathies are in the DDX for an RP-like fundus.

--In terms of function: With progressive loss of visual field and visual acuity resulting in blindness

--In terms of fundus appearance: With atrophy of the NS retina and RPE along with scattering of RPE pigment (often) *What are the four ciliopathies addressed in the BCSC?*

What is the gene

A **ciliopathy**

- J**oubert syndrome
- A**lström syndrome
- B**ardet-Biedl syndrome
- S**enior-Løken syndrome

Ciliopathies affect

effects on two other organs as well—what are they?

The kidney and the brain

What set of findings should prompt one to consider that the answer to an OKAP and/or Board question is a ciliopathy?

The inner and outer segments are connected by a specific sort of structure—what is it?

A **cilium**

So does this cilia allow the outer segments to wiggle about?

No—it's a **nonmotile** cilia, not a motile one



# A

## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?

When you see *“visual field and acuity loss, along with retinal/RPE atrophy and pigment spiculation—why does that sound so familiar?”* (slide-set), the retina refers to the neurosensory retina.

Because it's a spot-on description of **retinitis pigmentosa (RP)**.

In terms of fundus appearance: The ciliopathies are in the DDX for an RP-like fundus.

--In terms of function: With progressive loss of visual field and visual acuity resulting in blindness

--In terms of fundus appearance: With atrophy of the NS retina and RPE along with scattering of RPE pigment (often called *bone spicules*).  
What are the four ciliopathies addressed in the BCSC?

- J**oubert syndrome
- A**lström syndrome
- B**ardet-Biedl syndrome
- S**enior-Løken syndrome

What set of findings should prompt one to consider that the answer to an OKAP and/or Board question is a ciliopathy?

When the pt in question presents with an RP-like fundus along with relentlessly progressive renal failure resulting in ESRD early in life

What is the gene?

A **ciliopathy**

Ciliopathies affect other organs as well—what are they?

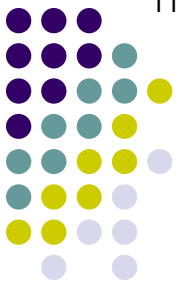
The kidney and the brain

The inner and outer segments are connected by a specific sort of structure—what is it?

A **cilium**

So does this cilia allow the outer segments to wiggle about?

No—it's a **nonmotile** cilia, not a motile one



## Retinal Anatomy and Histology

What is the difference between the retina and the neurosensory retina?

When you see *“visual field and acuity loss, along with retinal/RPE atrophy and pigment spiculation—why does that sound so familiar?”* (slide-set), the retina refers to the neurosensory retina.

Because it's a spot-on description of **retinitis pigmentosa (RP)**.

The ciliopathies are in the DDX for an RP-like fundus.

In terms of

--In terms of function: With progressive loss of visual field and visual acuity resulting in blindness

--In terms of fundus appearance: With atrophy of the NS retina and RPE along with scattering of RPE pigment (often called *bone spicules*).  
What are the four ciliopathies addressed in the RSCC?

What is  
A cilium

**For more on the ciliopathies, see slide-set R5**

Ciliopathies affect --**S**enior-Løken syndrome

effects on two other organs as well—what are they?

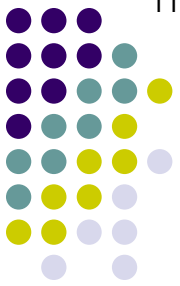
The kidney and the brain

The inner and outer segments are connected by a specific sort of structure—what is it?

A cilium

So does this cilia allow the outer segments to wiggle about?

No—it's a **nonmotile** cilia, not a motile one



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

-----Disposer cells

*Continuing our look at PR morphology...What portion is next to the outer segment?*

The inner segment

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A cilium

*The inner segment is considered to be composed of two subsections—what are they?*

## A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

-----Disks

*Continuing our look at PR morphology...What portion is next to the outer segment?*

The inner segment

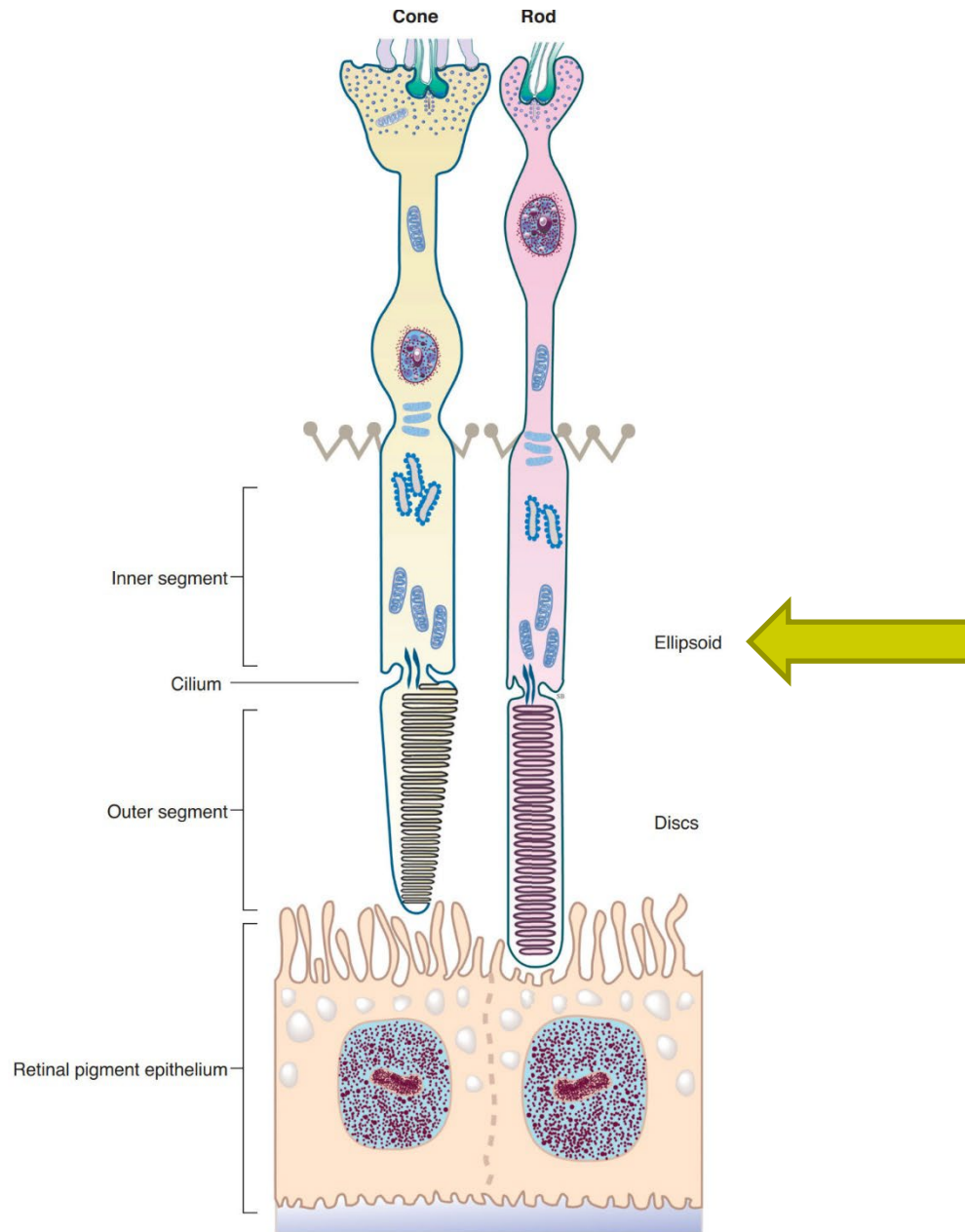
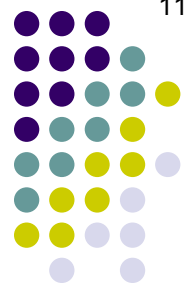
*The inner and outer segments are connected by a specific sort of structure—what is it?*

A cilium

*The inner segment is considered to be composed of two subsections—what are they?*

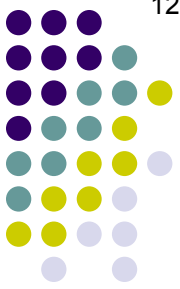
An ellipsoid immediately adjacent to the cilium...

# Retinal Anatomy and Histology



## A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

-----Disks

*Continuing our look at PR morphology...What portion is next to the outer segment?*

The inner segment

*The inner and outer segments are connected by a specific sort of structure—what is it?*

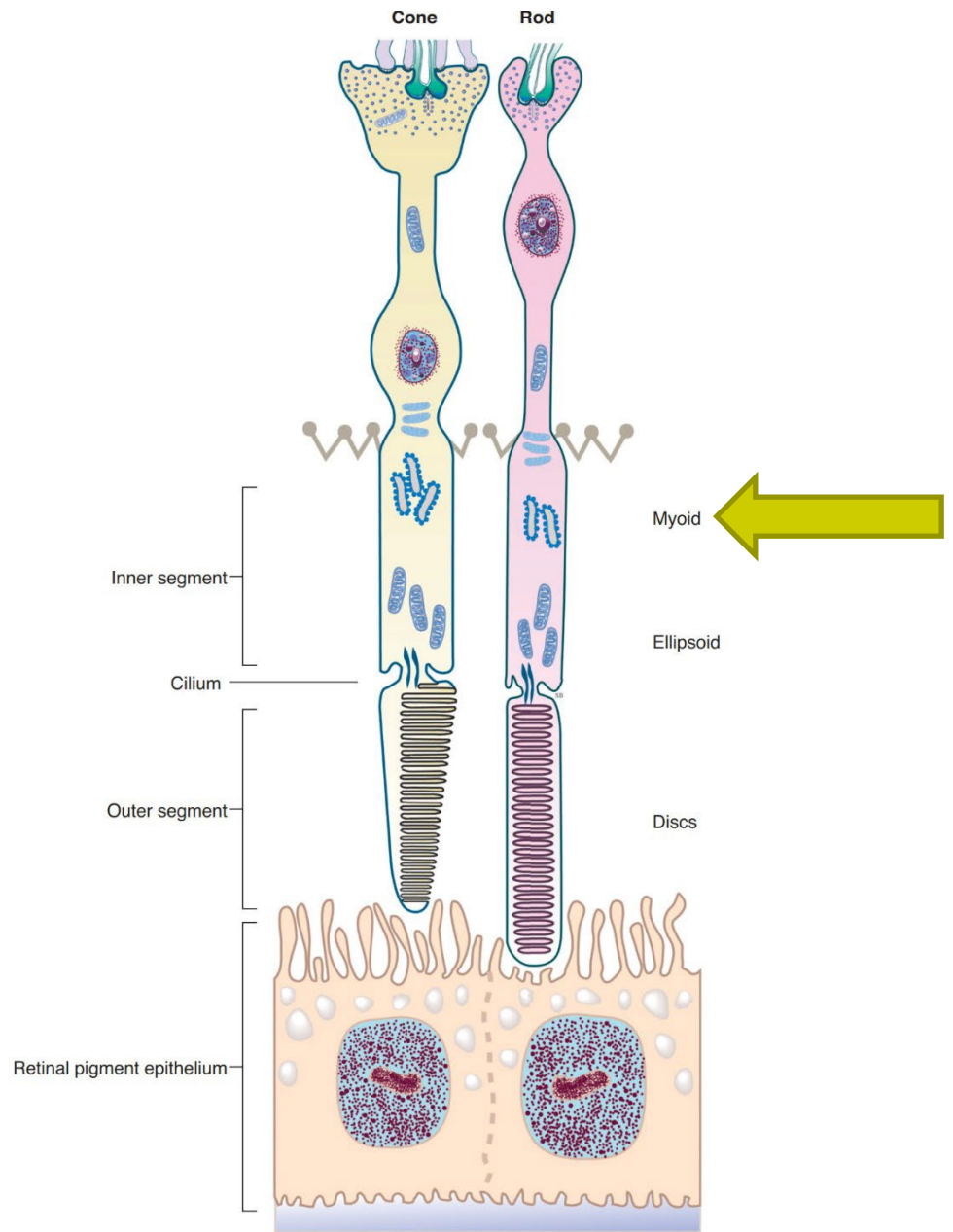
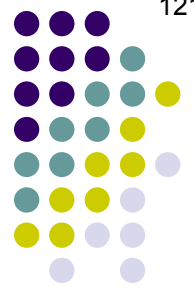
A cilium

*The inner segment is considered to be composed of two subsections—what are they?*

An *ellipsoid* immediately adjacent to the cilium...and then a *myoid*



# Retinal Anatomy and Histology





# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

Disks cells

*Continuing our look at PR morphology...What portion is next to the outer segment?*

The inner segment

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A cilium

*The inner segment is considered to be composed of two subsections—what are they?*

An *ellipsoid* immediately adjacent to the cilium...and then a *myoid*

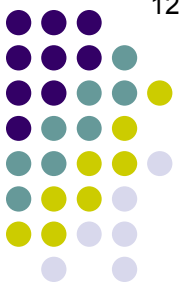
*Each area is known for something it contains a lot of. What are these contents?*

--The ellipsoid is chock full of...?

--The myoid is chock full of...

## A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

Disks cells

*Continuing our look at PR morphology...What portion is next to the outer segment?*

The inner segment

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A cilium

*The inner segment is considered to be composed of two subsections—what are they?*

An *ellipsoid* immediately adjacent to the cilium...and then a *myoid*

*Each area is known for something it contains a lot of. What are these contents?*

--The ellipsoid is chock full of...mitochondria

--The myoid is chock full of...



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

Disks

*Continuing our look at PR morphology...What portion is next to the outer segment?*

The inner segment

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A cilium

*The inner segment is considered to be composed of two subsections—what are they?*

An *ellipsoid* immediately adjacent to the cilium...and then a *myoid*

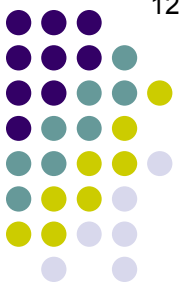
*Each area is known for something it contains a lot of. What are these contents?*

--The ellipsoid is chock full of...mitochondria

--The myoid is chock full of...?

## A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

Disks

*Continuing our look at PR morphology...What portion is next to the outer segment?*

The inner segment

*The inner and outer segments are connected by a specific sort of structure—what is it?*

A cilium

*The inner segment is considered to be composed of two subsections—what are they?*

An *ellipsoid* immediately adjacent to the cilium...and then a *myoid*

*Each area is known for something it contains a lot of. What are these contents?*

--The ellipsoid is chock full of...mitochondria

--The myoid is chock full of...glycogen



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

*Continuing on...What portion of the PR is next to the inner segment?*

----Müller cells

----Astrocytes

----Microglia

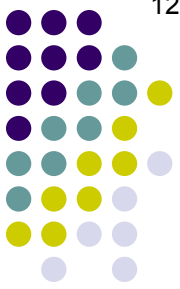
--Vascular:

----Endothelial cells

----Pericytes

## A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

*Continuing on...What portion of the PR is next to the inner segment?*

The cell body

----Müller cells

----Astrocytes

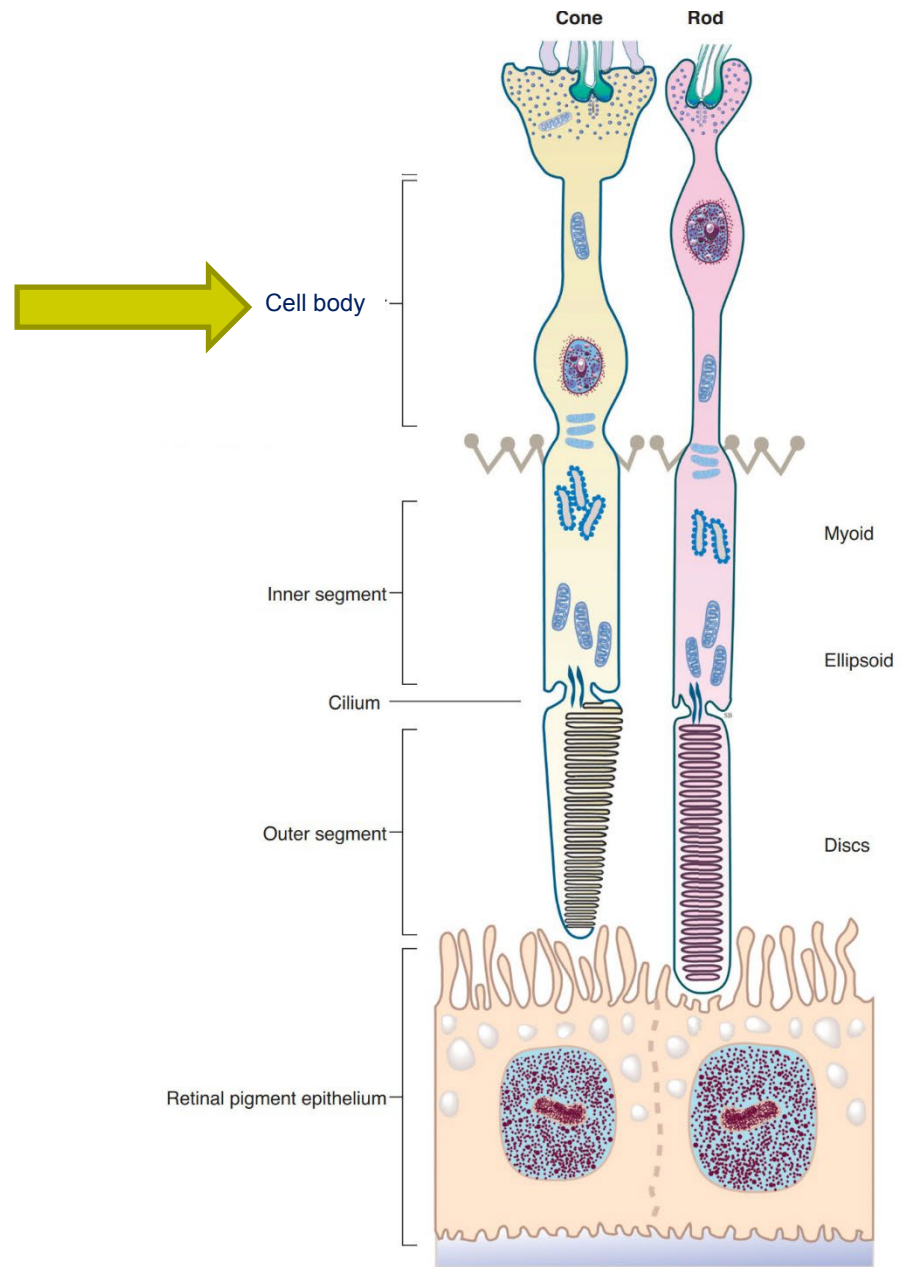
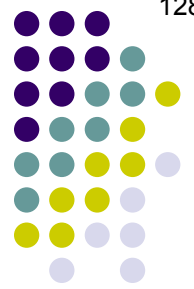
----Microglia

--Vascular:

----Endothelial cells

----Pericytes

# Retinal Anatomy and Histology





## A

## Retinal Anatomy and Histology



*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

*Continuing on...What portion of the PR is next to the inner segment?*

The cell body, which houses the cell nucleus

----Müller cells

----Astrocytes

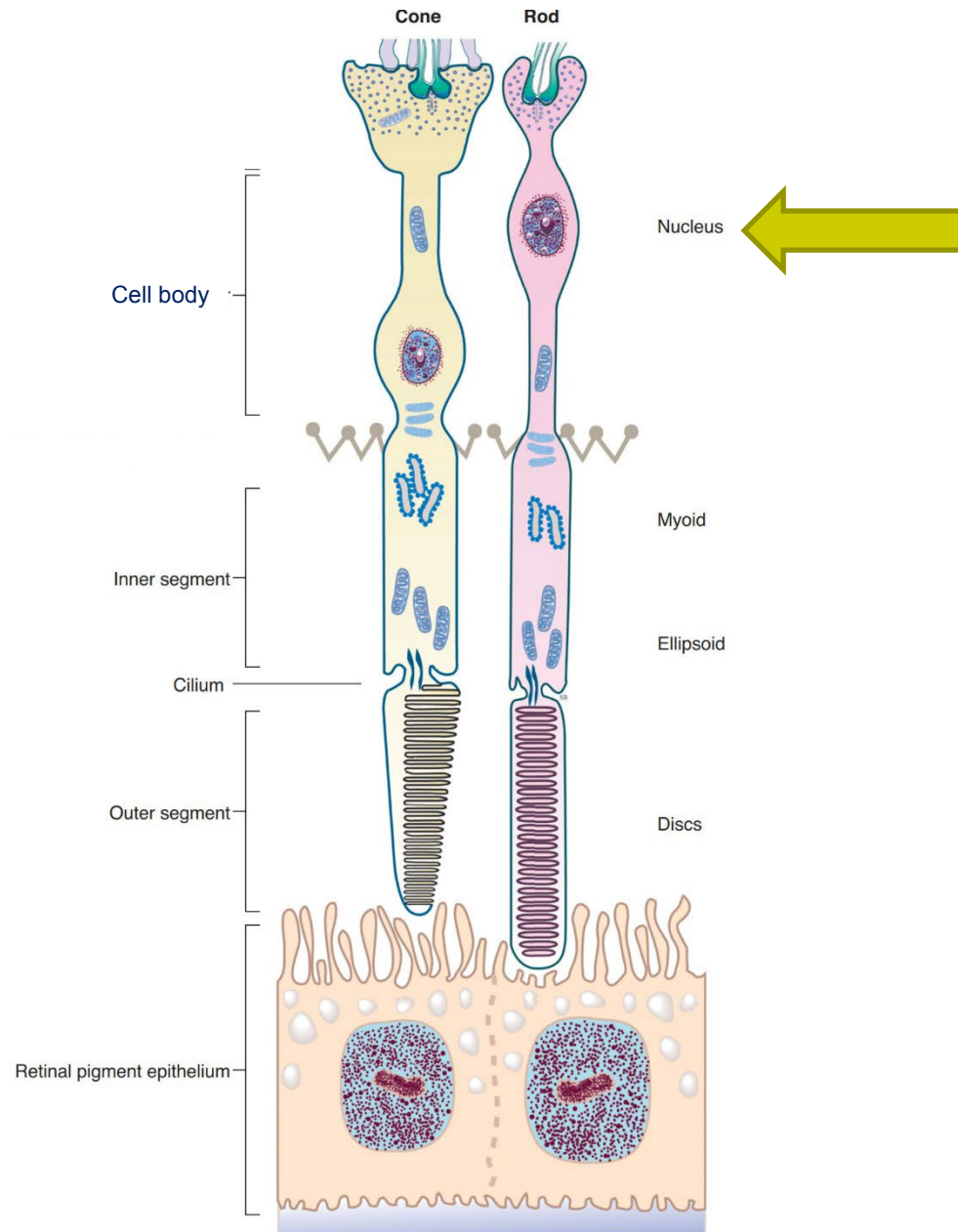
----Microglia

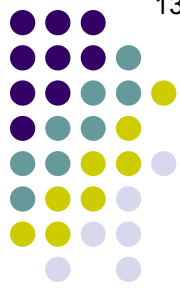
--Vascular:

----Endothelial cells

----Pericytes

# Retinal Anatomy and Histology





# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Disposer cells

*Continuing on...What portion of the PR is next to the **inner segment**?*

The **cell body**, which houses the cell nucleus.

*While not a part of the PRs per se, they (the PRs) contribute to an important retinal structure located at the juncture of the PR inner segment and cell body.  
 What is this structure?*

----Müller cells

----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

----Pericytes



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

*Continuing on...What portion of the PR is next to the **inner segment**?*

The **cell body**, which houses the cell nucleus.

*While not a part of the PRs per se, they (the PRs) contribute to an important retinal structure located at the juncture of the PR inner segment and cell body.  
 What is this structure?*

The external limiting membrane (ELM)

----Müller cells

----Astrocytes

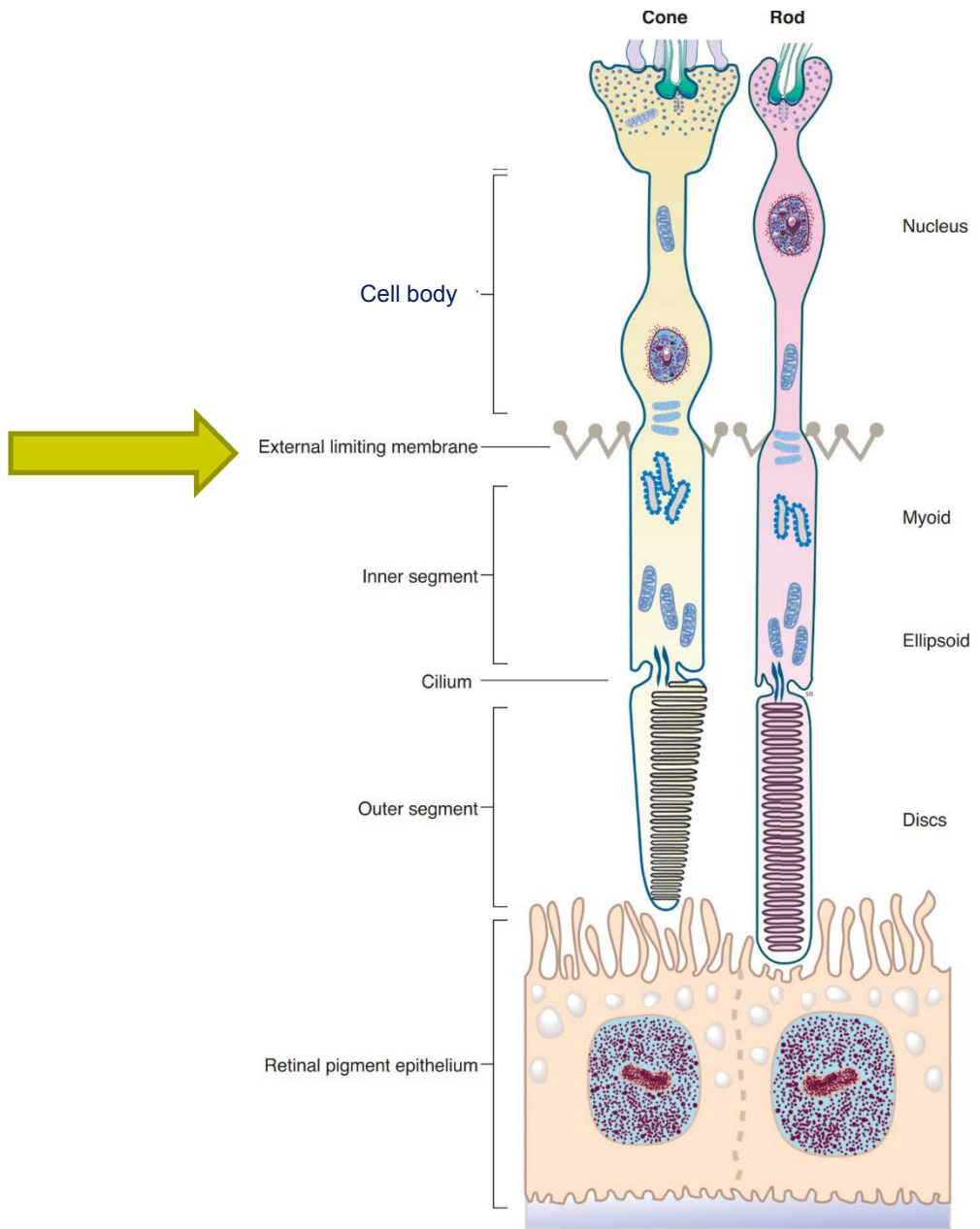
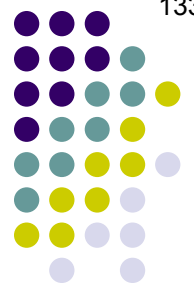
----Microglia

--Vascular:

----Endothelial cells

----Pericytes

# Retinal Anatomy and Histology





# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Disposer cells

*Continuing on...What portion of the PR is next to the **inner segment**?*

The **cell body**, which houses the cell nucleus.

*While not a part of the PRs per se, they (the PRs) contribute to an important retinal structure located at the juncture of the PR inner segment and cell body.  
 What is this structure?*

The external limiting membrane (ELM)

*Is the ELM a true membrane?*

----Müller cells

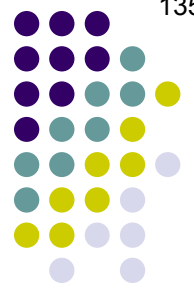
----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

----Pericytes



*What is the difference between the retina and the neurosensory retina?*  
While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they? There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Disposer cells

*Continuing on...What portion of the PR is next to the **inner segment**?*

The **cell body**, which houses the cell nucleus.

*While not a part of the PRs per se, they (the PRs) contribute to an important retinal structure located at the juncture of the PR inner segment and cell body. What is this structure?*  
The external limiting membrane (ELM)  
*Is the ELM a true membrane?*  
No, it is a barrier resulting from attachments between the PRs and adjacent

two words

----Müller cells

----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

----Pericytes



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

-----Disposer cells

*Continuing on...What portion of the PR is next to the **inner segment**?*

The **cell body**, which houses the cell nucleus.

*While not a part of the PRs per se, they (the PRs) contribute to an important retinal structure located at the juncture of the PR inner segment and cell body.  
 What is this structure?*

The external limiting membrane (ELM)

----Müller cells

----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

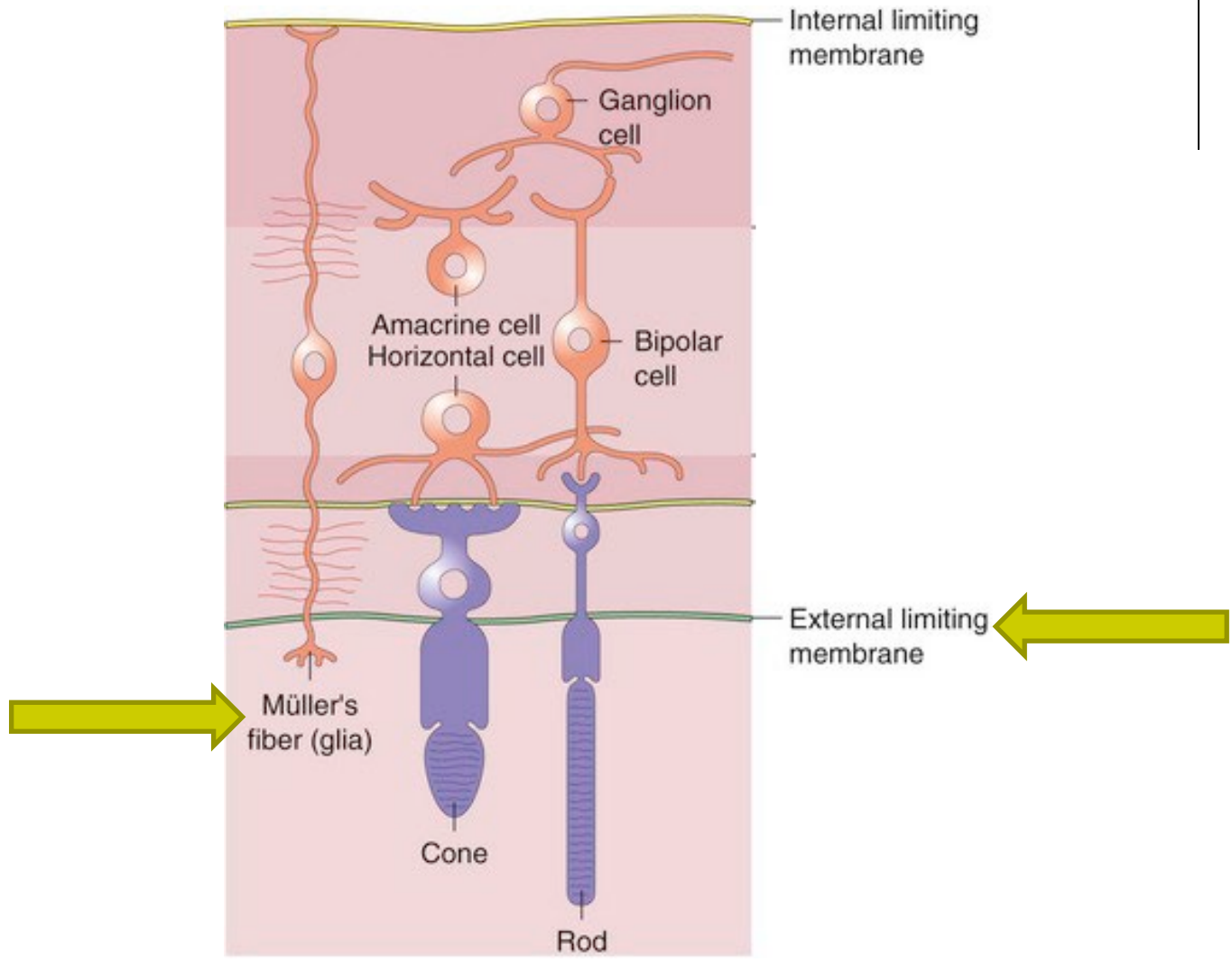
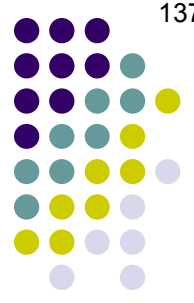
----Pericytes

*Is the ELM a true membrane?*

No, it is a barrier resulting from attachments between the PRs and adjacent Müller cells



# Retinal Anatomy and Histology



ELM, Müller cells and PRs



# Q

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?  
 There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

*Continuing on...What portion of the PR is next to the inner segment?*

The cell body, which houses the cell nucleus

*And after that?*



----Müller cells

----Astrocytes

----Microglia

--Vascular:

----Endothelial cells

----Pericytes



# A

## Retinal Anatomy and Histology

*What is the difference between the retina and the neurosensory retina?*  
 While often used interchangeably (including, on occasion, in this slide-set), these are technically not synonyms. The term *neurosensory retina* refers to the neural lining on the inside of the eye, whereas the term *retina* refers to this neural lining along with the retinal pigment epithelium (RPE).

*The neurosensory retina contains three classes of cells—what are they?*  
*There are five types of neural elements—what are they? What are the three types of glial cells? The two vascular cell types?*

--Neurons:

----Photoreceptors (PRs)

----Bipolar cells

*Continuing on...What portion of the PR is next to the inner segment?*

The cell body, which houses the cell nucleus

*And after that?*

An axon-like fiber terminating in the PR's synaptic processes

----Müller cells

----Astrocytes

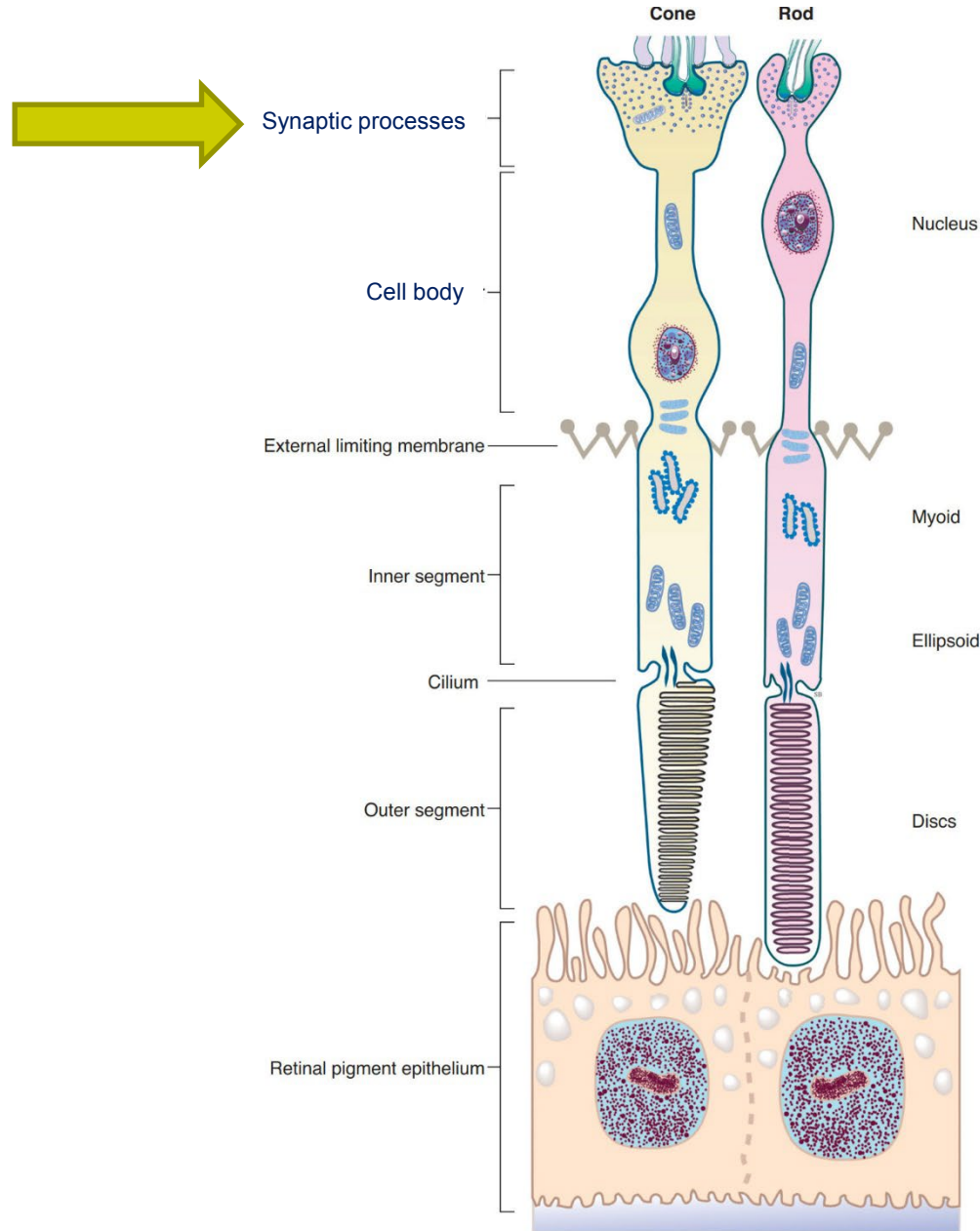
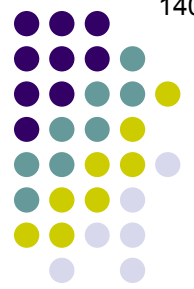
----Microglia

--Vascular:

----Endothelial cells

----Pericytes

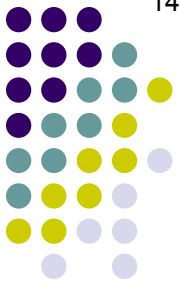
# Retinal Anatomy and Histology





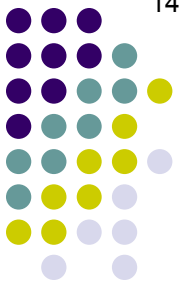
Next we will look at the layers of the neurosensory retina. But before we do, let's make sure you're on fleek\* regarding the critical aspects of retinal histology we've seen thus far.

## Retinal Anatomy and Histology



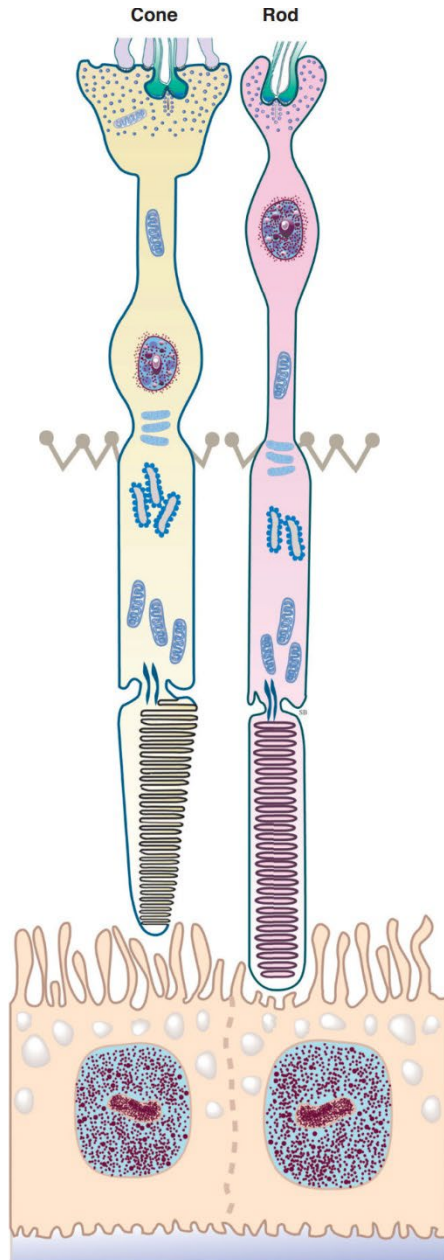
Next we will look at the layers of the neurosensory retina. But before we do, let's make sure you're on fleek\* regarding the critical aspects of retinal histology we've seen thus far. **Why? Because as we will see later in the slide-set, a firm grasp of this info is absolutely required to read OCTs. So go through the next section of slides over and over until they're burned into your brain. (You'll thank me later.)**

\*You're so cool, Dr Flynn



Q

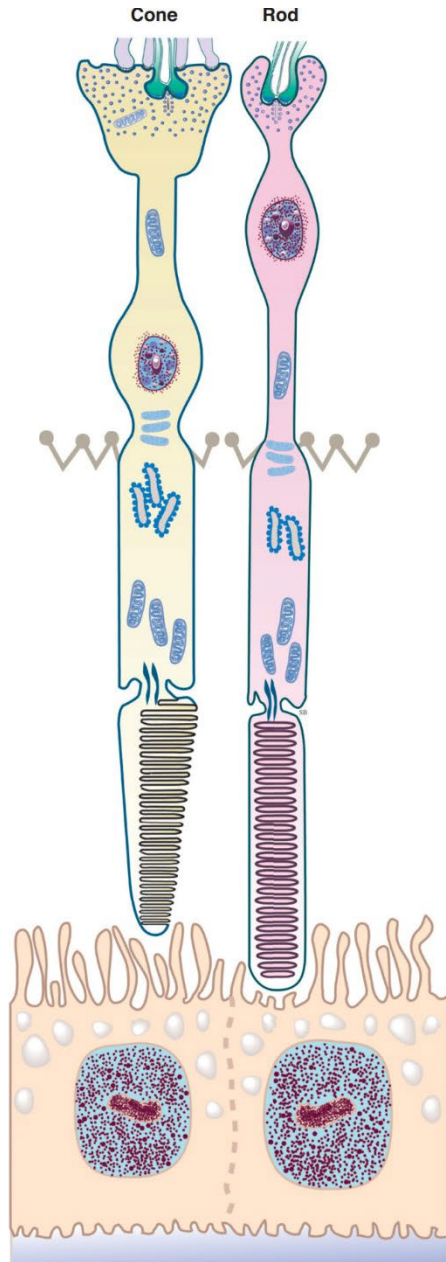
## Retinal Anatomy and Histology



*Working out → in: The first structure to be particularly aware of is...*

A

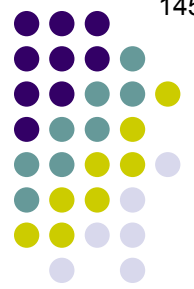
# Retinal Anatomy and Histology



*Working out → in: The first structure to be particularly aware of is...*

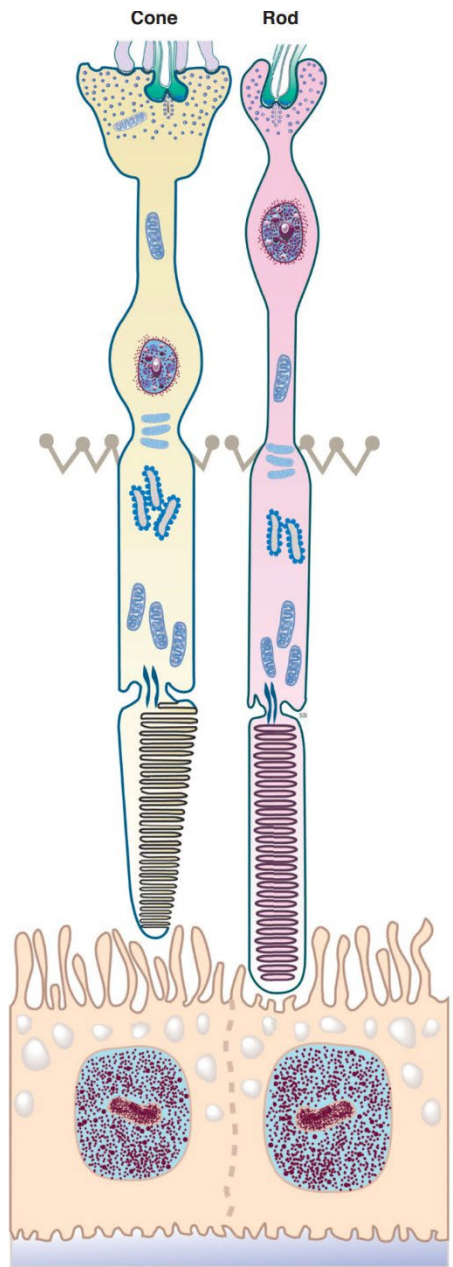
← RPE/Bruch's membrane complex





Q

# Retinal Anatomy and Histology

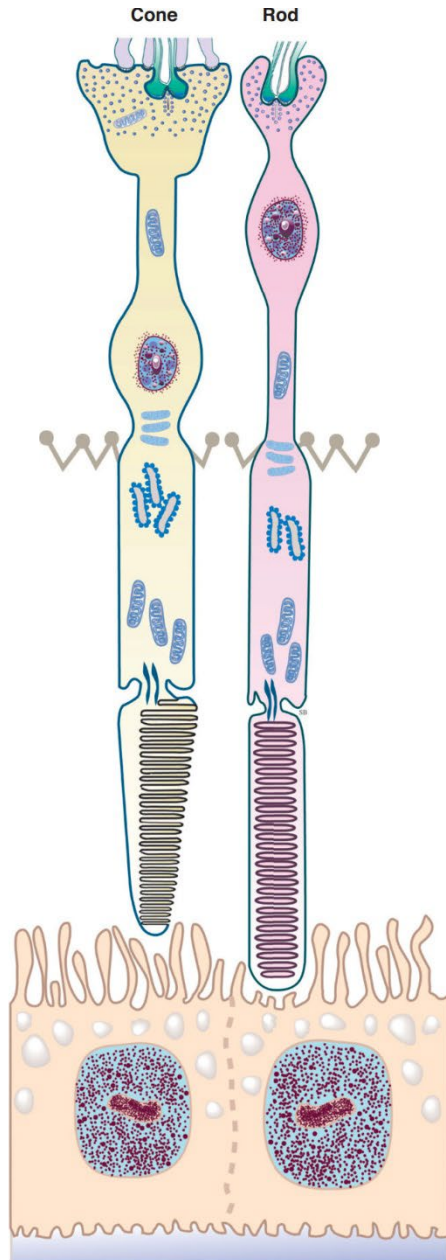
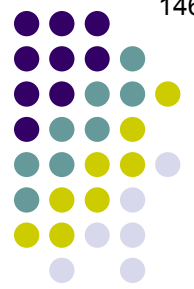


*The next is...*

← RPE/Bruch's membrane complex

A

# Retinal Anatomy and Histology



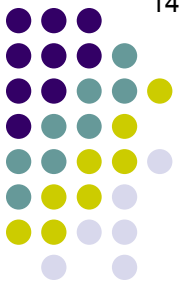
*The next is...*



The interdigitation zone

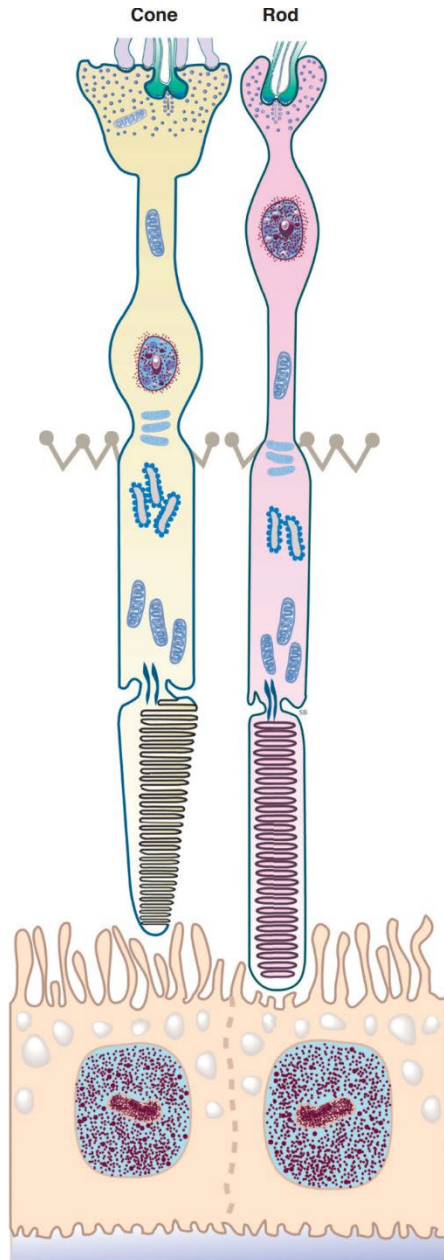


RPE/Bruch's membrane complex



Q

## Retinal Anatomy and Histology



*The next is...*



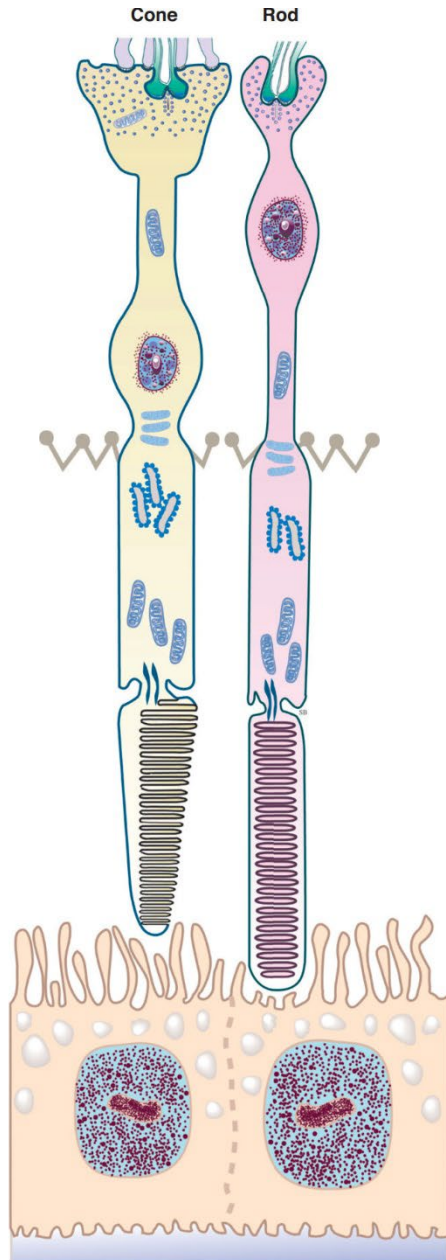
The interdigitation zone



RPE/Bruch's membrane complex

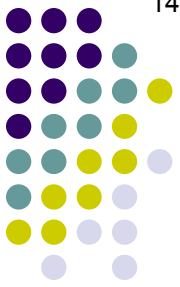
A

# Retinal Anatomy and Histology



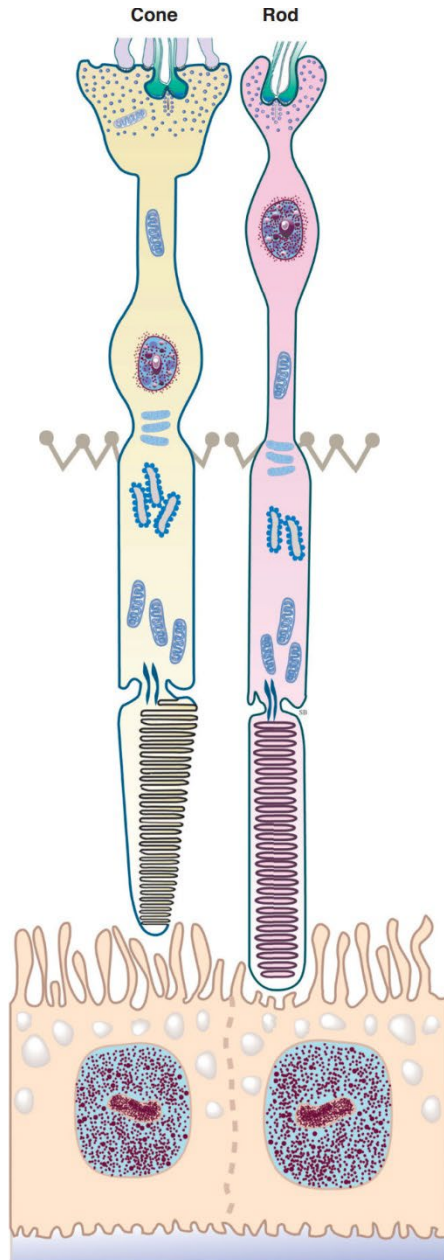
*The next is...*

- ← PR outer segs
- ← The interdigitation zone
- ← RPE/Bruch's membrane complex



Q

## Retinal Anatomy and Histology

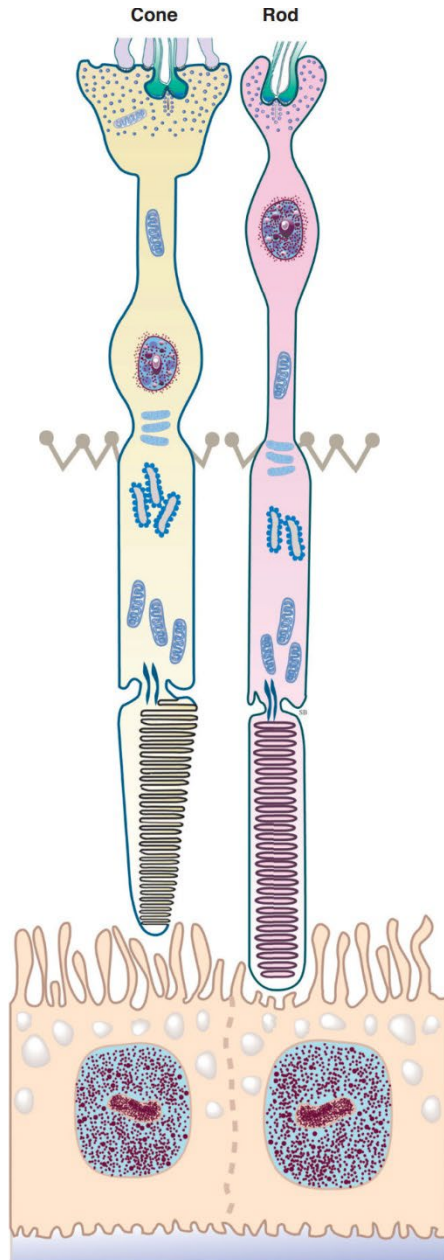
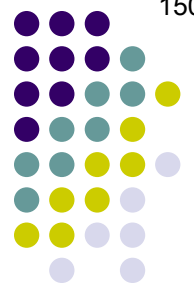


*The next is...*

- ← PR outer segs
- ← The interdigitation zone
- ← RPE/Bruch's membrane complex

A

# Retinal Anatomy and Histology



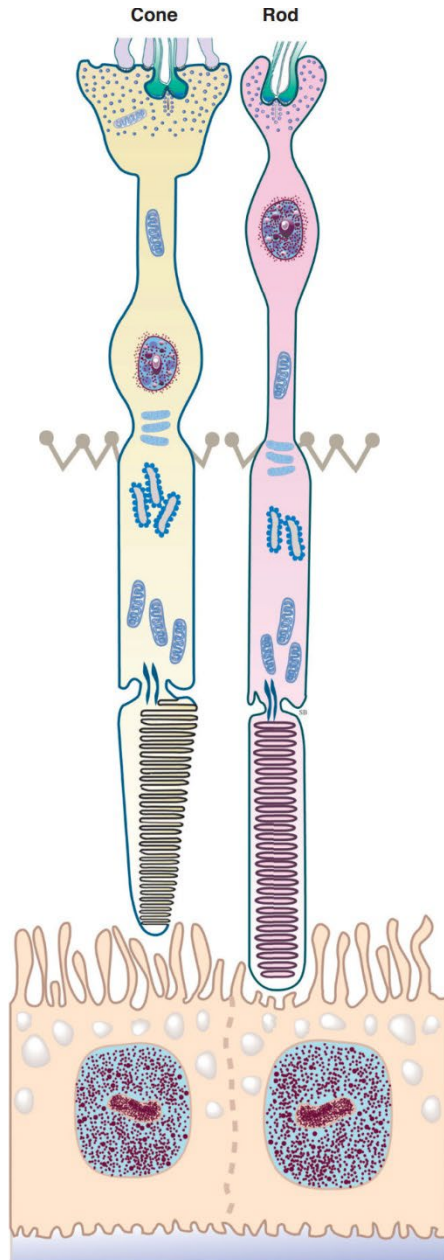
*The next is...*

- ← The ellipsoid zone
- ← PR outer segs
- ← The interdigitation zone
- ← RPE/Bruch's membrane complex



Q

## Retinal Anatomy and Histology

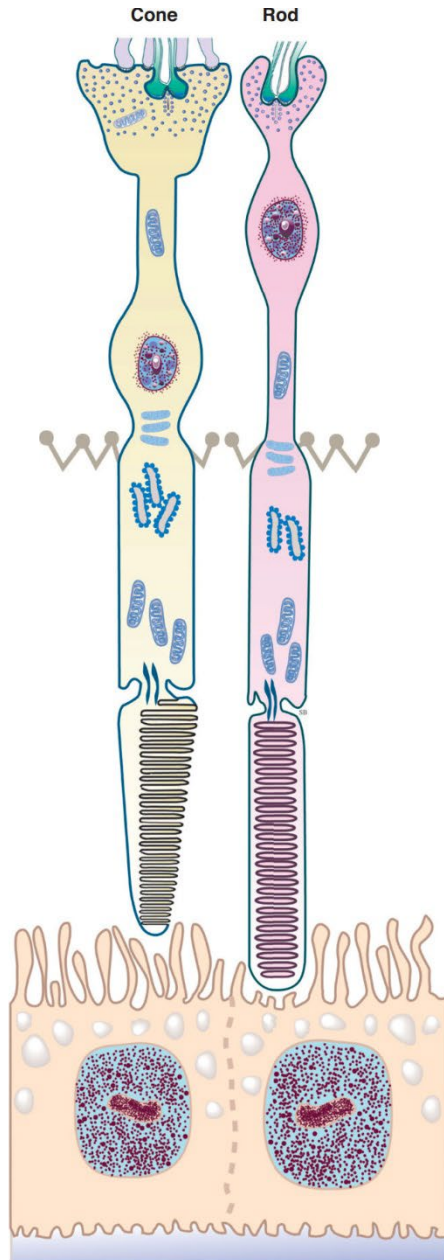


*The next is...*

- ← The ellipsoid zone
- ← PR outer segs
- ← The interdigitation zone
- ← RPE/Bruch's membrane complex

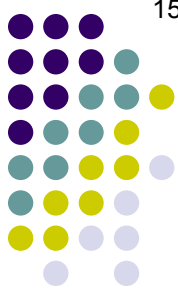
A

# Retinal Anatomy and Histology



*The next is...*

- ← The myoid zone
- ← The ellipsoid zone
- ← PR outer segs
- ← The interdigitation zone
- ← RPE/Bruch's membrane complex

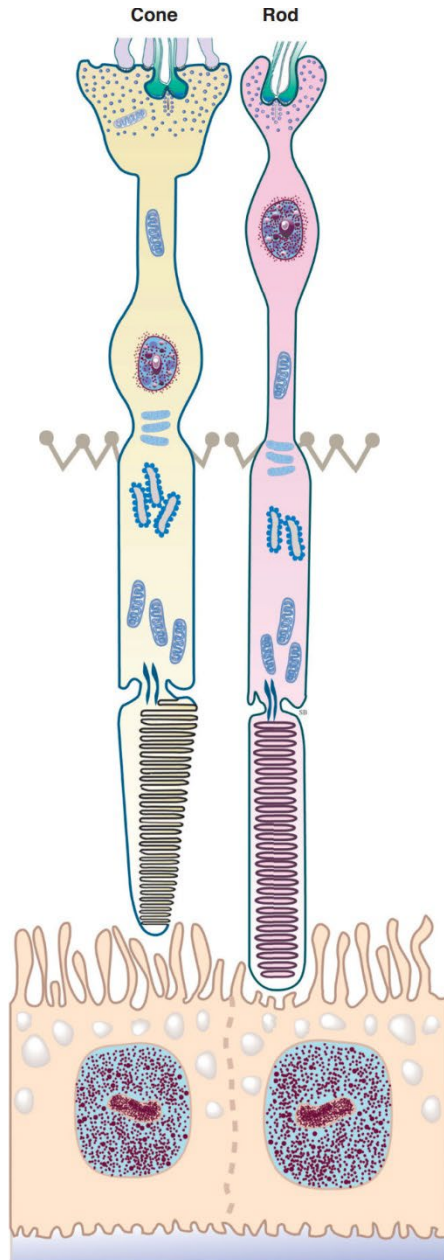






Q

## Retinal Anatomy and Histology

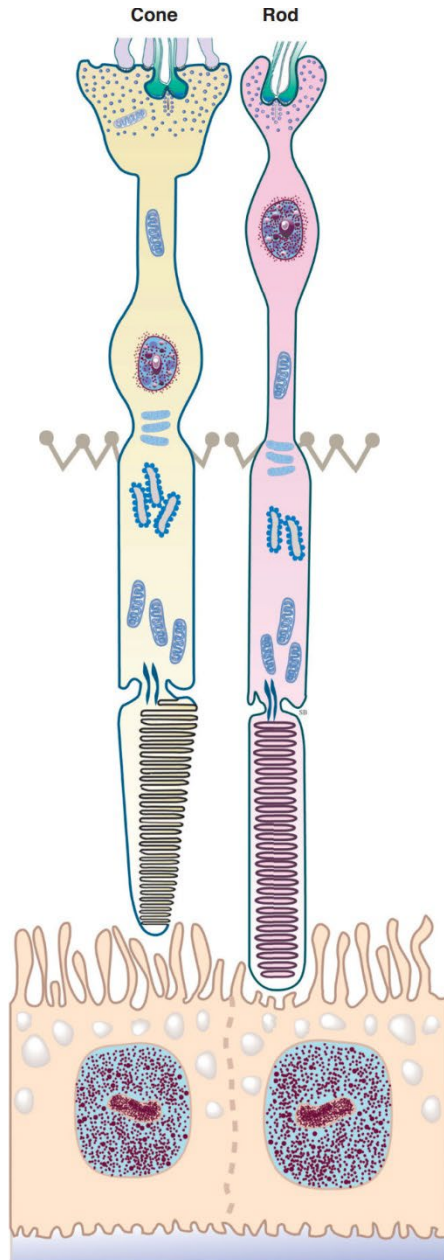
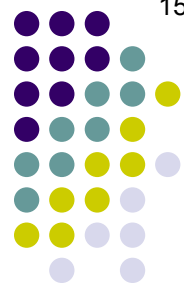


*And the last is...*







- ← The myoid zone
- ← The ellipsoid zone
- ← PR outer segs
- ← The interdigitation zone
- ← RPE/Bruch's membrane complex

A

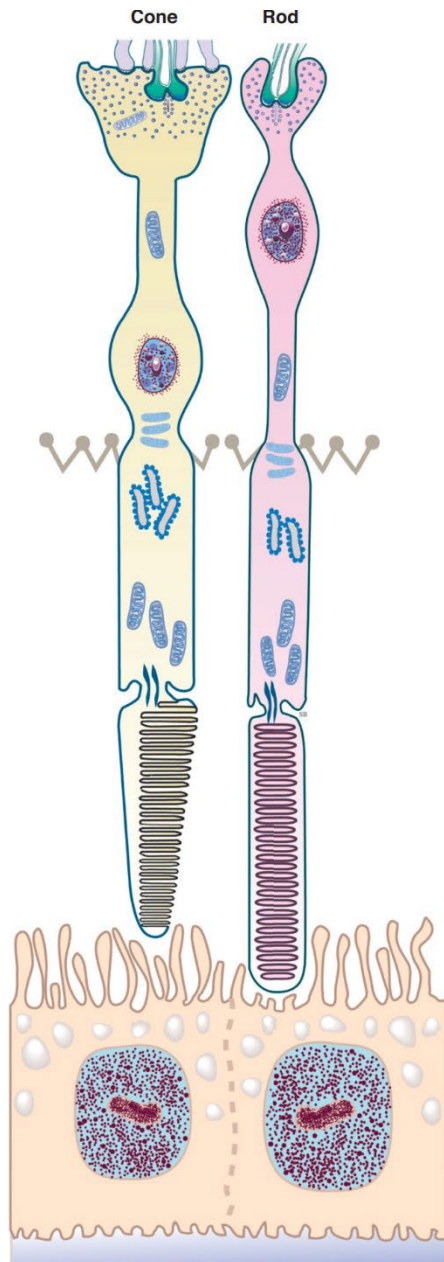
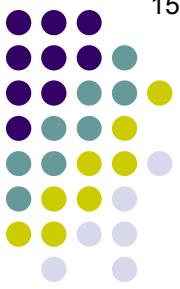
# Retinal Anatomy and Histology



*And the last is...*

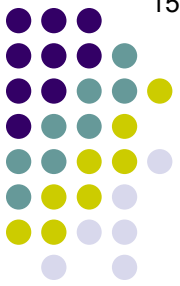
-  The ELM
-  The myoid zone
-  The ellipsoid zone
-  PR outer segs
-  The interdigitation zone
-  RPE/Bruch's membrane complex

# Retinal Anatomy and Histology



*Re-rack those until you know them cold!*

- ← The ELM
- ← The myoid zone
- ← The ellipsoid zone
- ← PR outer segs
- ← The interdigitation zone
- ← RPE/Bruch's membrane complex



- Neurosensory Retina Layers

- Internal limiting membrane



*Now we're ready to review the layers of the retina*



- External limiting membrane



- RPE

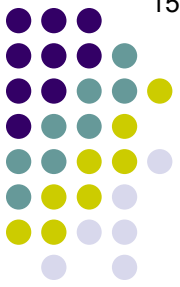
- Bruch's membrane

**Q****● Neurosensory Retina Layers**

- Internal limiting membrane

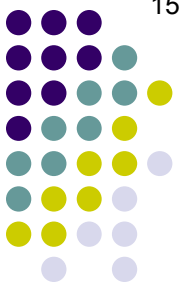


- External limiting membrane

**● RPE****● Bruch's membrane**

# A/Q

## Retinal Anatomy and Histology



- **Neurosensory Retina Layers**

- Internal limiting membrane
- Nerve fiber layer
- (*Next?*)
- 
- 
- 
- 
- External limiting membrane
- 

- **RPE**

- **Bruch's membrane**

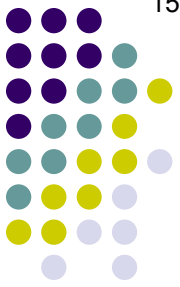
# A

- **Neurosensory Retina Layers**

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- 
- 
- 
- 
- External limiting membrane
- 

- **RPE**

- **Bruch's membrane**



**Q****● Neurosensory Retina Layers**

- Internal limiting membrane
- **Nerve fiber layer**
- Ganglion cell layer
- 
- 
- 
- 
- External limiting membrane
- 
- **RPE**
- **Bruch's membrane**

*Histologically speaking, the NFL is composed of what specific structures?*



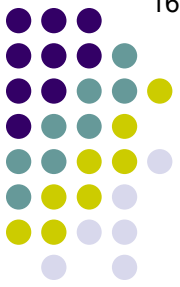
## A

### ● Neurosensory Retina Layers

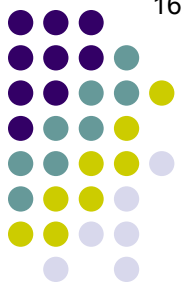
- Internal limiting membrane
- **Nerve fiber layer**
- Ganglion cell layer
- 
- 
- 
- 
- External limiting membrane
- 
- RPE
- Bruch's membrane

*Histologically speaking, the NFL is composed of what specific structures?*

Axons of the ganglion cells



## Q



### ● Neurosensory Retina Layers

- Internal limiting membrane
- **Nerve fiber layer**
- Ganglion cell layer
- 
- 
- 
- 
- External limiting membrane
- 
- RPE
- Bruch's membrane

*Histologically speaking, the NFL is composed of what specific structures?*

Axons of the ganglion cells

*Where are the ganglion-cell bodies located?*

## A

### ● Neurosensory Retina Layers

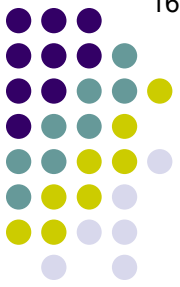
- Internal limiting membrane
- **Nerve fiber layer**
- **Ganglion cell layer**
- 
- 
- 
- 
- External limiting membrane
- 
- RPE
- Bruch's membrane

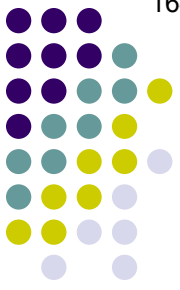
*Histologically speaking, the NFL is composed of what specific structures?*

Axons of the ganglion cells

*Where are the ganglion-cell bodies located?*

In the **ganglion cell layer**





## Retinal Anatomy and Histology

### Q

#### ● Neurosensory Retina Layers

- Internal limiting membrane
- **Nerve fiber layer**
- **Ganglion cell layer**
- 
- 
- 
- 
- External limiting membrane
- 
- RPE
- Bruch's membrane

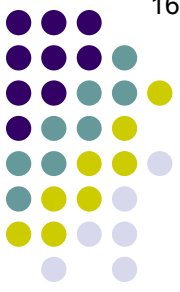
*Histologically speaking, the NFL is composed of what specific structures?*

Axons of the ganglion cells

*Where are the ganglion-cell bodies located?*

In the **ganglion cell layer**

*Anatomically speaking, what structure will the axons go on to form?*



## Retinal Anatomy and Histology

# A

## ● Neurosensory Retina Layers

- Internal limiting membrane
- **Nerve fiber layer**
- **Ganglion cell layer**
- 
- 
- 
- 
- External limiting membrane
- 
- RPE
- Bruch's membrane

*Histologically speaking, the NFL is composed of what specific structures?*

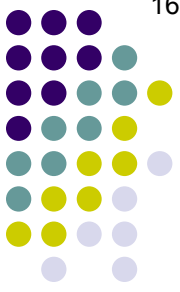
Axons of the ganglion cells

*Where are the ganglion-cell bodies located?*

In the **ganglion cell layer**

*Anatomically speaking, what structure will the axons go on to form?*

The optic nerve



## Retinal Anatomy and Histology

### Q

#### ● Neurosensory Retina Layers

- Internal limiting membrane
- **Nerve fiber layer**
- **Ganglion cell layer**
- 
- 
- 
- 
- External limiting membrane
- 
- RPE
- Bruch's membrane

*Histologically speaking, the NFL is composed of what specific structures?*

Axons of the ganglion cells

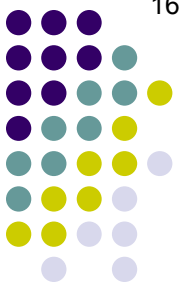
*Where are the ganglion-cell bodies located?*

In the **ganglion cell layer**

*Anatomically speaking, what structure will the axons go on to form?*

The optic nerve

*Where will most of these fibers eventually synapse?*



## Retinal Anatomy and Histology

# A

## ● Neurosensory Retina Layers

- Internal limiting membrane
- **Nerve fiber layer**
- **Ganglion cell layer**
- 
- 
- 
- 
- External limiting membrane
- 
- RPE
- Bruch's membrane

*Histologically speaking, the NFL is composed of what specific structures?*

Axons of the ganglion cells

*Where are the ganglion-cell bodies located?*

In the **ganglion cell layer**

*Anatomically speaking, what structure will the axons go on to form?*

The optic nerve

*Where will most of these fibers eventually synapse?*

The lateral geniculate nucleus (LGN)



## Retinal Anatomy and Histology

### Q

#### ● Neurosensory Retina Layers

- Internal limiting memb

- **Nerve fiber layer**

- **Ganglion cell layer**



- External limiting memb



- RPE

- Bruch's me

*Histologically speaking, the NFL is composed of what specific structures?*

Axons of the ganglion cells

*Where are the ganglion-cell bodies located?*

In the **ganglion cell layer**

*Anatomically speaking, what structure will the axons go on to form?*

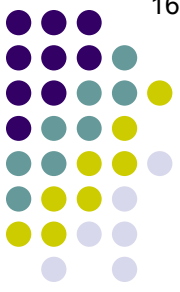
The optic nerve

*Where will **most** of these fibers eventually synapse?*

The lateral geniculate nucleus (LGN)

*Most? Where will the others synapse, and what are they responsible for?*





## Q/A

### ● Neurosensory Retina Layers

- Internal limiting memb

- **Nerve fiber layer**

- **Ganglion cell layer**

- 

- 

- 

- 

- External limiting memb

- 

- RPE

- Bruch's me

*Histologically speaking, the NFL is composed of what specific structures?*

Axons of the ganglion cells

*Where are the ganglion-cell bodies located?*

In the **ganglion cell layer**

*Anatomically speaking, what structure will the axons go on to form?*

The optic nerve

*Where will **most** of these fibers eventually synapse?*

The lateral geniculate nucleus (LGN)

*Most? Where will the others synapse, and what are they responsible for?*

Most of the others are involved in the

three words



## Retinal Anatomy and Histology

# A

## ● Neurosensory Retina Layers

- Internal limiting memb

- **Nerve fiber layer**

- **Ganglion cell layer**



- External limiting memb



- RPE

- Bruch's me

*Histologically speaking, the NFL is composed of what specific structures?*

Axons of the ganglion cells

*Where are the ganglion-cell bodies located?*

In the **ganglion cell layer**

*Anatomically speaking, what structure will the axons go on to form?*

The optic nerve

*Where will **most** of these fibers eventually synapse?*

The lateral geniculate nucleus (LGN)

*Most? Where will the others synapse, and what are they responsible for?*

Most of the others are involved in the pupillary light reflex .



## Retinal Anatomy and Histology

### Q

#### ● Neurosensory Retina Layers

- Internal limiting memb

- **Nerve fiber layer**

- **Ganglion cell layer**

- 

- 

- 

- 

- External limiting memb

- 

- RPE

- Bruch's me

*Histologically speaking, the NFL is composed of what specific structures?*

Axons of the ganglion cells

*Where are the ganglion-cell bodies located?*

In the **ganglion cell layer**

*Anatomically speaking, what structure will the axons go on to form?*

The optic nerve

*Where will **most** of these fibers eventually synapse?*

The lateral geniculate nucleus (LGN)

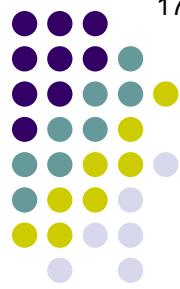
*Most? Where will the others synapse, and what are they responsible for?*

Most of the others are involved in the pupillary light reflex. They peel off

just prior to reaching the LGN, heading instead to the structure of the

location

to synapse in the structure-al nuclei



## Retinal Anatomy and Histology

# A

## ● Neurosensory Retina Layers

- Internal limiting memb

- **Nerve fiber layer**

- **Ganglion cell layer**

- 

- 

- 

- 

- External limiting memb

- 

- RPE

- Bruch's me

*Histologically speaking, the NFL is composed of what specific structures?*

Axons of the ganglion cells

*Where are the ganglion-cell bodies located?*

In the **ganglion cell layer**

*Anatomically speaking, what structure will the axons go on to form?*

The optic nerve

*Where will **most** of these fibers eventually synapse?*

The lateral geniculate nucleus (LGN)

*Most? Where will the others synapse, and what are they responsible for?*

Most of the others are involved in the pupillary light reflex. They peel off just prior to reaching the LGN, heading instead to the pretectum of the dorsal midbrain to synapse in the pretectal nuclei



## Retinal Anatomy and Histology

# Q

### ● Neurosensory Retina Layers

● Internal limiting memb

● **Nerve fiber layer**

● **Ganglion cell layer**

●

●

●

●

● External limiting memb

●

● RPE

● Bruch's me

*Histologically speaking, the NFL is composed of what specific structures?*

Axons of the ganglion cells

*Where are the ganglion-cell bodies located?*

In the **ganglion cell layer**

*Anatomically speaking, what structure will the axons go on to form?*

The optic nerve

*Where will **most** of these fibers eventually synapse?*

The lateral geniculate nucleus (LGN)

*Most? Where will the others synapse, and what are they responsible for?*

**Most** of the others are involved in the pupillary light reflex. They peel off just prior to reaching the LGN, heading instead to the pretectum of the

*Seriously?*

*OK, where will the others synapse, and what are they responsible for?*



## Retinal Anatomy and Histology

# A

## ● Neurosensory Retina Layers

- Internal limiting membrane *Histologically speaking, the NFL is composed of what specific structures?*  
Axons of the ganglion cells
- **Nerve fiber layer**
- **Ganglion cell layer**
- *Where are the ganglion-cell bodies located?*  
In the **ganglion cell layer**
- *Anatomically speaking, what structure will the axons go on to form?*  
The optic nerve
- External limiting membrane *Where will **most** of these fibers eventually synapse?*  
The lateral geniculate nucleus (LGN)

## ● RPE

- Bruch's membrane *Most? Where will the others synapse, and what are they responsible for?*  
**Most** of the others are involved in the pupillary light reflex. They peel off just prior to reaching the LGN, heading instead to the pretectum of the

*Seriously?*

*OK, where will the others synapse, and what are they responsible for?*

The hypothalamus, where they are involved in modulating circadian responses

# A

- **Neurosensory Retina Layers**

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- (Next?)
- 
- 
- 
- External limiting membrane
- 

- **RPE**

- **Bruch's membrane**



# A

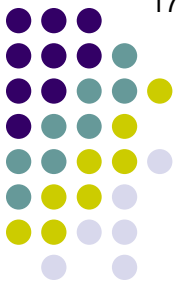
- **Neurosensory Retina Layers**
  - Internal limiting membrane
  - Nerve fiber layer
  - Ganglion cell layer
  - Inner plexiform layer
  - (Next?)
  - 
  - 
  - External limiting membrane
  -
- **RPE**
- **Bruch's membrane**





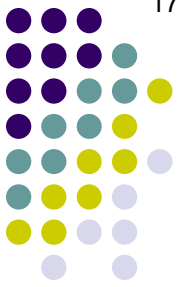
# A

- **Neurosensory Retina Layers**
  - Internal limiting membrane
  - Nerve fiber layer
  - Ganglion cell layer
  - Inner plexiform layer
  - Inner nuclear layer
  - (Next?)
  - 
  - External limiting membrane
  -
- **RPE**
- **Bruch's membrane**



# A

- **Neurosensory Retina Layers**
  - Internal limiting membrane
  - Nerve fiber layer
  - Ganglion cell layer
  - Inner plexiform layer
  - Inner nuclear layer
  - Outer plexiform layer
  - *(Next?)*
  - External limiting membrane
  -
- **RPE**
- **Bruch's membrane**



# A

- **Neurosensory Retina Layers**
  - Internal limiting membrane
  - Nerve fiber layer
  - Ganglion cell layer
  - Inner plexiform layer
  - Inner nuclear layer
  - Outer plexiform layer
  - Outer nuclear layer
  - External limiting membrane
  -
- **RPE**
- **Bruch's membrane**



**Q**

- **Neurosensory Retina**
  - Internal limiting membrane
  - Nerve fiber layer
  - Ganglion cell layer
  - **Inner plexiform layer**
  - Inner nuclear layer
  - **Outer plexiform layer**
  - Outer nuclear layer
  - External limiting membrane
  -
- **RPE**
- **Bruch's membrane**

*What does plexiform mean?*



## Retinal Anatomy and Histology

# A

- Neurosensory Retina
  - Internal limiting membrane
  - Nerve fiber layer
  - Ganglion cell layer
  - **Inner plexiform layer**
  - Inner nuclear layer
  - **Outer plexiform layer**
  - Outer nuclear layer
  - External limiting membrane
  -
- RPE
- Bruch's membrane

What does plexiform mean?  
It means 'plexus-like'

**Q****● Neurosensory Retina**

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- **Inner plexiform layer**
- Inner nuclear layer
- **Outer plexiform layer**
- Outer nuclear layer
- External limiting membrane
- 
- **RPE**
- **Bruch's membrane**

*What does plexiform mean?*

It means 'plexus-like'

*OK then, what is a plexus?*



## Retinal Anatomy and Histology

# A

- Neurosensory Retina
  - Internal limiting membrane
  - Nerve fiber layer
  - Ganglion cell layer
  - **Inner plexiform layer**
  - Inner nuclear layer
  - **Outer plexiform layer**
  - Outer nuclear layer
  - External limiting membrane
  -
- RPE
- Bruch's membrane

*What does plexiform mean?*  
It means 'plexus-like'

*OK then, what is a plexus?*  
An interlaced group of fibers

# Q

## ● Neurosensory Retina

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- **Inner plexiform layer**
- Inner nuclear layer
- **Outer plexiform layer**
- Outer nuclear layer
- External limiting membrane
- 
- RPE
- Bruch's membrane

*What does plexiform mean?*

It means 'plexus-like'

*OK then, what is a plexus?*

An interlaced group of fibers

*What does this indicate about the composition of the inner and outer plexiform layers?*





## Retinal Anatomy and Histology

# A

- Neurosensory Retina
  - Internal limiting membrane
  - Nerve fiber layer
  - Ganglion cell layer
  - **Inner plexiform layer**
  - Inner nuclear layer
  - **Outer plexiform layer**
  - Outer nuclear layer
  - External limiting membrane
  -
- RPE
- Bruch's membrane

*What does plexiform mean?*

It means 'plexus-like'

*OK then, what is a plexus?*

An interlaced group of fibers

*What does this indicate about the composition of the inner and outer plexiform layers?*

That they are composed of cell processes, ie, axons and dendrites



## Retinal Anatomy and Histology

### Q

#### ● Neurosensory Retina

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- **Inner plexiform layer**
- Inner nuclear layer
- **Outer plexiform layer**
- Outer nuclear layer
- External limiting membrane
- 

#### ● RPE

#### ● Bruch's membrane

*What does plexiform mean?*

It means 'plexus-like'

*OK then, what is a plexus?*

An interlaced group of fibers

*What does this indicate about the composition of the inner and outer plexiform layers?*

That they are composed of cell processes, ie, axons and dendrites

*Processes of what specific cells comprise these layers?*

**OPL:**

--Axons of...

--Dendrites of...



## Retinal Anatomy and Histology

# A

## ● Neurosensory Retina

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- **Inner plexiform layer**
- Inner nuclear layer
- **Outer plexiform layer**
- Outer nuclear layer
- External limiting membrane
- 
- RPE
- Bruch's membrane

*What does plexiform mean?*

It means 'plexus-like'

*OK then, what is a plexus?*

An interlaced group of fibers

*What does this indicate about the composition of the inner and outer plexiform layers?*

That they are composed of cell processes, ie, axons and dendrites

*Processes of what specific cells comprise these layers?*

**OPL:**

--Axons of...photoreceptors

--Dendrites of...bipolar cells



## Retinal Anatomy and Histology

Q

### ● Neurosensory Retina

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- **Inner plexiform layer**
- Inner nuclear layer
- **Outer plexiform layer**
- Outer nuclear layer
- External limiting membrane
- 

### ● RPE

### ● Bruch's membrane

*What does plexiform mean?*

It means 'plexus-like'

*OK then, what is a plexus?*

An interlaced group of fibers

*What does this indicate about the composition of the inner and outer plexiform layers?*

That they are composed of cell processes, ie, axons and dendrites

*Processes of what specific cells comprise these layers?*

**OPL:**

- Axons of...photoreceptors
- Dendrites of...bipolar cells

**IPL:**

- Axons of...
- Dendrites of...



## Retinal Anatomy and Histology

# A

## ● Neurosensory Retina

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- **Inner plexiform layer**
- Inner nuclear layer
- **Outer plexiform layer**
- Outer nuclear layer
- External limiting membrane
- 
- RPE
- Bruch's membrane

*What does plexiform mean?*

It means 'plexus-like'

*OK then, what is a plexus?*

An interlaced group of fibers

*What does this indicate about the composition of the inner and outer plexiform layers?*

That they are composed of cell processes, ie, axons and dendrites

*Processes of what specific cells comprise these layers?*

**OPL:**

- Axons of...photoreceptors
- Dendrites of...bipolar cells

**IPL:**

- Axons of...bipolar cells
- Dendrites of...ganglion cells



## Retinal Anatomy and Histology

Q

### ● Neurosensory Retina

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- **Inner plexiform layer**
- Inner nuclear layer
- **Outer plexiform layer**
- Outer nuclear layer
- External limiting membrane
- 

### ● RPE

### ● Bruch's membrane

*What does plexiform mean?*

It means 'plexus-like'

*OK then, what is a plexus?*

An interlaced group of fibers

*What does this indicate about the composition of the inner and outer plexiform layers?*

That they are composed of cell processes, ie, axons and dendrites

*Processes of what specific cells comprise these layers?*

**OPL:**

- Axons of...photoreceptors
- Dendrites of...bipolar cells

**IPL:**

- Axons of...bipolar cells
- Dendrites of...ganglion cells

*Another layer consists solely of cell processes— which one?*



## Retinal Anatomy and Histology

# A

## ● Neurosensory Retina

- Internal limiting membrane
- **Nerve fiber layer**
- Ganglion cell layer
- **Inner plexiform layer**
- Inner nuclear layer
- **Outer plexiform layer**
- Outer nuclear layer
- External limiting membrane
- 

## ● RPE

## ● Bruch's membrane

*What does plexiform mean?*

It means 'plexus-like'

*OK then, what is a plexus?*

An interlaced group of fibers

*What does this indicate about the composition of the inner and outer plexiform layers?*

That they are composed of cell processes, ie, axons and dendrites

*Processes of what specific cells comprise these layers?*

**OPL:**

- Axons of...photoreceptors
- Dendrites of...bipolar cells

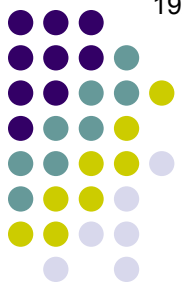
**IPL:**

- Axons of...bipolar cells
- Dendrites of...ganglion cells

*Another layer consists solely of cell processes— which one?*

The **nerve fiber layer** consists solely of the axons of ganglion cells

## Q



### ● Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- **Inner nuclear layer**
- Outer plexiform layer
- **Outer nuclear layer**
- External limiting membrane
- 
- RPE
- Bruch's membrane

*If the plexiform layers are composed of cell axons, what are the nuclear layers composed of?*





## Retinal Anatomy and Histology

# A

## ● Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- **Inner nuclear layer**
- Outer plexiform layer
- **Outer nuclear layer**
- External limiting membrane
- 
- RPE
- Bruch's membrane

*If the plexiform layers are composed of cell axons, what are the nuclear layers composed of?*

**Cell bodies**



## Retinal Anatomy and Histology

### Q

#### ● Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- **Inner nuclear layer**
- Outer plexiform layer
- **Outer nuclear layer**
- External limiting membrane
- 
- RPE
- Bruch's membrane

*If the plexiform layers are composed of cell axons, what are the nuclear layers composed of?*

**Cell bodies**

*What cell types have their bodies in these layers?*

**INL:**

**ONL:**



## Retinal Anatomy and Histology

# A

## ● Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- **Inner nuclear layer**
- Outer plexiform layer
- **Outer nuclear layer**
- External limiting membrane
- 
- RPE
- Bruch's membrane

*If the plexiform layers are composed of cell axons, what are the nuclear layers composed of?*

**Cell bodies**

*What cell types have their bodies in these layers?*

**INL:** Bipolar, amacrine and horizontal cells

**ONL:** Photoreceptors



## Retinal Anatomy and Histology

### Q

#### ● Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- **Inner nuclear layer**
- Outer plexiform layer
- **Outer nuclear layer**
- External limiting membrane
- 
- RPE
- Bruch's membrane

*If the plexiform layers are composed of cell axons, what are the nuclear layers composed of?*

**Cell bodies**

*What cell types have their bodies in these layers?*

**INL:** Bipolar, amacrine and horizontal cells

**ONL:** Photoreceptors

*Another retinal layer also consists of cell bodies— which one?*

## A

- Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- **Ganglion cell layer**
- Inner plexiform layer
- **Inner nuclear layer**
- Outer plexiform layer
- **Outer nuclear layer**
- External limiting membrane
- 
- RPE
- Bruch's membrane

*If the plexiform layers are composed of cell axons, what are the nuclear layers composed of?*

**Cell bodies**

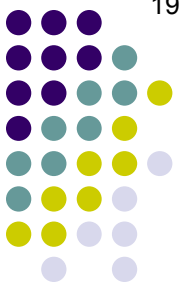
*What cell types have their bodies in these layers?*

**INL:** Bipolar, amacrine and horizontal cells

**ONL:** Photoreceptors

*Another retinal layer also consists of cell bodies— which one?*

The **ganglion cell layer**



## Retinal Anatomy and Histology



- Neurosensory Retina Layers
  - Internal limiting membrane
  - Nerve fiber layer ← Processes
  - Ganglion cell layer ← Bodies
  - Inner plexiform layer ← Processes
  - Inner nuclear layer ← Bodies
  - Outer plexiform layer ← Processes
  - Outer nuclear layer ← Bodies
  - External limiting membrane
  -
- RPE
- Bruch's membrane

Note that this section of the retina consists of alternating layers of cell **processes** and cell **bodies**. This pattern can help you remember which layer is next to which!

**Q****● Neurosensory Retina Layers**

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer

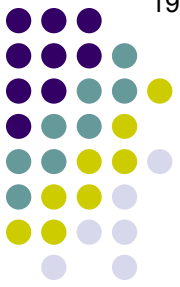
**● Outer plexiform layer = ?**

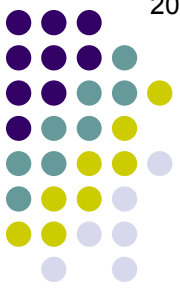
- Outer nuclear layer

*The outer plexiform layer is often referred to by an eponym.*

- *What is this eponymous name?*

- 

**● RPE****● Bruch's membrane**



## Retinal Anatomy and Histology

# A

## ● Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer

- **Outer plexiform layer = Henle's layer (sort of)**

- Outer nuclear layer

*The outer plexiform layer is often referred to by an eponym.*

- *What is this eponymous name?*

- **Henle's layer** (However, as we will see when we correlate retinal anatomy with OCT imaging later in the slide-set,

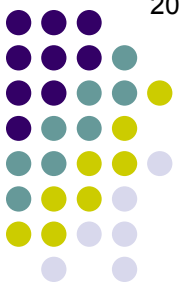
- **RP** these terms are in fact **not** synonyms!)

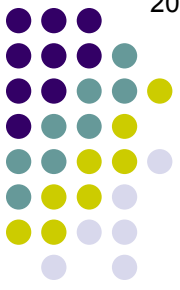
- **Bruch's membrane**



**Q****● Neurosensory Retina Layers**

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- (Next?)

**● RPE****● Bruch's membrane**



## A

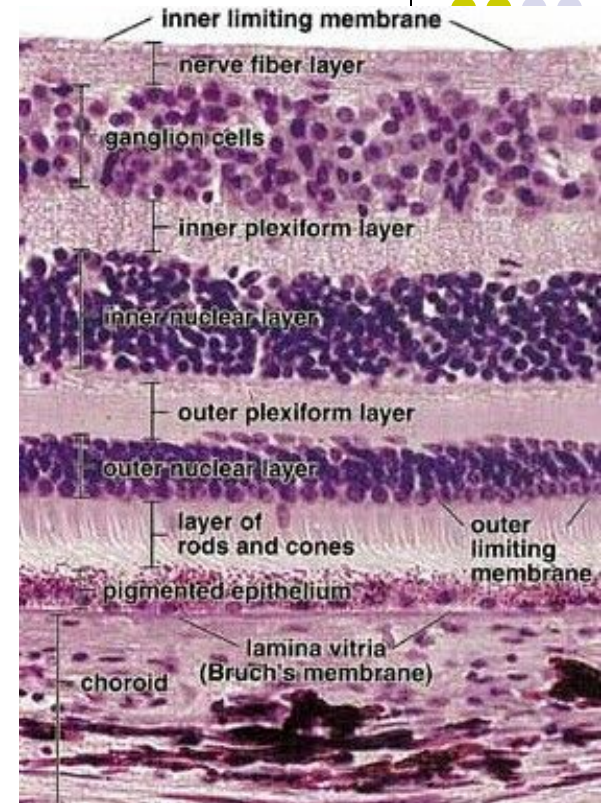
- **Neurosensory Retina Layers**
  - Internal limiting membrane
  - Nerve fiber layer
  - Ganglion cell layer
  - Inner plexiform layer
  - Inner nuclear layer
  - Outer plexiform layer
  - Outer nuclear layer
  - External limiting membrane
  - Rod & cone inner and outer segments
- **RPE**
- **Bruch's membrane**

# Retinal Anatomy and Histology



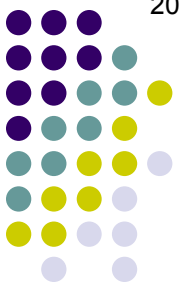
- **Neurosensory Retina Layers**
    - Internal limiting membrane
    - Nerve fiber layer
    - Ganglion cell layer
    - Inner plexiform layer
    - Inner nuclear layer
    - Outer plexiform layer
    - Outer nuclear layer
    - External limiting membrane
    - Rod & cone inner and outer segments
  - **RPE**
  - **Bruch's membrane**
- We'll have more to say about the RPE and Bruch's shortly*

- **Neurosensory Retina Layers**
  - Internal limiting membrane
  - Nerve fiber layer
  - Ganglion cell layer
  - Inner plexiform layer
  - Inner nuclear layer
  - Outer plexiform layer
  - Outer nuclear layer
  - External limiting membrane
  - Rod & cone inner and outer segments
- RPE
- Bruch's membrane



*Review slide—no questions*

# Q



## ● Neurosensory Retina Layers

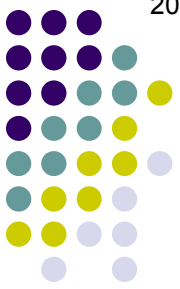
- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

*What cell extends the entire breadth of the retina?*

## ● RPE

## ● Bruch's membrane

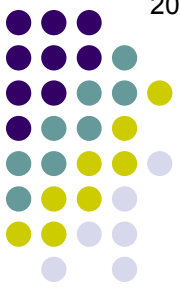
# A



- **Neurosensory Retina Layers**
  - Internal limiting membrane
  - Nerve fiber layer
  - Ganglion cell layer
  - Inner plexiform layer
  - Inner nuclear layer
  - Outer plexiform layer
  - Outer nuclear layer
  - External limiting membrane
  - Rod & cone inner and outer segments
- **RPE**
- **Bruch's membrane**

*What cell extends the entire breadth of the retina?*  
**Müller cells**

# Q



## ● Neurosensory Retina Layers

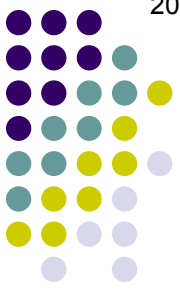
- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

*What cell extends the entire breadth of the retina?*  
**Müller cells**

*Remind me: What do their foot processes create?*

## ● RPE

## ● Bruch's membrane



## Retinal Anatomy and Histology

# A

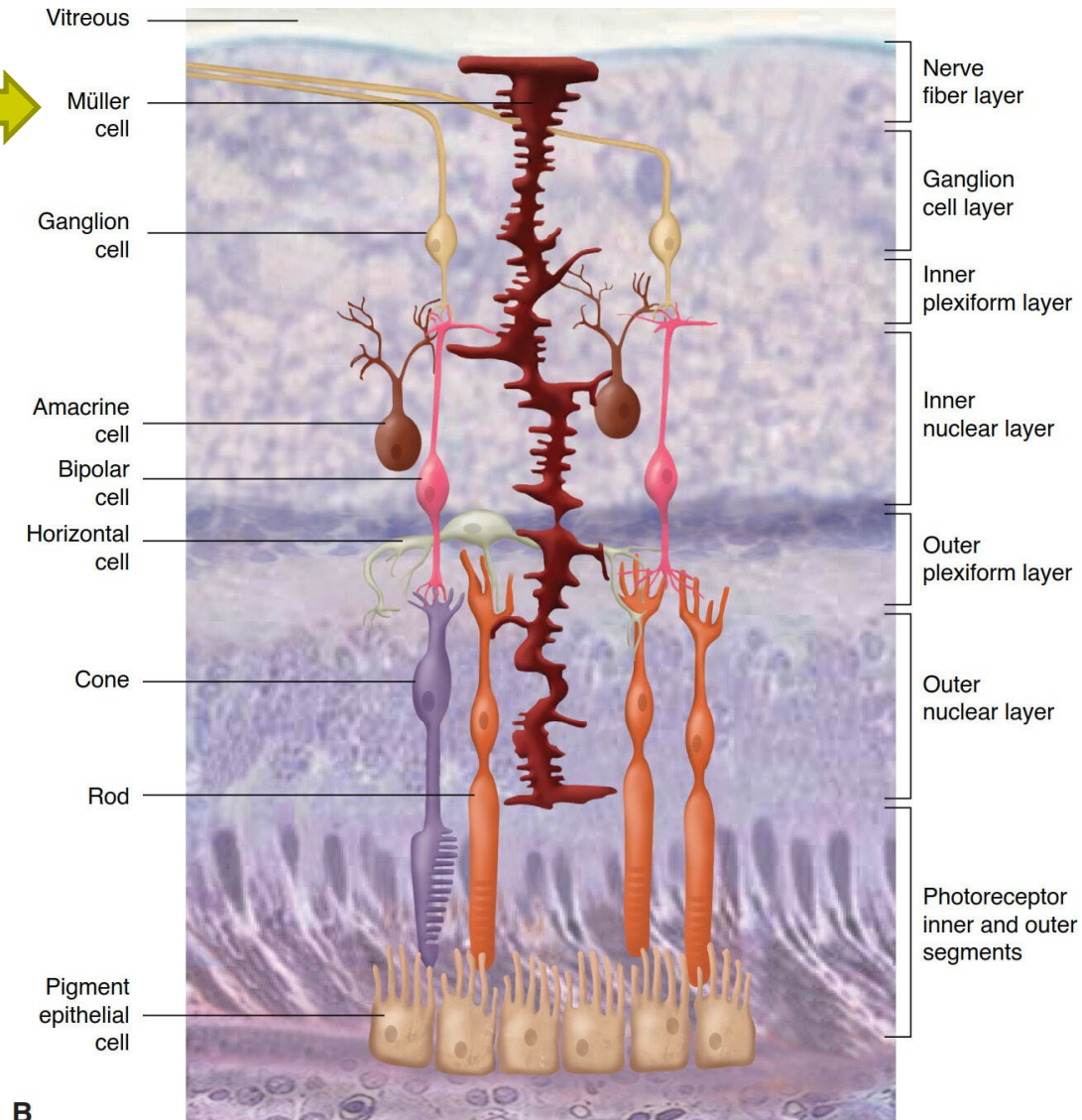
- Neurosensory Retina Layers
  - **Internal limiting membrane**
  - Nerve fiber layer
  - Ganglion cell layer
  - Inner plexiform layer
  - Inner nuclear layer
  - Outer plexiform layer
  - Outer nuclear layer
  - External limiting membrane
  - Rod & cone inner and outer segments
- RPE
- Bruch's membrane

*What cell extends the entire breadth of the retina?*  
**Müller cells**

*Remind me: What do their foot processes create?*  
**The internal limiting membrane**



# Retinal Anatomy and Histology



Müller cells



# Q



- **Neurosensory Retina Layers**
  - Internal limiting membrane
  - Nerve fiber layer
  - Ganglion cell layer
  - Inner plexiform layer
  - Inner nuclear layer
  - Outer plexiform layer
  - Outer nuclear layer
  - External limiting membrane
  - Rod & cone inner and outer segments
- **RPE**
- **Bruch's membrane**

*Remind me: Which cells comprise the retinal vertical pathway, and what is meant by that term?*

# A

To CNS

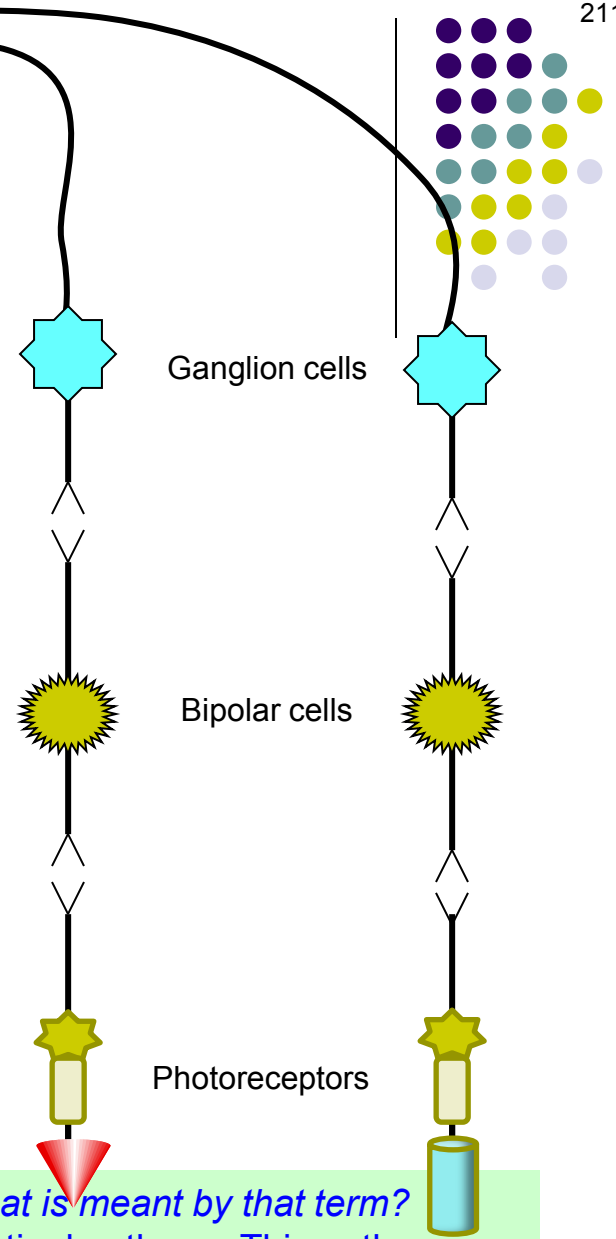
Ganglion-cell axons

## Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

## RPE

## Bruch's membrane



*Remind me: Which cells comprise the retinal vertical pathway, and what is meant by that term? The photoreceptors, bipolar and ganglion cells comprise the vertical retinal pathway. This pathway is vertical in the sense that it is the direct path from photic stimulation to the CNS processing centers.*

# Q/A

## ● Neurosensory Retina Layers

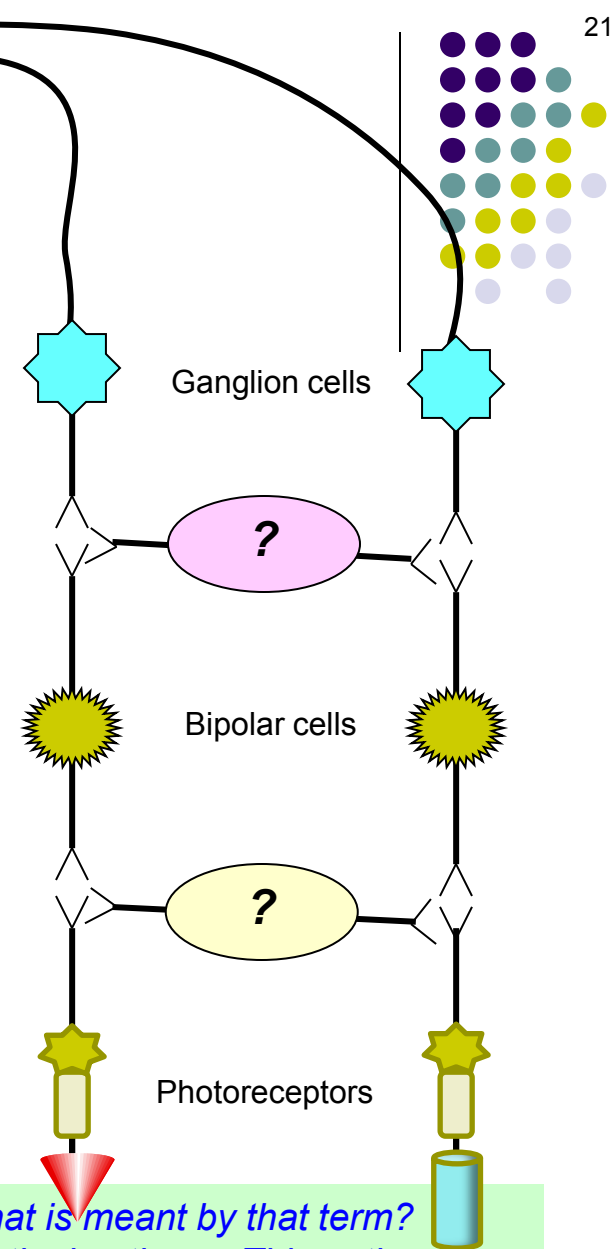
- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

## ● RPE

## ● Bruch's membrane

To CNS

Ganglion-cell axons



*Remind me: Which cells comprise the retinal vertical pathway, and what is meant by that term?*  
 The *photoreceptors, bipolar and ganglion cells* comprise the vertical retinal pathway. This pathway is vertical in the sense that it is the direct path from photic stimulation to the CNS processing centers.  
 [ ] cells and [ ] cells comprise the [ ] pathway, forming connections between neural cells, but not directly getting impulses out of the eye and on their way to the CNS.

A

To CNS

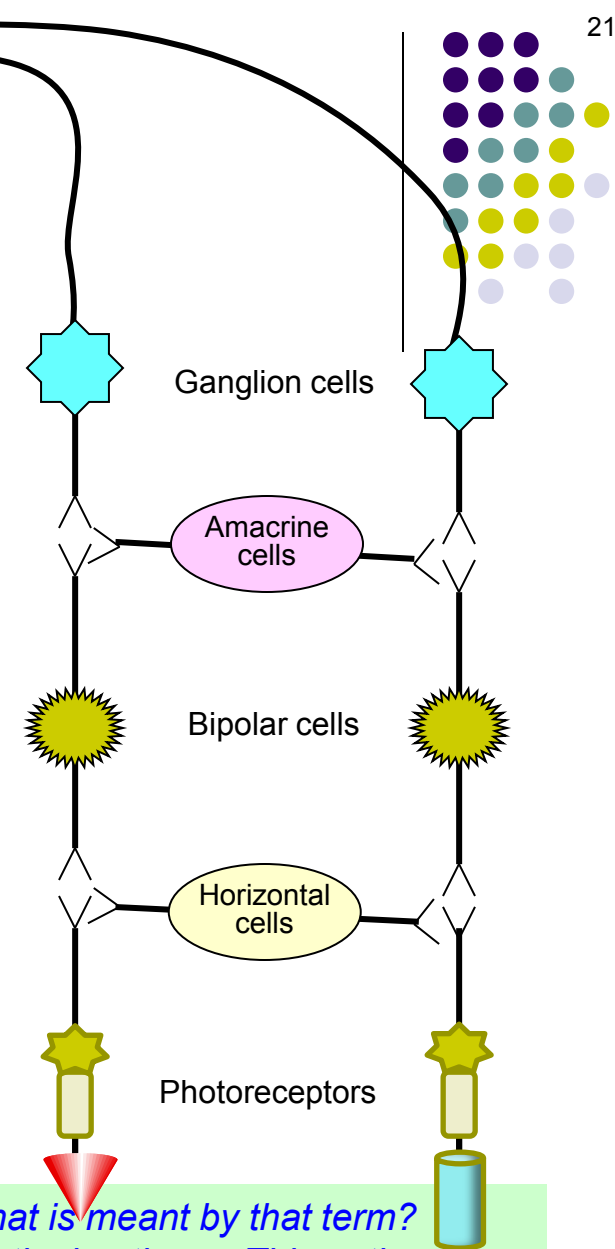
Ganglion-cell axons

## ● Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

## ● RPE

## ● Bruch's membrane



*Remind me: Which cells comprise the retinal vertical pathway, and what is meant by that term? The photoreceptors, bipolar and ganglion cells comprise the vertical retinal pathway. This pathway is vertical in the sense that it is the direct path from photic stimulation to the CNS processing centers. Horizontal cells and amacrine cells comprise the horizontal pathway, forming connections between neural cells, but not directly getting impulses out of the eye and on their way to the CNS.*

# Q

To CNS

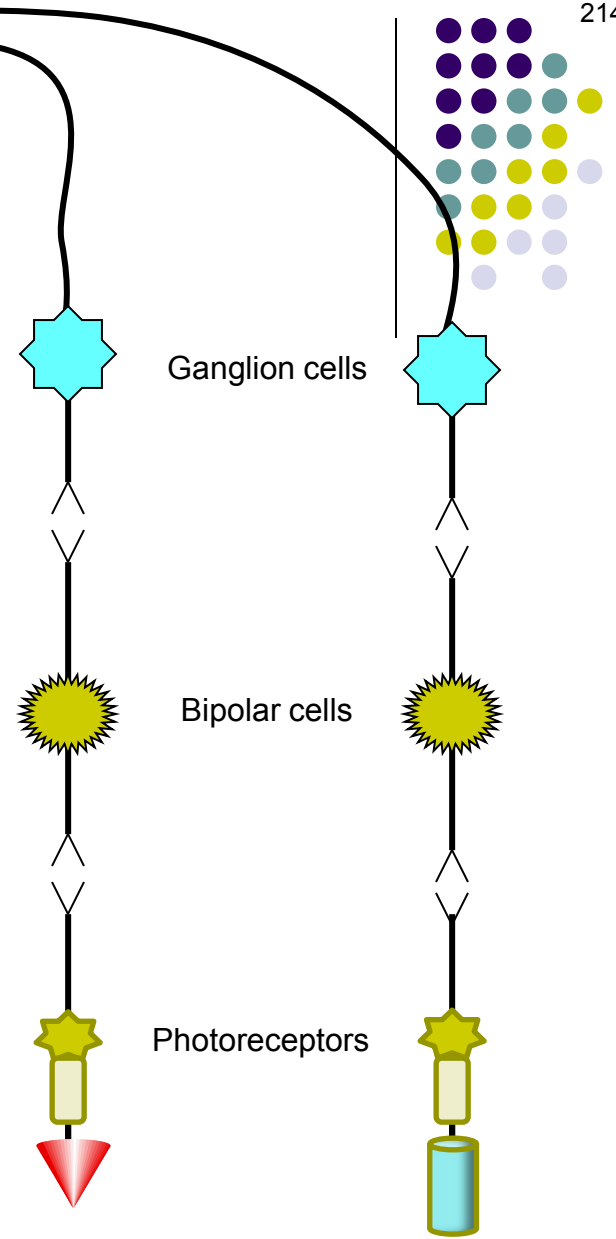
Ganglion-cell axons

## Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

## RPE

## Bruch's membrane



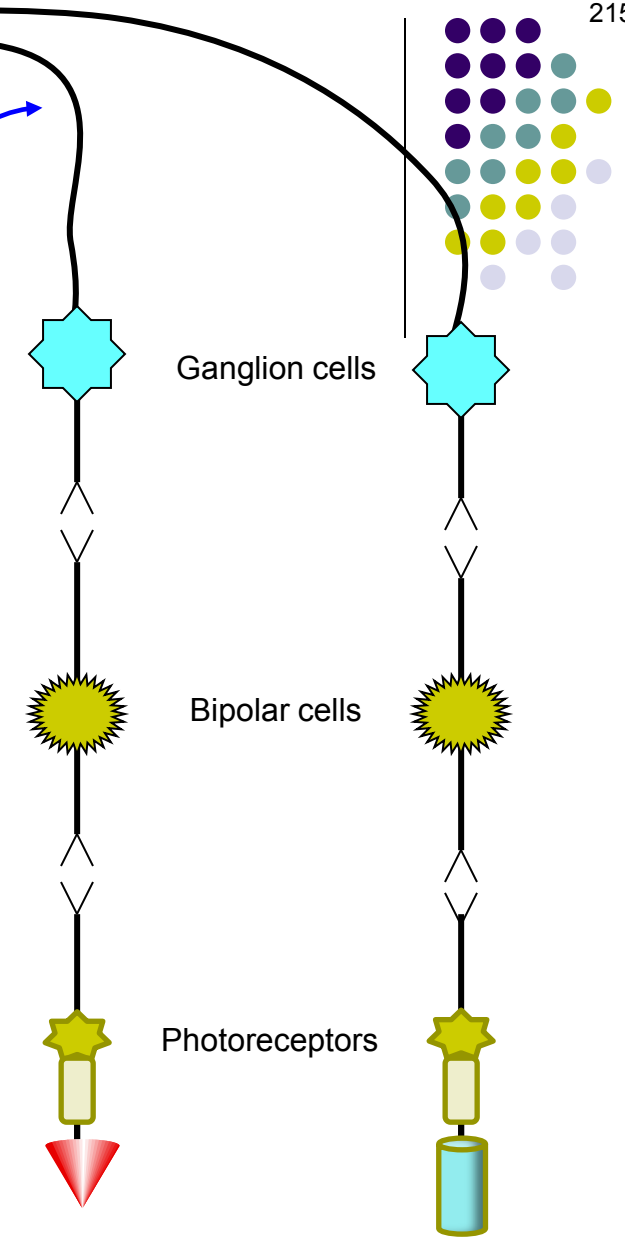
Let's make sure we're clear regarding the specific structures that comprise the retinal layers (for simplicity, I've dropped the interneurons):

*The NFL is comprised of...*

# A

- **Neurosensory Retina Layers**
  - Internal limiting membrane
  - **Nerve fiber layer**
  - Ganglion cell layer
  - Inner plexiform layer
  - Inner nuclear layer
  - Outer plexiform layer
  - Outer nuclear layer
  - External limiting membrane
  - Rod & cone inner and outer segments
- **RPE**
- **Bruch's membrane**

To CNS ← Ganglion-cell axons



Let's make sure we're clear regarding the specific structures that comprise the retinal layers (for simplicity, I've dropped the interneurons):

*The NFL is comprised of...Ganglion-cell axons*

Q

To CNS

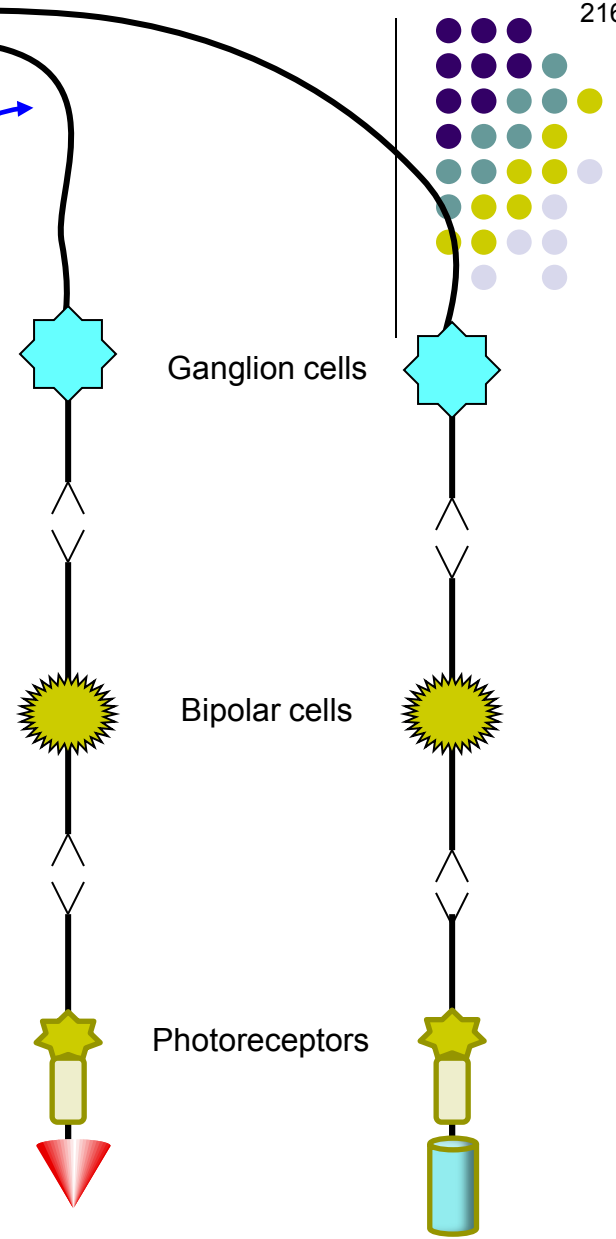
Ganglion-cell axons

### Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

● RPE

● Bruch's membrane



Let's make sure we're clear regarding the specific structures that comprise the retinal layers (for simplicity, I've dropped the interneurons):

*The ganglion cell layer is comprised of...*



# A

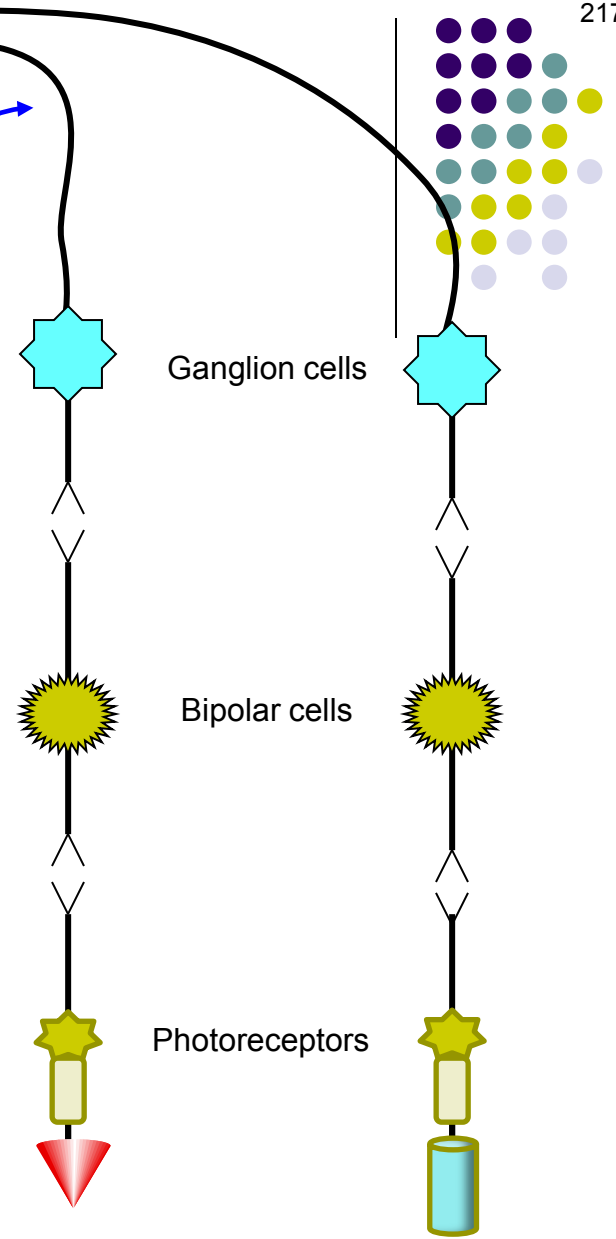
## ● Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

## ● RPE

## ● Bruch's membrane

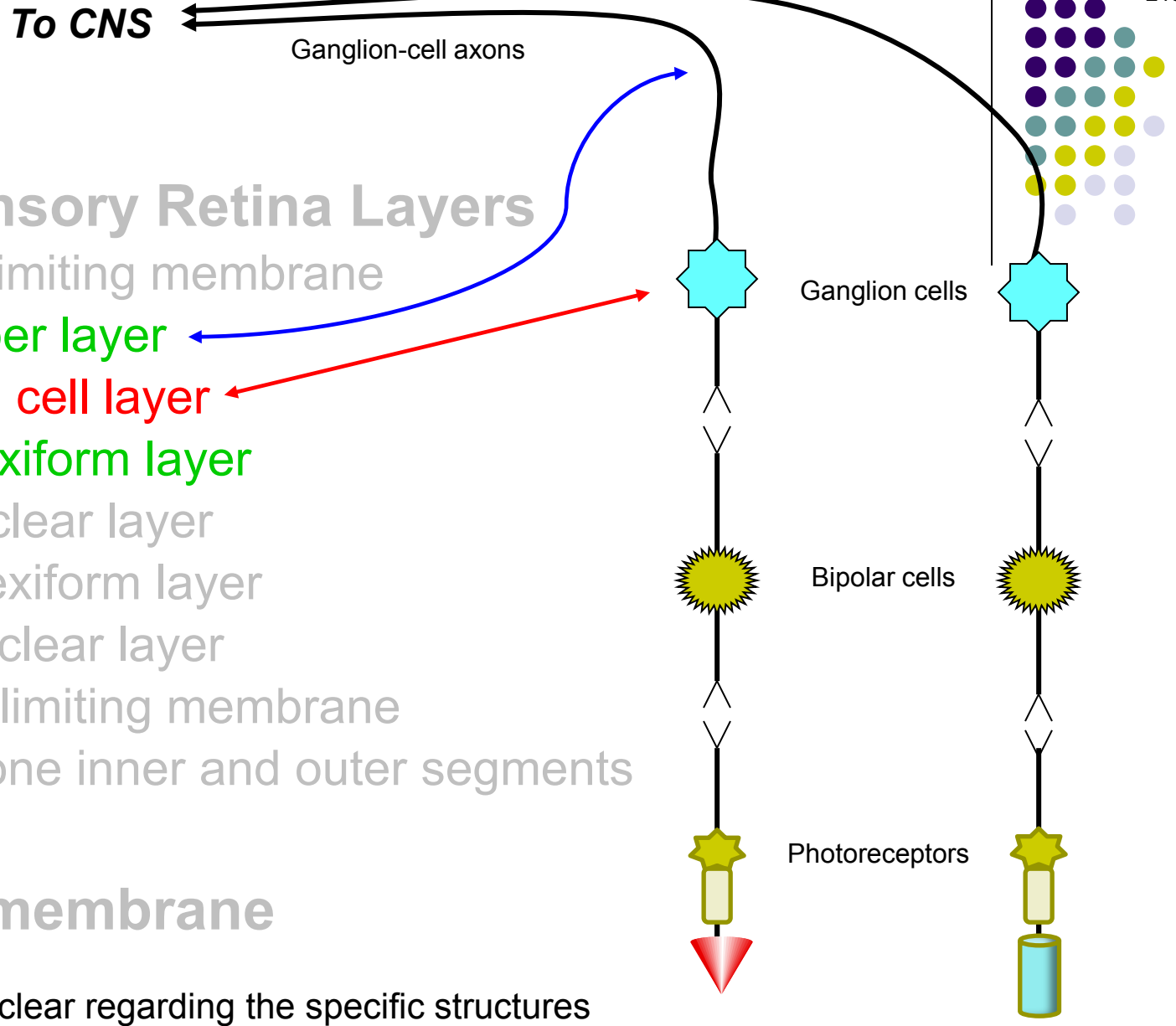
To CNS ← Ganglion-cell axons



Let's make sure we're clear regarding the specific structures that comprise the retinal layers (for simplicity, I've dropped the interneurons):

*The ganglion cell layer is comprised of...Ganglion-cell cell bodies*

Q



- Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments
- RPE
- Bruch's membrane

Let's make sure we're clear regarding the specific structures that comprise the retinal layers (for simplicity, I've dropped the interneurons):

*The inner plexiform layer is comprised of...*

# A

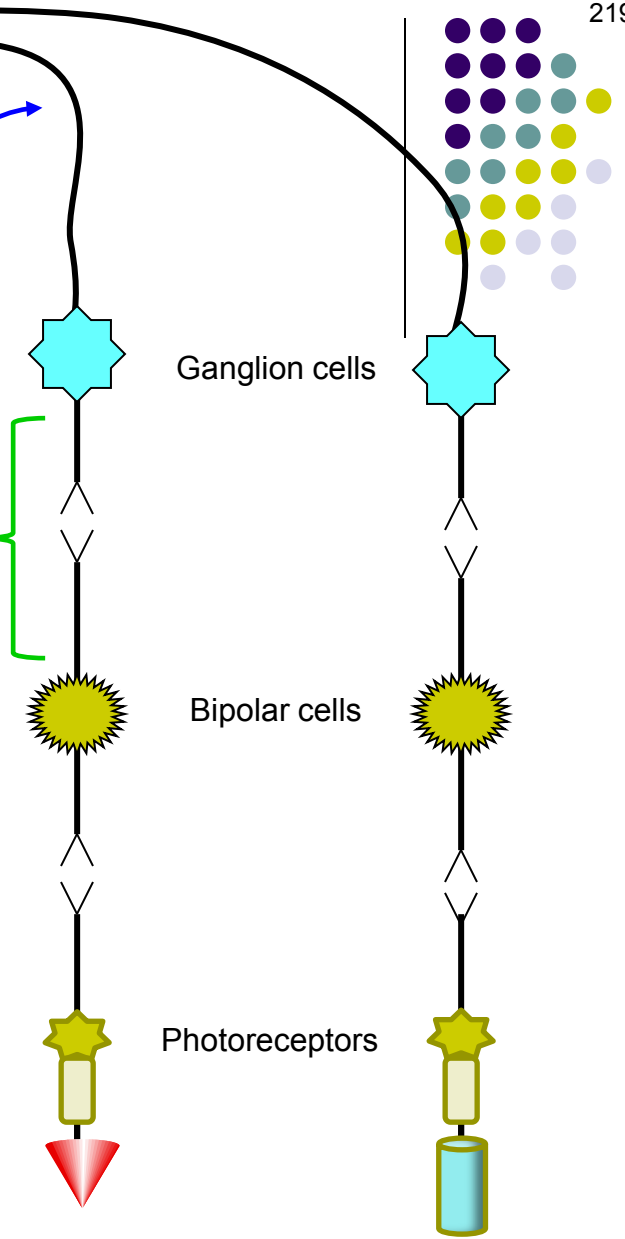
## ● Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

## ● RPE

## ● Bruch's membrane

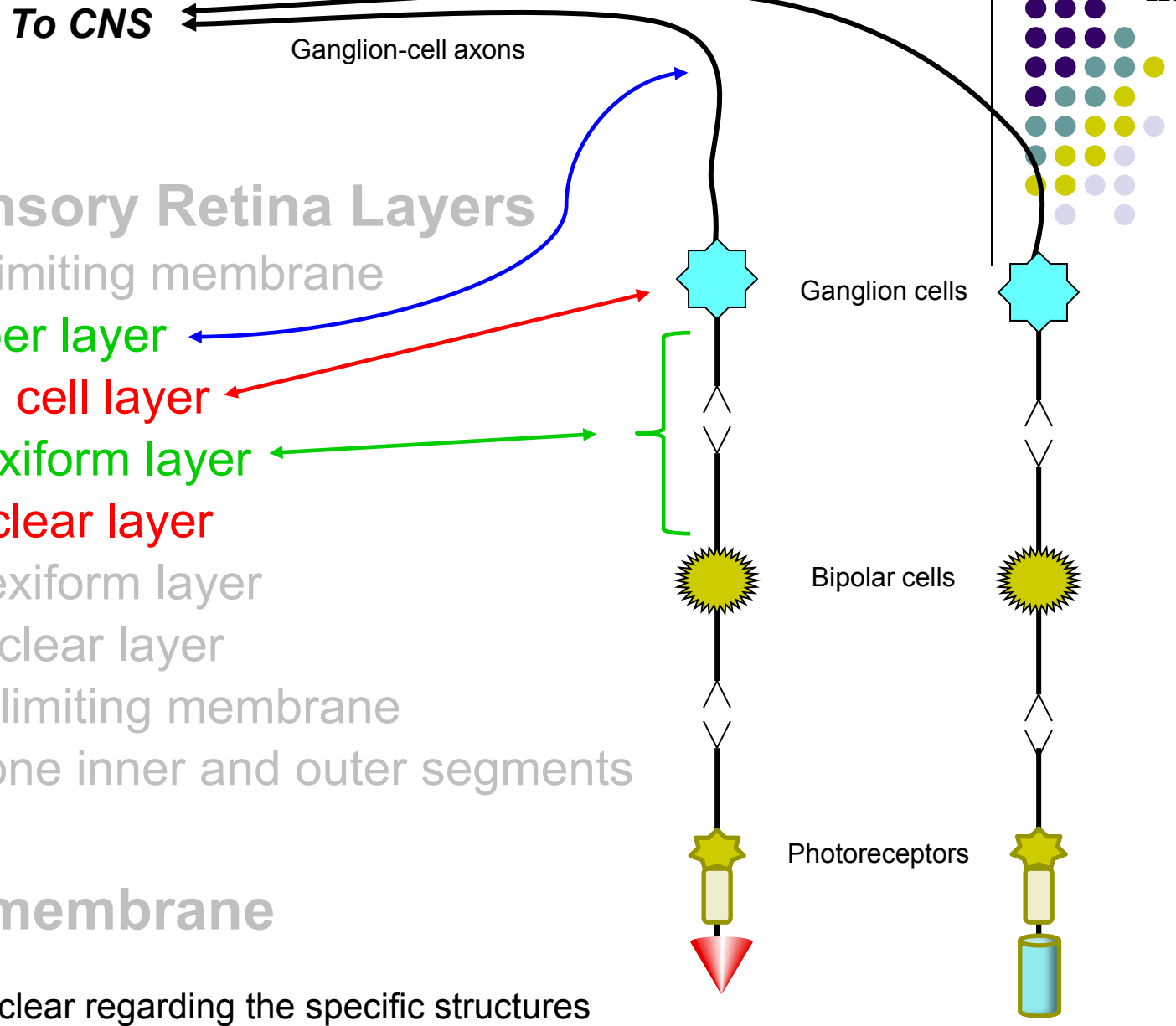
To CNS ← Ganglion-cell axons



Let's make sure we're clear regarding the specific structures that comprise the retinal layers (for simplicity, I've dropped the interneurons):

*The inner plexiform layer is comprised of...Ganglion-cell dendrites and bipolar-cell axons*

Q



- Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

- RPE

- Bruch's membrane

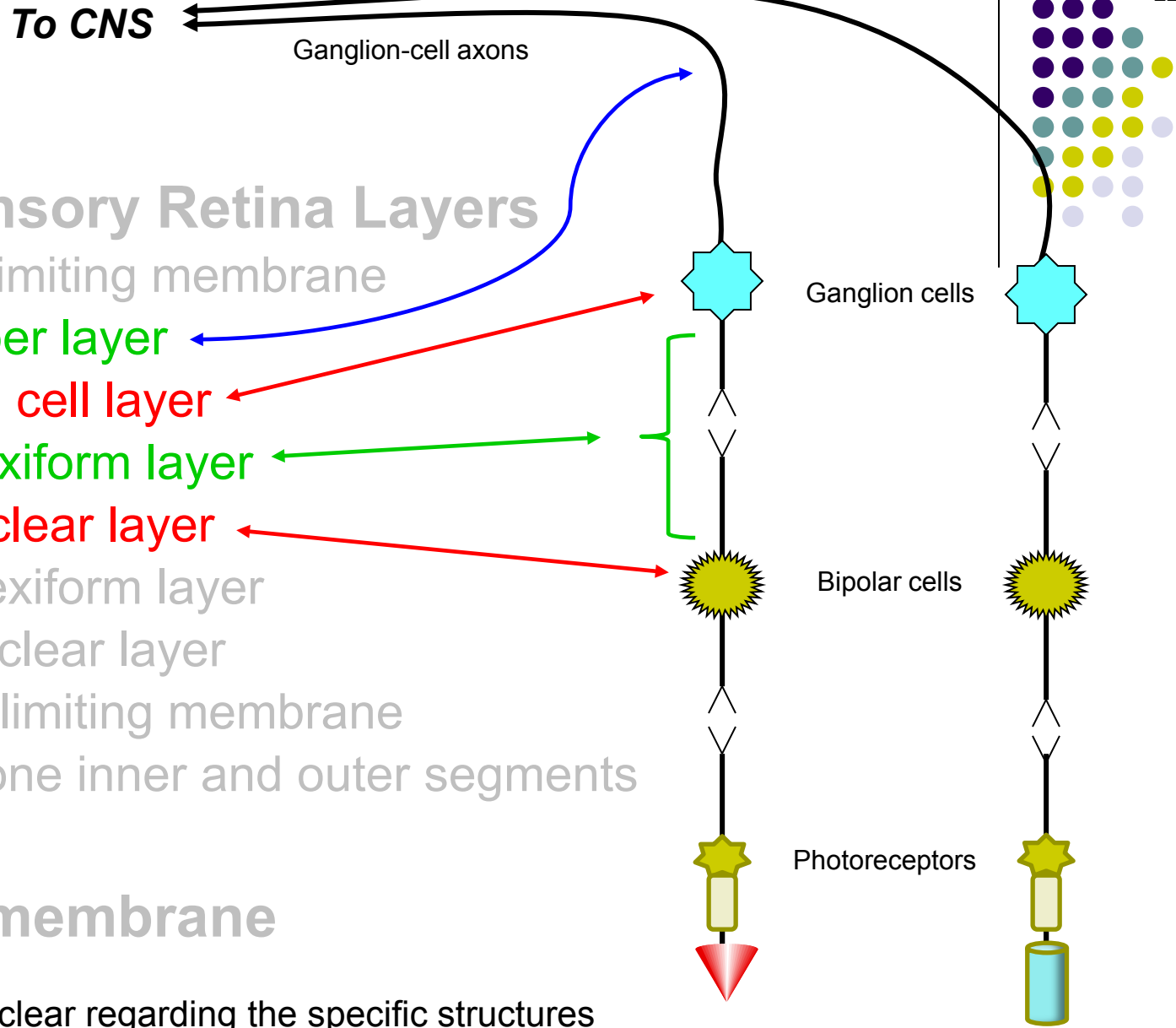
Let's make sure we're clear regarding the specific structures that comprise the retinal layers (for simplicity, I've dropped the interneurons):

*The inner nuclear layer is comprised of...*

# A

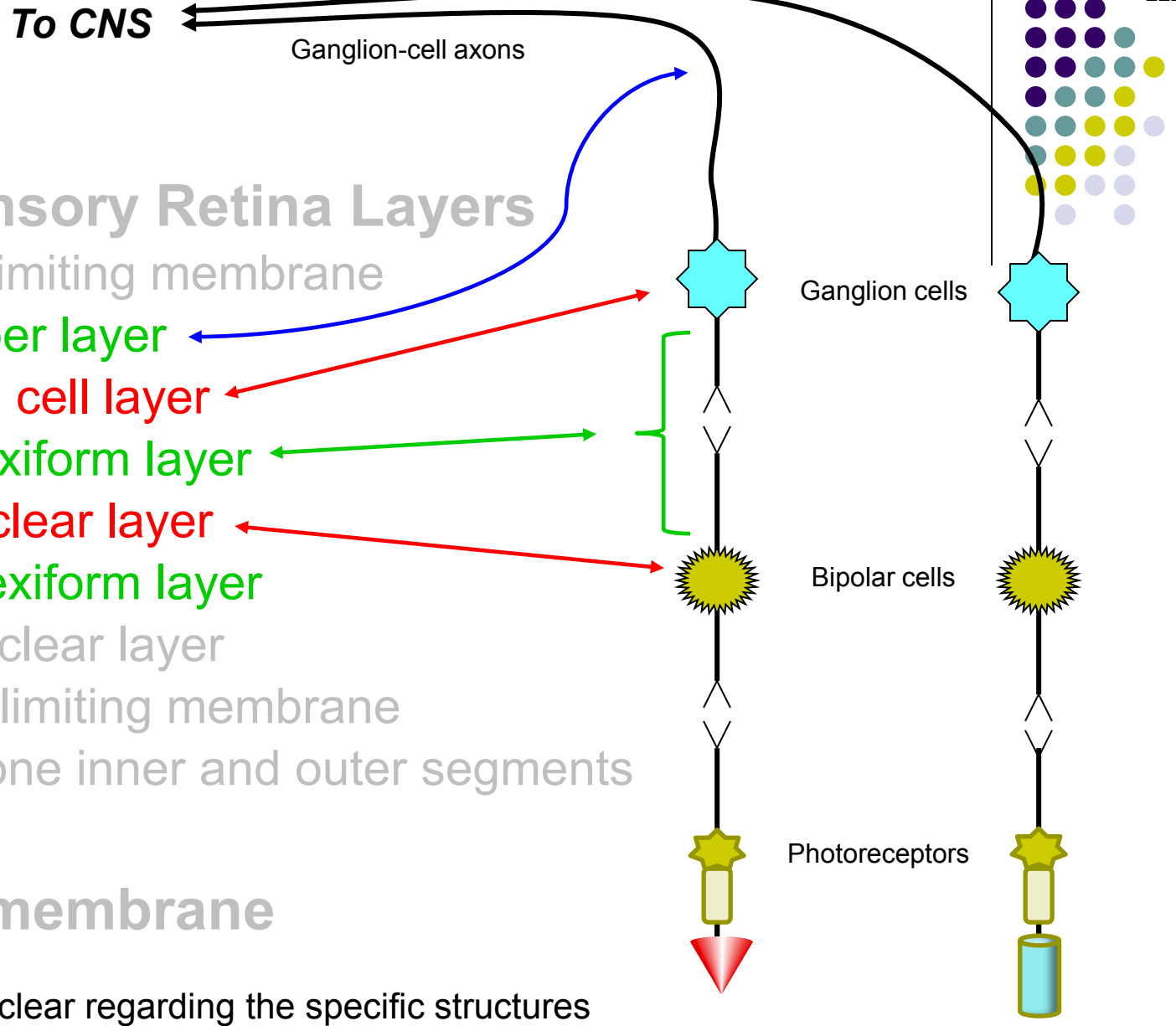
## ● Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments
- RPE
- Bruch's membrane



Let's make sure we're clear regarding the specific structures that comprise the retinal layers (for simplicity, I've dropped the interneurons):  
*The inner nuclear layer is comprised of...Bipolar-cell cell bodies (Note: Horizontal- and amacrine-cell cell bodies are in the INL as well)*

Q



- Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

- RPE

- Bruch's membrane

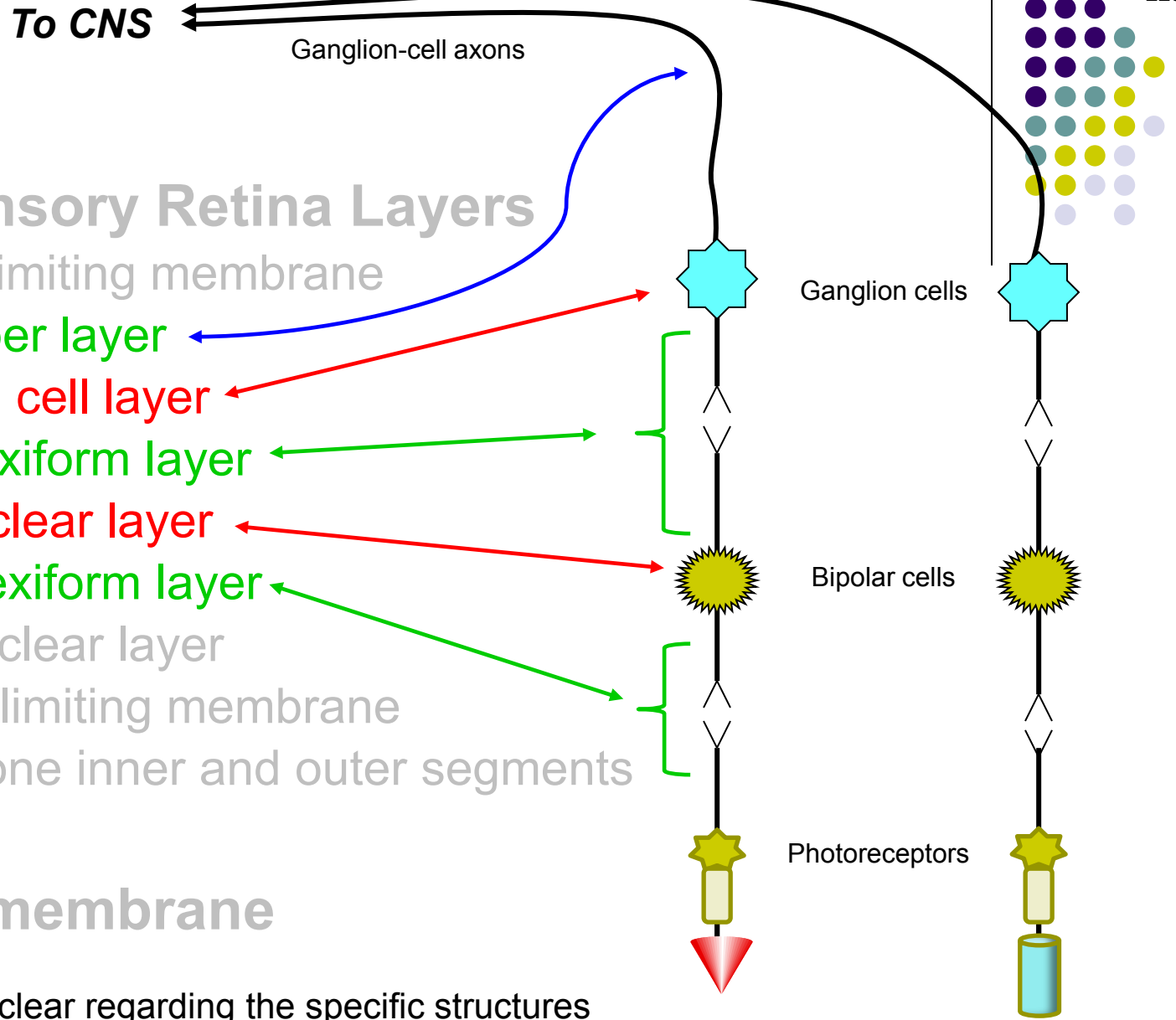
Let's make sure we're clear regarding the specific structures that comprise the retinal layers (for simplicity, I've dropped the interneurons):

*The outer plexiform layer is comprised of...*

# A

## ● Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments
- RPE
- Bruch's membrane



Let's make sure we're clear regarding the specific structures that comprise the retinal layers (for simplicity, I've dropped the interneurons):  
*The outer plexiform layer is comprised of...Bipolar-cell dendrites and PR axons*

Q

To CNS

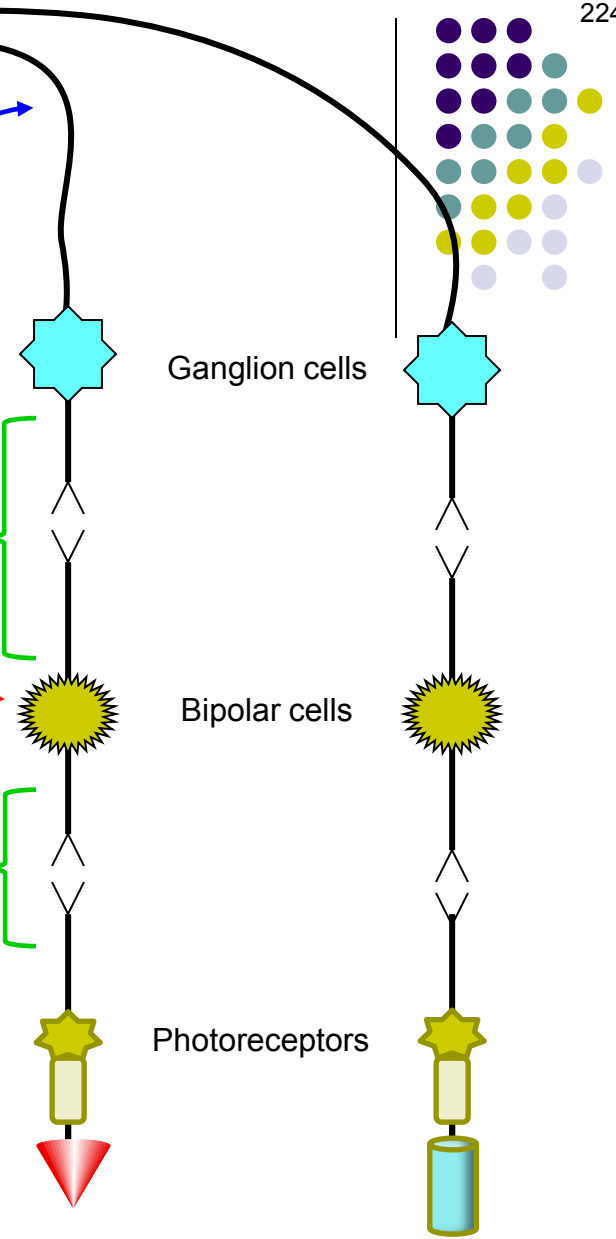
Ganglion-cell axons

### Neurosensory Retina Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

### RPE

### Bruch's membrane

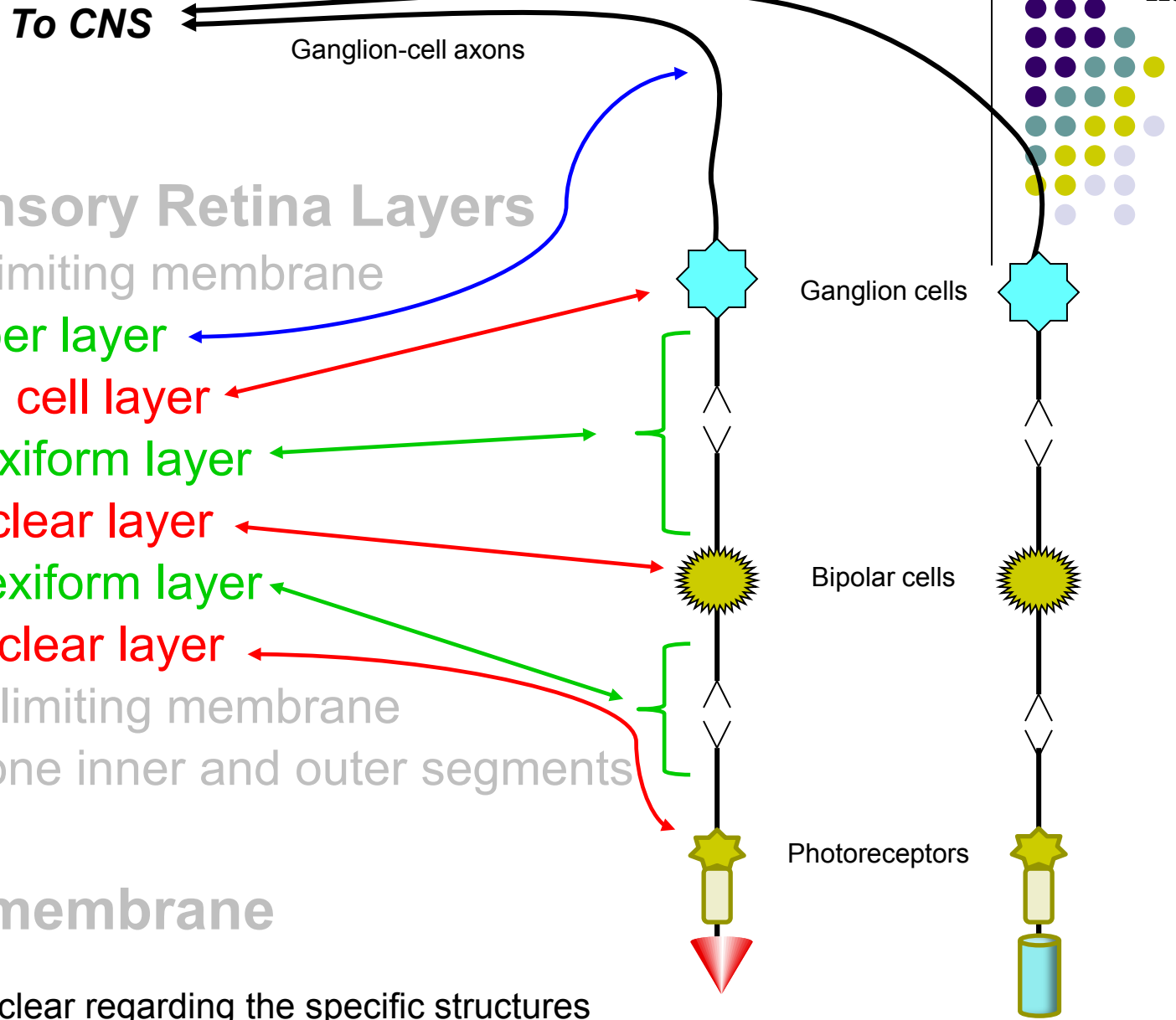


Let's make sure we're clear regarding the specific structures that comprise the retinal layers (for simplicity, I've dropped the interneurons):

*The outer nuclear layer is comprised of...*



# A



- Neurosensory Retina Layers

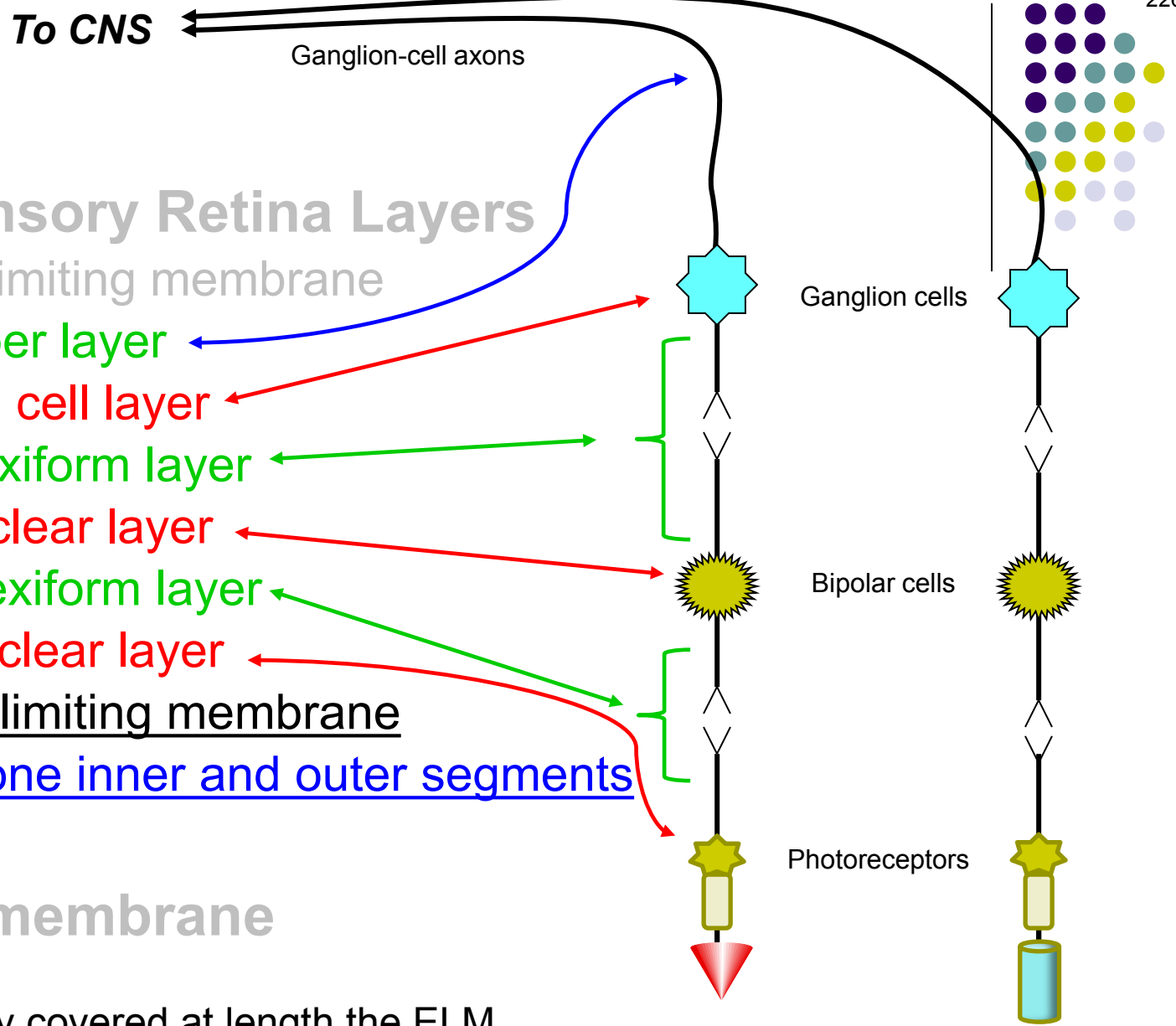
- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments

- RPE

- Bruch's membrane

Let's make sure we're clear regarding the specific structures that comprise the retinal layers (for simplicity, I've dropped the interneurons):

*The outer nuclear layer is comprised of...PR cell bodies*



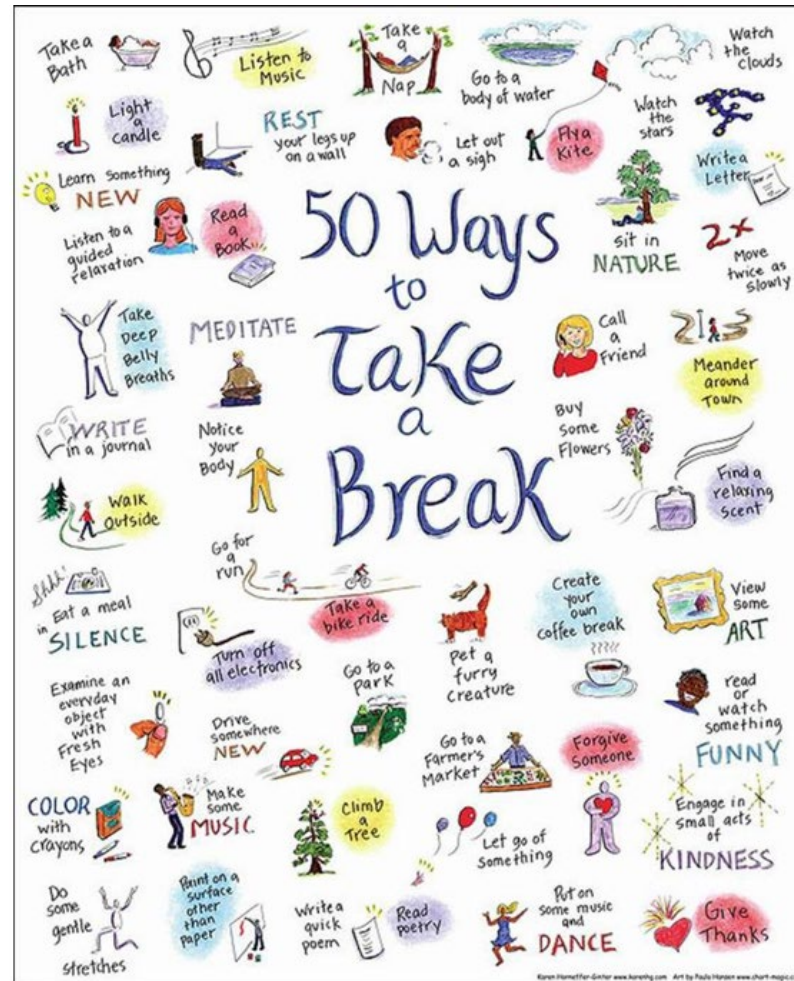
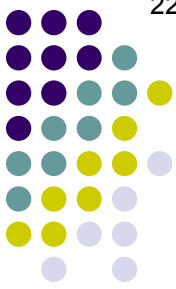
- **Neurosensory Retina Layers**

- Internal limiting membrane
- **Nerve fiber layer**
- **Ganglion cell layer**
- **Inner plexiform layer**
- **Inner nuclear layer**
- **Outer plexiform layer**
- **Outer nuclear layer**
- External limiting membrane
- Rod & cone inner and outer segments

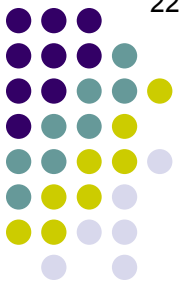
- **RPE**

- **Bruch's membrane**

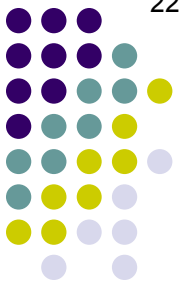
(We've already covered at length the ELM, and the PR inner and outer segs)



(This is a good point in the set to take a break)

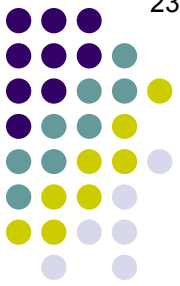


Now that we're familiar with the histology of the retina, we're ready to tackle the topography of the *macula*

**Q**

- Define the term *macula*...
- ...**anatomically**: The retinal area in which

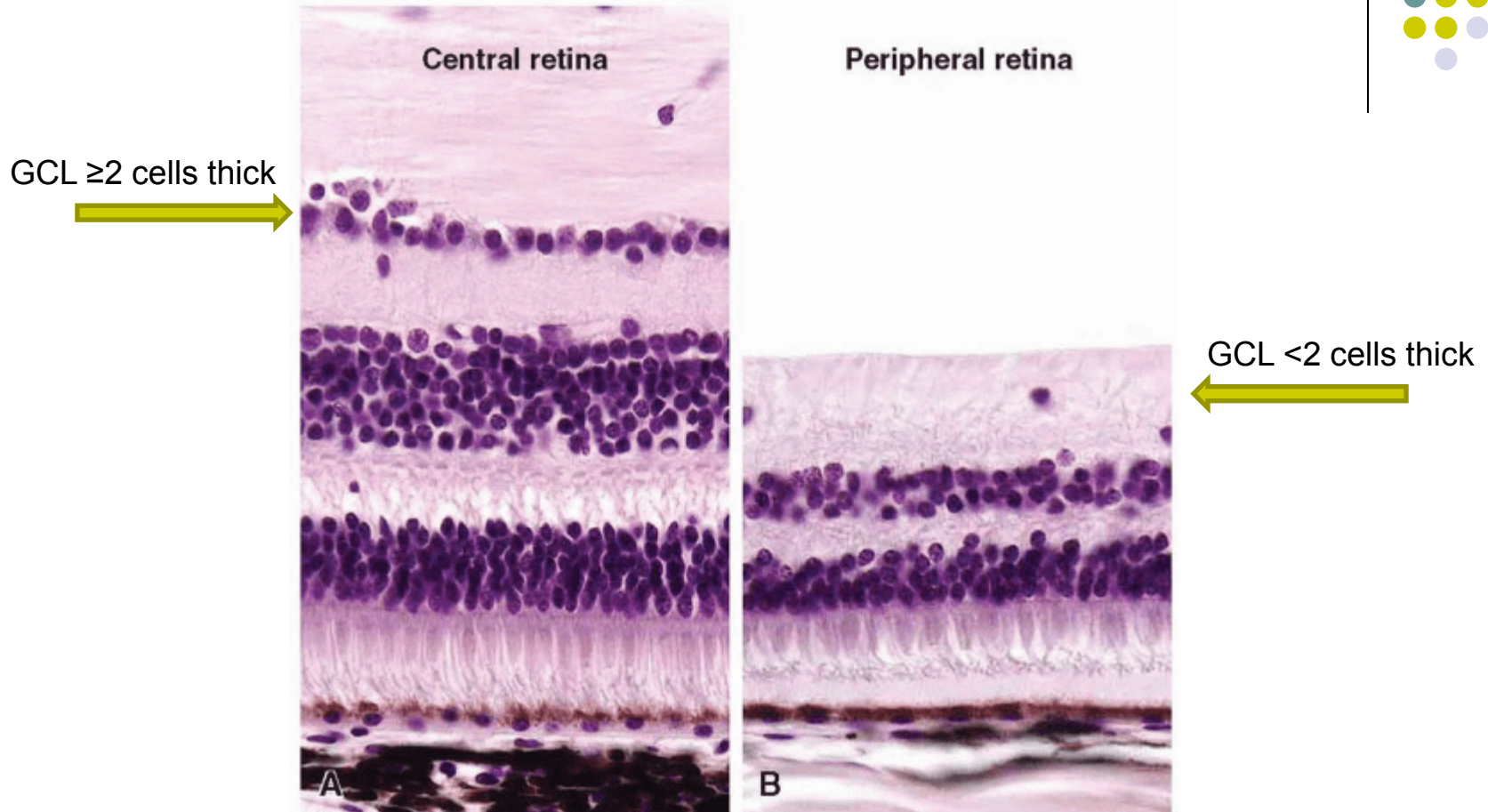




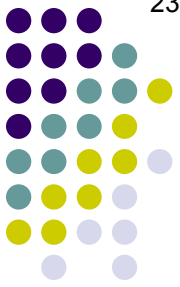
## A

- Define the term *macula*...
  - ...**anatomically**: The retinal area in which the ganglion-cell layer is  $\geq 2$  cells thick

# Retinal Anatomy and Histology



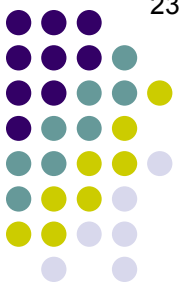
Changes in retinal thickness. Two sections through the central (A) and peripheral (B) regions of the retina, aligned at the retinal pigment epithelium. The peripheral retina is thinner and has only rare cell nuclei in the ganglion cell layer (the uppermost layer of nuclei).

**Q**

- Define the term *macula*...
  - ...**anatomically**: The retinal area in which the ganglion-cell layer is  $\geq 2$  cells thick
  - ...**histologically**: The retinal area containing

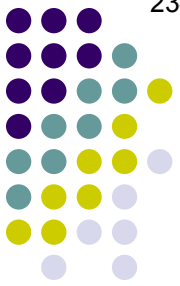






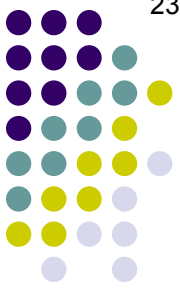
# A

- Define the term *macula*...
  - ...**anatomically**: The retinal area in which the ganglion-cell layer is  $\geq 2$  cells thick
  - ...**histologically**: The retinal area containing xanthophyll pigment



- Define the term *macula*...
  - ...**anatomically**: The retinal area in which the ganglion-cell layer is  $\geq 2$  cells thick
  - ...**histologically**. The retinal area containing **xanthophyll pigment**

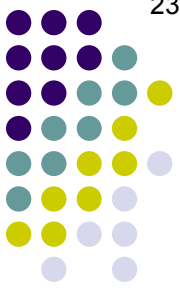
The latest iteration of the *Retina* book refers to this pigment as “oxygenated carotenoids, in particular lutein and zeaxanthin”



# Q

- Define the term *macula*...
  - ...**anatomically**: The retinal area in which the ganglion-cell layer is  $\geq 2$  cells thick
  - ...**histologically**: The retinal area containing xanthophyll pigment
  - ...**clinically**: The retinal area bounded by

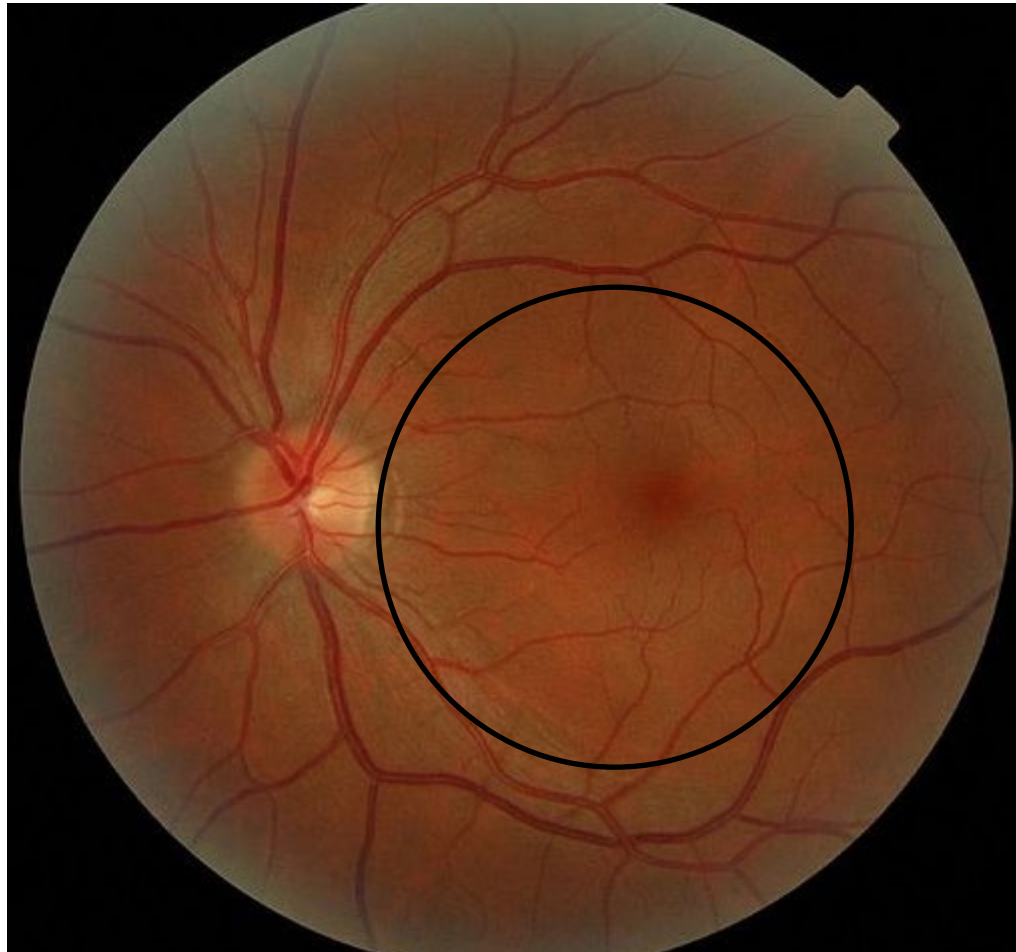
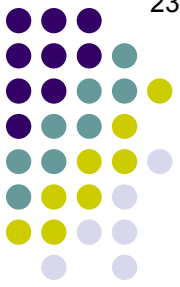




## A

- Define the term *macula*...
  - ...**anatomically**: The retinal area in which the ganglion-cell layer is  $\geq 2$  cells thick
  - ...**histologically**: The retinal area containing xanthophyll pigment
  - ...**clinically**: The retinal area bounded by the temporal vascular arcades

# Retinal Anatomy and Histology



Macula



## Retinal Anatomy and Histology

# Q

- Define the term *macula*...
  - ...**anatomically**: The retinal area in which the ganglion-cell layer is  $\geq 2$  cells thick
  - ...**histologically**: The retinal area containing xanthophyll pigment
  - ...**clinically**: The retinal area bounded by the temporal vascular arcades

*What is the full name of the macula (ie, what is its 'last name')?*

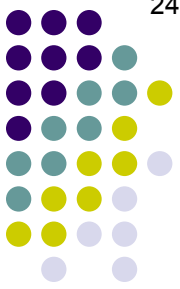


## Retinal Anatomy and Histology

# A

- Define the term *macula...lutea*
  - ...**anatomically**: The retinal area in which the ganglion-cell layer is  $\geq 2$  cells thick
  - ...**histologically**: The retinal area containing xanthophyll pigment
  - ...**clinically**: The retinal area bounded by the temporal vascular arcades

What is the full name of the macula (ie, what is its 'last name')?  
The macula lutea



## Retinal Anatomy and Histology

# Q

- Define the term *macula...lutea*
  - ...**anatomically**: The retinal area in which the ganglion-cell layer is  $\geq 2$  cells thick
  - ...**histologically**: The retinal area containing xanthophyll pigment
  - ...**clinically**: The retinal area bounded by the temporal vascular arcades

*What is the full name of the macula (ie, what is its 'last name')?*  
The macula lutea

*What does the word lutea mean?*





# A

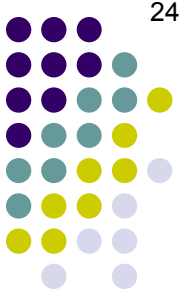
## Retinal Anatomy and Histology

- Define the term *macula...lutea*
  - ...**anatomically**: The retinal area in which the ganglion-cell layer is  $\geq 2$  cells thick
  - ...**histologically**: The retinal area containing **xanthophyll pigment**
  - ...**clinically**: The retinal area bounded by the temporal vascular arcades

What is the full name of the macula (ie, what is its 'last name')?  
The macula **lutea**

What does the word **lutea** mean?  
It means '**yellow**'

## Retinal Anatomy and Histology



**Macula lutea** If you use your imagination, you can sort of see that the macula has a yellow tint



## Retinal Anatomy and Histology

Q

- Define the term *macula...lutea*

- ...anatomically: The the ganglion-cell layer

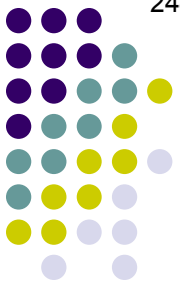
*The macula lutea has another two-word name, because of course it does. What is it?*

- ...histologically: The retinal area containing **xanthophyll pigment**

- ...clinically: The retinal area bounded by the temporal vascular arcades

*What is the full name of the macula (ie, what is its 'last name')?*  
The macula lutea

*What does the word lutea mean?*  
It means 'yellow'



# A

## Retinal Anatomy and Histology

- Define the term *macula...lutea*

- ...anatomically: The the ganglion-cell layer

*The macula lutea has another two-word name, because of course it does. What is it?*

The area centralis

- ...histologically: The retinal area containing **xanthophyll pigment**

- ...clinically: The retinal area bounded by the temporal vascular arcades

*What is the full name of the macula (ie, what is its 'last name')?*  
The macula lutea

*What does the word lutea mean?*  
It means 'yellow'



## Retinal Anatomy and Histology

Q

- Define the term *macula...lutea*

- ...anatomically: The **the ganglion-cell layer**
  - The **macula lutea** has another two-word name, because of course it does. What is it?
  - The **area centralis**

- ...histologically: **xanthophyll pigment**
  - The macula lutea/area centralis has yet another name (because, why not?) What is its third name? (Hint: This one is used commonly in the clinic.)

- ...clinically: The retinal area bounded by the temporal vascular arcades

What is the full name of the macula (ie, what is its 'last name')?  
The macula lutea

What does the word lutea mean?  
It means 'yellow'



# A

## Retinal Anatomy and Histology

- Define the term *macula...lutea*

- ...anatomically: The the ganglion-cell layer
  - The *macula lutea* has another two-word name, because of course it does. What is it?
  - The **area centralis**

- ...histologically:
  - xanthophyll pigment**
  - The *macula lutea/area centralis* has yet another name (because, why not?) What is its third name? (Hint: This one is used commonly in the clinic.)
  - The **posterior pole**

- ...clinically: The retinal area bounded by the temporal vascular arcades

What is the full name of the macula (ie, what is its 'last name')?  
The macula lutea

What does the word lutea mean?  
It means 'yellow'



## Retinal Anatomy and Histology

Q

Let's define some terms

FAZ

*What does FAZ stand for in this context?*



# A

## Retinal Anatomy and Histology

Let's define some terms

**FAZ**

*What does FAZ stand for in this context?*  
**Foveal avascular zone**





## Retinal Anatomy and Histology

# Q

Let's define some terms

**FAZ**

*What does FAZ stand for in this context?*  
**Foveal avascular zone**

**GCL/INL**

*How about GCL and INL?*  
**GCL =**  
**INL =**

A

# Retinal Anatomy and Histology



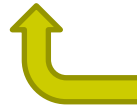
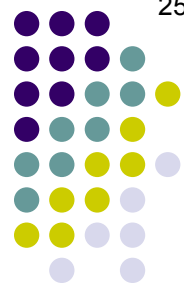
Let's define some terms

**FAZ**

*What does FAZ stand for in this context?*  
**Foveal avascular zone**

**GCL/INL**

*How about GCL and INL?*  
**GCL = Ganglion cell layer**  
**INL = Inner nuclear layer**



With that out of the way, let's do some...

**FAZ**

*What does FAZ stand for in this context?*  
**Foveal avascular zone**

**GCL/INL**

*How about GCL and INL?*  
**GCL = Ganglion cell layer**  
**INL = Inner nuclear layer**

## Retinal Anatomy and Histology

Q

Matching! (some on the left have more than one answer)

With that out of the way, let's do some...

Fovea

Start here

Foveola

Umbo

Perifoveal zone

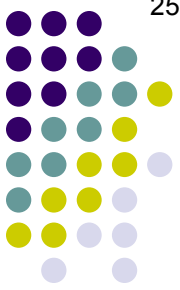
Parafoveal zone

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)
- Just within the **FAZ**
- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- **GCL/INL** absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center

## Retinal Anatomy and Histology

# A

**Matching!** (some on the left have more than one answer)



**Fovea**

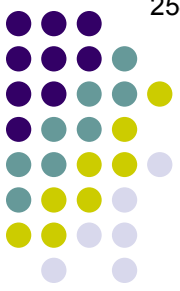
- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)
- Just within the FAZ
- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center

Foveola

Umbo

Perifoveal zone

Parafoveal zone



## Retinal Anatomy and Histology

# Q

**Matching! (some on the left have more than one answer)**

### Fovea

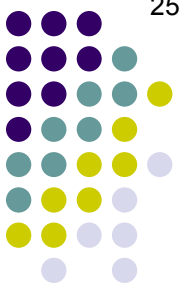
*Like the macula, the fovea has a last name. What is its full name?*

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)
- Just within the FAZ
- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center

Umbo

Perifoveal zone

Parafoveal zone



## Retinal Anatomy and Histology

# A

**Matching! (some on the left have more than one answer)**

**Fovea** *centralis*

*Like the macula, the fovea has a last name.  
What is its full name?*

The **fovea centralis**

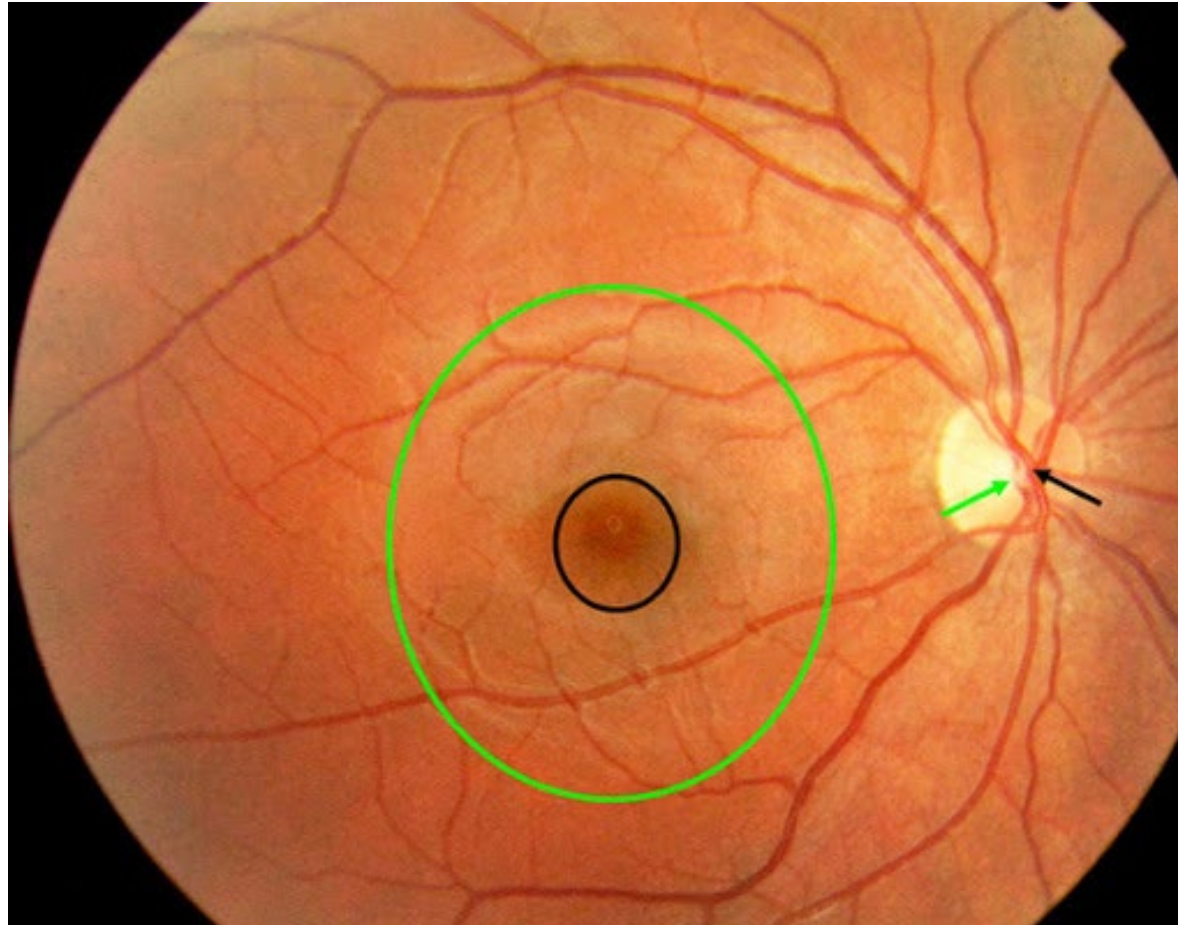
- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)
- Just within the FAZ
- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center

Umbo

Perifoveal zone

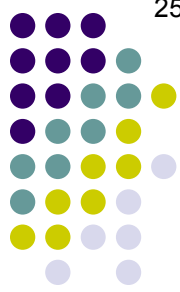
Parafoveal zone

# Retinal Anatomy and Histology



Fovea centralis (black circle)





## Retinal Anatomy and Histology

Q

Matching! (some on the left have more than one answer)

Fovea

Foveola

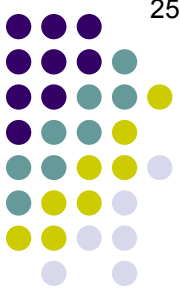
now here

Umbo

Perifoveal zone

Parafoveal zone

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)
- Just within the FAZ
- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center



## Retinal Anatomy and Histology

# A

**Matching!** (some on the left have more than one answer)

Fovea

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)

Foveola

- Just within the FAZ
- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- GCL/INL absent from here on in

Umbo

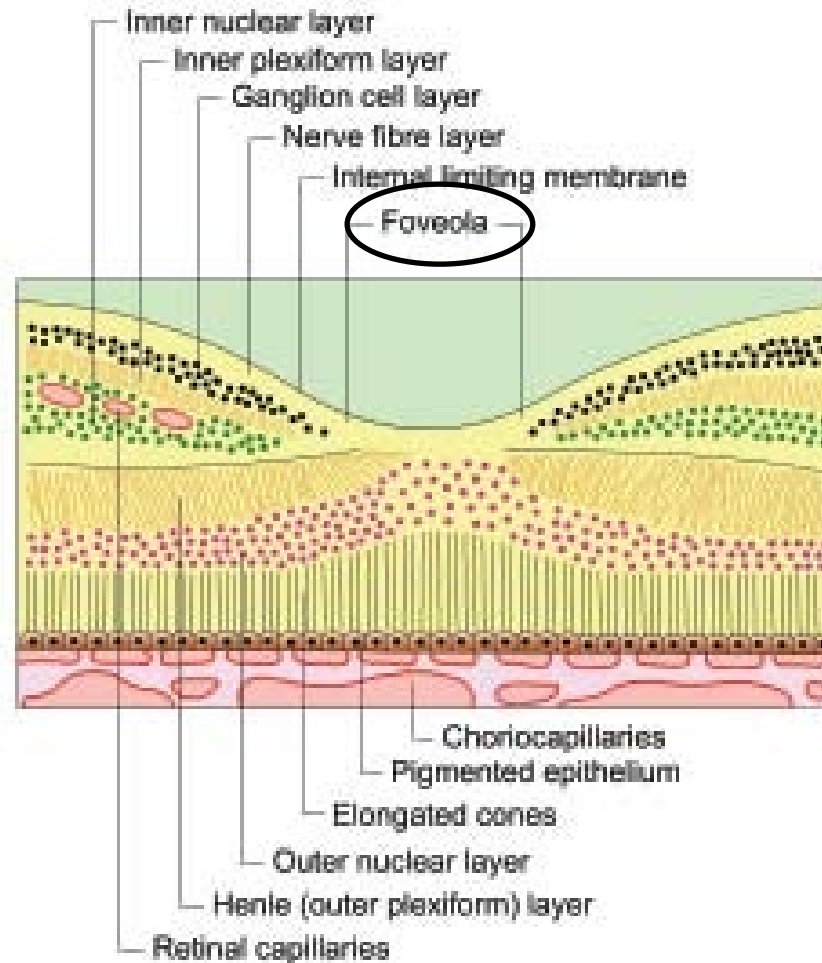
- Very center of fovea
- All cones from here on in
- Farthest from center

Perifoveal zone

Parafoveal zone

- Farthest from center

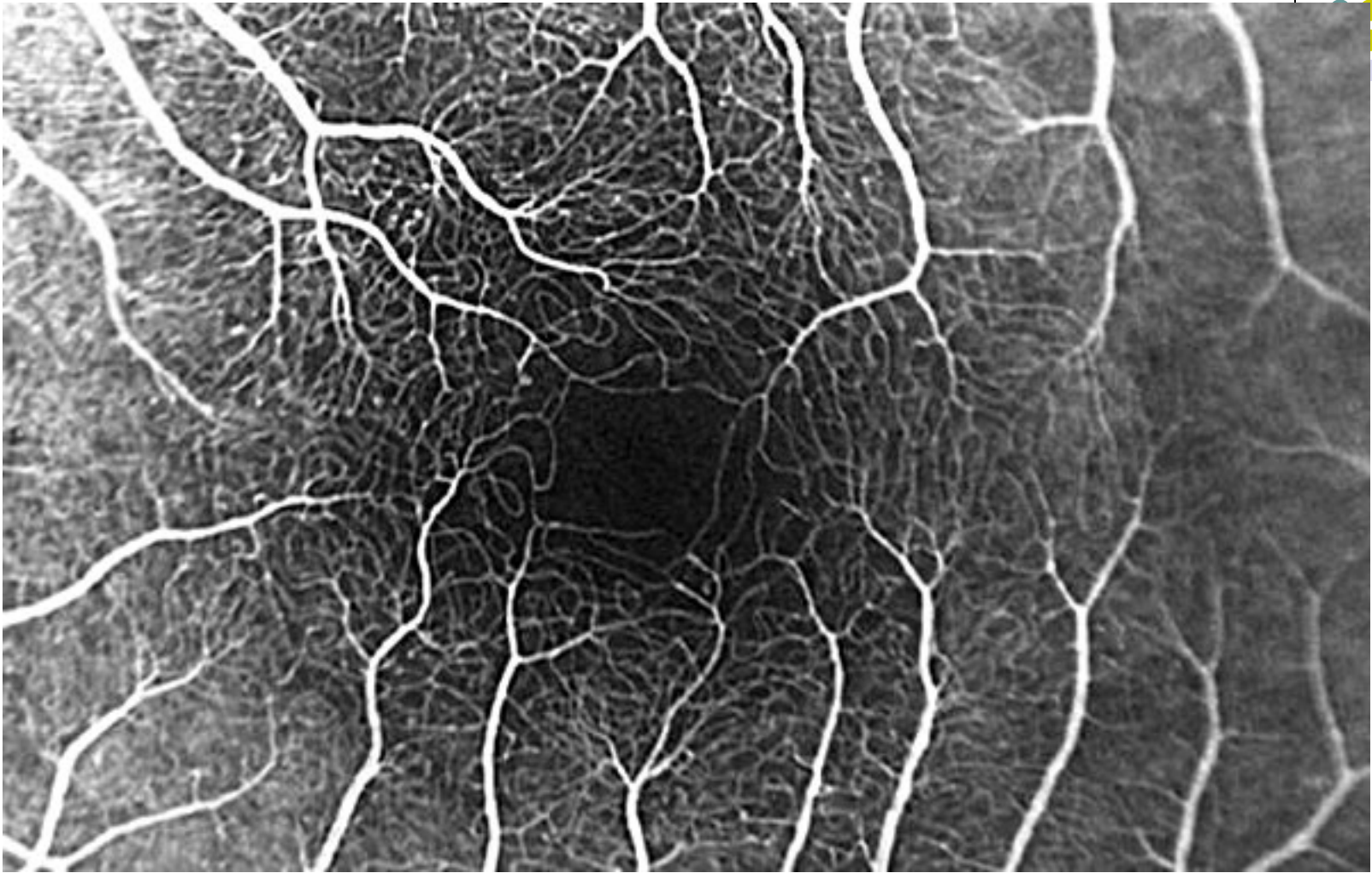
# Retinal Anatomy and Histology



Foveola



## Retinal Anatomy and Histology



Foveola is within the foveal avascular zone (FAZ)

## Retinal Anatomy and Histology

# Q

**Matching!** (some on the left have more than one answer)



Fovea

Foveola

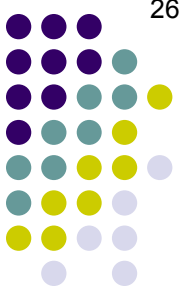
Umbo

Perifoveal zone

Parafoveal zone

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)
- Just within the FAZ
- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center

Next



## Retinal Anatomy and Histology

# A

**Matching!** (some on the left have more than one answer)

Fovea

Foveola

Umbo

Perifoveal zone

Parafoveal zone

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)
- Just within the FAZ
- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center



## Retinal Anatomy and Histology

Q

**Matching! (some on the left have more than one answer)**

Fovea

Foveola

**Umbo**

Perifoveal zone

Parafoveal zone

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)
- Just within the FAZ

*What very common DFE finding is directly attributable to the umbo?*

- ... portion of retina
- ... diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center



## Retinal Anatomy and Histology

# A

**Matching! (some on the left have more than one answer)**

Fovea

Foveola

**Umbo**

Perifoveal zone

Parafoveal zone

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)
- Just within the FAZ

What very common DFE finding is directly attributable to the umbo?  
The so-called 'foveal reflex'

- ... portion of retina
- ... diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center





## Retinal Anatomy and Histology

Q

Matching! (some on the left have more than one answer)

Fovea

Foveola

Umbo

Perifoveal zone

Parafoveal zone

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)
- Just within the FAZ
- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center

Next

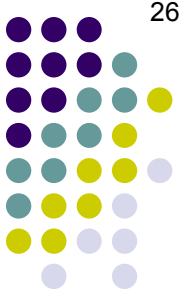


## Retinal Anatomy and Histology

# A

**Matching!** (some on the left have more than one answer)

- Fovea**
- Foveola**
- Umbo**
- Perifoveal zone**
- Parafoveal zone
- Ring 1.5 mm diameter
  - Ring 0.5 mm diameter
  - ~1 DD in size (1.5mm)
  - Just within the FAZ
  - Thickest portion of retina
  - ~1 cup in diameter (0.35mm)
  - GCL/INL absent from here on in
  - Very center of fovea
  - All cones from here on in
  - Farthest from center
-



## Retinal Anatomy and Histology

Q

Matching! (some on the left have more than one answer)

Fovea

Foveola

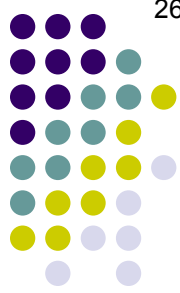
Umbo

Perifoveal zone

Parafoveal zone

Next

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)
- Just within the FAZ
- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center



## Retinal Anatomy and Histology

# A

**Matching!** (some on the left have more than one answer)

- Fovea  
 Foveola  
 Umbo  
 Perifoveal zone  
 Parafoveal zone
- Ring 1.5 mm diameter
  - Ring 0.5 mm diameter
  - ~1 DD in size (1.5mm)
  - Just within the FAZ
  - Thickest portion of retina
  - ~1 cup in diameter (0.35mm)
  - GCL/INL absent from here on in
  - Very center of fovea
  - All cones from here on in
  - Farthest from center
-

## Retinal Anatomy and Histology

Q

Matching! (some on the left have more than one answer)



Fovea

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)

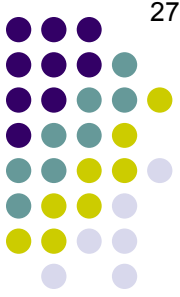
How are the fovea, perifoveal zone and parafoveal zone spatially related to one another?

Umbo

- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center

Perifoveal zone

Parafoveal zone



## Retinal Anatomy and Histology

# A/Q

**Matching! (some on the left have more than one answer)**

**Fovea**

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)

How are the fovea, perifoveal zone and parafoveal zone spatially related to one another? The  zone is a ring around the fovea, whereas the  zone is a ring around the  zone

Umbo

- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center

**Perifoveal zone**

**Parafoveal zone**



## Retinal Anatomy and Histology

# A

**Matching!** (some on the left have more than one answer)

**Fovea**

- Ring 1.5 mm diameter
- Ring 0.5 mm diameter
- ~1 DD in size (1.5mm)

*How are the fovea, perifoveal zone and parafoveal zone spatially related to one another?*  
 The parafoveal zone is a ring around the fovea, whereas the perifoveal zone is a ring around the parafoveal zone

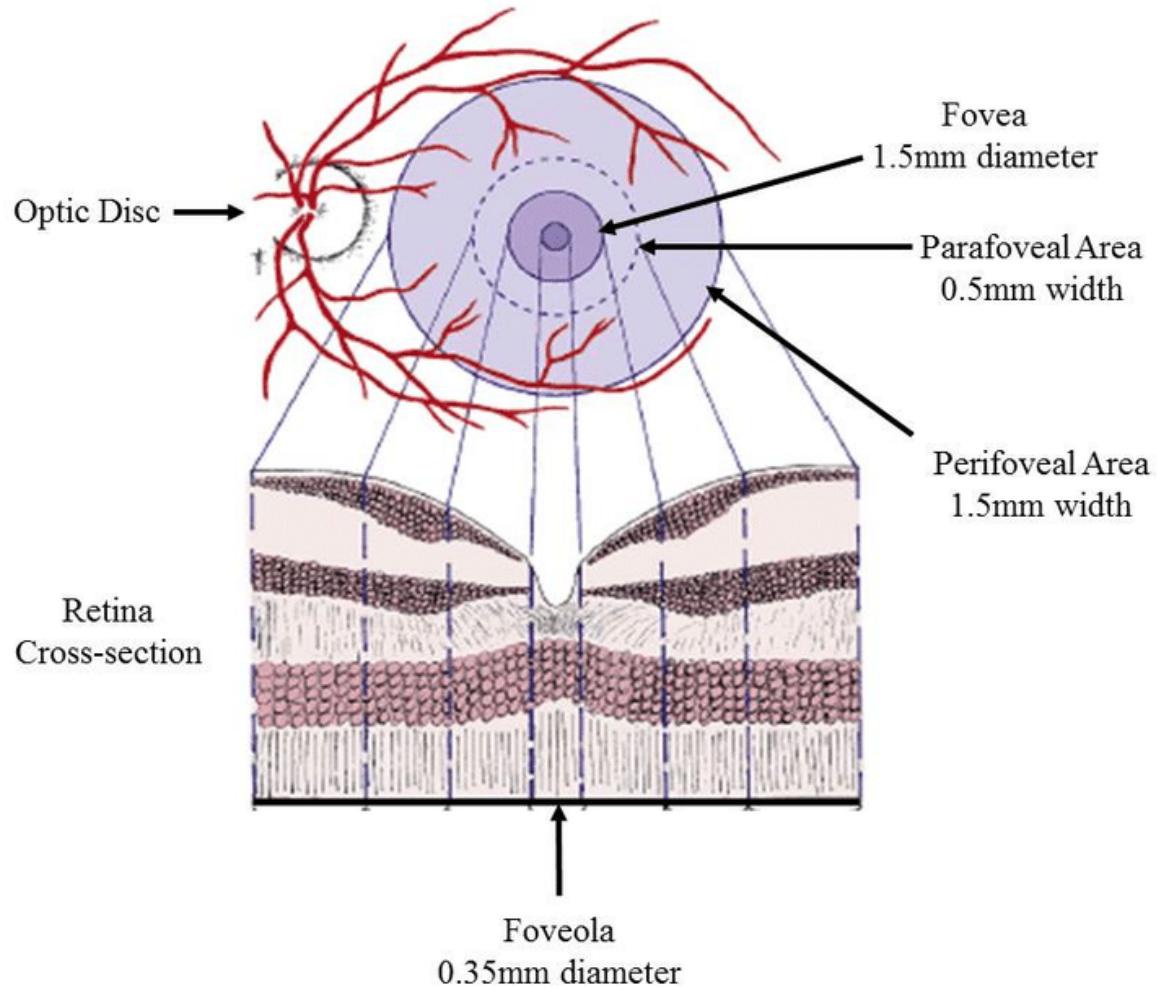
**Umbo**

- Thickest portion of retina
- ~1 cup in diameter (0.35mm)
- GCL/INL absent from here on in
- Very center of fovea
- All cones from here on in
- Farthest from center

**Perifoveal zone**

**Parafoveal zone**

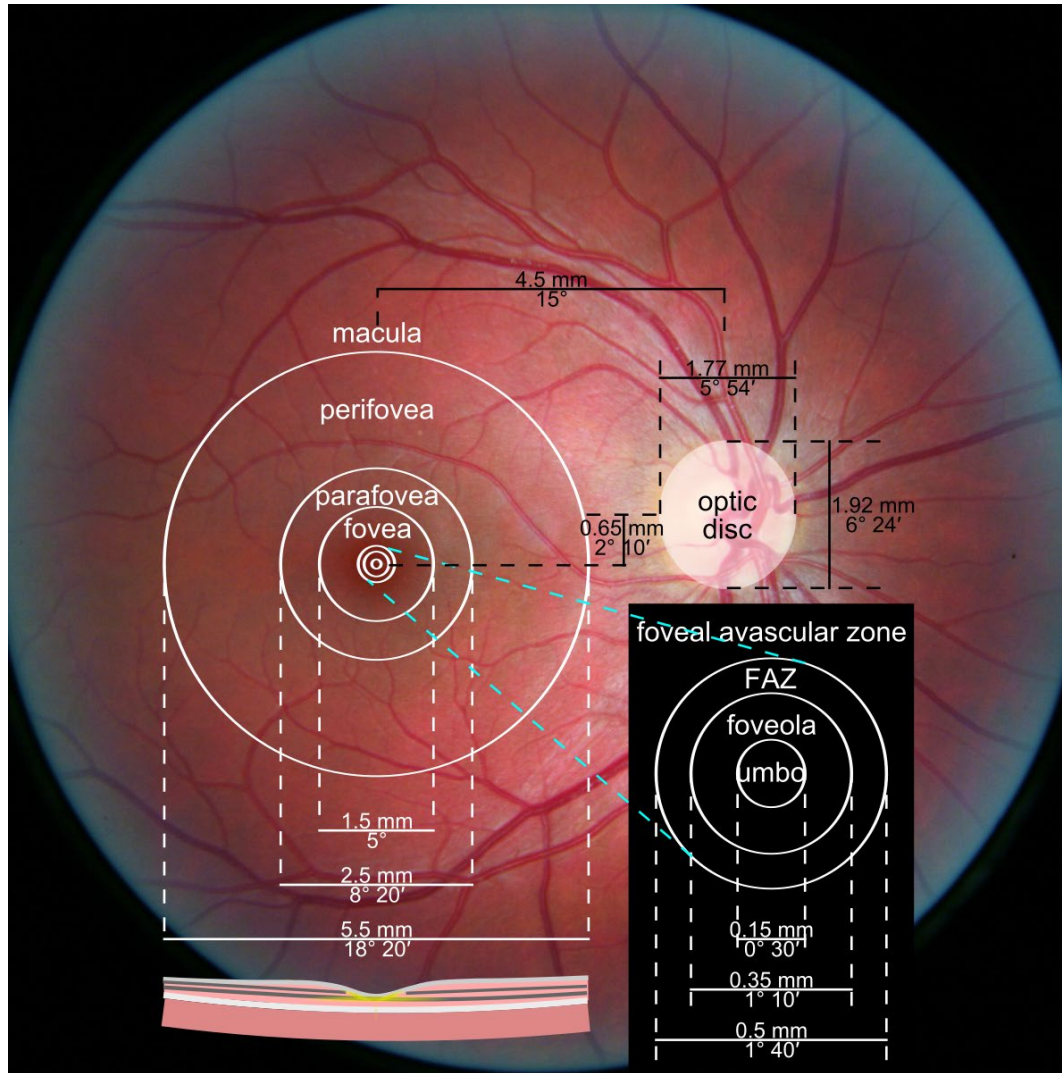
# Retinal Anatomy and Histology



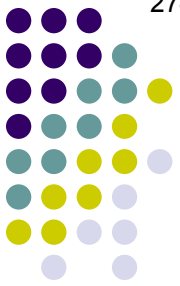
Macula: The zones



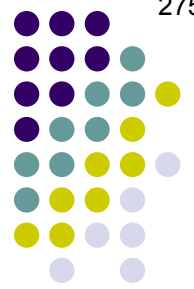
# Retinal Anatomy and Histology



Macula: The zones, another view



***Next let's look at the retina's  
blood supplies***



# Retinal Anatomy and Histology

Q

Blood supply

Blood supply

Blood supply

Blood supply

Blood supply

*How many blood supplies does the retina receive?*

Blood supply

Blood supply

Blood supply

Blood supply

Blood supply

Blood supply

Blood supply

Blood supply

A

## *Retinal Anatomy and Histology*



**Blood supply**

*How many blood supplies does the retina receive? **Two***

**Blood supply**

Q

## *Retinal Anatomy and Histology*



**Blood supply:**  
**?**

***What are the sources of the retina's two blood supplies?***

**Blood supply:**  
**?**

A

## *Retinal Anatomy and Histology*



278

**Blood supply:**  
***Central retinal artery***

***What are the sources of the retina's two blood supplies?***

**Blood supply:**  
***Choriocapillaris***

## Q

### ● Retinal Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments
- RPE
- Bruch's membrane



Blood supply:  
**Central retinal artery**

*Which layers are supplied  
by each blood supply?*

Blood supply:  
**Choriocapillaris**

## Retinal Anatomy and Histology

# A

### ● Retinal Layers

- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- External limiting membrane
- Rod & cone inner and outer segments
- RPE
- Bruch's membrane

Inner 2/3 of INL on in

Outer 1/3 of INL on out

Blood supply:  
**Central retinal artery**

*Which layers are supplied  
by each blood supply?*

Blood supply:  
**Choriocapillaris**

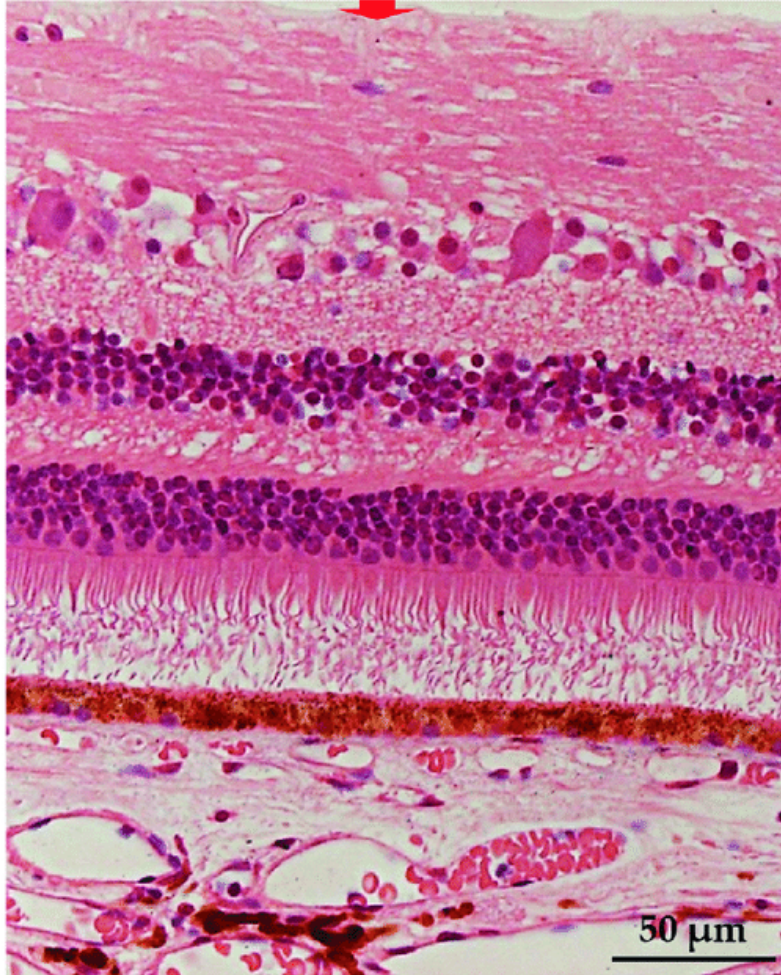




# Retinal Anatomy and Histology



Light



Internal limiting membrane

Nerve fiber layer

Ganglion cell layer

Inner plexiform layer

Inner nuclear layer

Outer plexiform layer

Outer nuclear layer

Layer of Rods and Cones

Retinal pigmented epithelium

Choroid

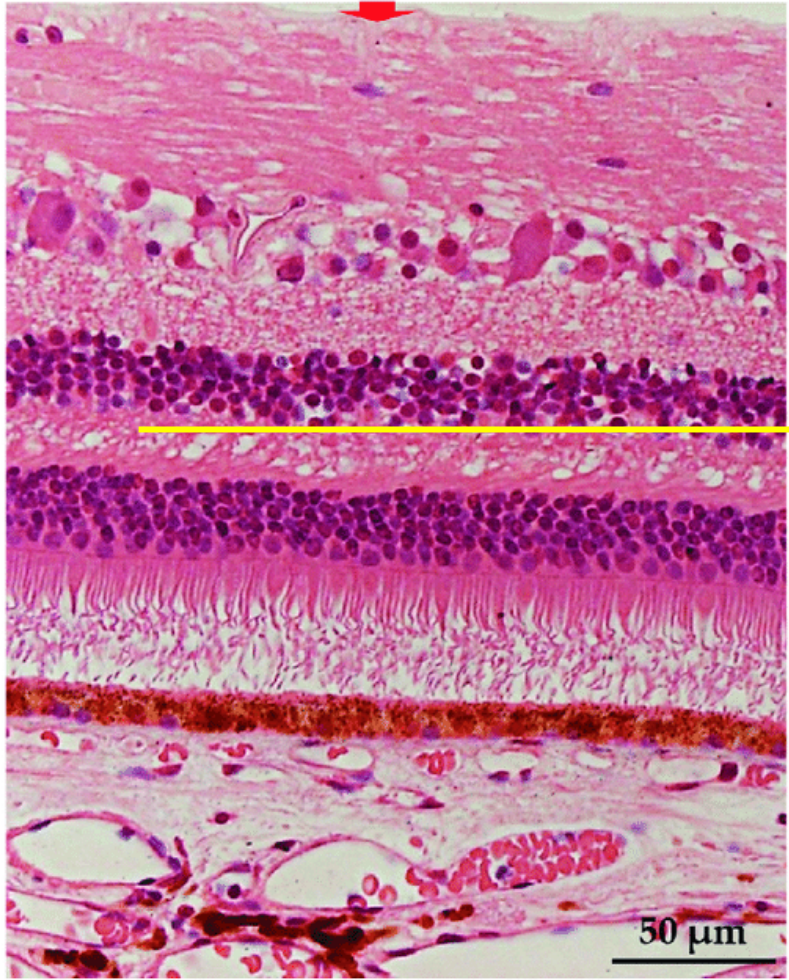
Here is a photomicrograph of the normal human retina

(No question—proceed when ready)

# Retinal Anatomy and Histology



Light



- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- Layer of Rods and Cones
- Retinal pigmented epithelium
- Choroid

Here is a photomicrograph of the normal human retina

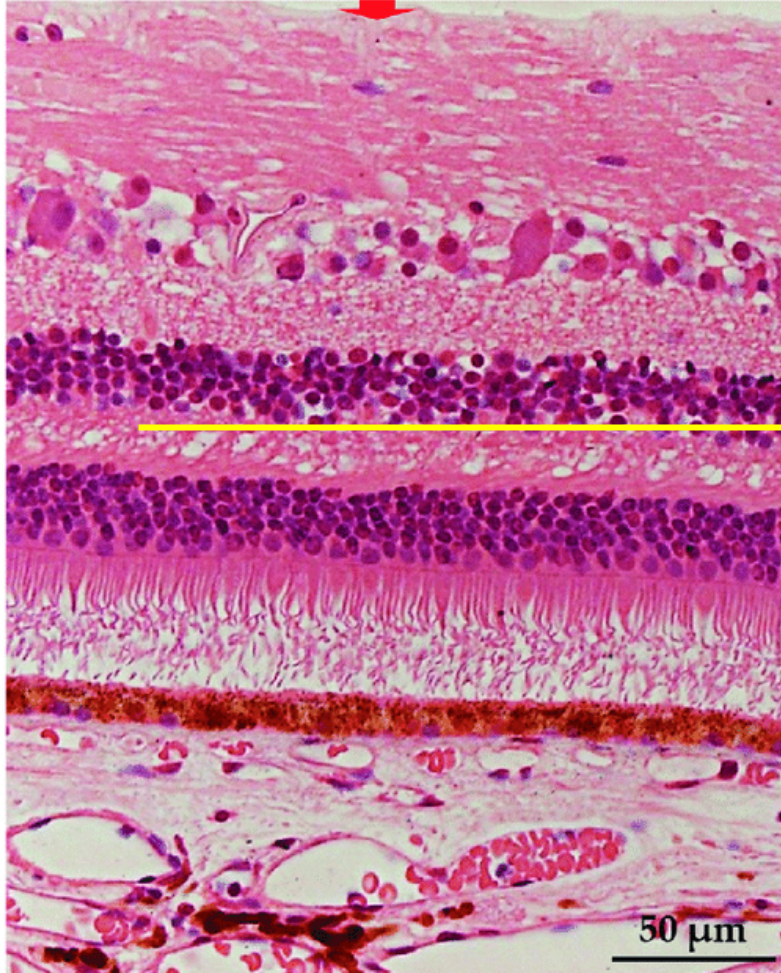
Here, approximately, is the demarcation between the layers perfused by the CRA vs the choriocapillaris

(No question—proceed when ready)

# Retinal Anatomy and Histology



Light



Internal limiting membrane

Nerve

Gangl

Inner

Inner

Outer

Outer

Layer

Retina

Choro



ph  
ina  
the  
e  
CRA

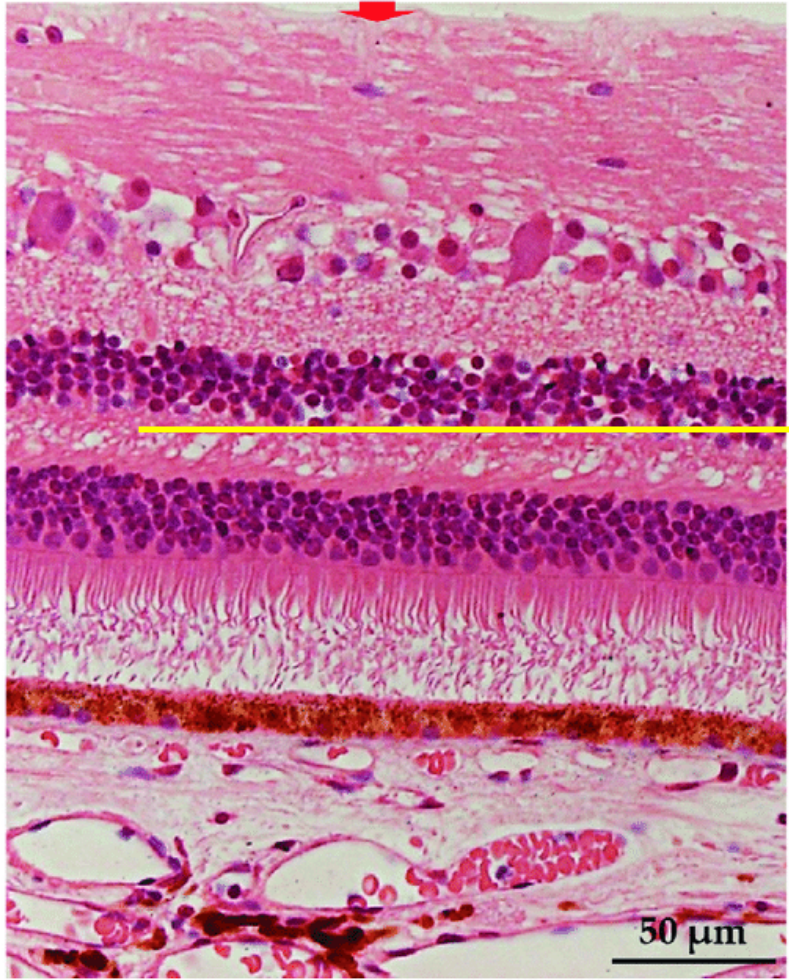
Standard (ie, dye-based) FA allows visualization of the retinal and choroidal vasculatures, but the layers are all superimposed upon one another, making it impossible to distinguish among them

(No question—proceed when ready)

# Retinal Anatomy and Histology



Light



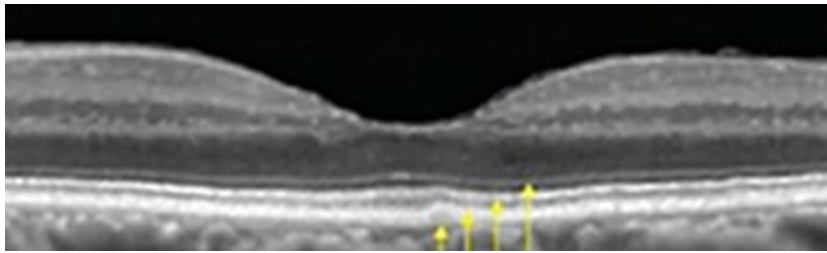
- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- Layer of Rods and Cones
- Retinal pigmented epithelium
- Choroid



Instead, let's use *en face* OCTA to look at the ultrastructure of foveal circulation.



Here is a photomicrograph of the normal macula. The demarcation between the layers perfused by the CRA vs the choriocapillaris



Optical coherence tomography (OCT) through the fovea (cross-sectional, not *en face*)

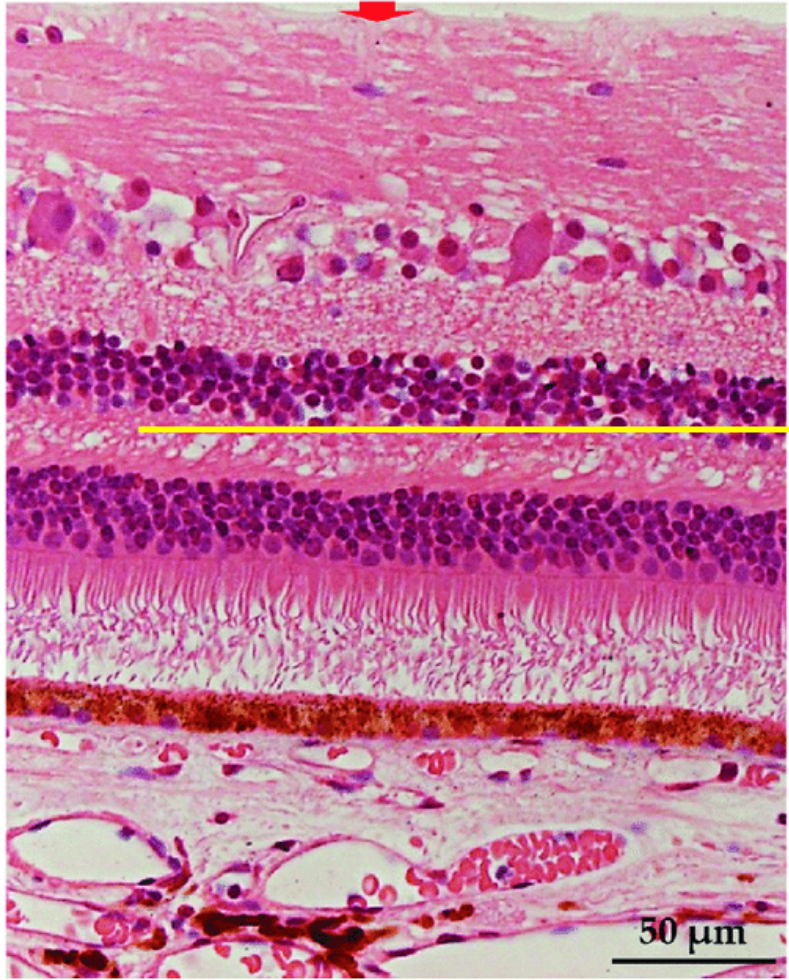
(No question—proceed when ready)

Q

# Retinal Anatomy and Histology



Light



Internal limiting membrane



Instead, let's use *en face* **OCTA**

What does the **A** in **OCTA** stand for in this context?

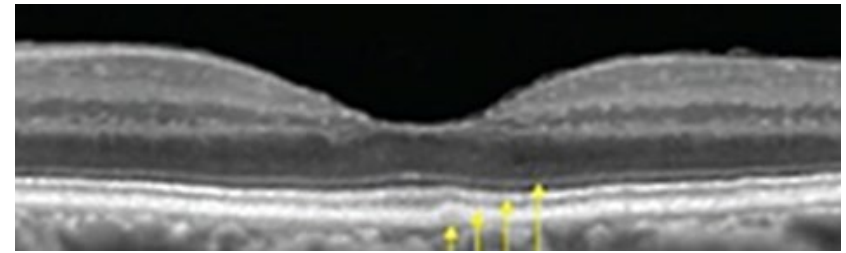
demarcation between the layers perfused by the CRA vs the choriocapillaris

Outer nuclear layer

Layer of Rods and Cones

Retinal pigmented epithelium

Choroid

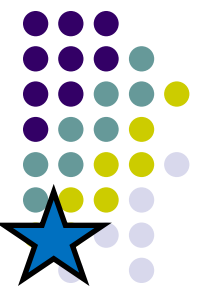


Optical coherence tomography (OCT) through the fovea (cross-sectional, not *en face*)

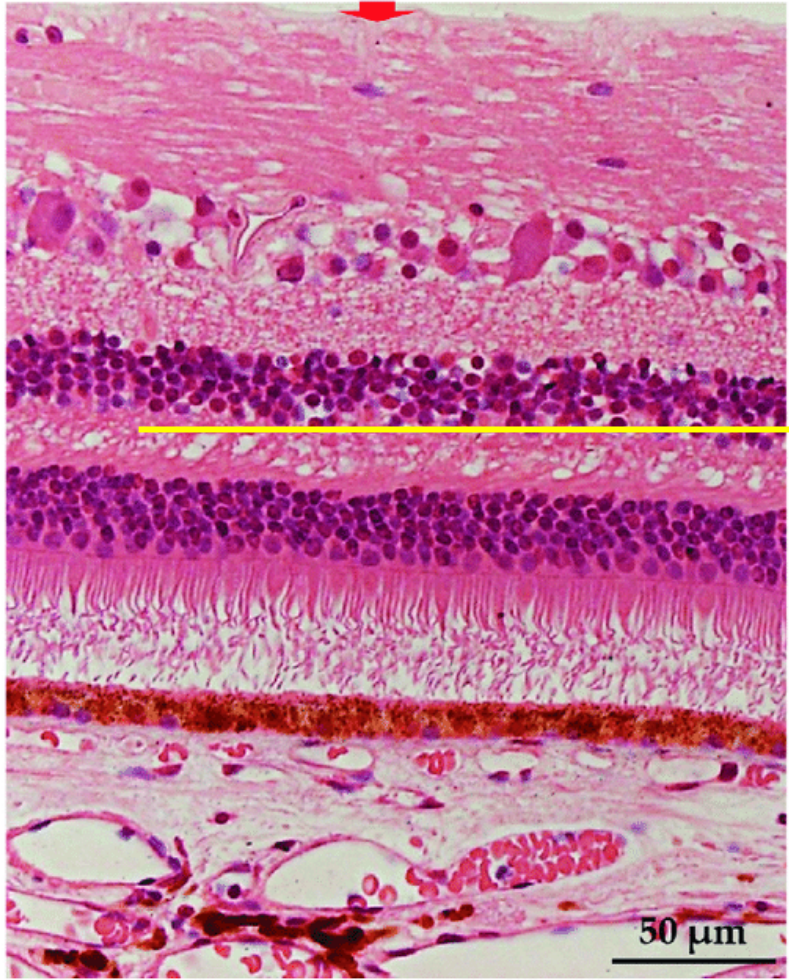
(No question—proceed when ready)

# A

## Retinal Anatomy and Histology



Light



Internal limiting membrane



Instead, let's use *en face* **OCTA**

What does the **A** in OCTA stand for in this context? 'Angiography.' OCT angiography makes possible the visualization of the retinal vasculature, but without the need for intravascular dye as in FA.

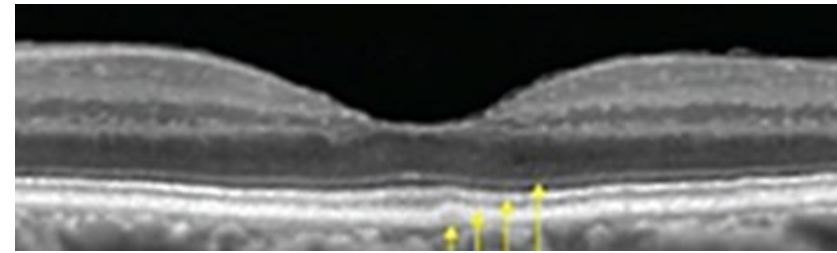
Outer nuclear layer

demarcation between the layers perfused by the CRA vs the choriocapillaris

Layer of Rods and Cones

Retinal pigmented epithelium

Choroid



Optical coherence tomography (OCT) through the fovea (cross-sectional, not *en face*)

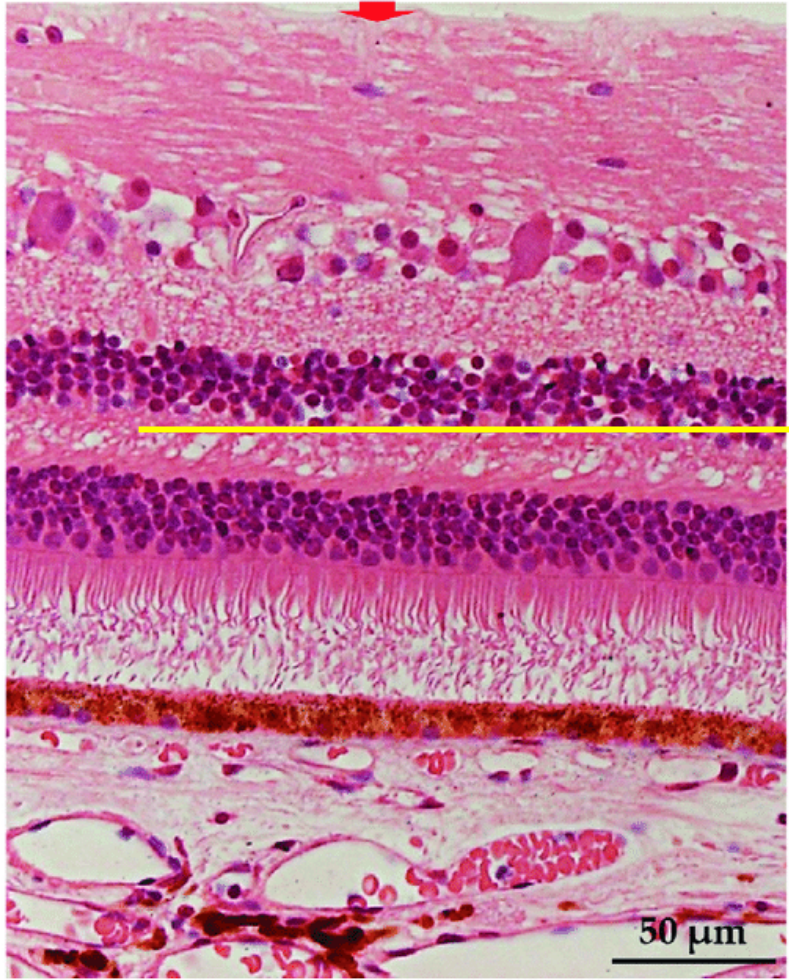
(No question—proceed when ready)

# A

## Retinal Anatomy and Histology



Light



Internal limiting membrane



Instead, let's use *en face* **OCTA**

What does the **A** in OCTA stand for in this context? 'Angiography.' OCT angiography makes possible the visualization of the retinal vasculature, but without the need for intravascular dye as in FA. Further, *en face* OCTA not only allows us to see the vasculature, it allows us to 'slice' and inspect it layer by layer—something that cannot be done via conventional FA.

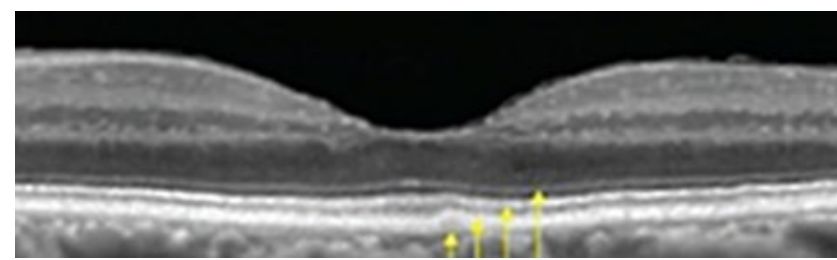
Outer nuclear layer

Layer of Rods and Cones

Retinal pigmented epithelium

Choroid

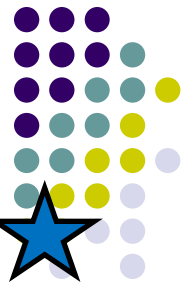
demarcation between the layers perfused by the CRA vs the choriocapillaris



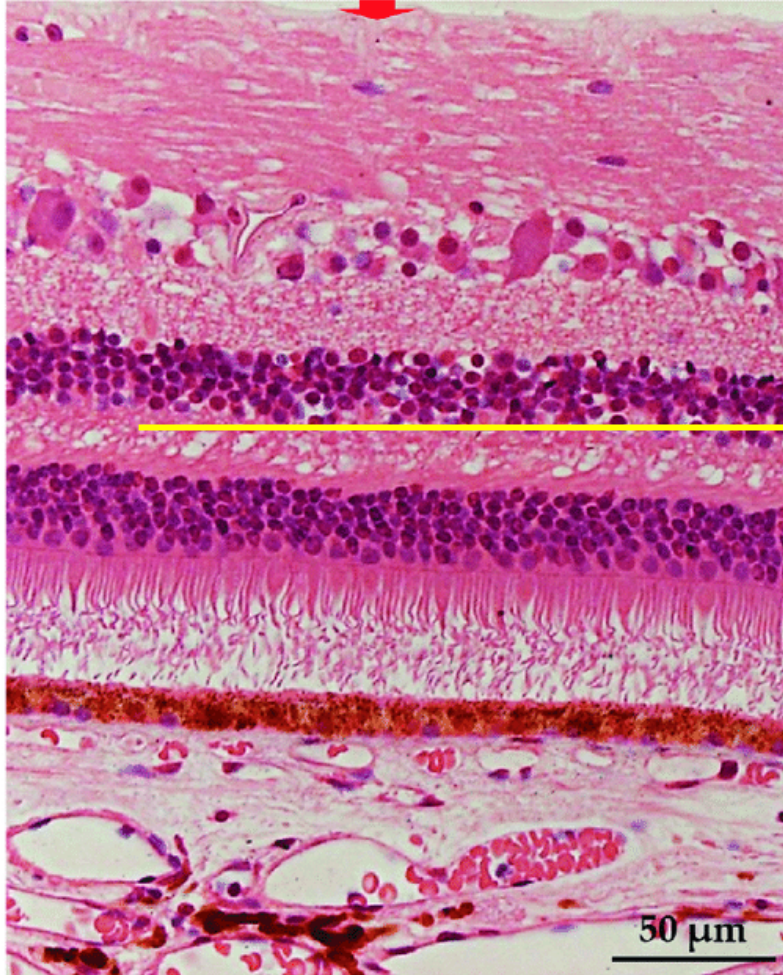
Optical coherence tomography (OCT) through the fovea (cross-sectional, not *en face*)

(No question—proceed when ready)

# Retinal Anatomy and Histology



Light



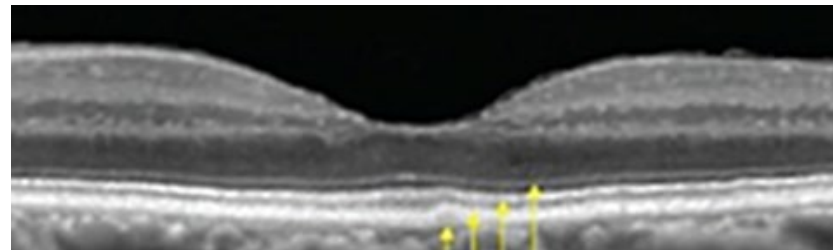
- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- Layer of Rods and Cones
- Retinal pigmented epithelium
- Choroid



Instead, let's use *en face* OCT to look at the ultrastructure of foveal circulation. For illustration purposes, we're gonna pretend this is a photomicrograph of the fovea (it's not).



Here is a photomicrograph of the fovea, showing the demarcation between the layers perfused by the CRA vs the choriocapillaris



Optical coherence tomography (OCT) through the fovea (cross-sectional, not *en face*)

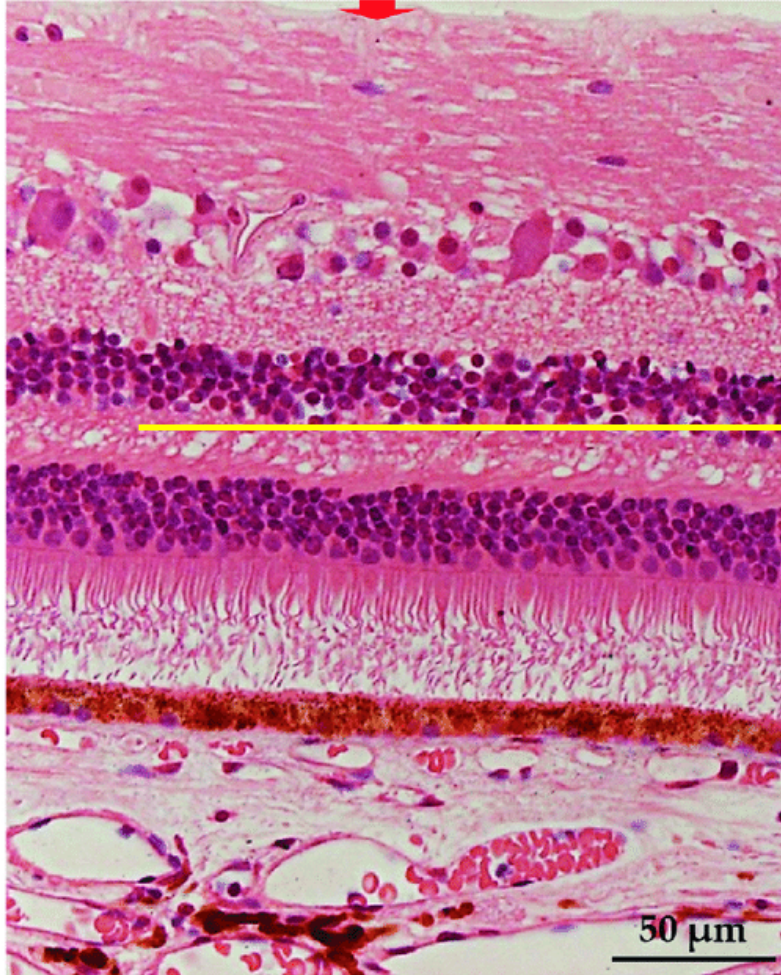
(No question—proceed when ready)



# Retinal Anatomy and Histology

## En face OCTA

Light



Internal limiting membrane

← Layer of vasc visualized

Nerve fiber layer

Ganglion cell layer

Inner plexiform layer

Inner nuclear layer

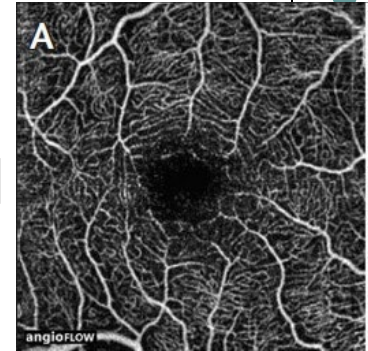
Outer plexiform layer

Outer nuclear layer

Layer of Rods and Cones

Retinal pigmented epithelium

Choroid



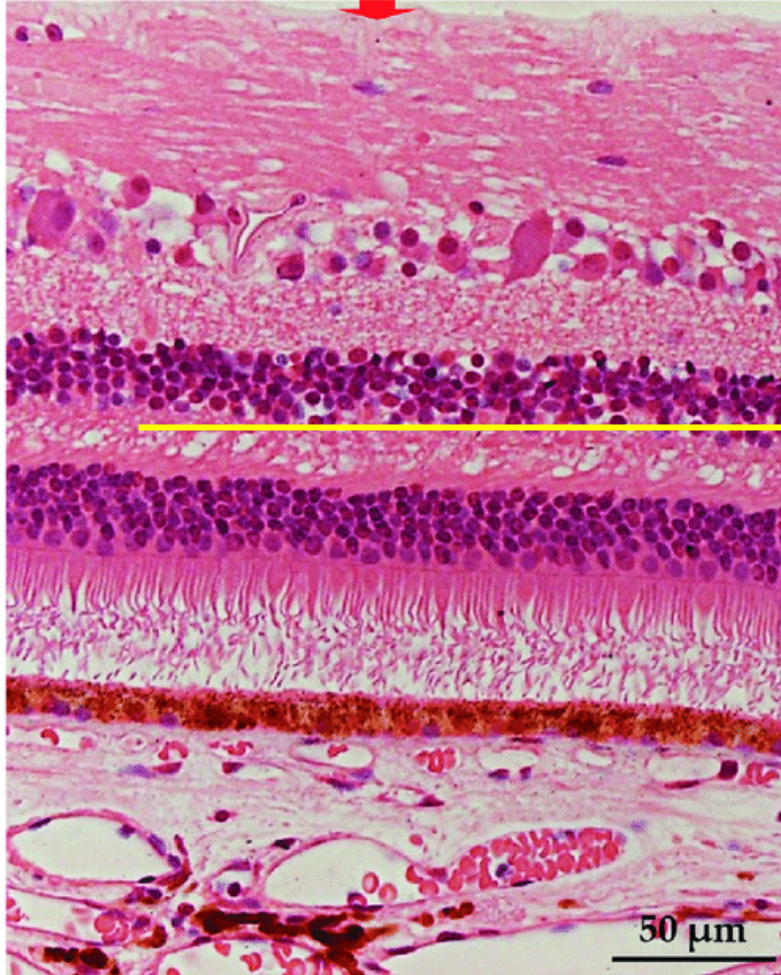
Pics **A**, **B** and **C** depict the parafoveal vasculature as we progress deeper into the retina

(No question—proceed when ready)

# Retinal Anatomy and Histology

## En face OCTA

Light



Internal limiting membrane

Nerve fiber layer

Layer of vasc visualized

Ganglion cell layer

Inner plexiform layer

Inner nuclear layer

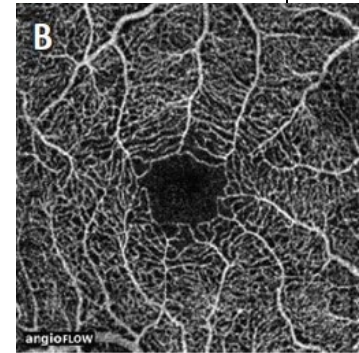
Outer plexiform layer

Outer nuclear layer

Layer of Rods and Cones

Retinal pigmented epithelium

Choroid

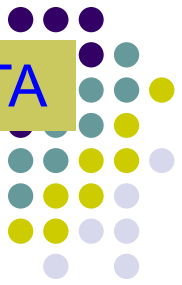


Pics **A**, **B** and **C** depict the parafoveal vasculature as we progress deeper into the retina

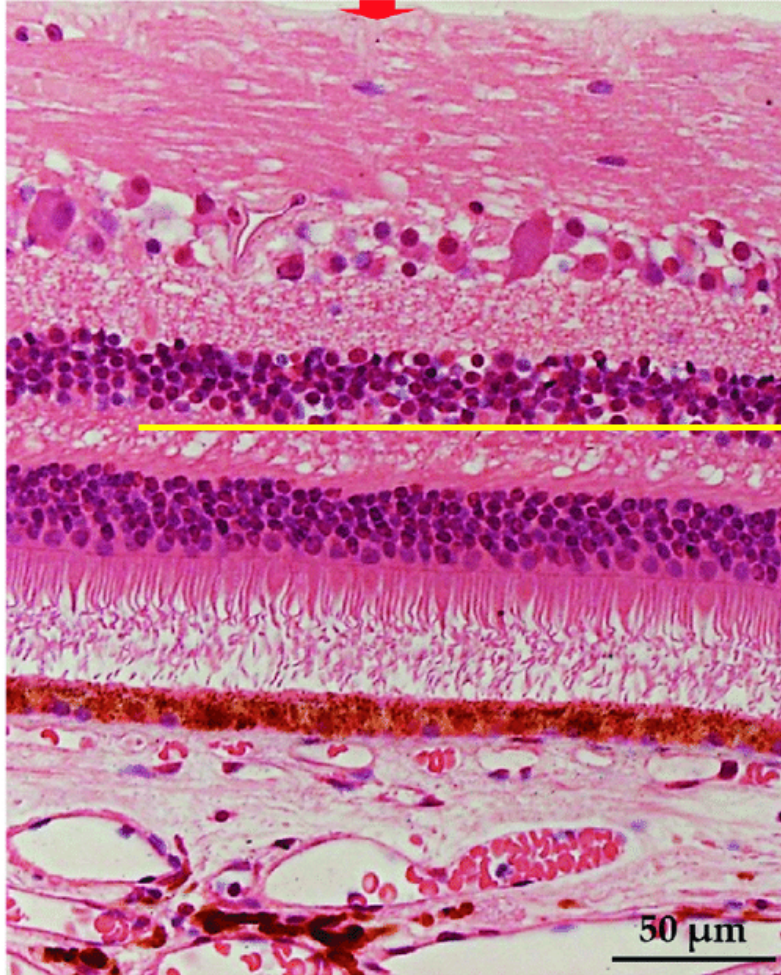
(No question—proceed when ready)

# Retinal Anatomy and Histology

## En face OCTA



Light



Internal limiting membrane

Nerve fiber layer

Ganglion cell layer

Layer of vasc visualized

Inner plexiform layer

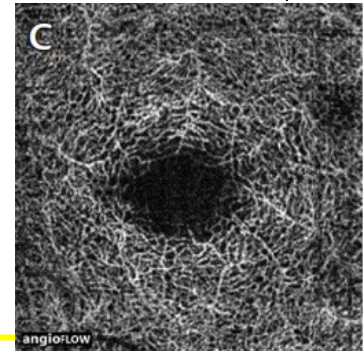
Outer plexiform layer

Outer nuclear layer

Layer of Rods and Cones

Retinal pigmented epithelium

Choroid



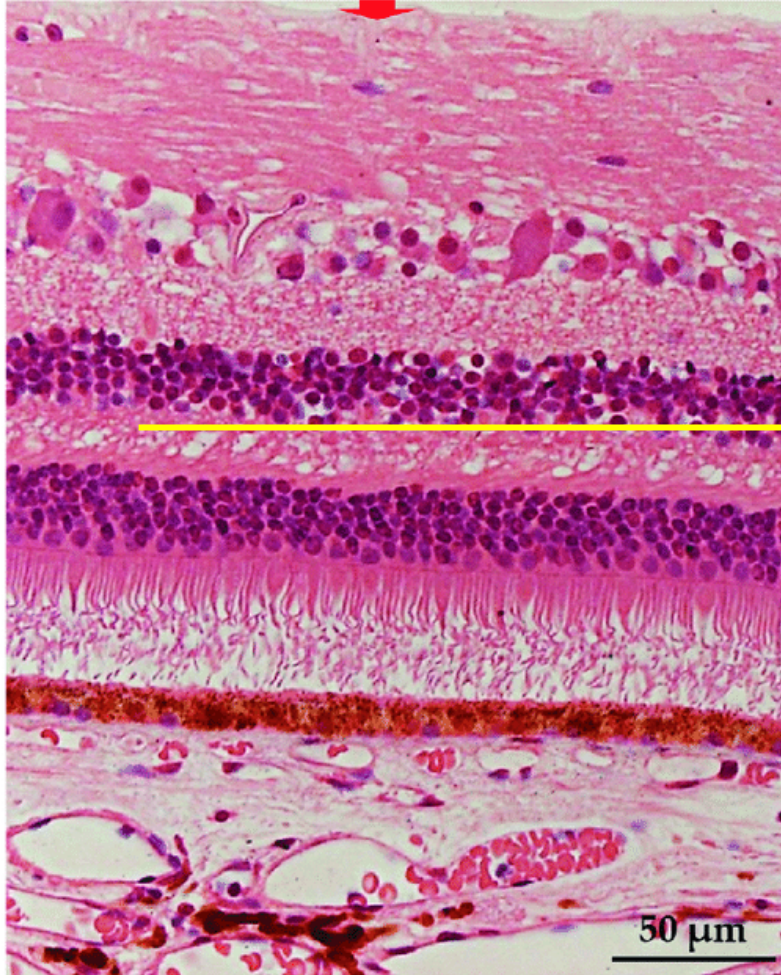
Pics A, B and C depict the parafoveal vasculature as we progress deeper into the retina

(No question—proceed when ready)

# Retinal Anatomy and Histology

## En face OCTA

Light



Internal limiting membrane

Nerve fiber layer

Ganglion cell layer

Inner plexiform layer

Inner nuclear layer

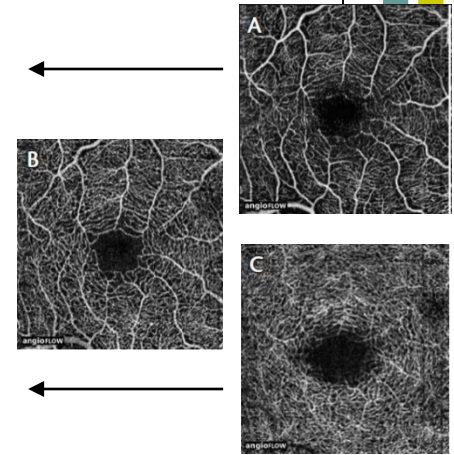
Outer plexiform layer

Outer nuclear layer

Layer of Rods and Cones

Retinal pigmented epithelium

Choroid

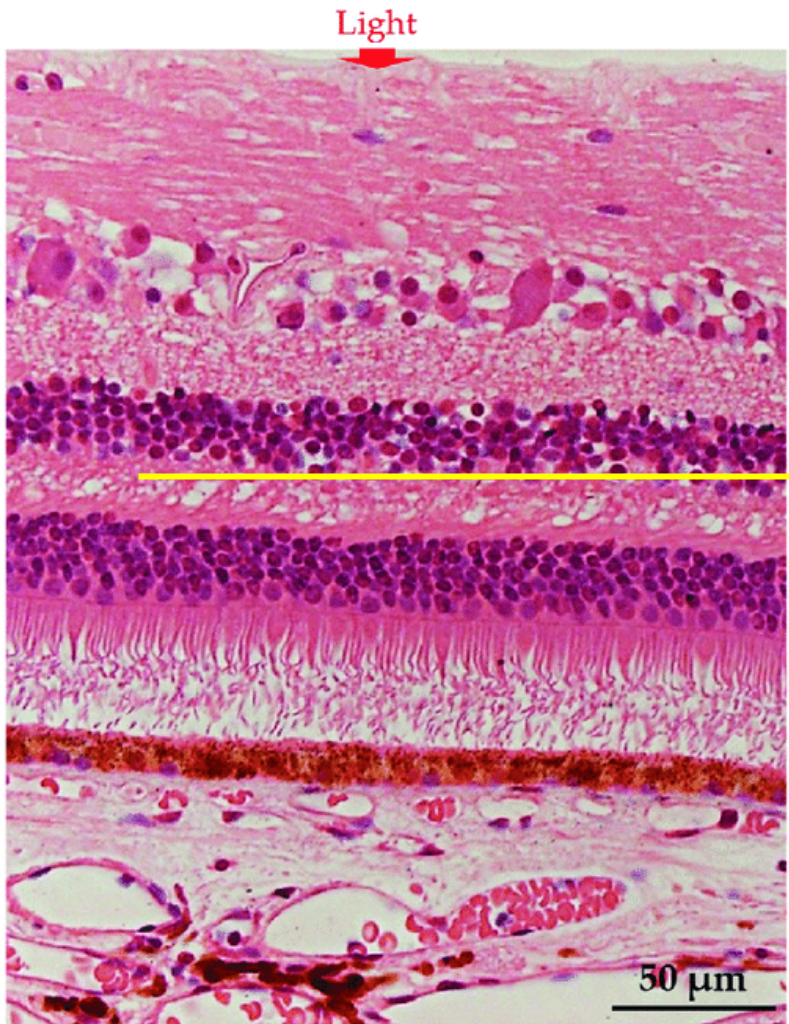


*Note the foveal avascular zone (FAZ) is present in all three layers*

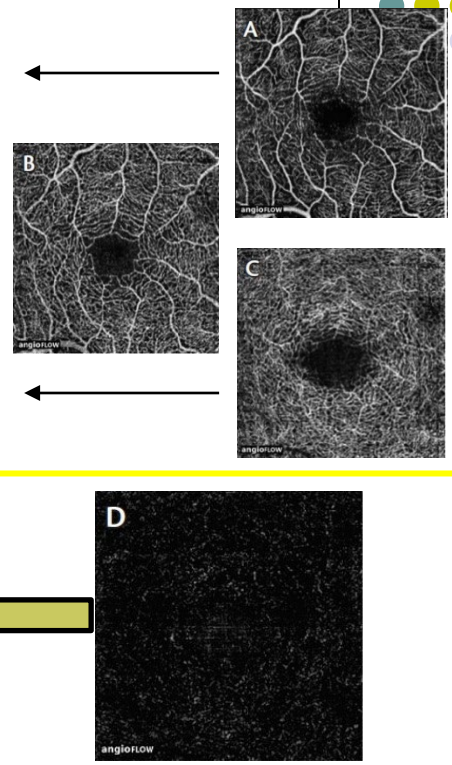
(No question—proceed when ready)

# Retinal Anatomy and Histology

## En face OCTA



- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- Layer of Rods and Cones
- Retinal pigmented epithelium
- Choroid

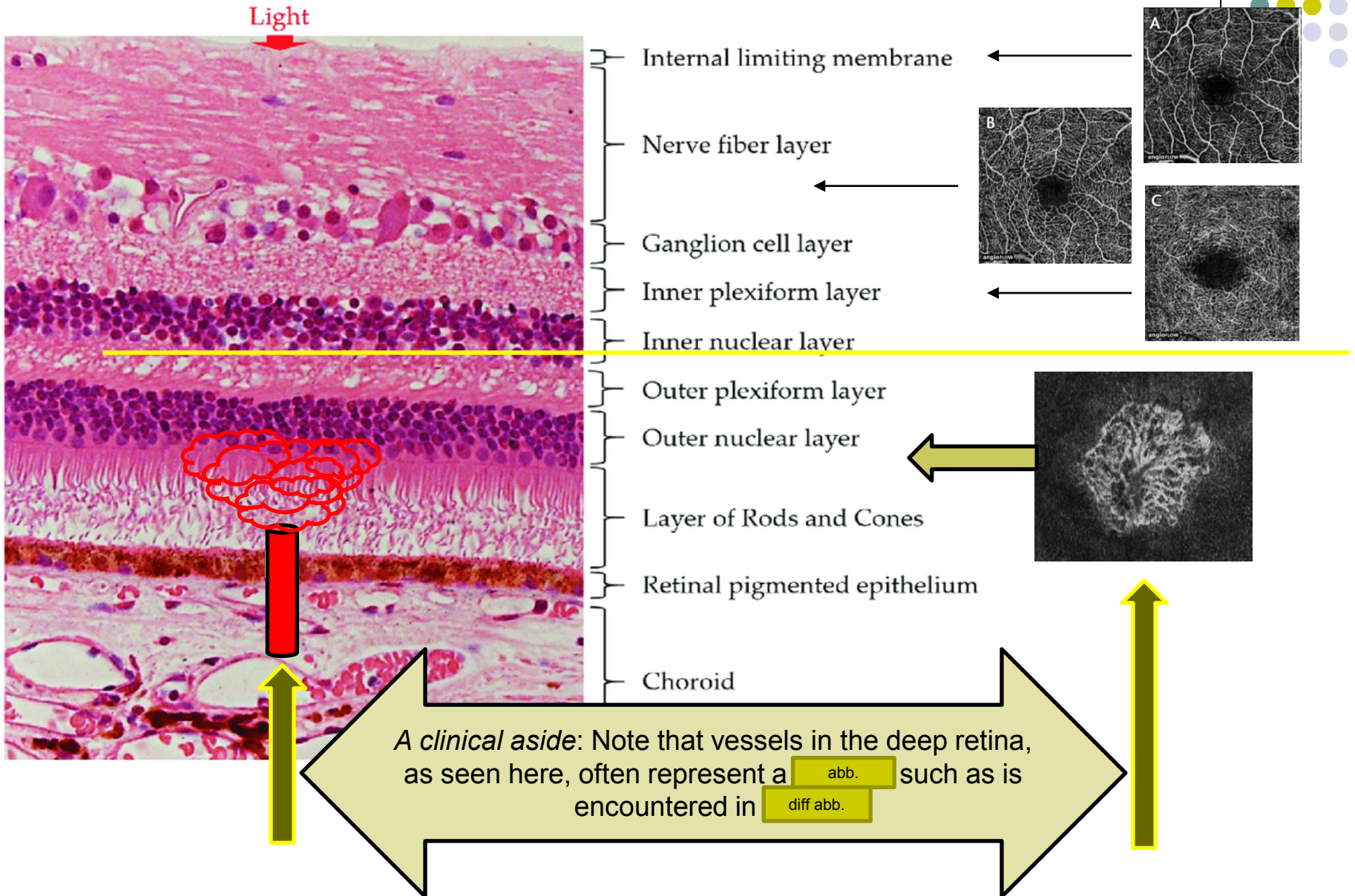


As expected, imaging of the deeper retina (D) reveals the **absence** of intraretinal vasculature

Q

# Retinal Anatomy and Histology

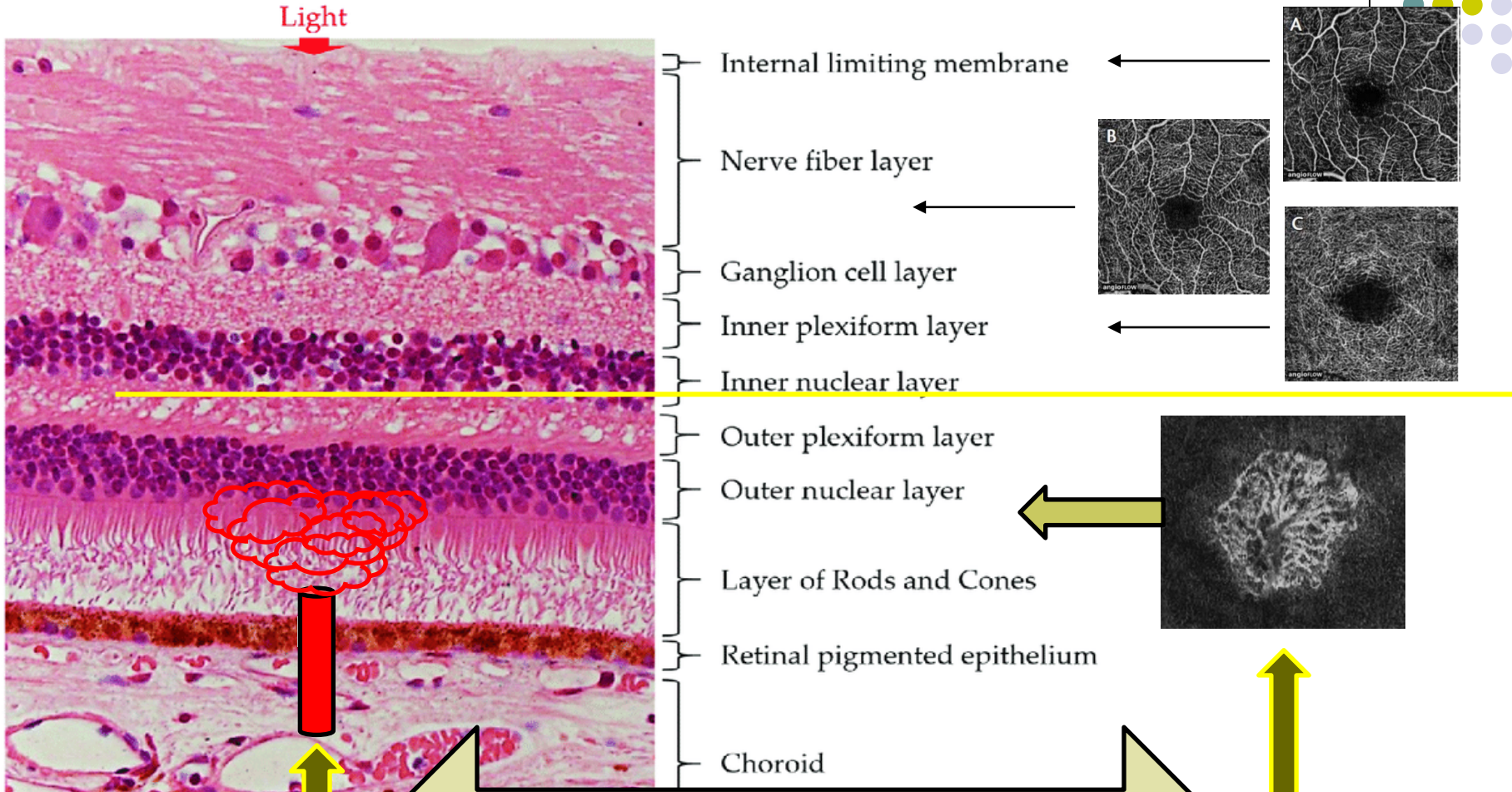
## En face OCTA



# A

## Retinal Anatomy and Histology

## En face OCTA

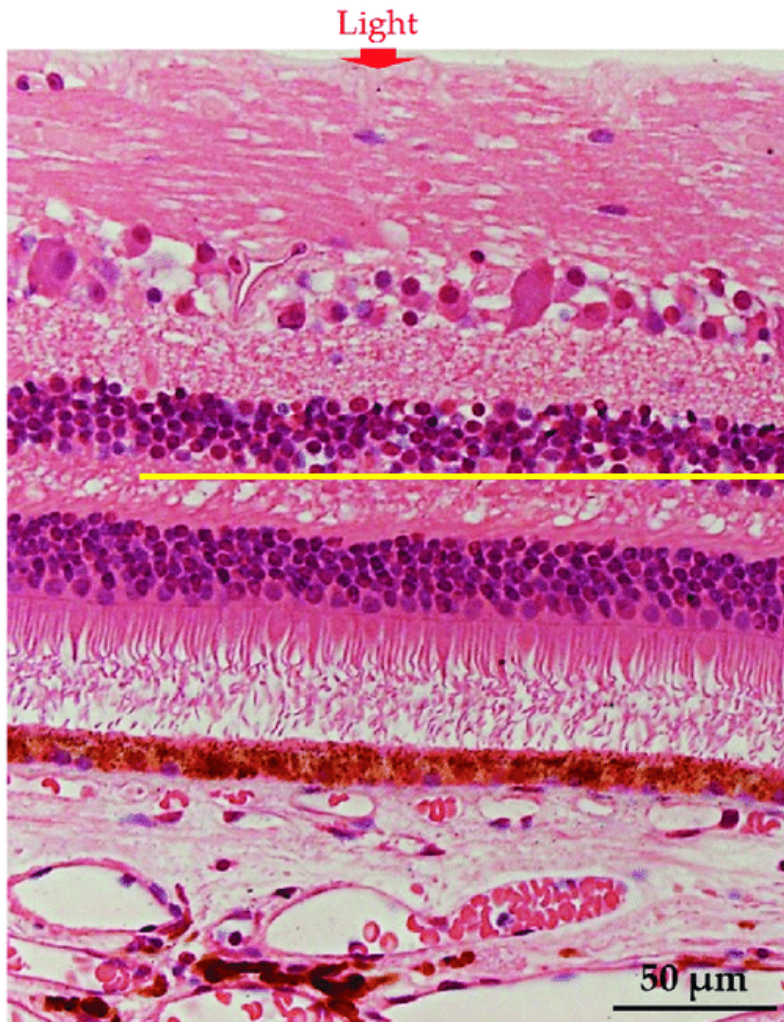


*A clinical aside:* Note that vessels in the deep retina, as seen here, often represent a CNVM such as is encountered in ARMD

**CNVM:** Choroidal neovascular membrane  
**ARMD:** Age-related macular degeneration

# Retinal Anatomy and Histology

## En face OCTA



Internal limiting membrane

Nerve fiber layer

Ganglion cell layer

Inner plexiform layer

Inner nuclear layer

Outer plexiform layer

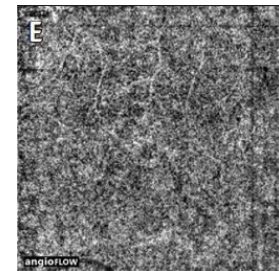
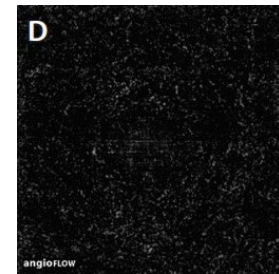
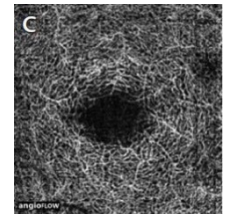
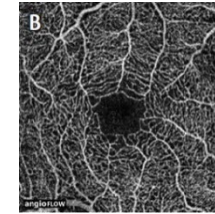
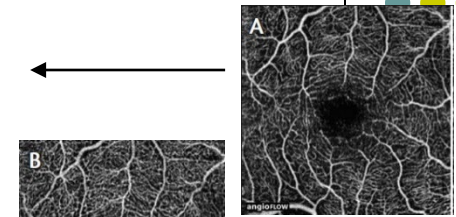
Outer nuclear layer

Layer of Rods and Cones

Retinal pigmented epithelium

Choroid

Layer of vasc  
visualized



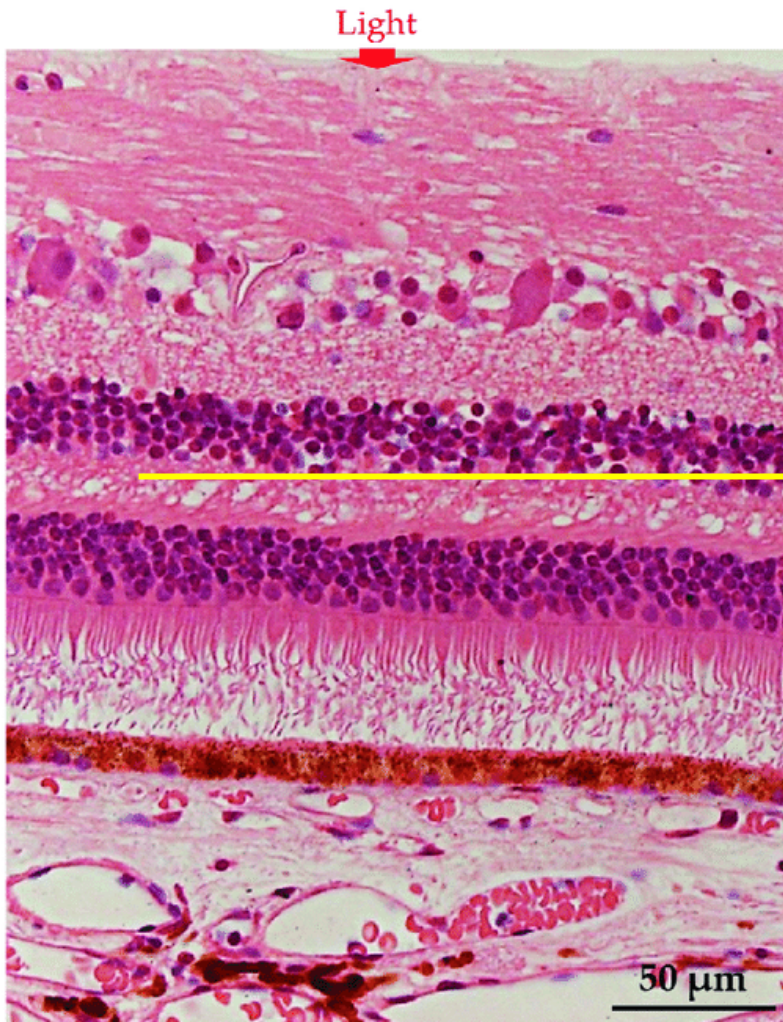
Imaging of the choriocapillaris (E) indicates it contains a dense, robust vasculature.

(No question—proceed when ready)

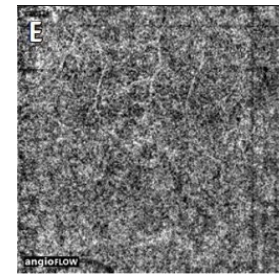
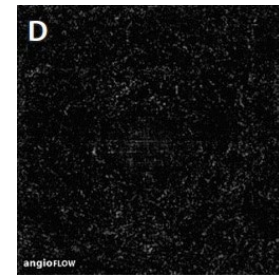
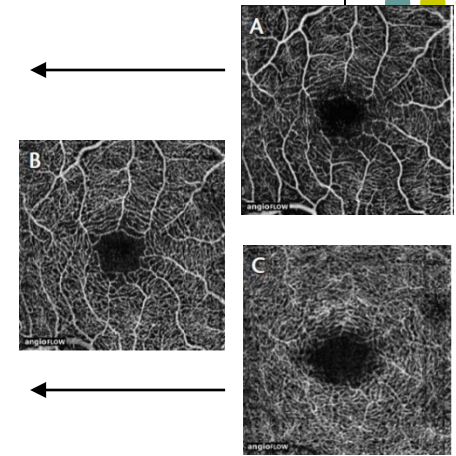


# Retinal Anatomy and Histology

## En face OCTA

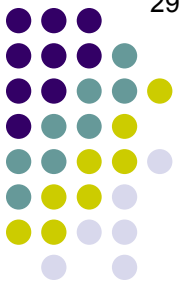


- Internal limiting membrane
- Nerve fiber layer
- Ganglion cell layer
- Inner plexiform layer
- Inner nuclear layer
- Outer plexiform layer
- Outer nuclear layer
- Layer of Rods and Cones
- Retinal pigmented epithelium
- Choroid



Imaging of the choriocapillaris (E) indicates it contains a dense, robust vasculature. As expected, note the absence of a void corresponding to the FAZ.

(No question—proceed when ready)



- **RPE**

*Next let's look in detail at the function and structure of the **RPE***

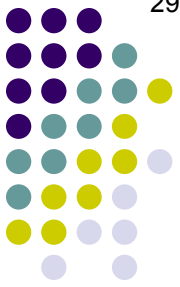
# Q

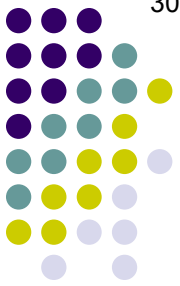
- **RPE: Functions**

1)

2)

3)





# Q

## Retinal Anatomy and Histology

### ● RPE: Functions

1) Outer

2)

3)

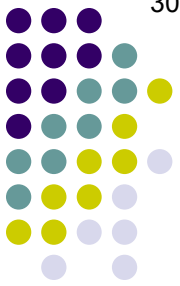
# A

- **RPE: Functions**

1) Outer *blood-ocular barrier*

2)

3)





## Q

### ● RPE: Functions

1) Outer *blood-ocular barrier*

- Formed by  near cell apices

2)

3)

## A

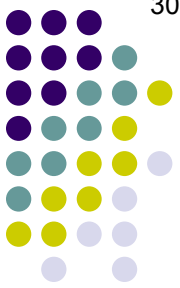
- **RPE: Functions**

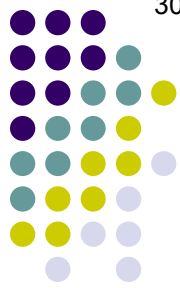
- 1) Outer *blood-ocular barrier*

- Formed by *zonulae occludens* near cell apices

- 2)

- 3)





## Q

### ● RPE: Functions

#### 1) Outer *blood-ocular barrier*

- Formed by *zonulae occludens* near cell apices

As a result of this barrier, the photoreceptor environment is determined by the transport properties of the RPE—bringing  in, and carrying  out. The RPE also  the subretinal space, thereby maintaining structural integrity of the retina.





# A

## Retinal Anatomy and Histology

### ● RPE: Functions

#### 1) Outer *blood-ocular barrier*

- Formed by *zonulae occludens* near cell apices

As a result of this barrier, the photoreceptor environment is determined by the transport properties of the RPE—bringing metabolites in, and carrying waste products out. The RPE also dehydrates the subretinal space, thereby maintaining structural integrity of the retina.



## Q

### ● RPE: Functions

1) Outer *blood-ocular barrier*

- Formed by *zonulae occludens* near cell apices

2) *Phagocytosis of*

3)



## A

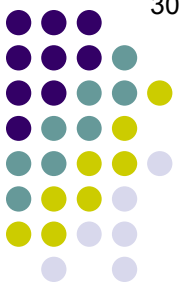
### ● RPE: Functions

1) Outer *blood-ocular barrier*

- Formed by *zonulae occludens* near cell apices

2) *Phagocytosis of rod/cone outer segments*

3)



## Q

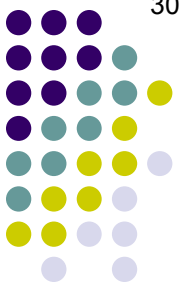
### ● RPE: Functions

1) Outer *blood-ocular barrier*

- Formed by *zonulae occludens* near cell apices

2) *Phagocytosis of rod/cone outer segments*

3) *Vitamin ? metabolism*



# A

## Retinal Anatomy and Histology

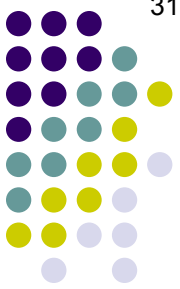
### ● RPE: Functions

1) Outer *blood-ocular barrier*

- Formed by *zonulae occludens* near cell apices

2) *Phagocytosis of rod/cone outer segments*

3) *Vitamin A metabolism*



## Q

### ● RPE: Functions

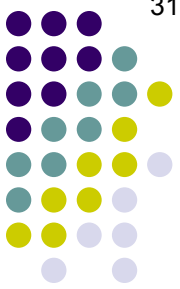
#### 1) Outer *blood-ocular barrier*

- Formed by *zonulae occludens* near cell apices

#### 2) *Phagocytosis of rod/cone outer segments*

#### 3) *Vitamin A metabolism*

- specific substance acquired, stored and transported by RPE



## A

### ● RPE: Functions

#### 1) Outer *blood-ocular barrier*

- Formed by *zonulae occludens* near cell apices

#### 2) Phagocytosis of *rod/cone outer segments*

#### 3) Vitamin *A* metabolism

- *Retinol* acquired, stored and transported by RPE

Q

## Retinal Anatomy and Histology



What are the five layers of Bruch's membrane?

- Bruch's membrane
- 1) *(Start here)*
  - 2)
  - 3)
  - 4)
  - 5)

*Innermost*

*Outermost*





# Q/A



What are the five layers of Bruch's membrane?

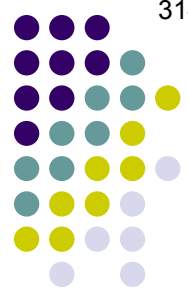
- Bruch's membrane
- 1) two words of RPE
  - 2)
  - 3)
  - 4)
  - 5)

*Innermost*

*Outermost*

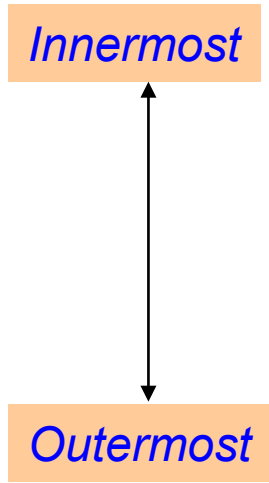


# A



What are the five layers of Bruch's membrane?

- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) (Next)
  - 3)
  - 4)
  - 5)





What are the five layers of Bruch's membrane?

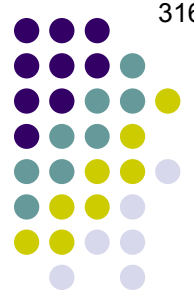
- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner one word layer
  - 3)
  - 4)
  - 5)

*Innermost*

*Outermost*

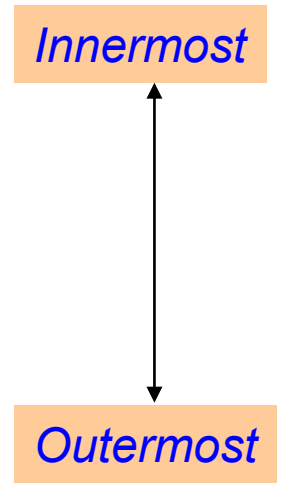


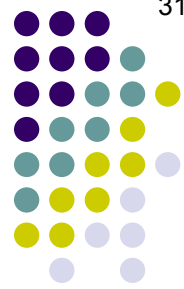
# A



What are the five layers of Bruch's membrane?

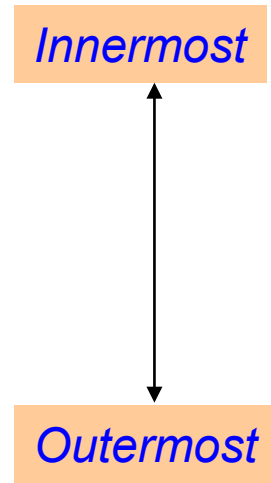
- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) (Next)
  - 4)
  - 5)





What are the five layers of Bruch's membrane?

- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) diff one word layer
  - 4)
  - 5)

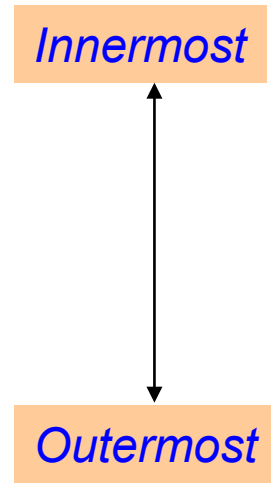


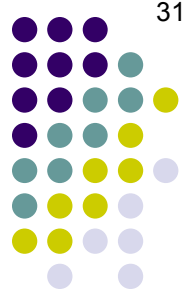
# A



What are the five layers of Bruch's membrane?

- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) (Next)
  - 5)





What are the five layers of Bruch's membrane?

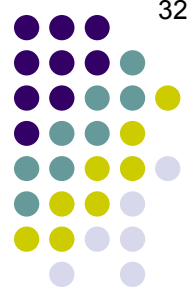
- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer one familiar word layer
  - 5)

*Innermost*

*Outermost*



# A

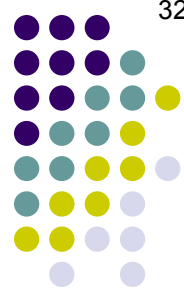


What are the five layers of Bruch's membrane?

- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) (Next)







### What are the five layers of Bruch's membrane?

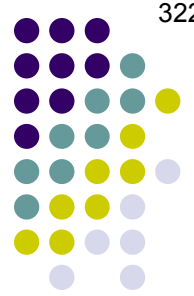
- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) two familiar words of choriocapillaris

*Innermost*

*Outermost*

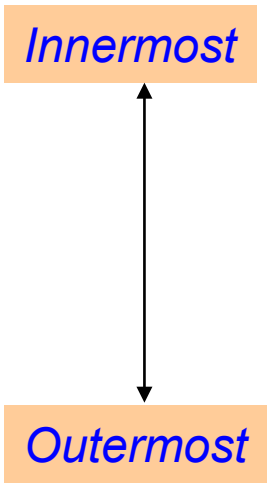


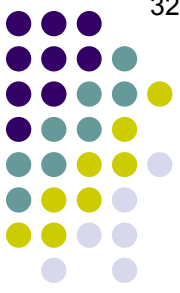
# A



What are the five layers of Bruch's membrane?

- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) Basement membrane of choriocapillaris





## Retinal Anatomy and Histology

# Q

What are the five layers of Bruch's membrane?

o) ?

← What (non-Bruch's) structure goes here?

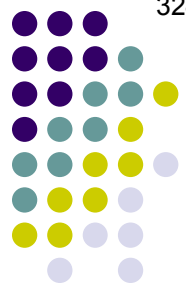
- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) Basement membrane of choriocapillaris

Innermost

Outermost

## A

## Retinal Anatomy and Histology



What are the five layers of Bruch's membrane?

0) RPE cells

What (non-Bruch's) structure goes here? The RPE cells themselves

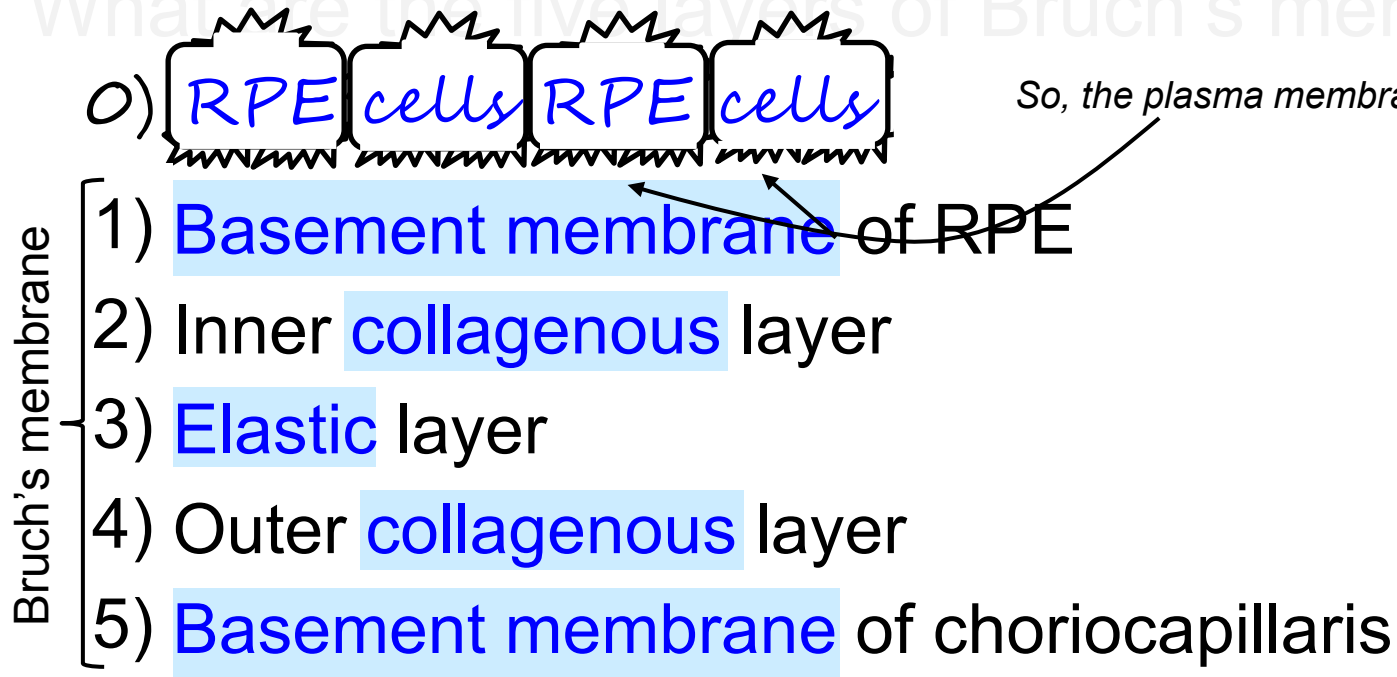
- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) Basement membrane of choriocapillaris

Innermost

Outermost



What are the five layers of Bruch's membrane?

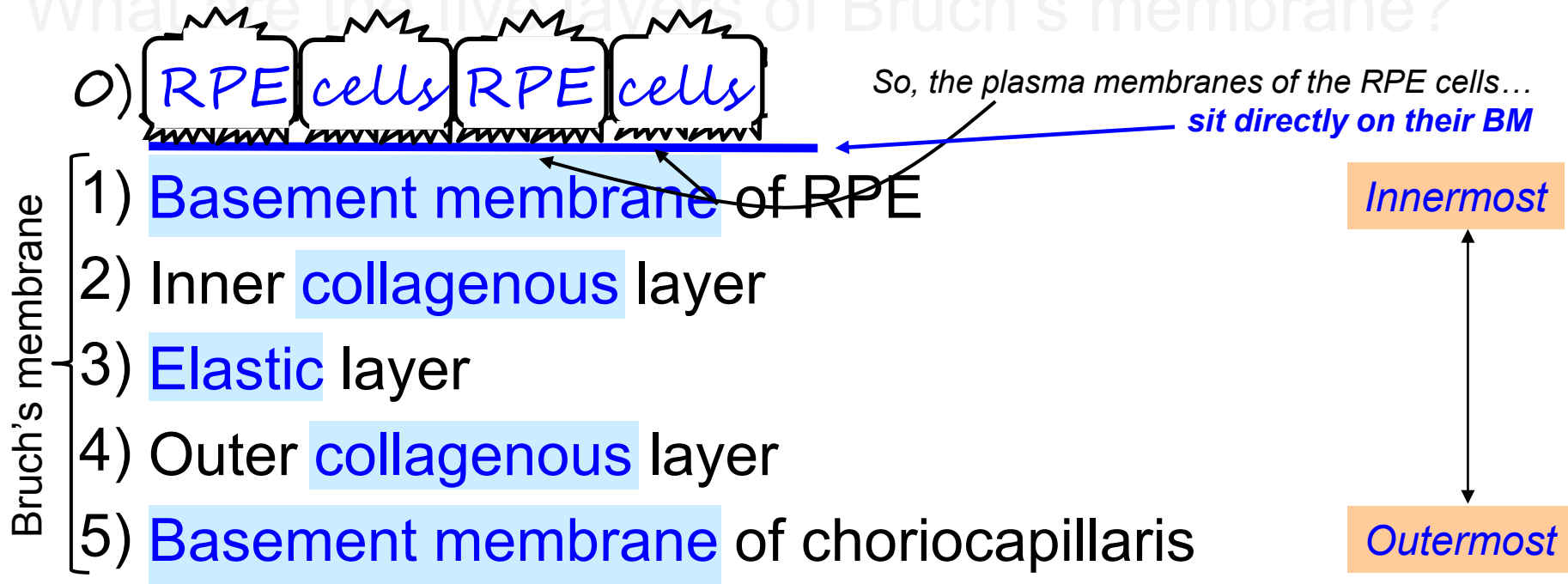


Innermost

Outermost



What are the five layers of Bruch's membrane?



# Retinal Anatomy and Histology

## Q



What (non-RPE) structures go here?

-1) ?

0) RPE cells RPE cells

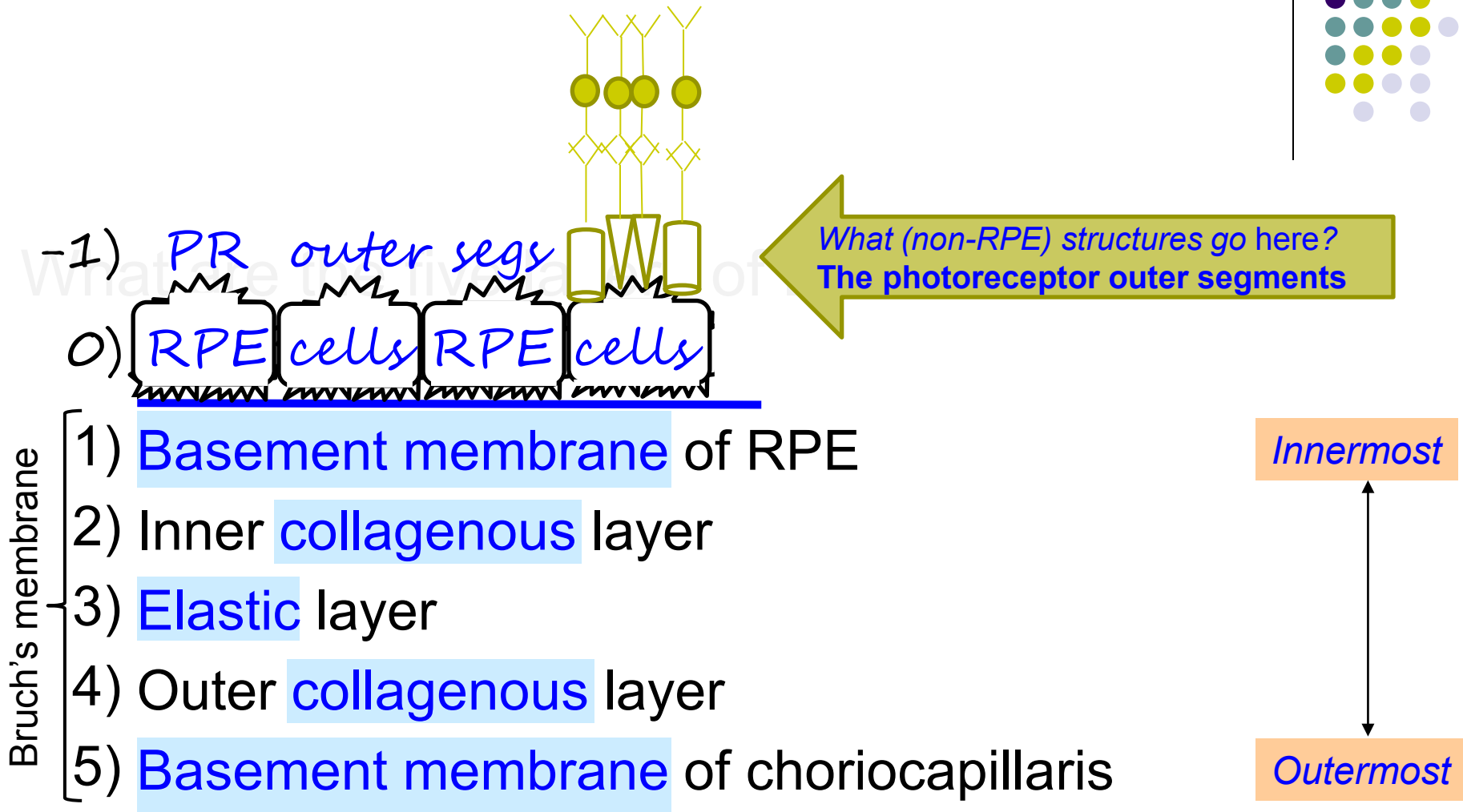
- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) Basement membrane of choriocapillaris

Innermost

Outermost

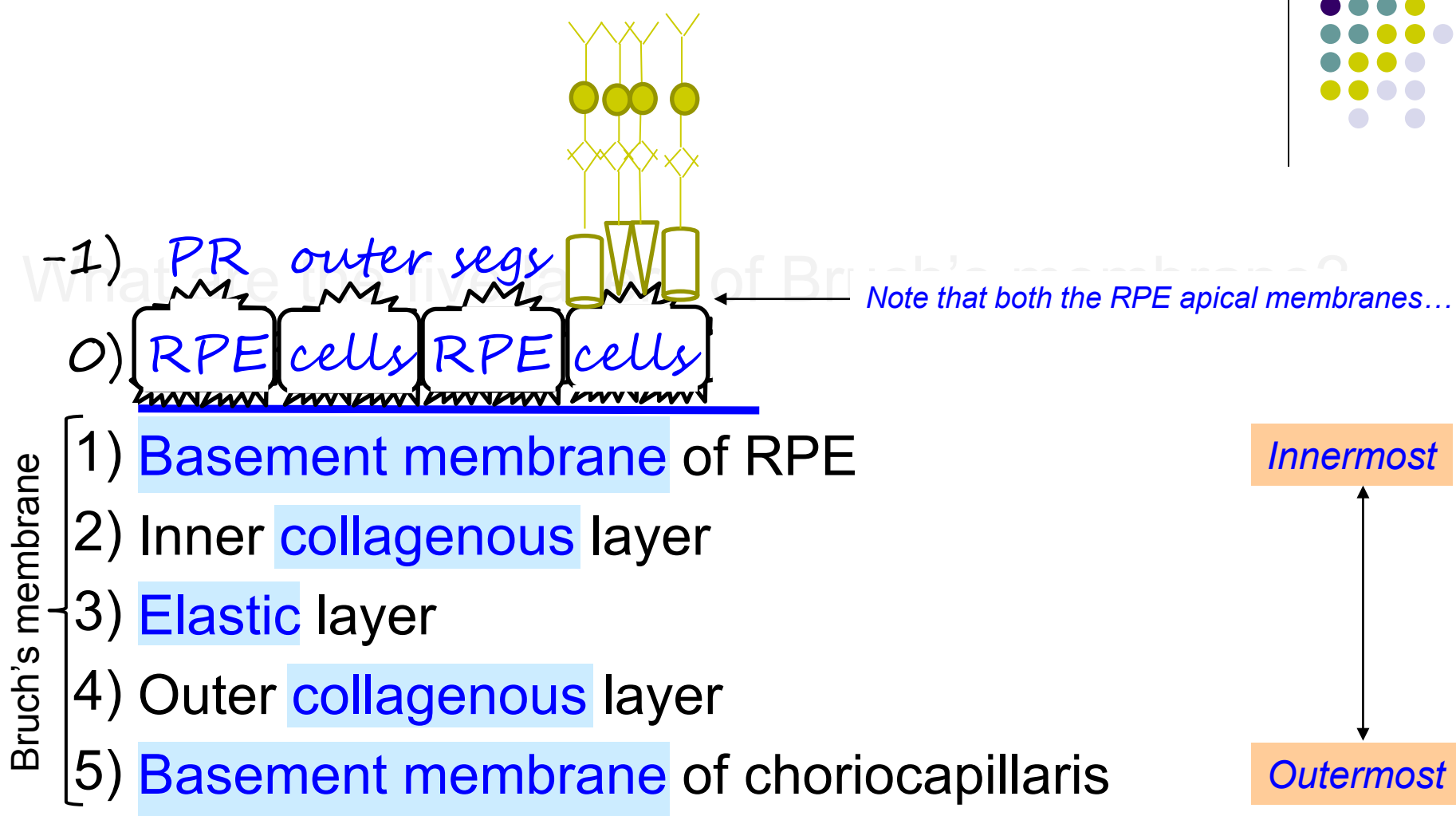
# Retinal Anatomy and Histology

## A

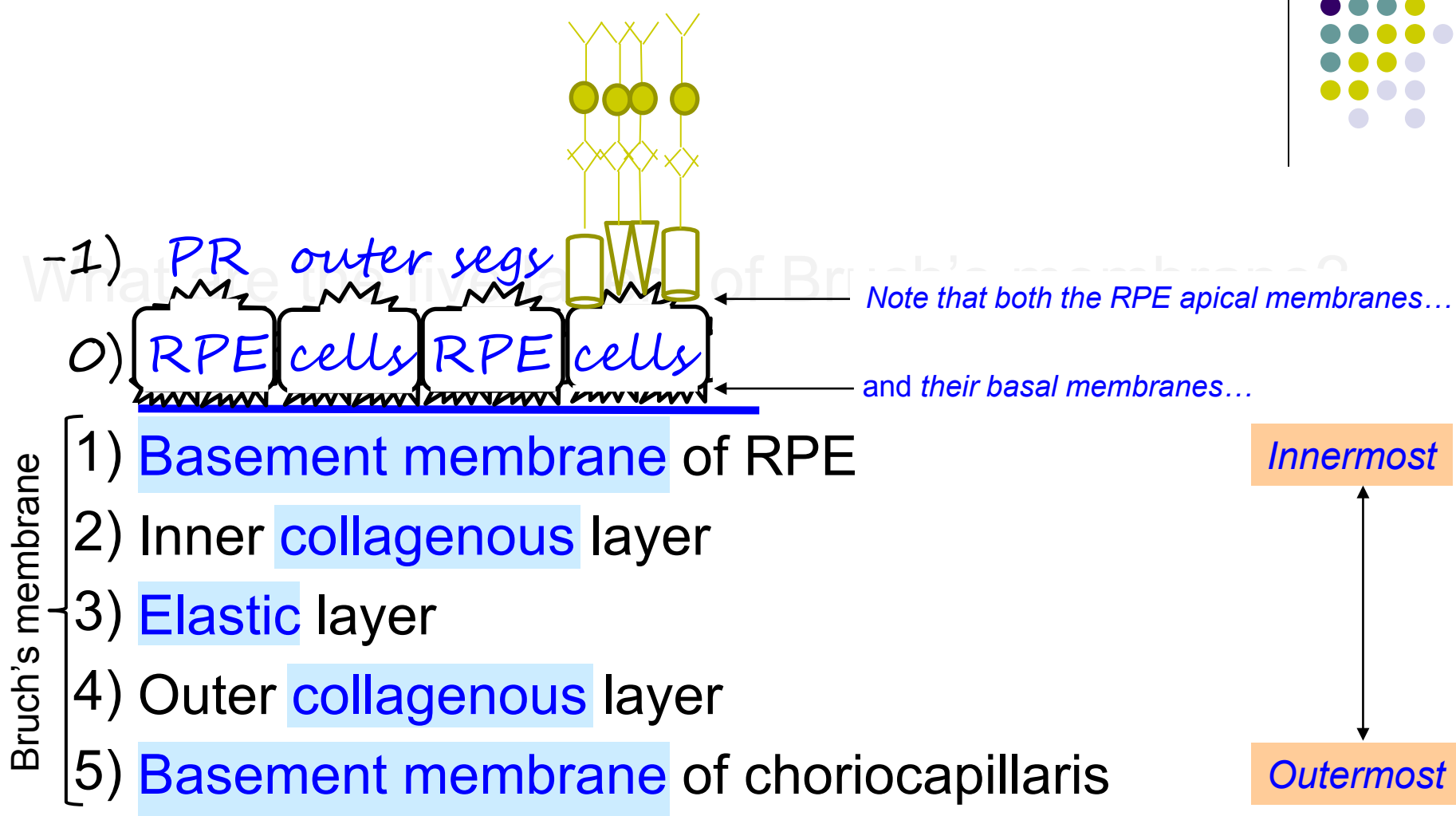




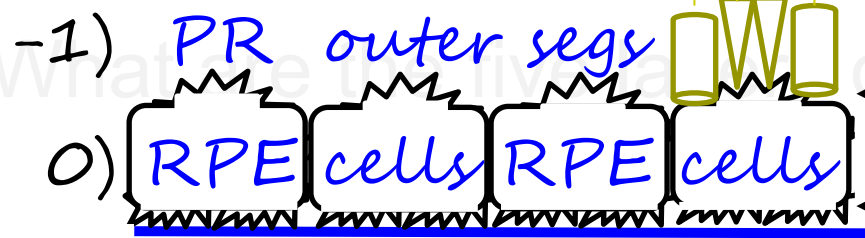
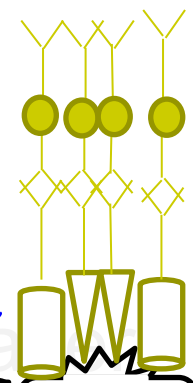
# Retinal Anatomy and Histology



# Retinal Anatomy and Histology

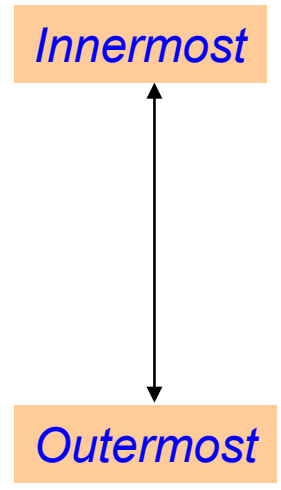


# Retinal Anatomy and Histology

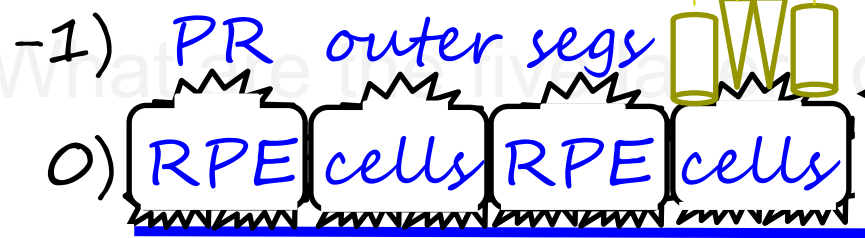
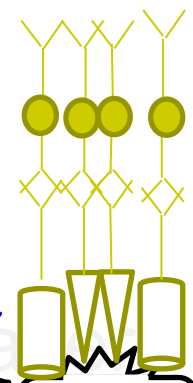
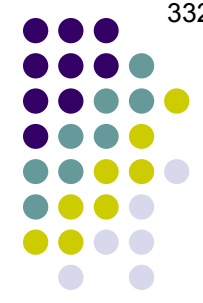


Note that both the RPE apical membranes...  
**are highly infolded.**  
and their basal membranes...

- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) Basement membrane of choriocapillaris

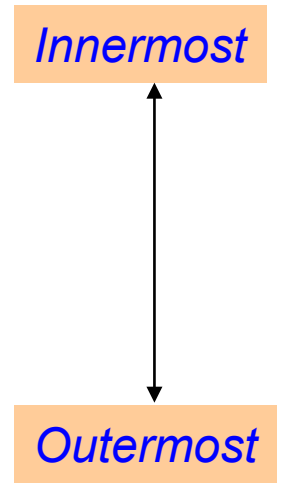


# Retinal Anatomy and Histology

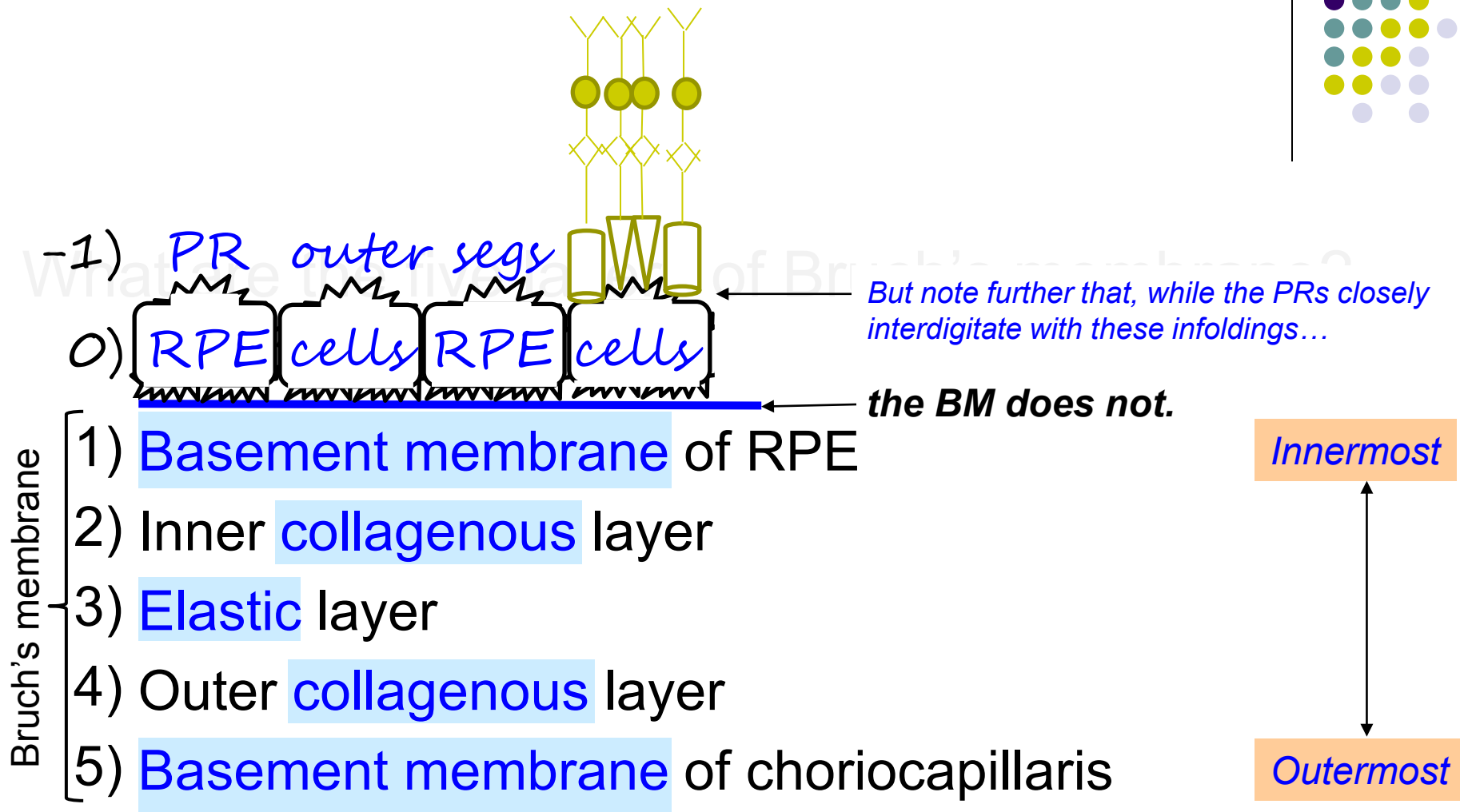


But note further that, while the PRs closely interdigitate with these infoldings...

- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) Basement membrane of choriocapillaris

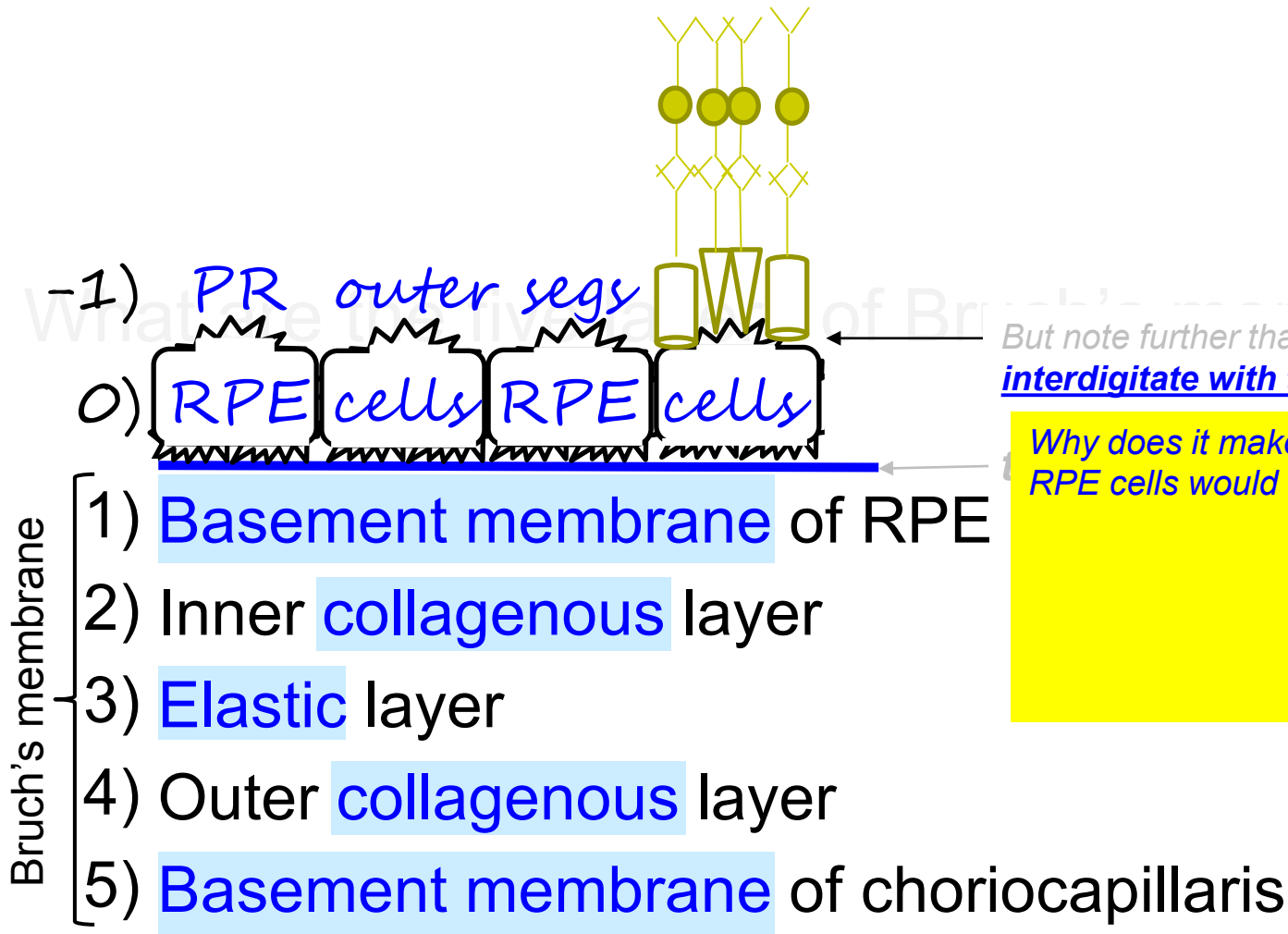


# Retinal Anatomy and Histology



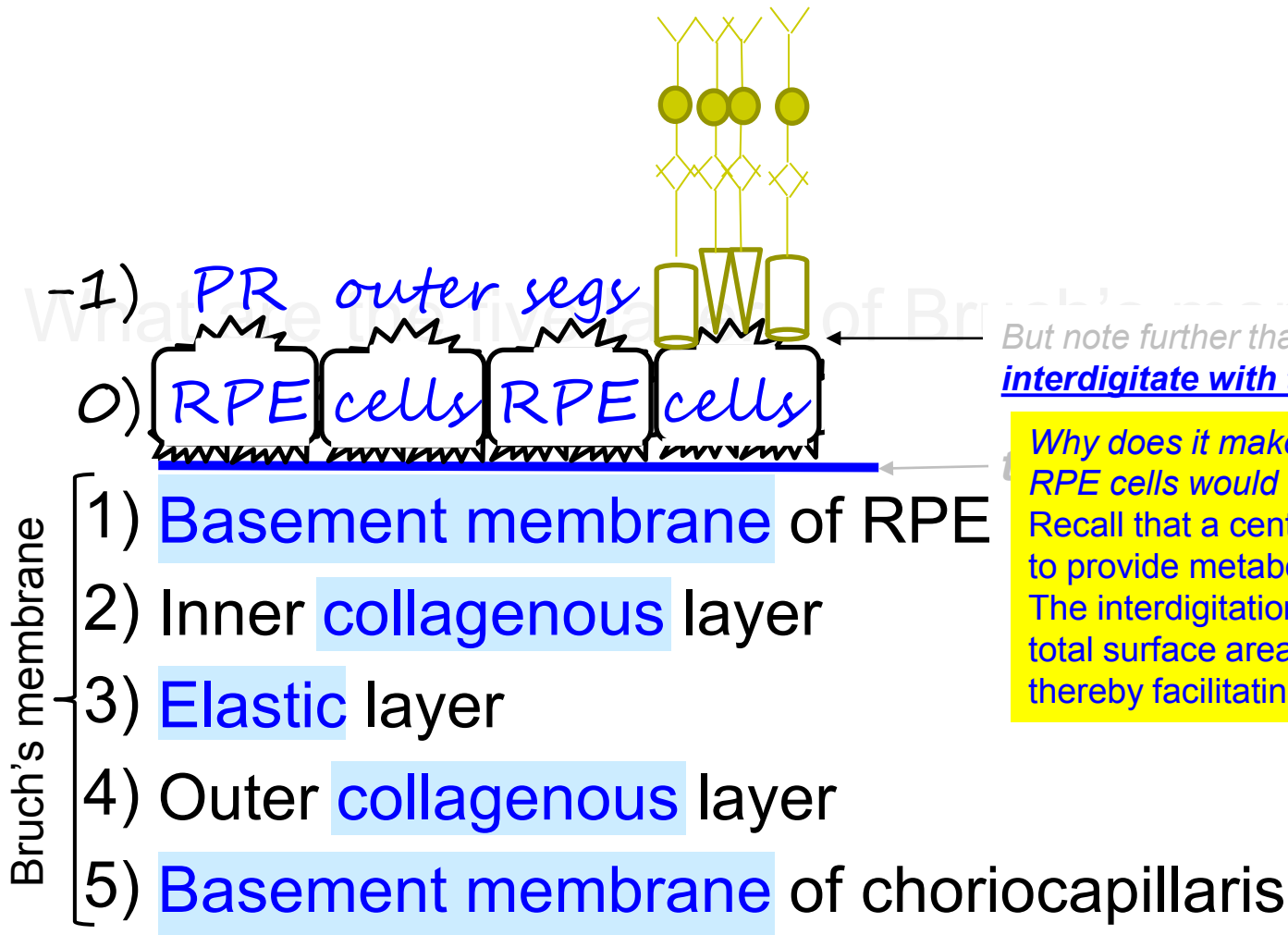
# Retinal Anatomy and Histology

# Q



# Retinal Anatomy and Histology

# A



But note further that, while the PRs closely interdigitate with these infoldings...

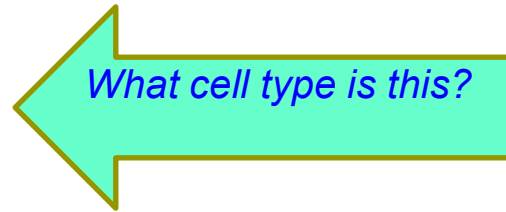
Why does it make sense that the PRs and RPE cells would be highly interdigitated? Recall that a central function of the RPE is to provide metabolic support for the PRs. The interdigitations greatly increase the total surface area of PR-RPE contact, thereby facilitating these metabolic efforts.

Outermost

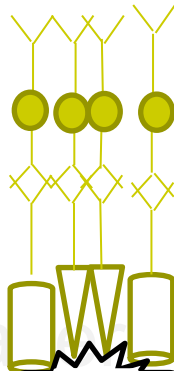
# Retinal Anatomy and Histology

Q

-2) ?



-1) PR outer segs

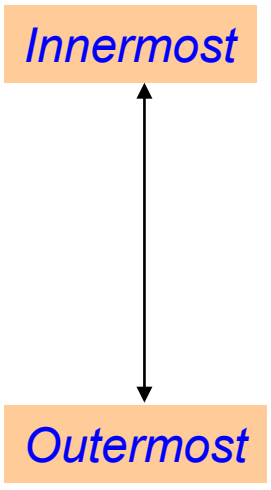


0) RPE cells RPE cells



Bruch's membrane

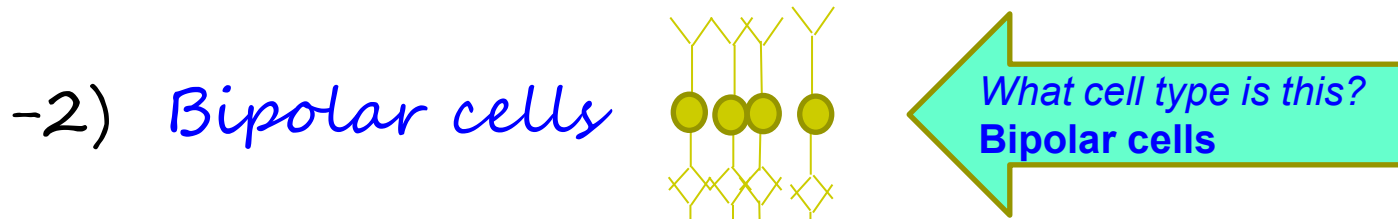
- 1) Basement membrane of RPE
- 2) Inner collagenous layer
- 3) Elastic layer
- 4) Outer collagenous layer
- 5) Basement membrane of choriocapillaris





# Retinal Anatomy and Histology

## A



-1) PR outer segs



- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) Basement membrane of choriocapillaris

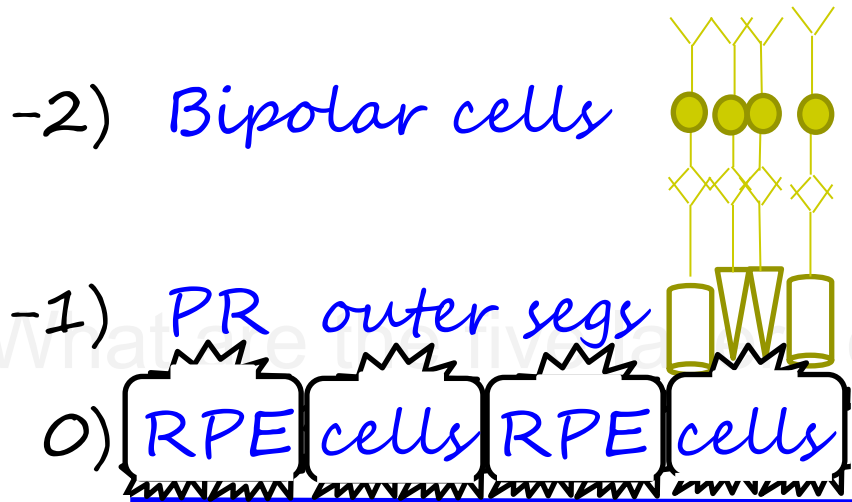
Innermost

Outermost



# Retinal Anatomy and Histology

## Q

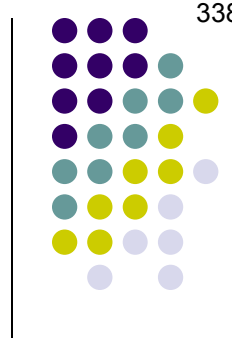


- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) Basement membrane of choriocapillaris
  - 6) ?

Innermost

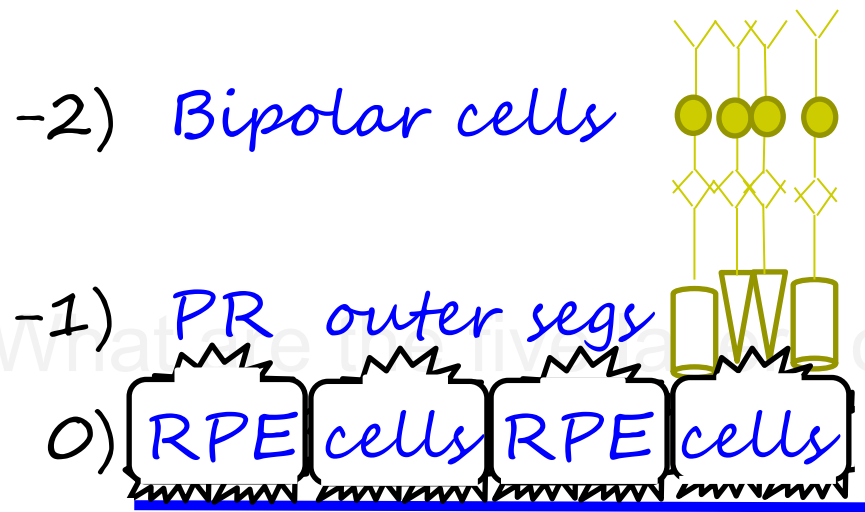
Outermost


What structure is this?



**Retinal Anatomy and Histology**

**A**

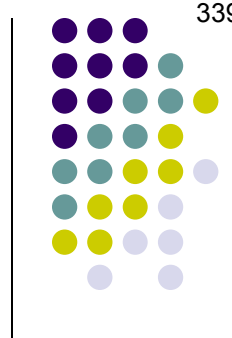


- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) Basement membrane of choriocapillaris
  - 6)  Choriocapillaris

Innermost

Outermost

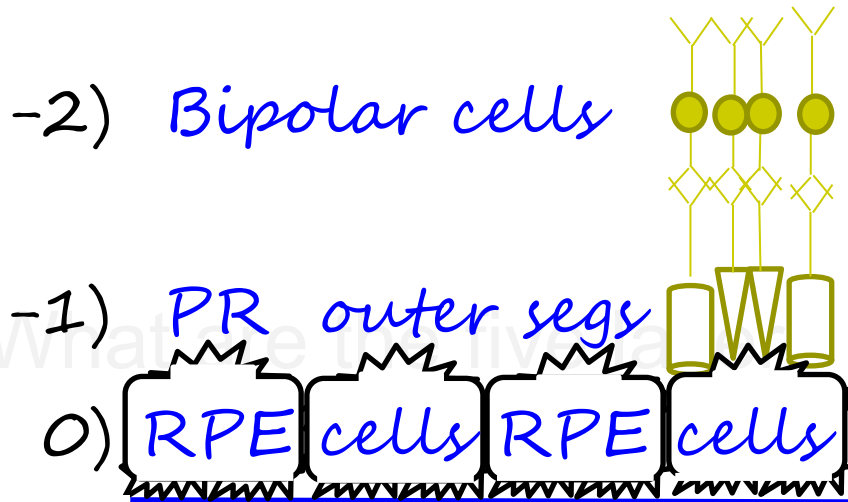
What structure is this?  
The choriocapillaris



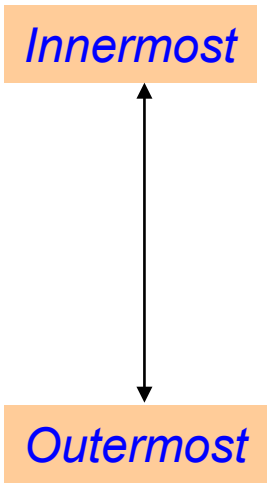
What are the primary components of Bruch's membrane?

# Retinal Anatomy and Histology

## Q



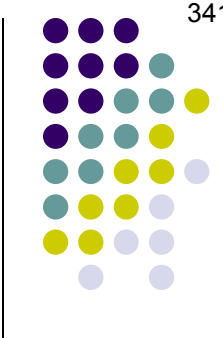
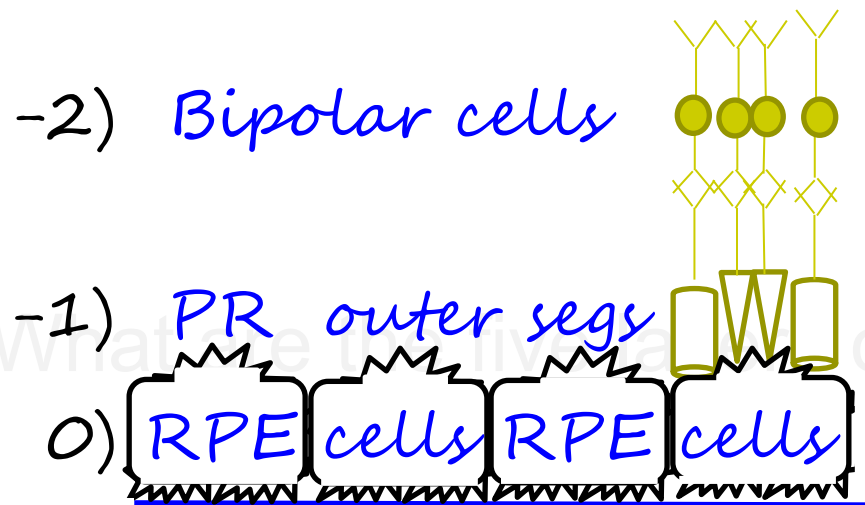
- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) Basement membrane of choriocapillaris
  - 6) ~~Choriocapillaris~~ Choriocapillaris
  - 7) ~~?~~ ?



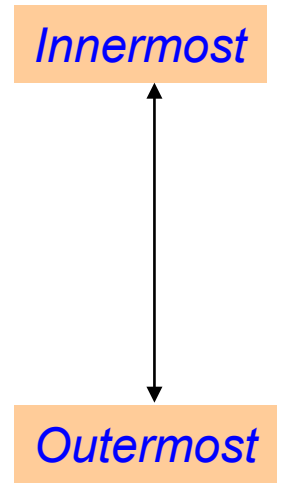
What structure is this?

# Retinal Anatomy and Histology

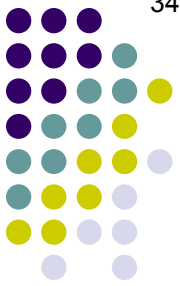
## A



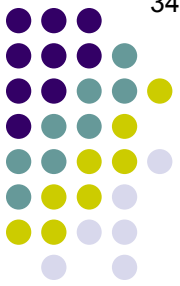
- Bruch's membrane
- 1) Basement membrane of RPE
  - 2) Inner collagenous layer
  - 3) Elastic layer
  - 4) Outer collagenous layer
  - 5) Basement membrane of choriocapillaris
  - 6) ~~Choriocapillaris~~ Choriocapillaris
  - 7) ~~Choroid~~ Choroid



What structure is this?  
The choroid



*Next we will look at macular OCT, and relate it to what we've learned about the anatomy of the retina*



# Q

## *Retinal Anatomy and Histology*

*What does OCT stand for?*

*Next we will look at macular OCT, and relate it to what we've learned about the anatomy of the retina*

# A

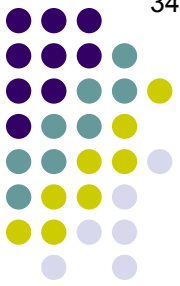
## Retinal Anatomy and Histology



*What does OCT stand for?*  
Optical coherence tomography

*Next we will look at macular OCT, and relate it to what we've learned about the anatomy of the retina*





# Q

## *Retinal Anatomy and Histology*

*What does OCT stand for?*

Optical coherence tomography

*What is it?*

*Next we will look at macular OCT, and relate it to what we've learned about the anatomy of the retina*

# A

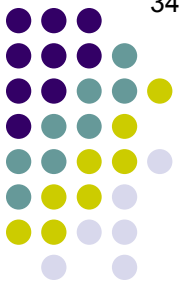
## Retinal Anatomy and Histology



*What does OCT stand for?*  
Optical coherence tomography

*What is it?*  
A technology that allows cross-sectional imaging of ocular structures, including the retina (*tomography* means 'cross-sectional image')

*Next we will look at macular OCT, and relate it to what we've learned about the anatomy of the retina*



# Q

## Retinal Anatomy and Histology

*What does OCT stand for?*

Optical coherence tomography

*What is it?*

A technology that allows cross-sectional imaging of ocular structures, including the retina (*tomography* means 'cross-sectional image')

***Next we will look at macular OCT, and relate it to what we've learned about the anatomy of the retina***

*How does it work?*



# A

## Retinal Anatomy and Histology

*What does OCT stand for?*

Optical coherence tomography

*What is it?*

A technology that allows cross-sectional imaging of ocular structures, including the retina (*tomography* means 'cross-sectional image')

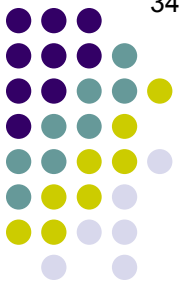
*Next we will look at macular OCT, and relate it to what we've learned about the anatomy of the retina*

*How does it work?*

Via **interferometry**. A beam of coherent light is directed toward the retina. As the light penetrates the retina, it is reflected at boundaries between tissue layers. The device gathers the reflected light and compares it to a standardized beam of light reflected from a reference mirror.

# A

## Retinal Anatomy and Histology



*What does OCT stand for?*

Optical coherence tomography

*What is it?*

A technology that allows cross-sectional imaging of ocular structures, including the retina (*tomography* means 'cross-sectional image')

*Next we will look at macular OCT, and relate it to what we've learned about the anatomy of the retina*

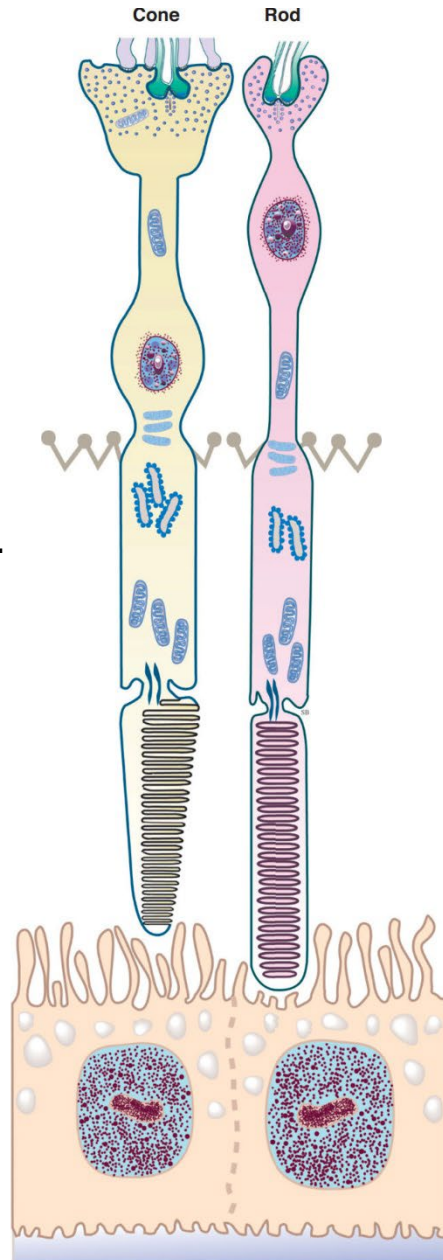
*How does it work?*

Via **interferometry**. A beam of coherent light is directed toward the retina. As the light penetrates the retina, it is reflected at boundaries between tissue layers. The device gathers the reflected light and compares it to a standardized beam of light reflected from a reference mirror. In *spectral-domain OCT* (sdOCT), differences in the frequencies of the two reflected beams are used to infer the ultrastructure of the retina.

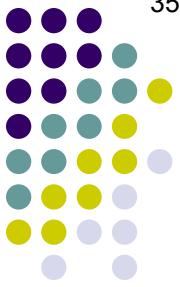
# Retinal Anatomy and Histology



Recall this slide from earlier.  
The time/effort you spent  
committing it to memory is  
about to pay off.



- ← The ELM
- ← The myoid zone
- ← The ellipsoid zone
- ← PR outer segs
- ← Interdigitation zone
- ← RPE/Bruch's membrane



Recall this slide from earlier.  
The time/effort you spent  
committing it to memory is  
about to pay off. *As we will see,*  
*these structures are visible on*  
*sdOCT, and it's vital you be*  
*able to recognize them.*

The ELM

The myoid zone

The ellipsoid zone

PR outer segs

Interdigitation zone

RPE/Bruch's membrane

Q

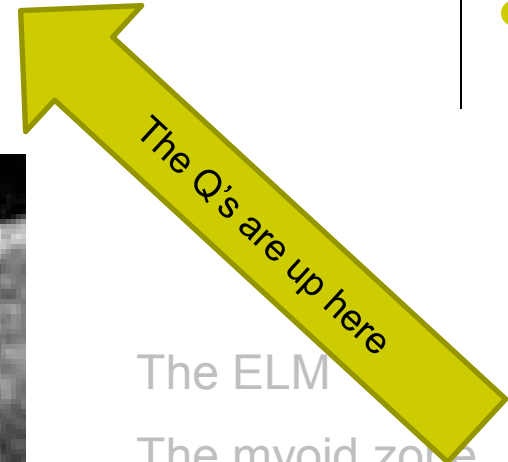
## Retinal Anatomy and Histology

Let's identify the RPE/Bruch's complex first. Where is it?



(Ignore this line)

(And this one)



The ELM

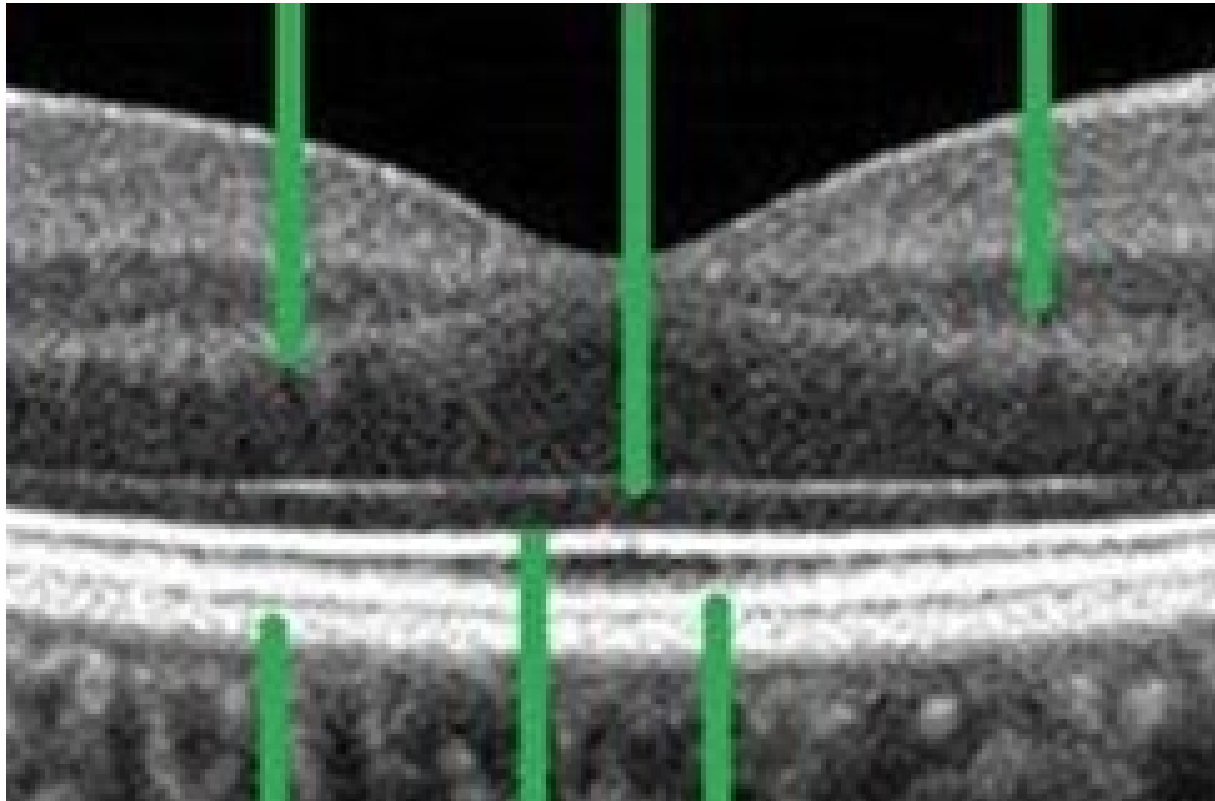
The myoid zone

The ellipsoid zone

PR outer segs

Interdigitation zone

**RPE/Bruch's membrane**





A

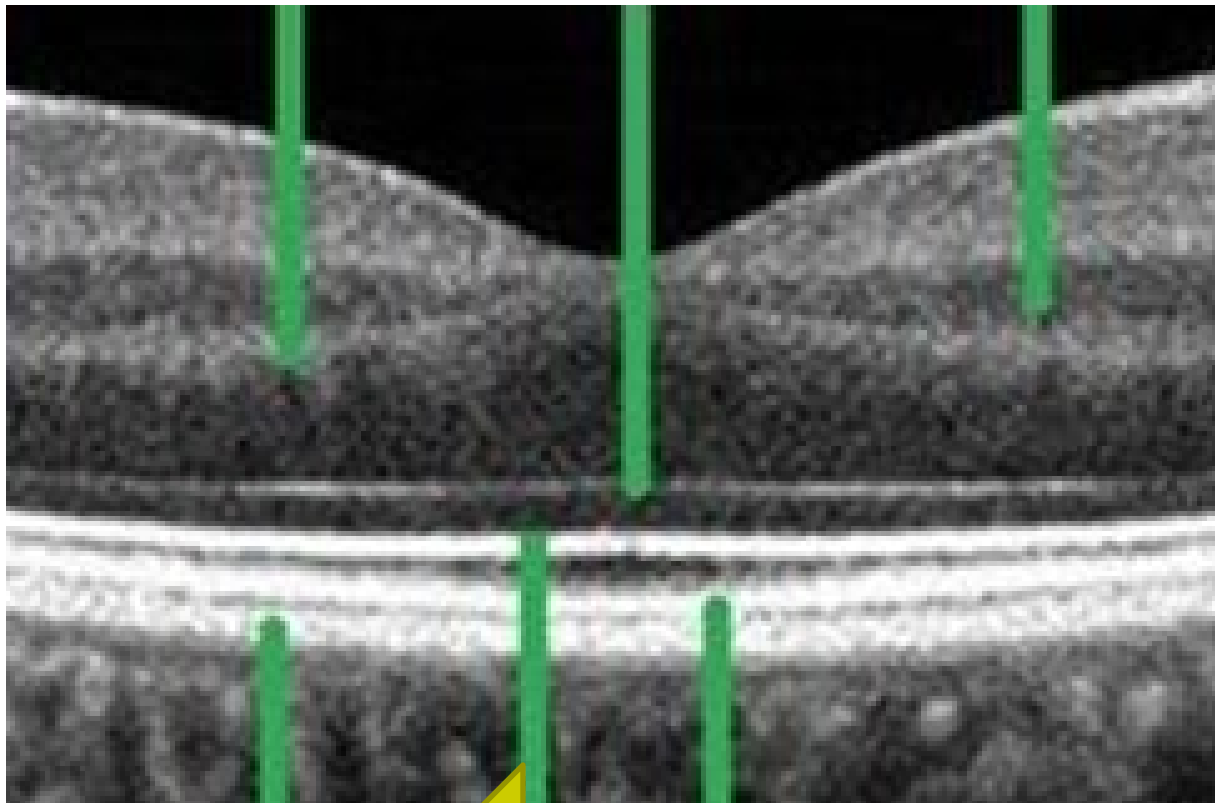
## Retinal Anatomy and Histology

Let's identify the RPE/Bruch's complex first. Where is it?  
The RPE/Bruch's complex is the outermost heavy white line



(Ignore this line)

(And this one)



The ELM

The myoid zone

The ellipsoid zone

PR outer segs

Interdigitation zone

**RPE/Bruch's membrane**

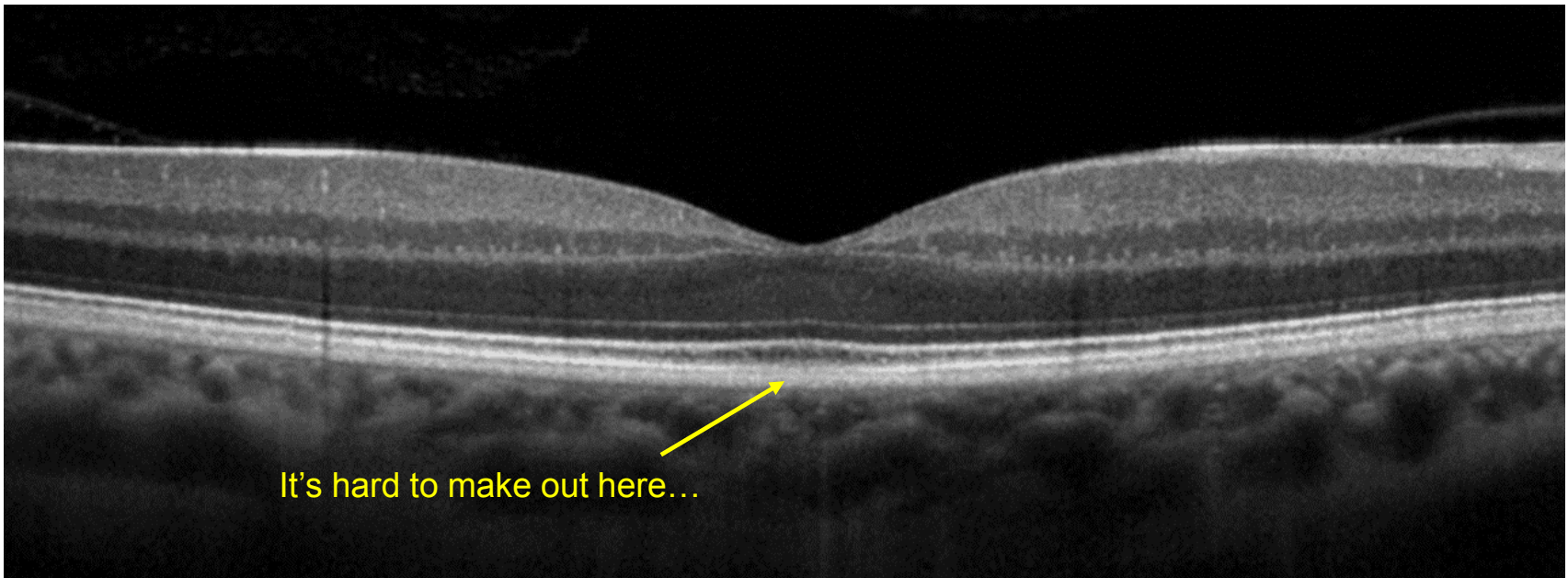
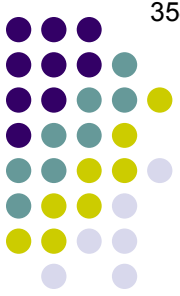
RPE/Bruch's  
membrane

Some A's will be down here

*(The green line is pointing to it)*

## Retinal Anatomy and Histology

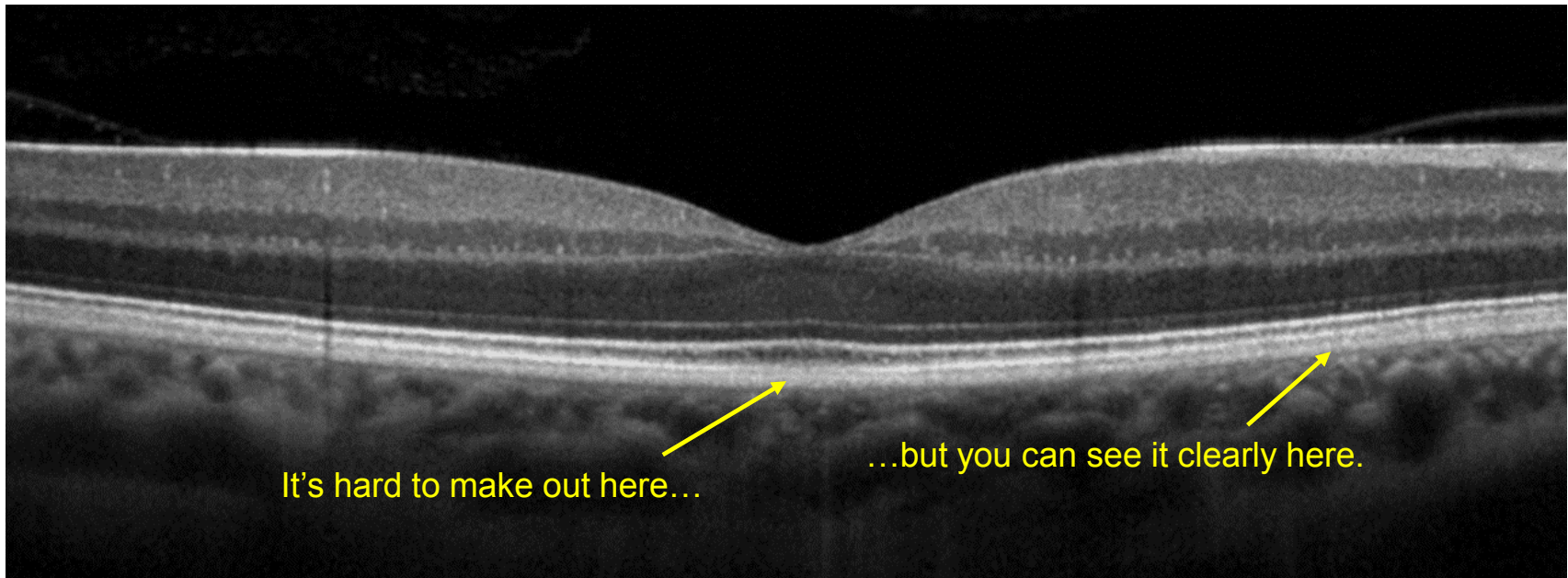
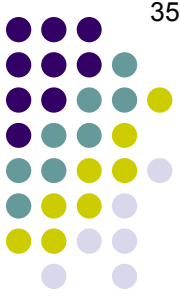
Let's identify the **RPE/Bruch's complex** first. Where is it?  
The RPE/Bruch's complex is the outermost heavy white line



(Locating the same structure on a full-size OCT image)

## Retinal Anatomy and Histology

Let's identify the **RPE/Bruch's complex** first. Where is it?  
The RPE/Bruch's complex is the outermost heavy white line



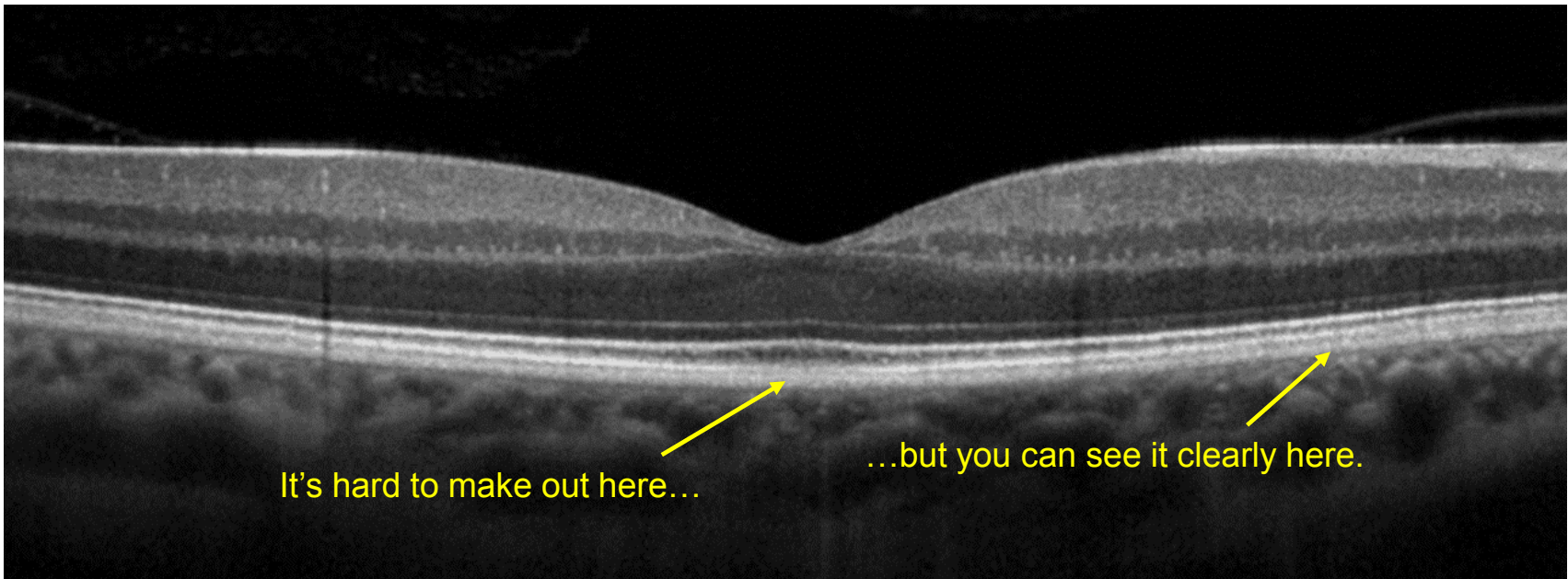
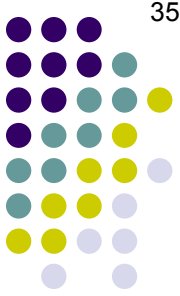
It's hard to make out here...

...but you can see it clearly here.

(Locating the same structure on a full-size OCT image)

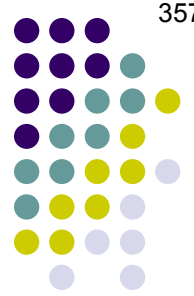
## Retinal Anatomy and Histology

Let's identify the **RPE/Bruch's complex** first. Where is it?  
The RPE/Bruch's complex is the outermost heavy white line



*You must identify **and** assess the integrity of the RPE/Bruch's complex on every OCT you read!*

(Locating the same structure on a full-size OCT image)



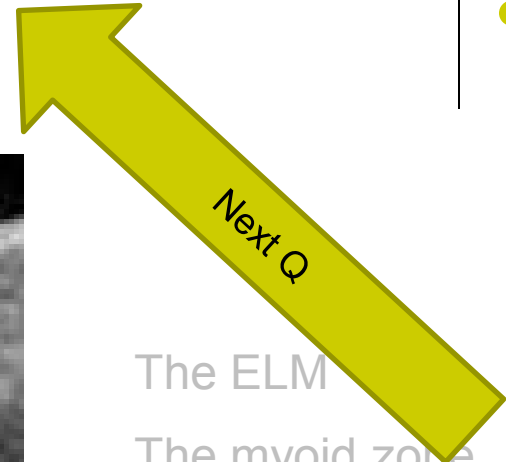
# Retinal Anatomy and Histology

# Q

Next is the interdigitation zone. Where is it?

(Ignore this line)

(And this one)

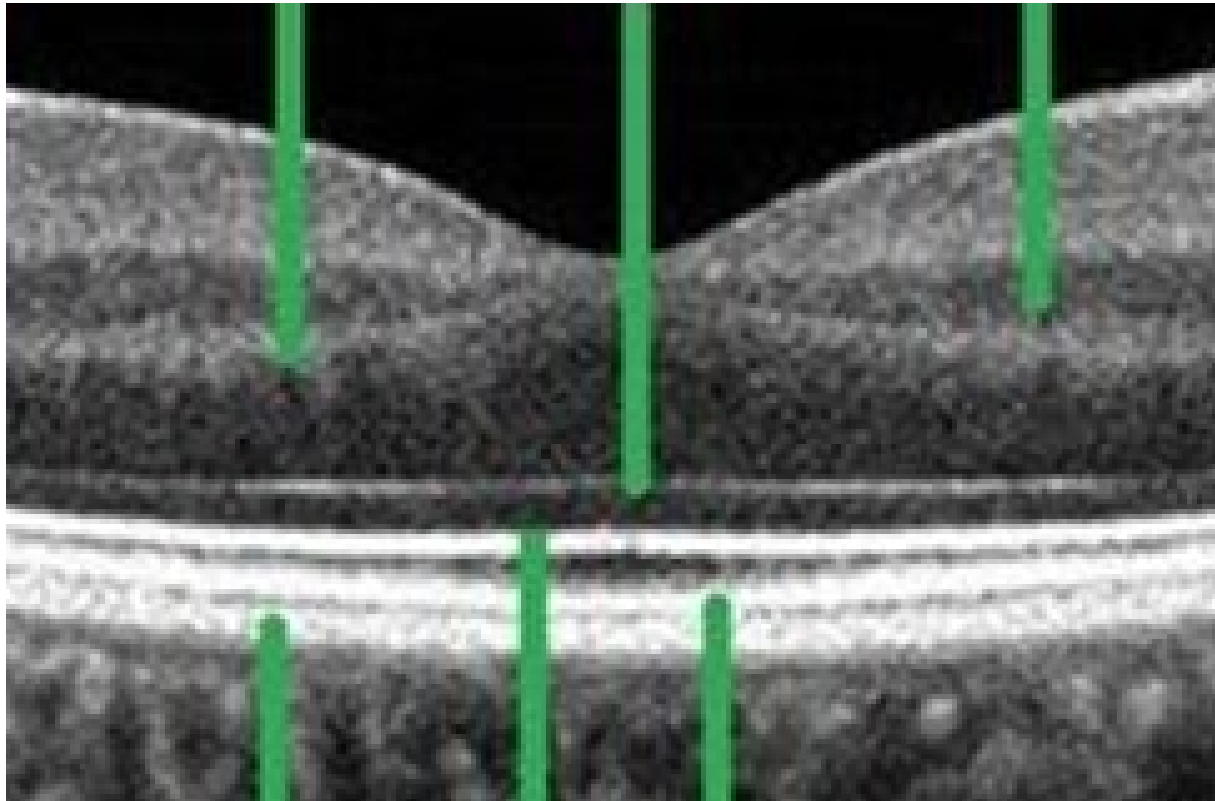


- The ELM
- The myoid zone
- The ellipsoid zone
- PR outer segs

**Interdigitation zone**

RPE/Bruch's membrane

RPE/Bruch's membrane



A

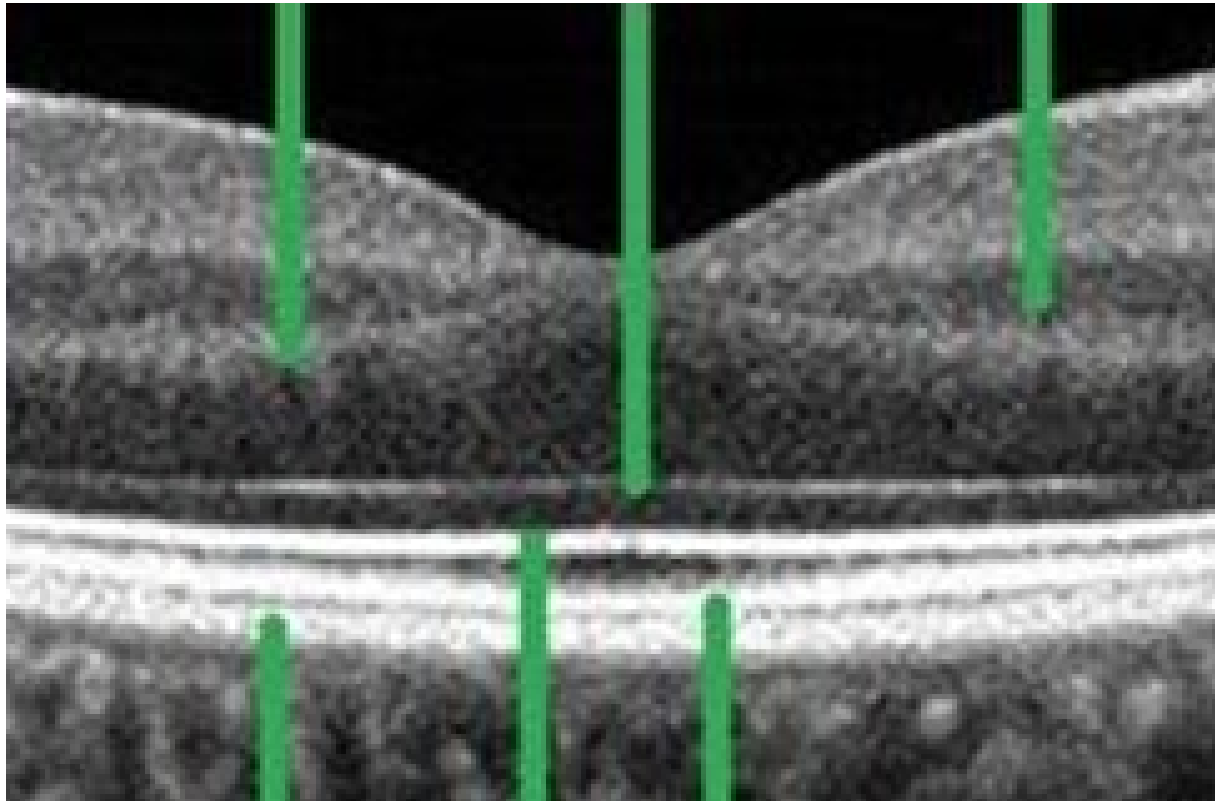
## Retinal Anatomy and Histology

Next is the interdigitation zone. Where is it?  
It is the next heavy white line



(Ignore this line)

(And this one)



RPE/Bruch's  
membrane

Interdigitation  
zone  
*(Ditto)*

The ELM

The myoid zone

The ellipsoid zone

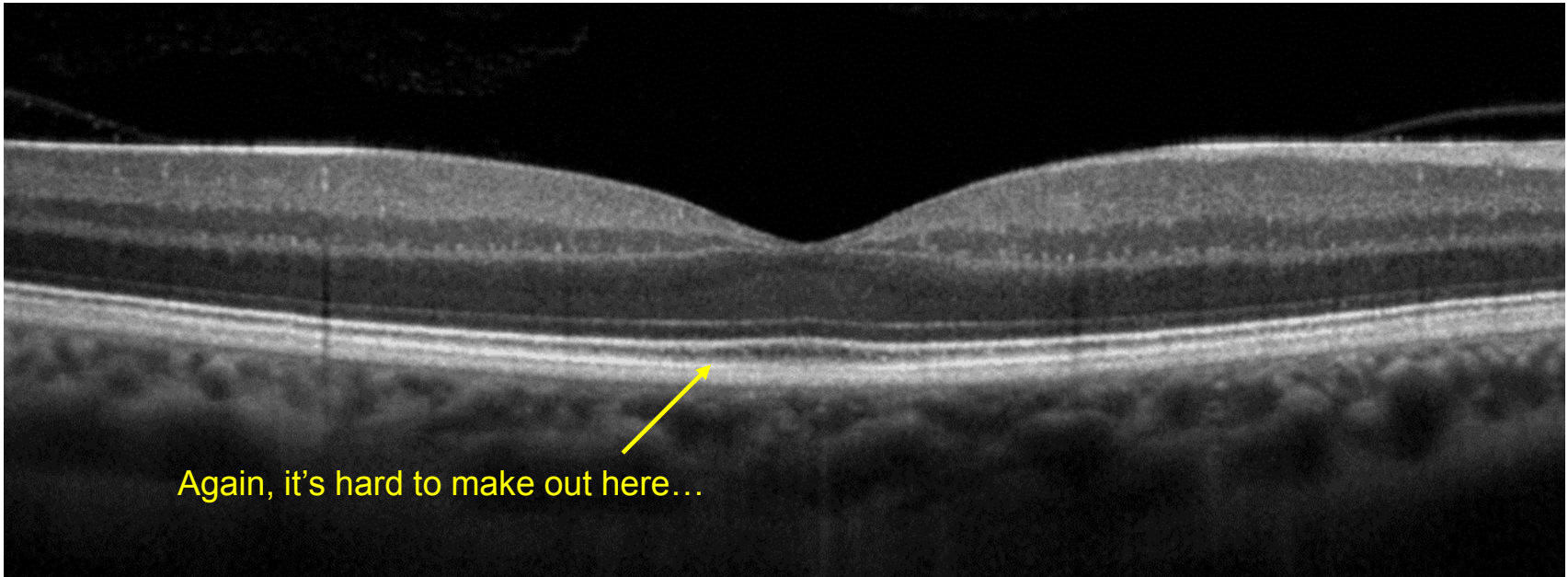
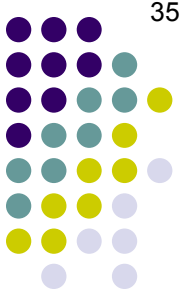
PR outer segs

**Interdigitation zone**

RPE/Bruch's membrane

## Retinal Anatomy and Histology

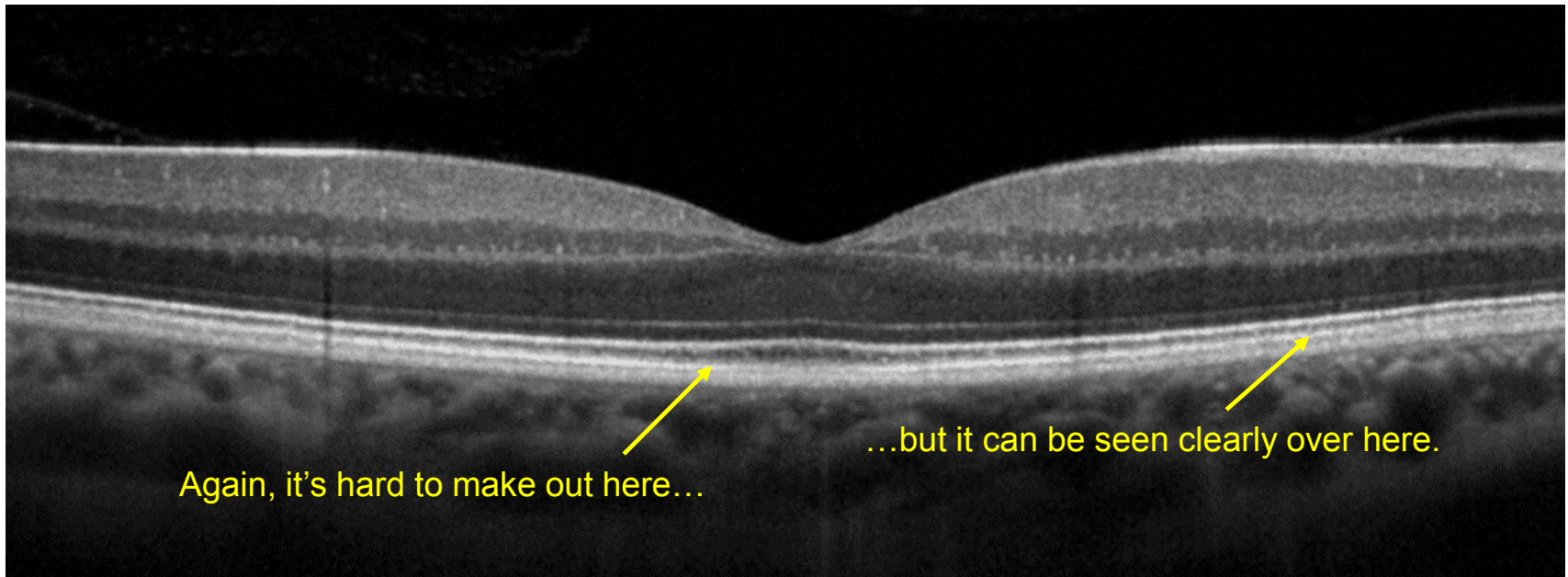
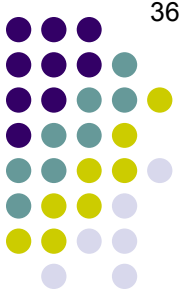
Next is the **interdigitation zone**. Where is it?  
It is the next heavy white line



(Locating the same structure on a full-size OCT image)

## Retinal Anatomy and Histology

Next is the **interdigitation zone**. Where is it?  
It is the next heavy white line

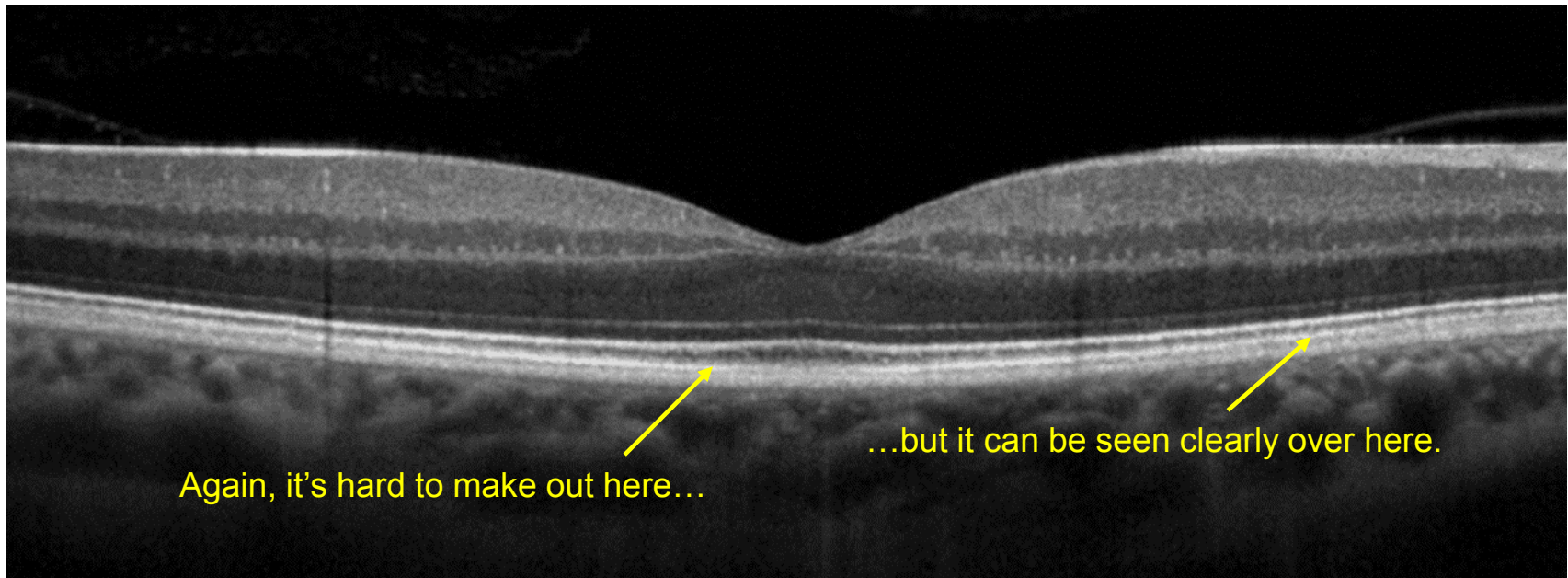
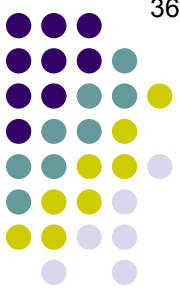


(Locating the same structure on a full-size OCT image)



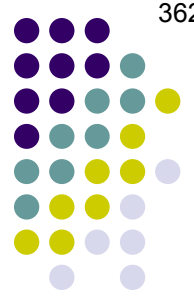
## Retinal Anatomy and Histology

Next is the **interdigitation zone**. Where is it?  
It is the next heavy white line



*The interdigitation zone is not always clearly visible on OCT*

(Locating the same structure on a full-size OCT image)



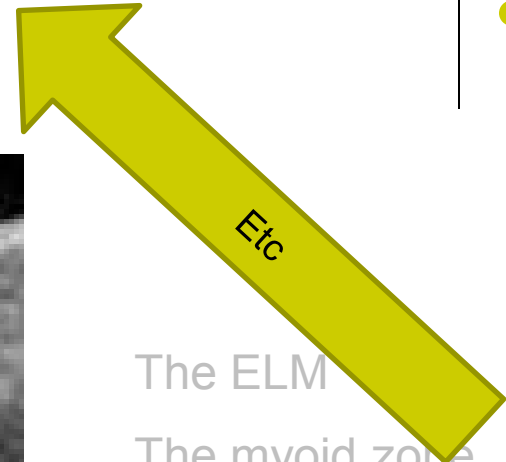
Q

# Retinal Anatomy and Histology

Next is the PR outer segs. Where are they?

(Ignore this line)

(And this one)

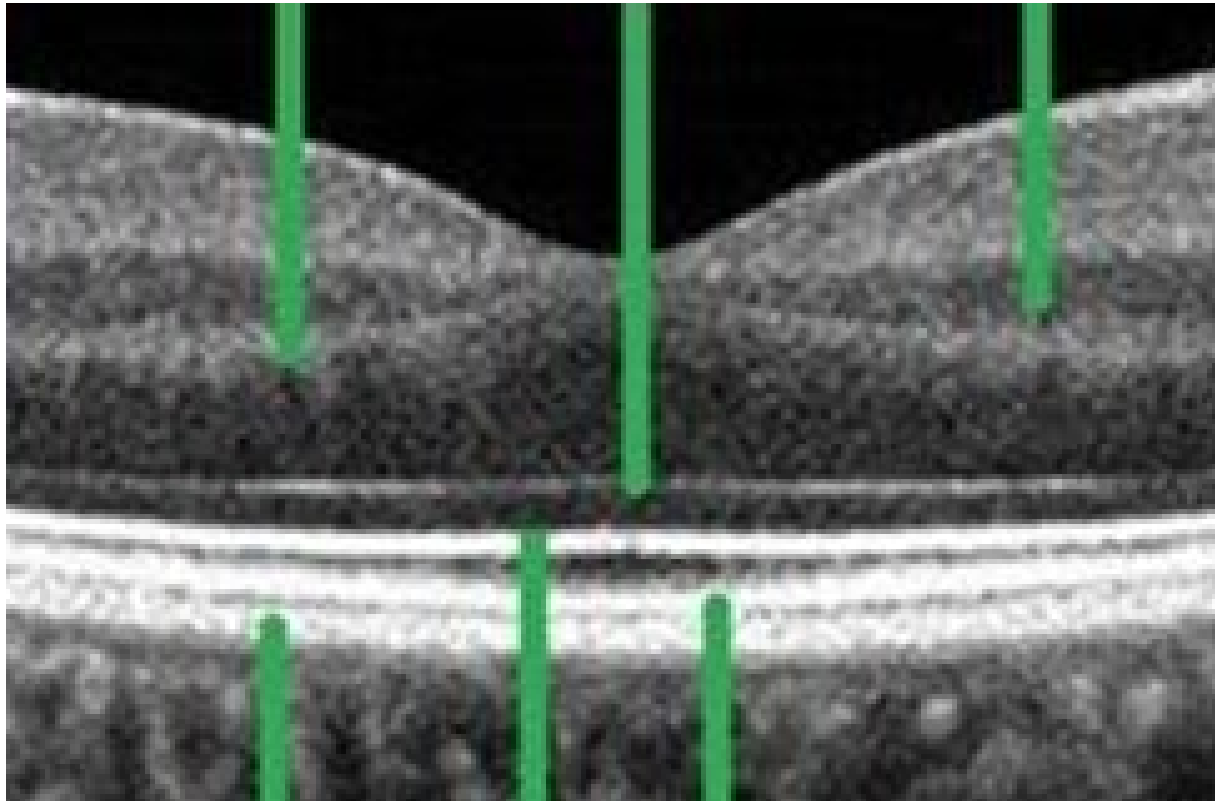


The ELM  
The myoid zone  
The ellipsoid zone

**PR outer segs**

Interdigitation zone

RPE/Bruch's membrane



RPE/Bruch's membrane

Interdigitation zone

# A

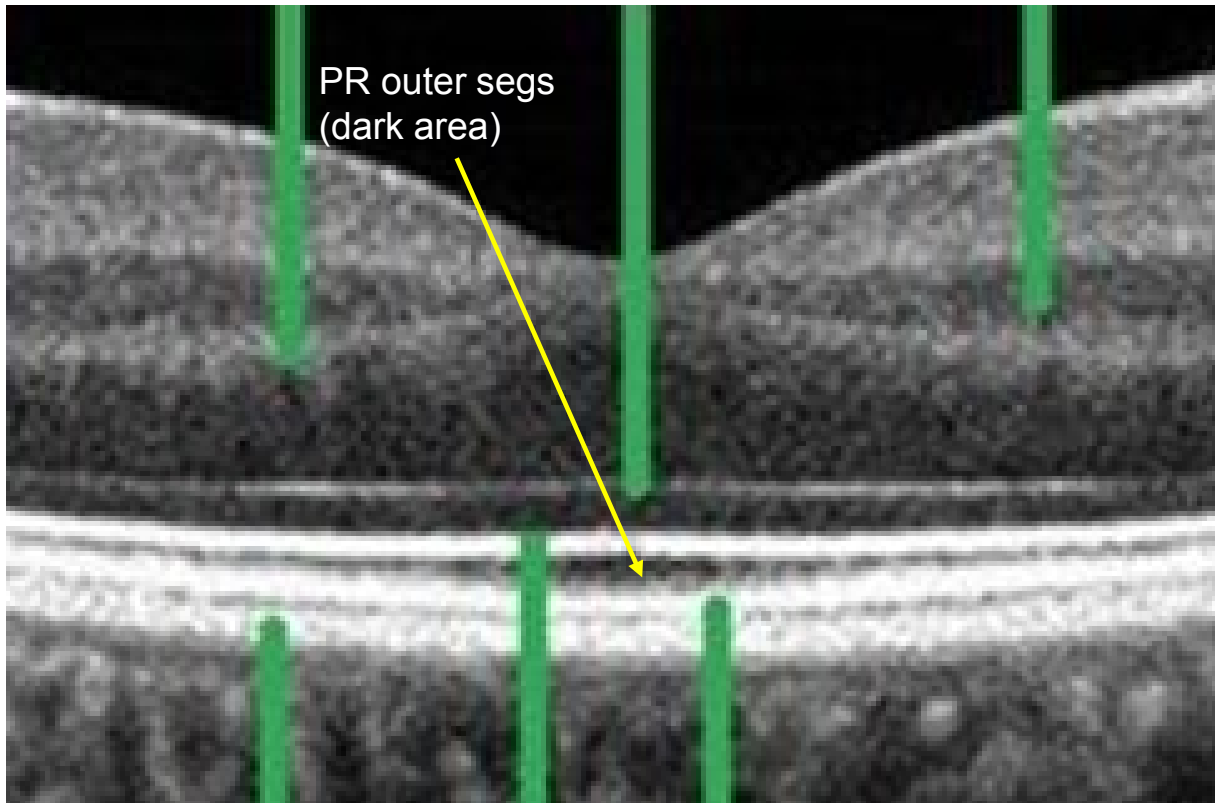
## Retinal Anatomy and Histology



Next is the PR outer segs. Where are they?  
In the dark band just inside the interdigitation zone

(Ignore this line)

(And this one)



PR outer segs  
(dark area)

RPE/Bruch's  
membrane

Interdigitation  
zone

The ELM

The myoid zone

The ellipsoid zone

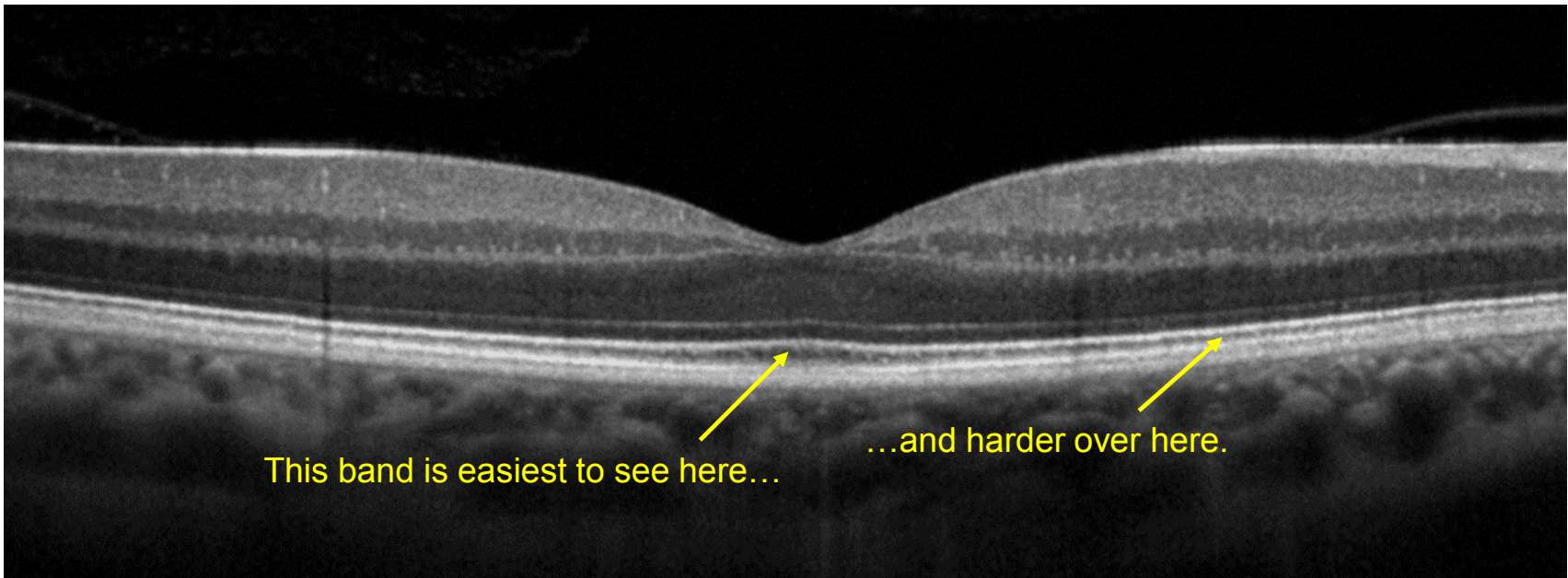
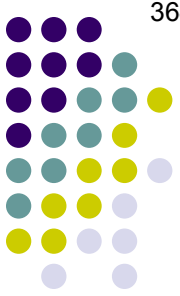
**PR outer segs**

Interdigitation zone

RPE/Bruch's membrane

## Retinal Anatomy and Histology

Next is the **PR outer segs**. Where are they?  
In the dark band just inside the interdigitation zone

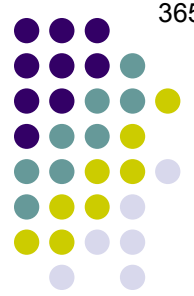


*The PR outer segs band is taller at the fovea because the outer segs are longer here*

(Locating the same structure on a full-size OCT image)

Q

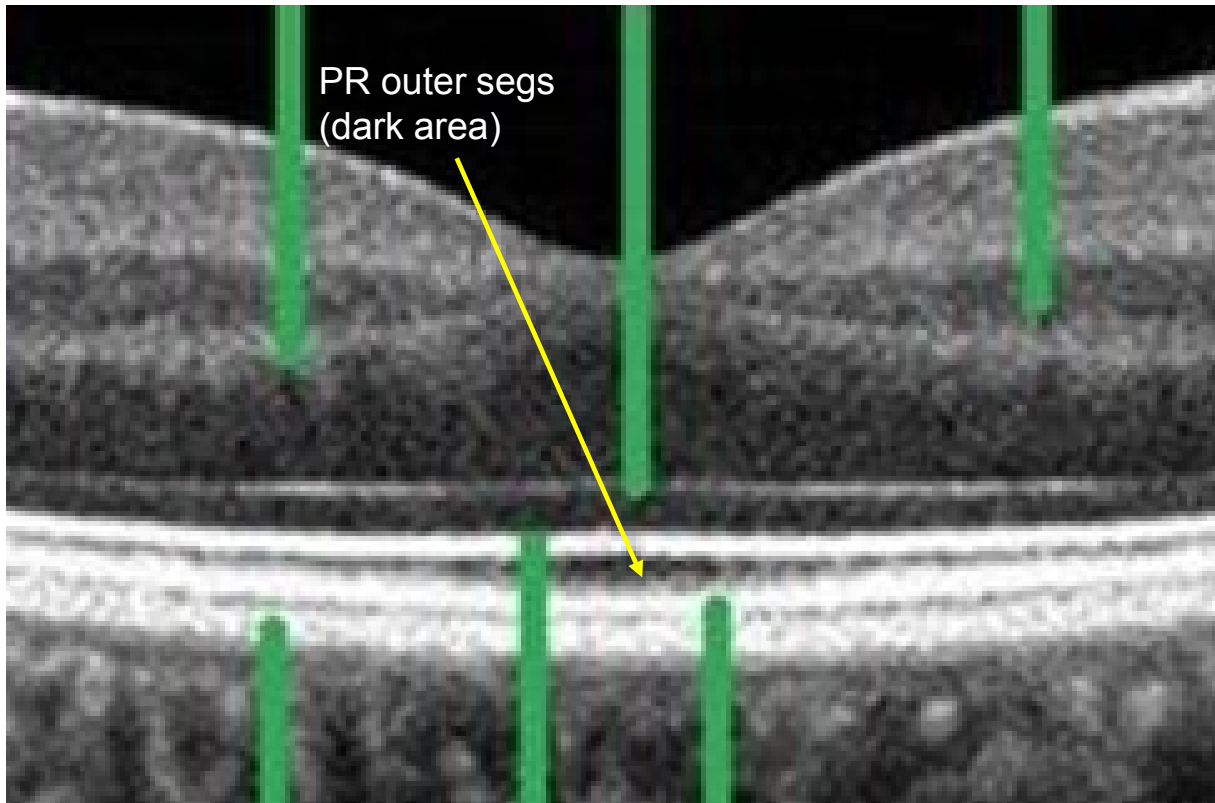
# Retinal Anatomy and Histology



Next is the ellipsoid zone. Where is it?

(Ignore this line)

(And this one)



PR outer segs  
(dark area)

RPE/Bruch's  
membrane

Interdigitation  
zone

The ELM

The myoid zone

**The ellipsoid zone**

PR outer segs

Interdigitation zone

RPE/Bruch's membrane

# A

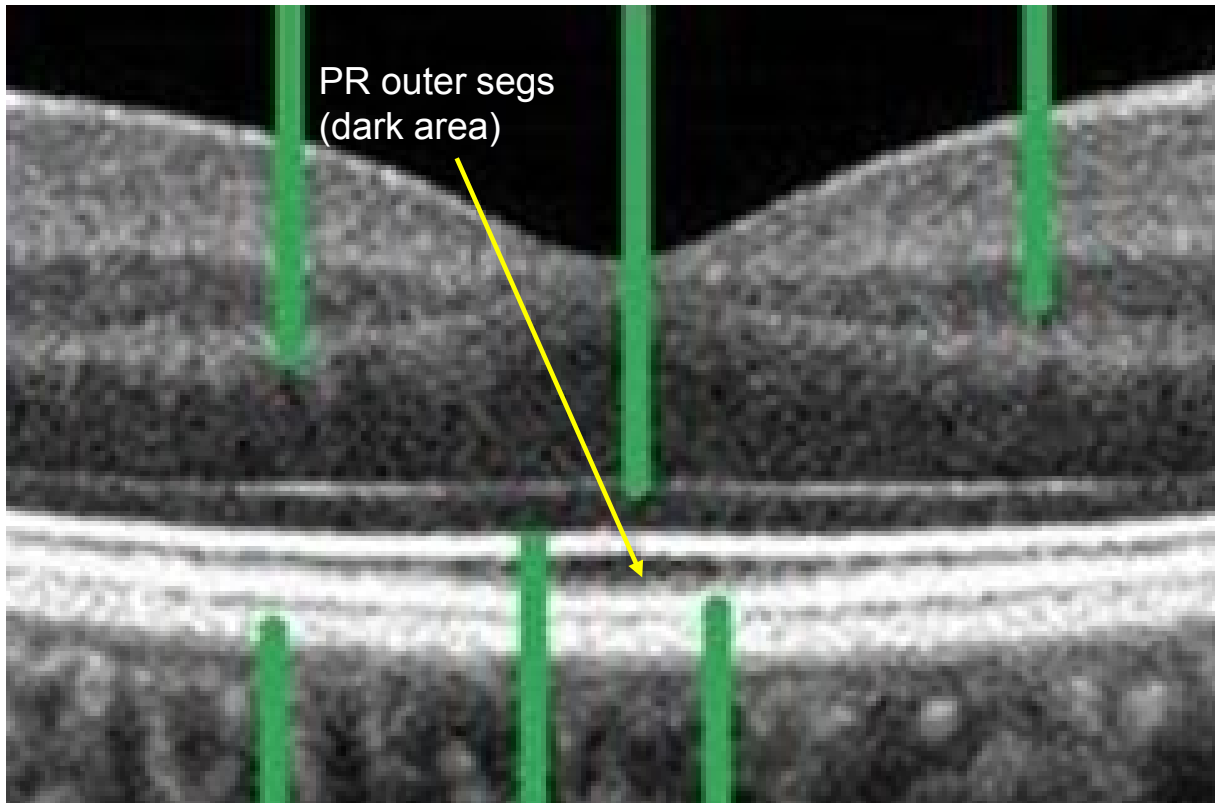
## Retinal Anatomy and Histology



Next is the ellipsoid zone. Where is it?  
It is the heavy white band inside the outer segs

(Ignore this line)

(And this one)



PR outer segs  
(dark area)

The ELM

The myoid zone

**The ellipsoid zone**

PR outer segs

Interdigitation zone

RPE/Bruch's membrane

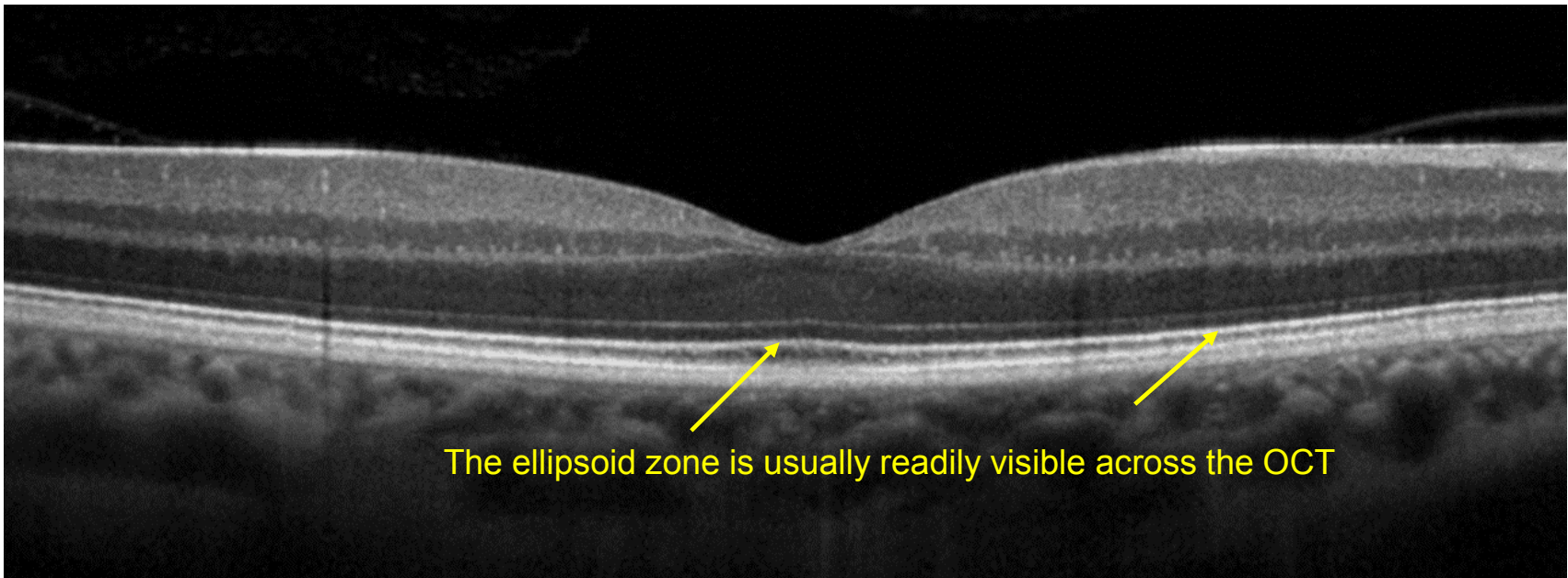
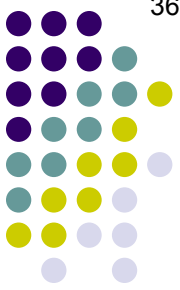
RPE/Bruch's  
membrane

Ellipsoid zone  
(the white line)

Interdigitation  
zone

## Retinal Anatomy and Histology

Next is the **ellipsoid zone**. Where is it?  
It is the heavy white band inside the outer segs



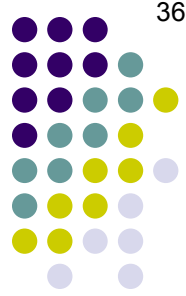
Many PR and other outer-retinal diseases manifest as changes to the EZ. Like the RPE/Bruch's complex, [the EZ must be identified and assessed on every retinal OCT!](#)

(Locating the same structure on a full-size OCT image)

Q

## Retinal Anatomy and Histology

Next is the myoid zone. Where is it?



(Ignore this line)

(And this one)

PR outer segs  
(dark area)

The ELM

**The myoid zone**

The ellipsoid zone

PR outer segs

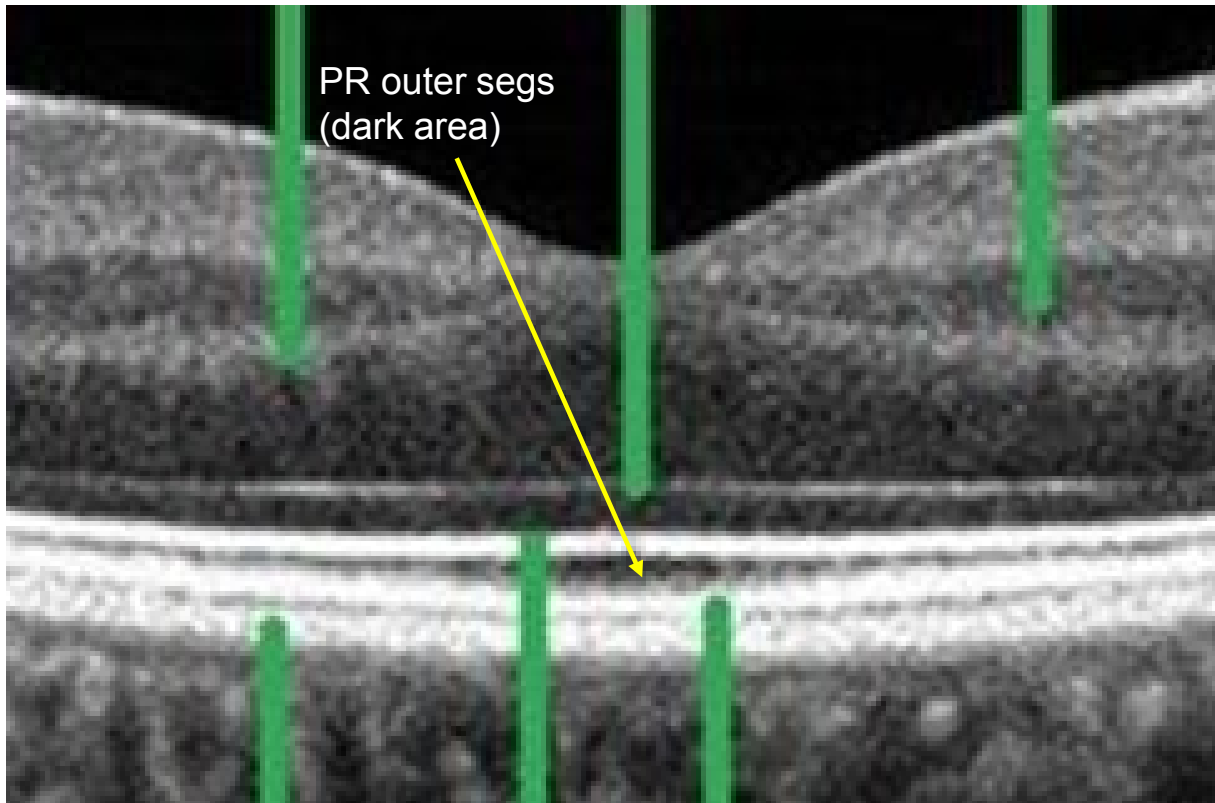
Interdigitation zone

RPE/Bruch's membrane

RPE/Bruch's  
membrane

Ellipsoid zone  
(the white line)

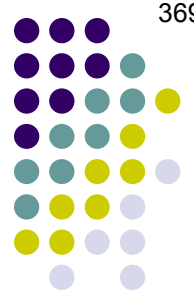
Interdigitation  
zone





# A

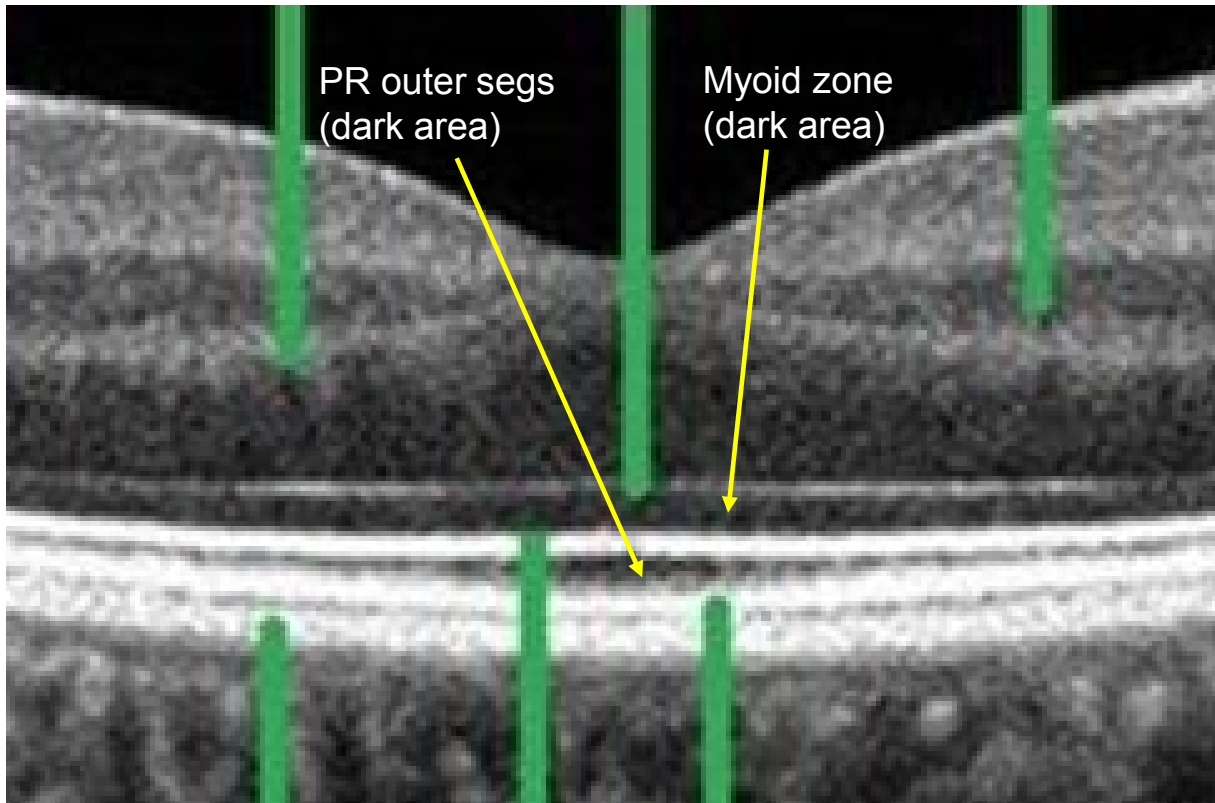
## Retinal Anatomy and Histology



Next is the myoid zone. Where is it?  
The dark band just inside the ellipsoid zone

(Ignore this line)

(And this one)



The ELM

**The myoid zone**

The ellipsoid zone

PR outer segs

Interdigitation zone

RPE/Bruch's membrane

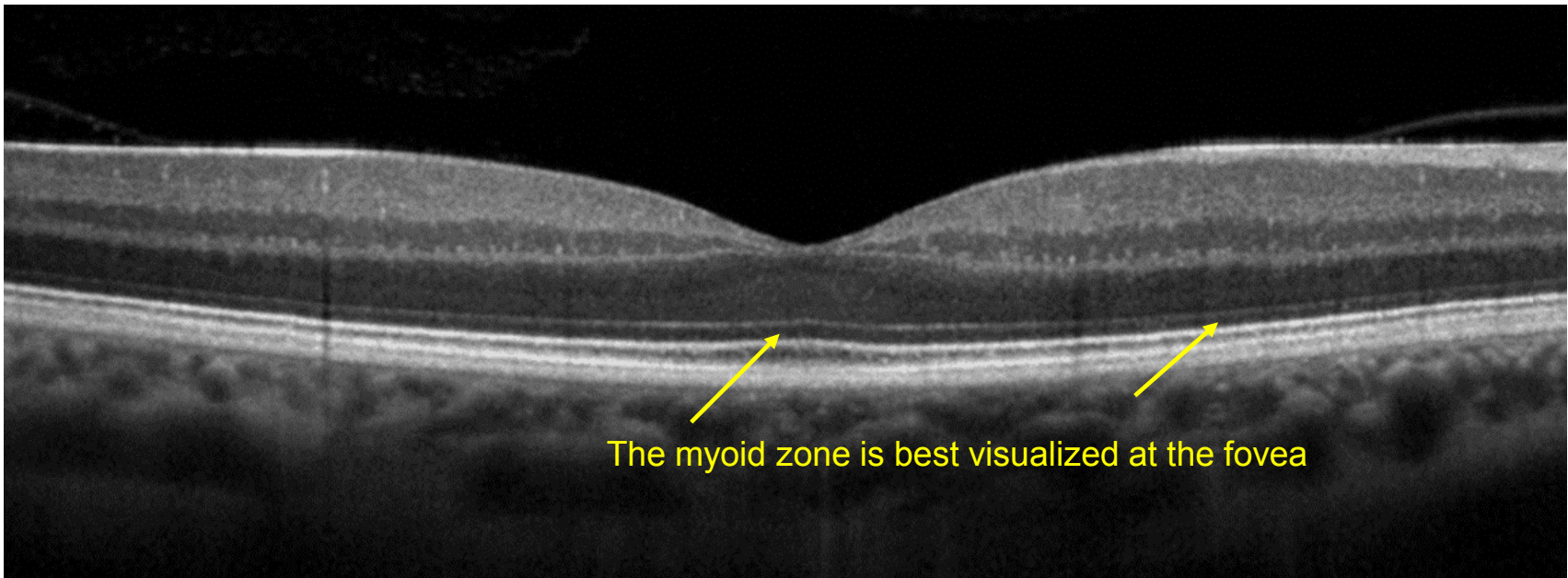
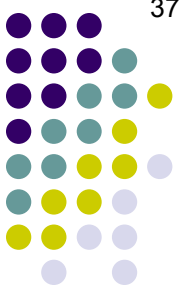
RPE/Bruch's membrane

Ellipsoid zone (the white line)

Interdigitation zone

## Retinal Anatomy and Histology

Next is the **myoid zone**. Where is it?  
The dark band just inside the ellipsoid zone



(Locating the same structure on a full-size OCT image)

Q

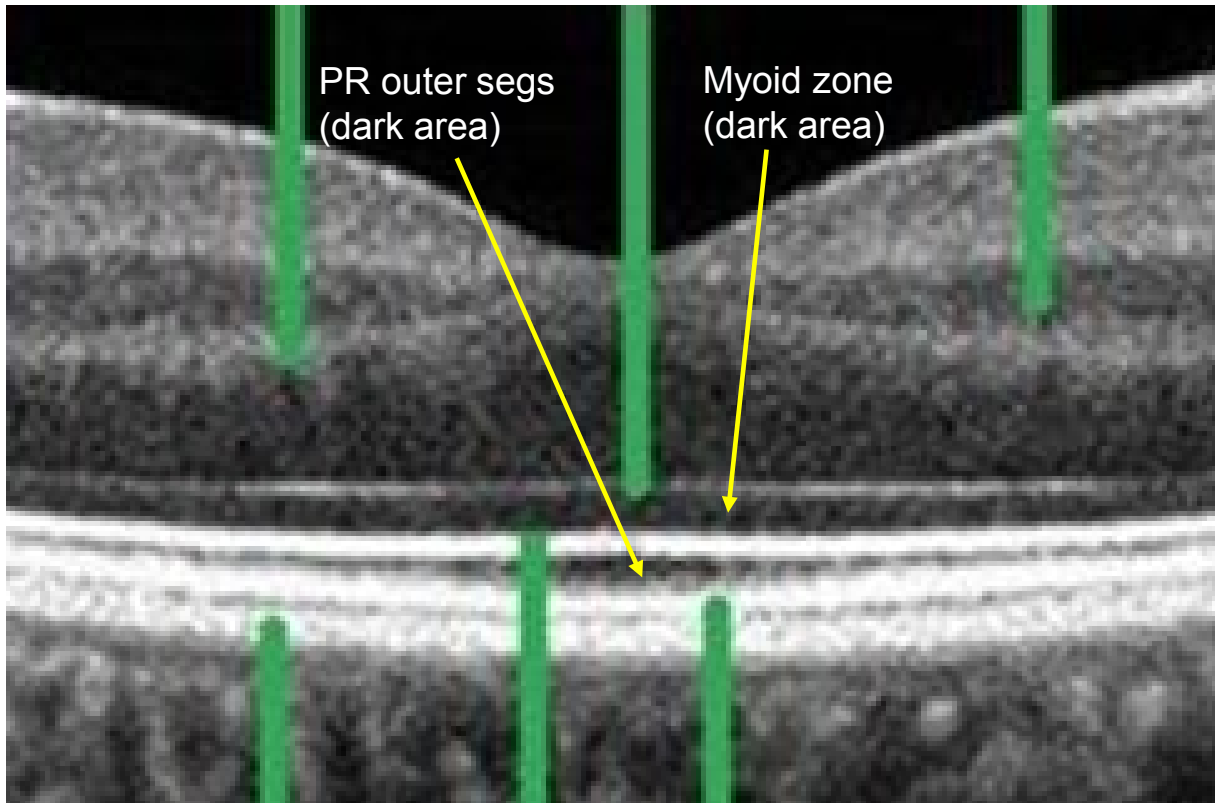
# Retinal Anatomy and Histology



Next is the ELM. Where is it?

(Ignore this line)

(And this one)



## The ELM

The myoid zone

The ellipsoid zone

PR outer segs

Interdigitation zone

RPE/Bruch's membrane

RPE/Bruch's membrane

Ellipsoid zone (the white line)

Interdigitation zone

# A

## Retinal Anatomy and Histology



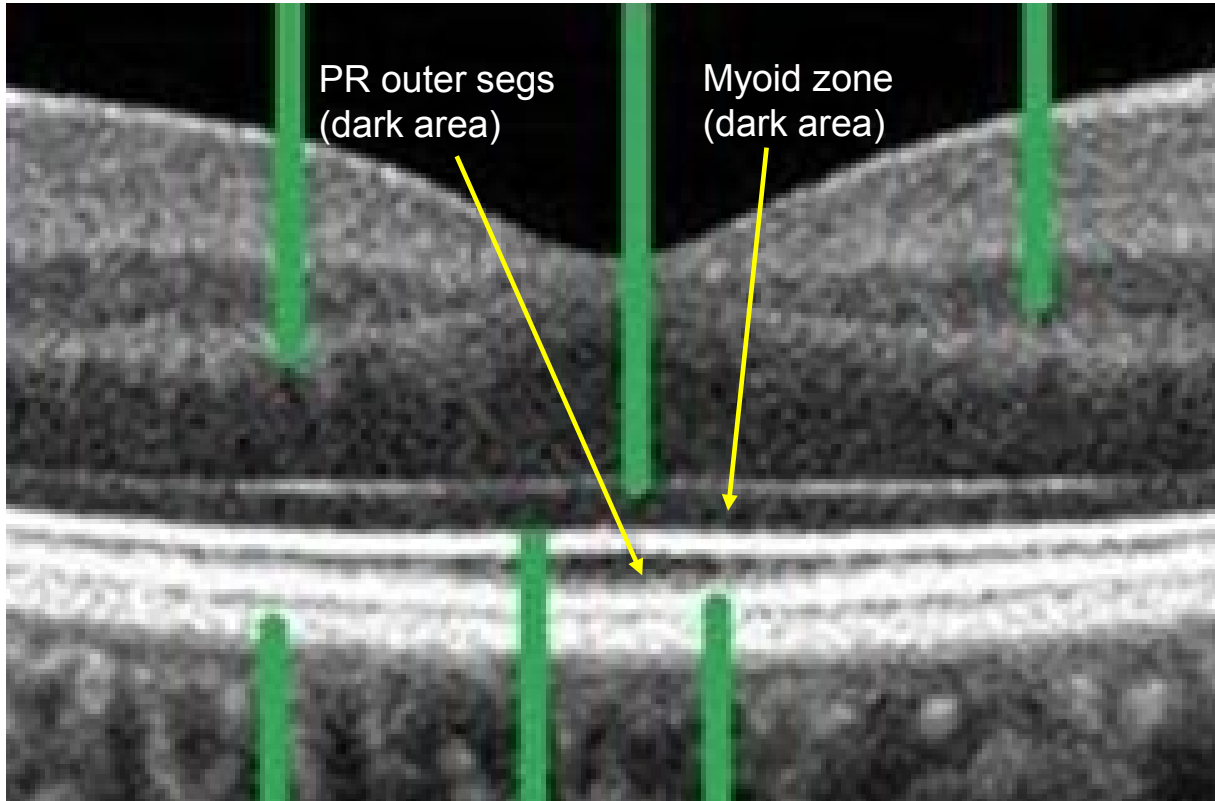
Next is the ELM. Where is it?

It's the thin white band just inside the myoid zone

(Ignore this line) (the white line) ELM (And this one)

PR outer segs  
(dark area)

Myoid zone  
(dark area)



RPE/Bruch's  
membrane

Ellipsoid zone  
(the white line)

Interdigitation  
zone

**The ELM**

The myoid zone

The ellipsoid zone

PR outer segs

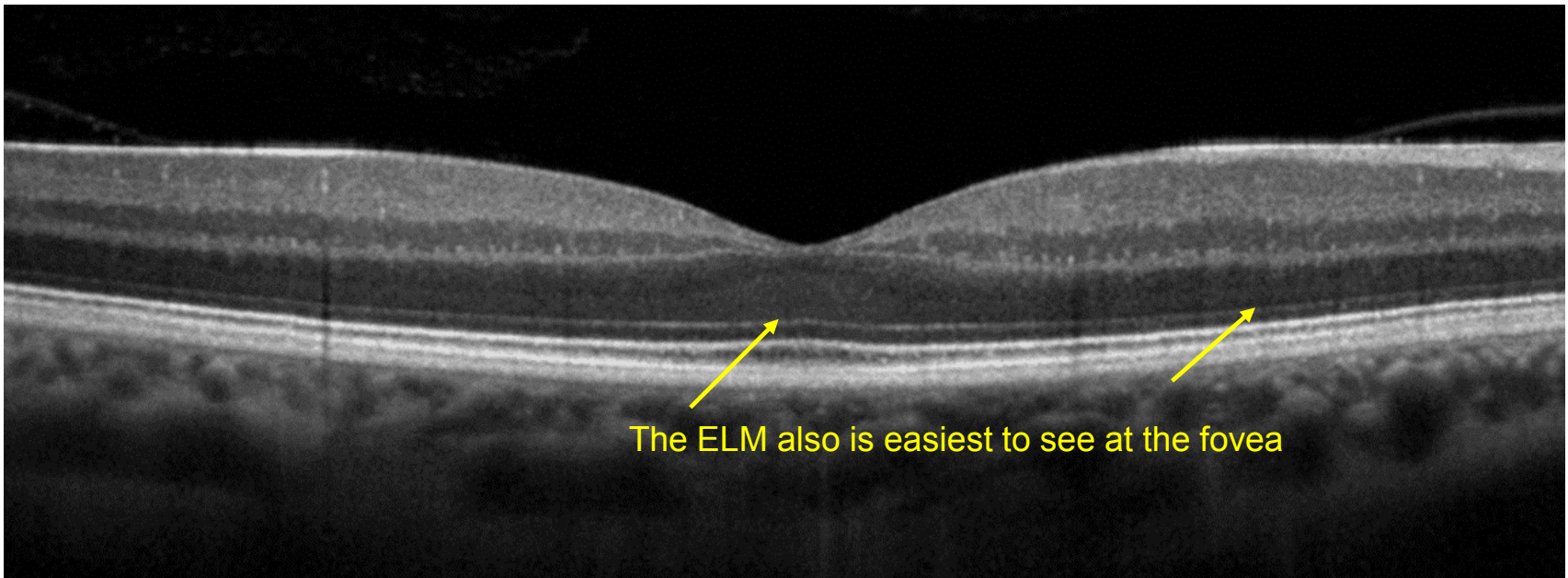
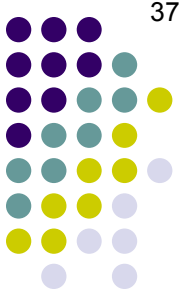
Interdigitation zone

RPE/Bruch's membrane

## Retinal Anatomy and Histology

Next is the **ELM**. Where is it?

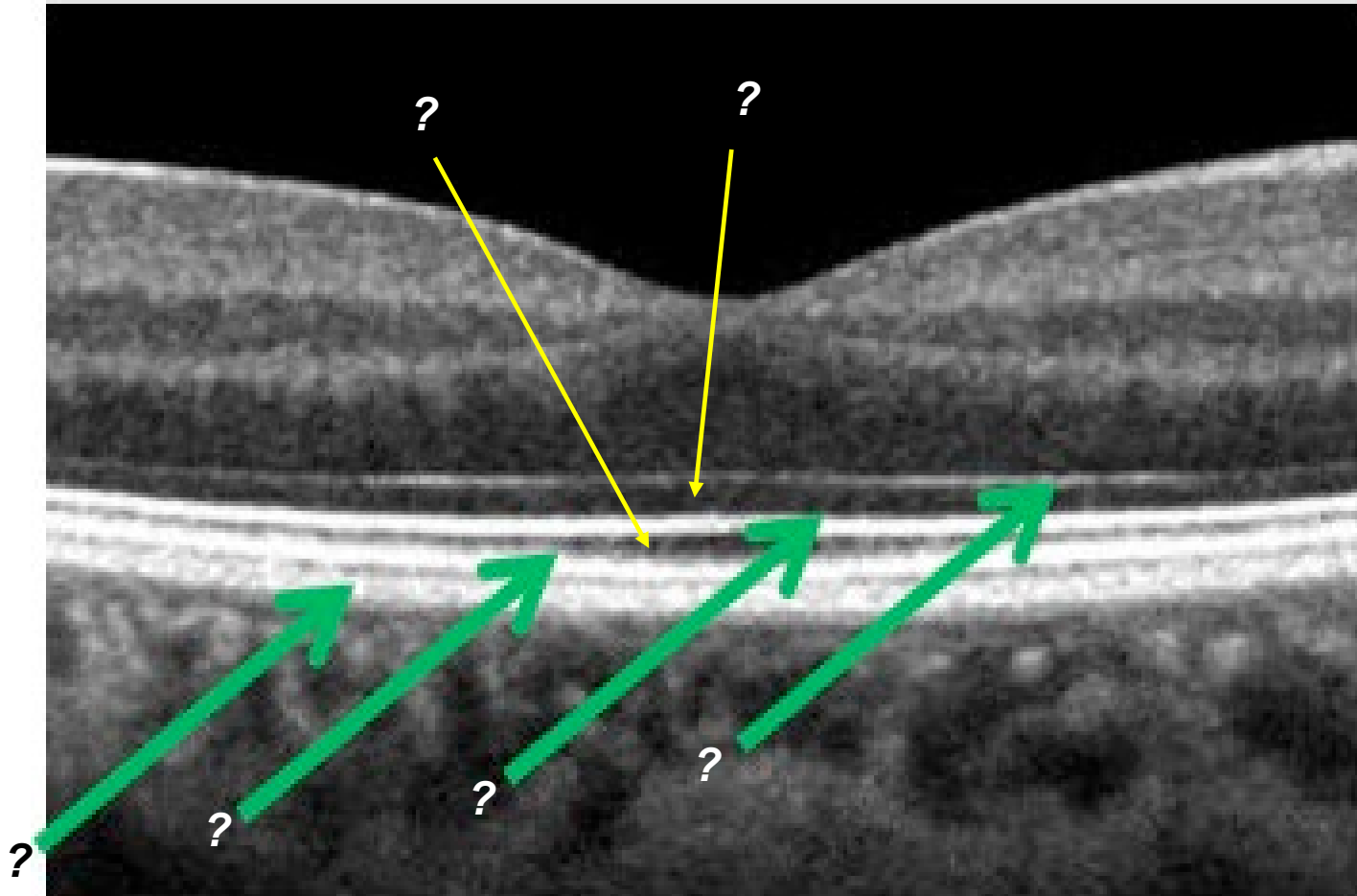
It's the thin white band just inside the myoid zone



(Locating the same structure on a full-size OCT image)

Q

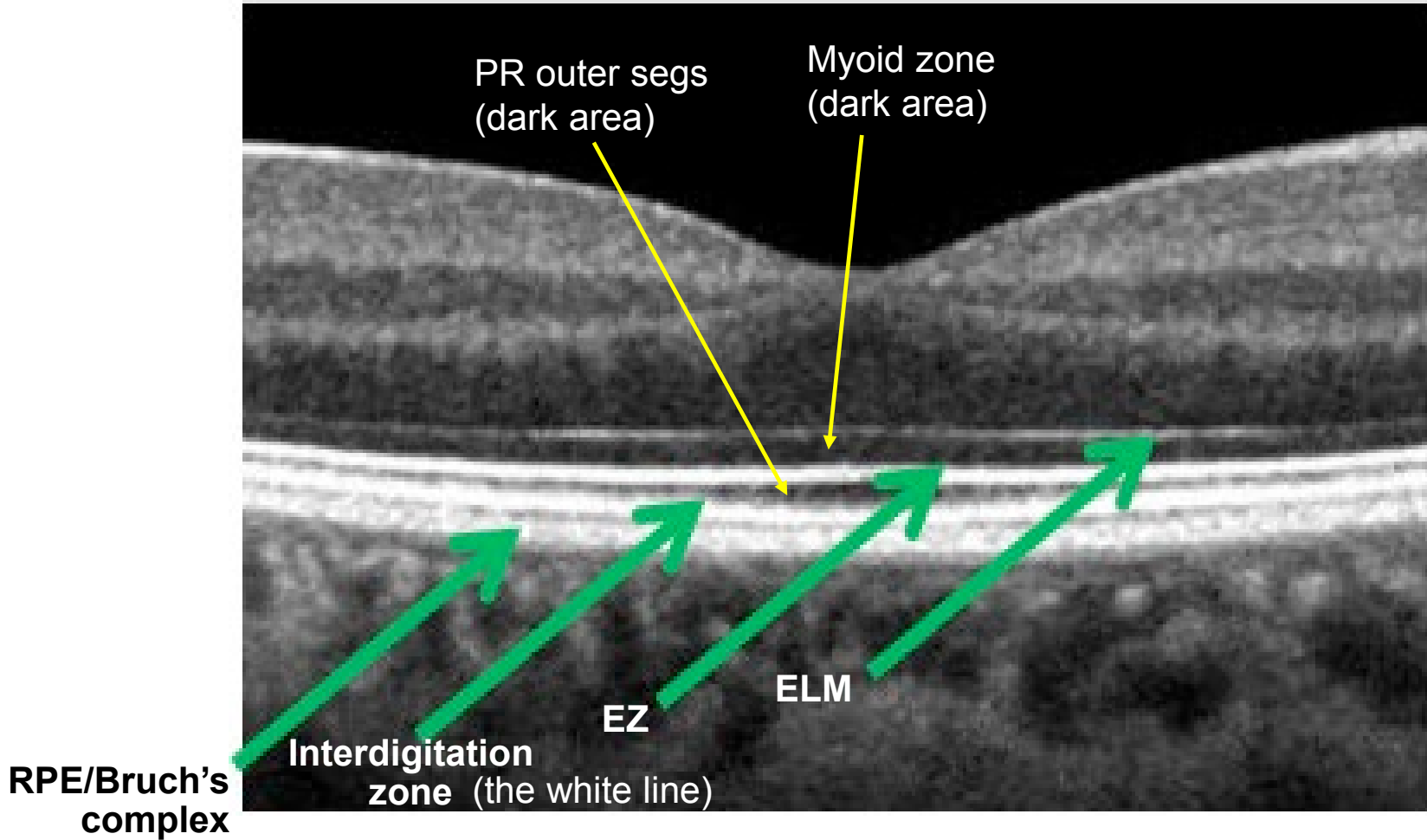
# Retinal Anatomy and Histology



*Quiz yourself by toggling back and forth between this slide and the next*

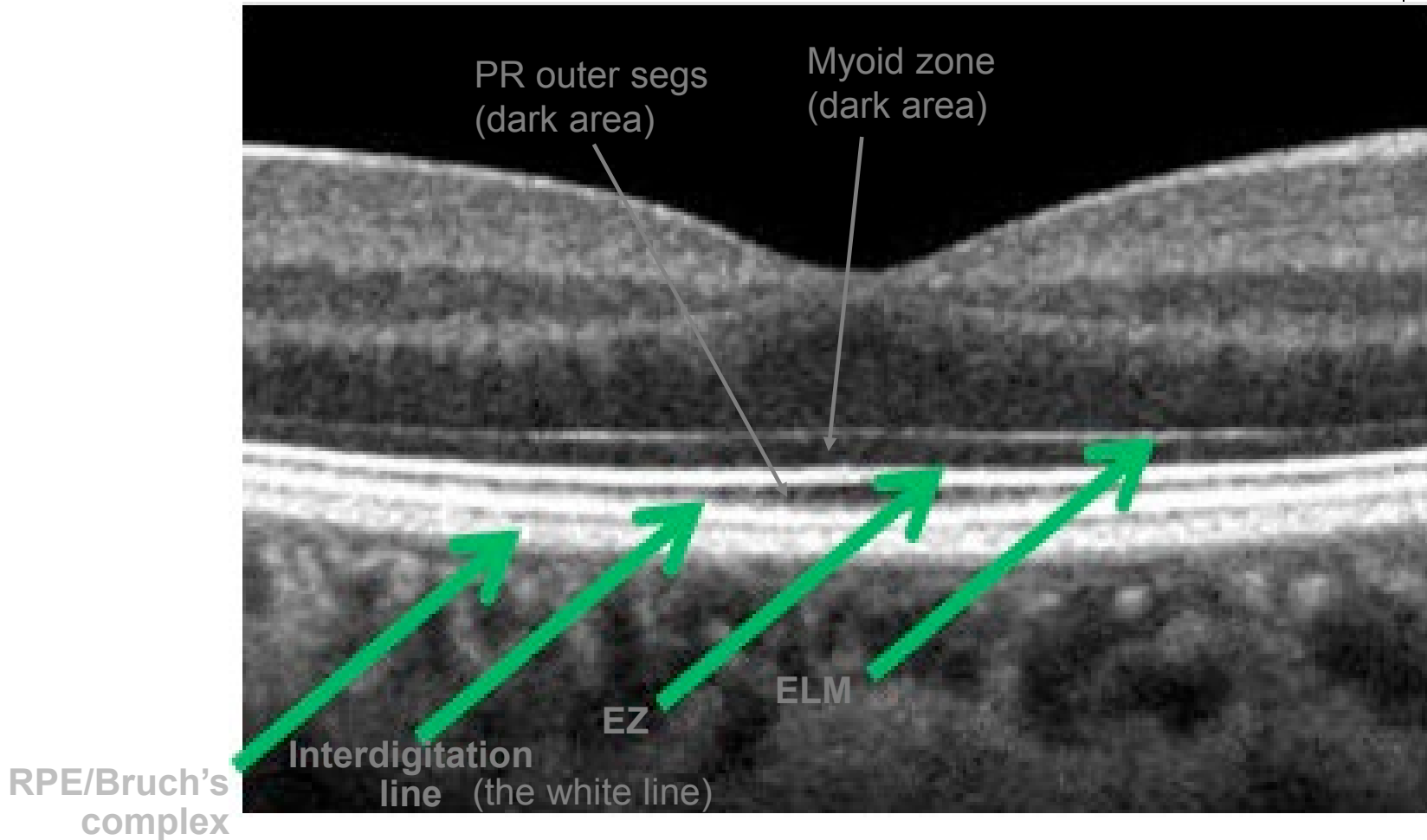
A

# Retinal Anatomy and Histology



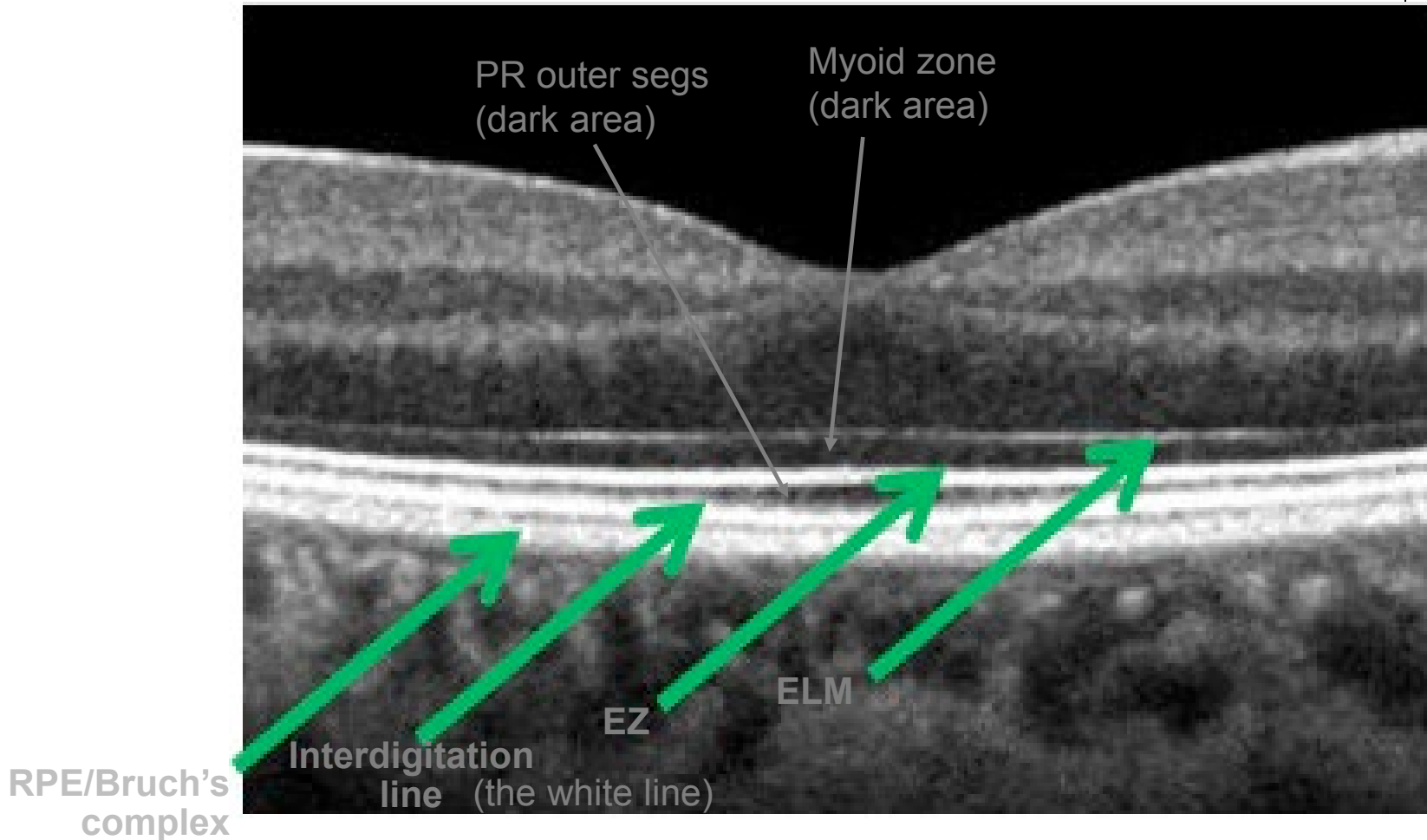
*Quiz yourself by toggling back and forth between this slide and the next*

# Retinal Anatomy and Histology

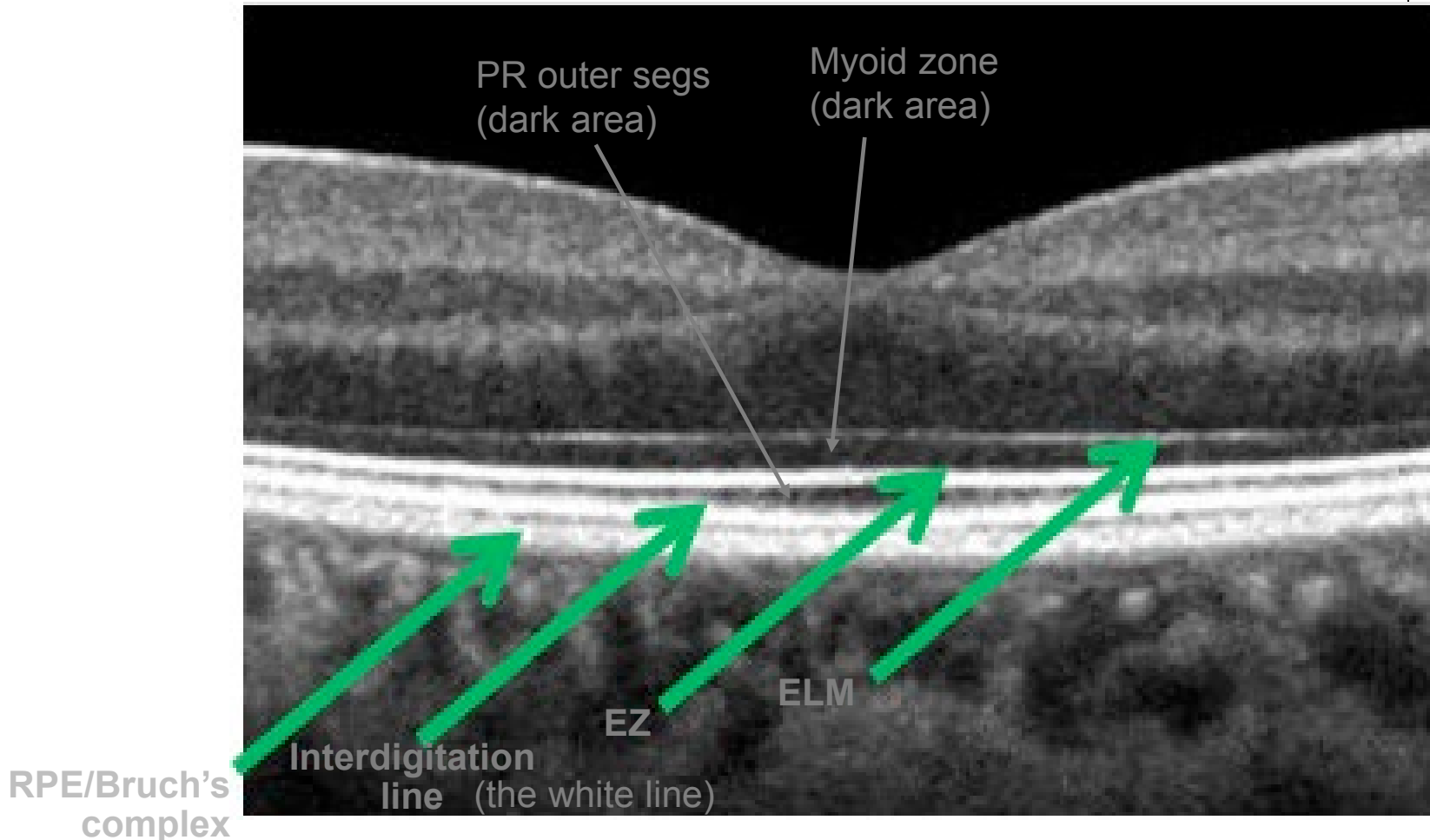


An important meta-point to come away with from all this is, OCT bands are determined by differences in tissue reflectivity, but *differences in reflectivity don't necessarily correlate 1:1 with retinal anatomy.*



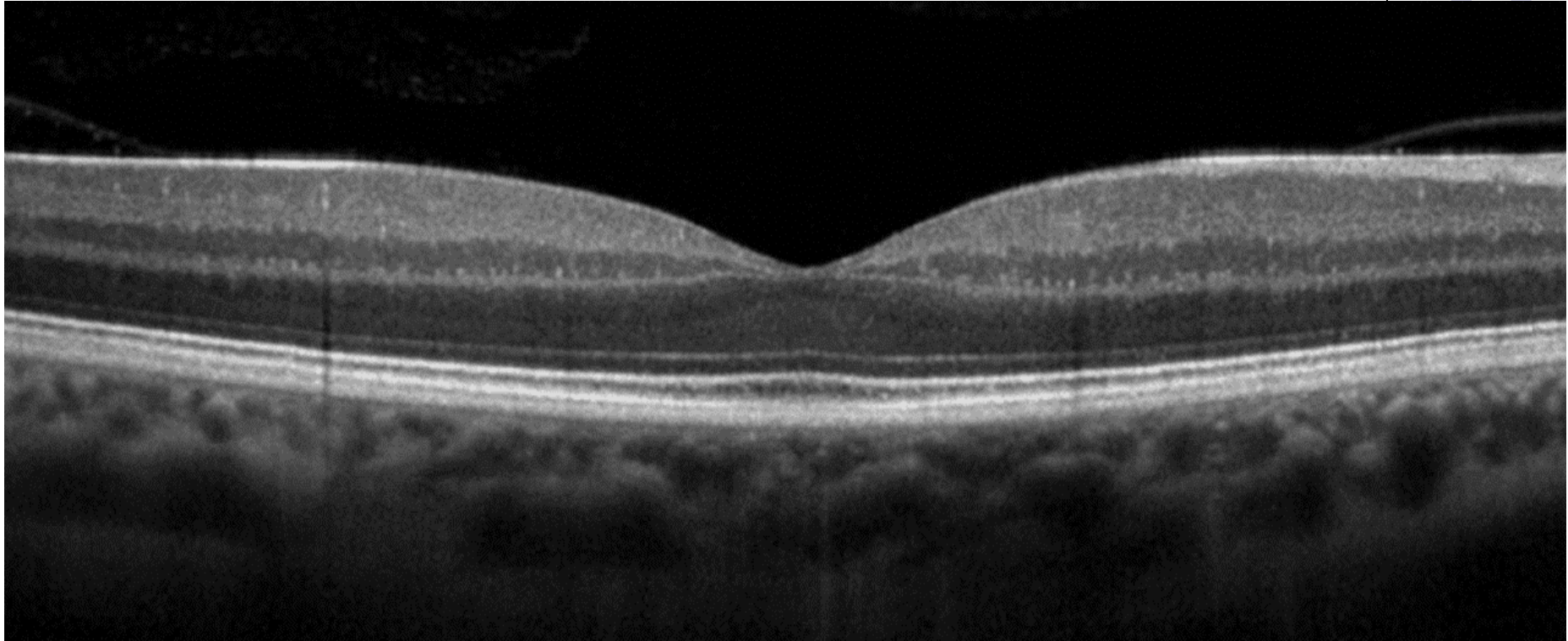


An important meta-point to come away with from all this is, OCT bands are determined by differences in tissue reflectivity, but *differences in reflectivity don't necessarily correlate 1:1 with retinal anatomy*. Consider the ellipsoid and myoid of the PRs. They are parts of the same anatomic structure (the PR inner seg), but to the OCT scanner, they look **radically** different from one another.



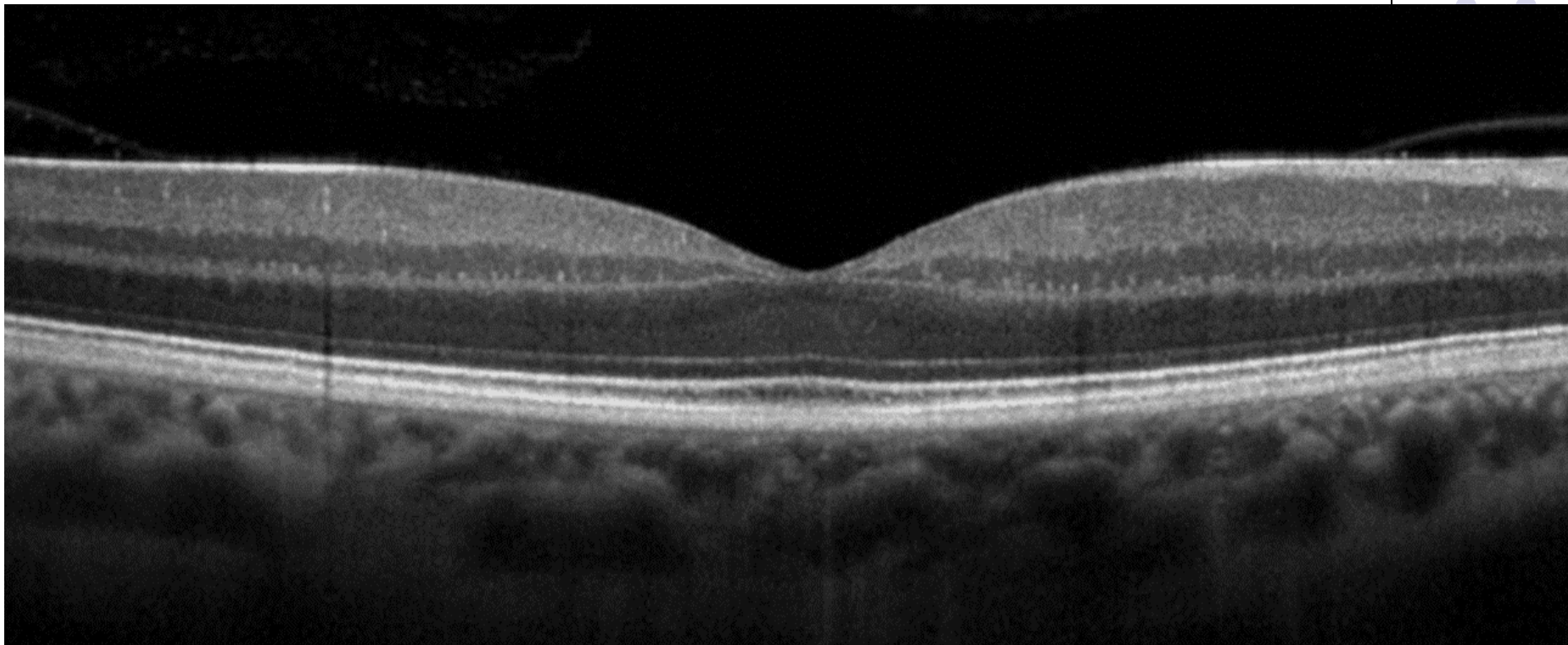
An important meta-point to come away with from all this is, OCT bands are determined by differences in tissue reflectivity, but *differences in reflectivity don't necessarily correlate 1:1 with retinal anatomy*. Consider the ellipsoid and myoid of the PRs. They are parts of the same anatomic structure (the PR inner seg), but to the OCT scanner, they look **radically** different from one another. Remember, the OCT is under no obligation to 'see' the retina the way an anatomist sees it.

## Retinal Anatomy and Histology



*For the remainder of our intro to OCT, we're going to switch gears and work **outward** from the **inner** aspect of the scan*

*(No question—proceed when ready)*

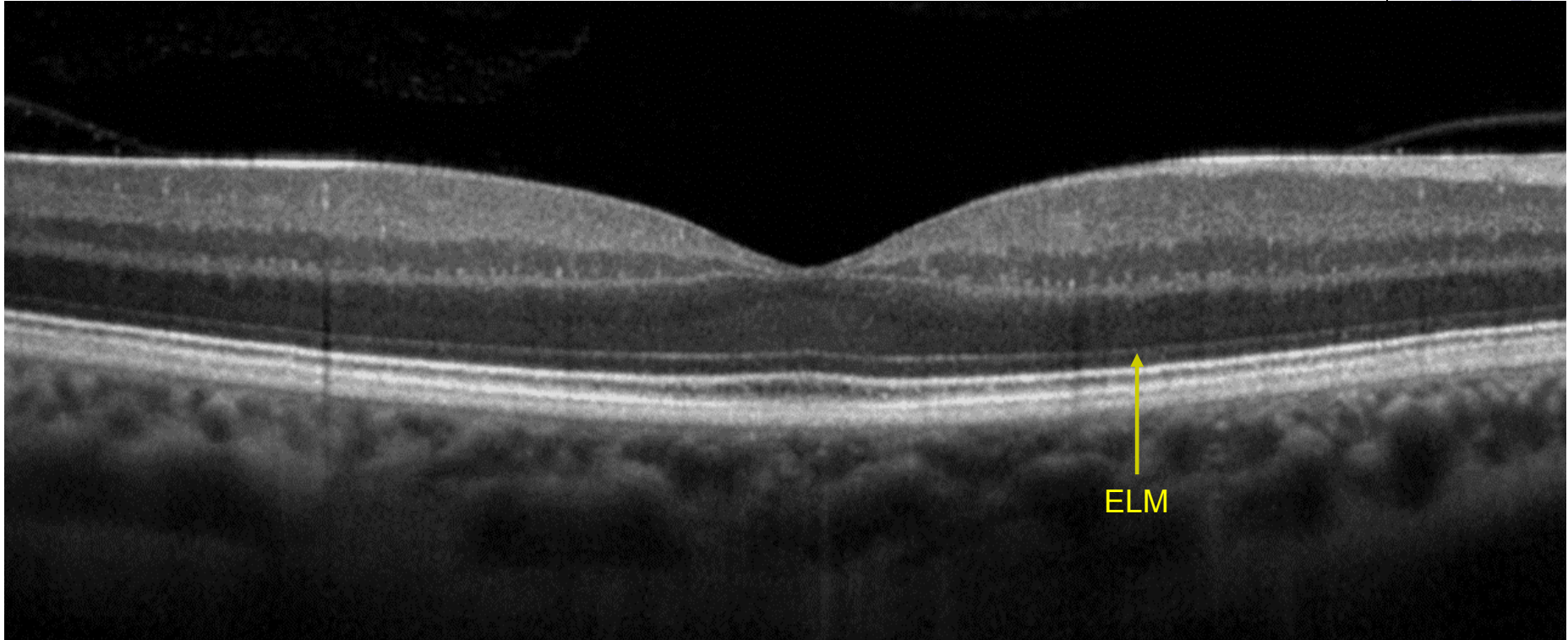


First things first: In order to ‘set the floor’ re how far down we need to go, [locate the ELM:](#)

A

## Retinal Anatomy and Histology

381

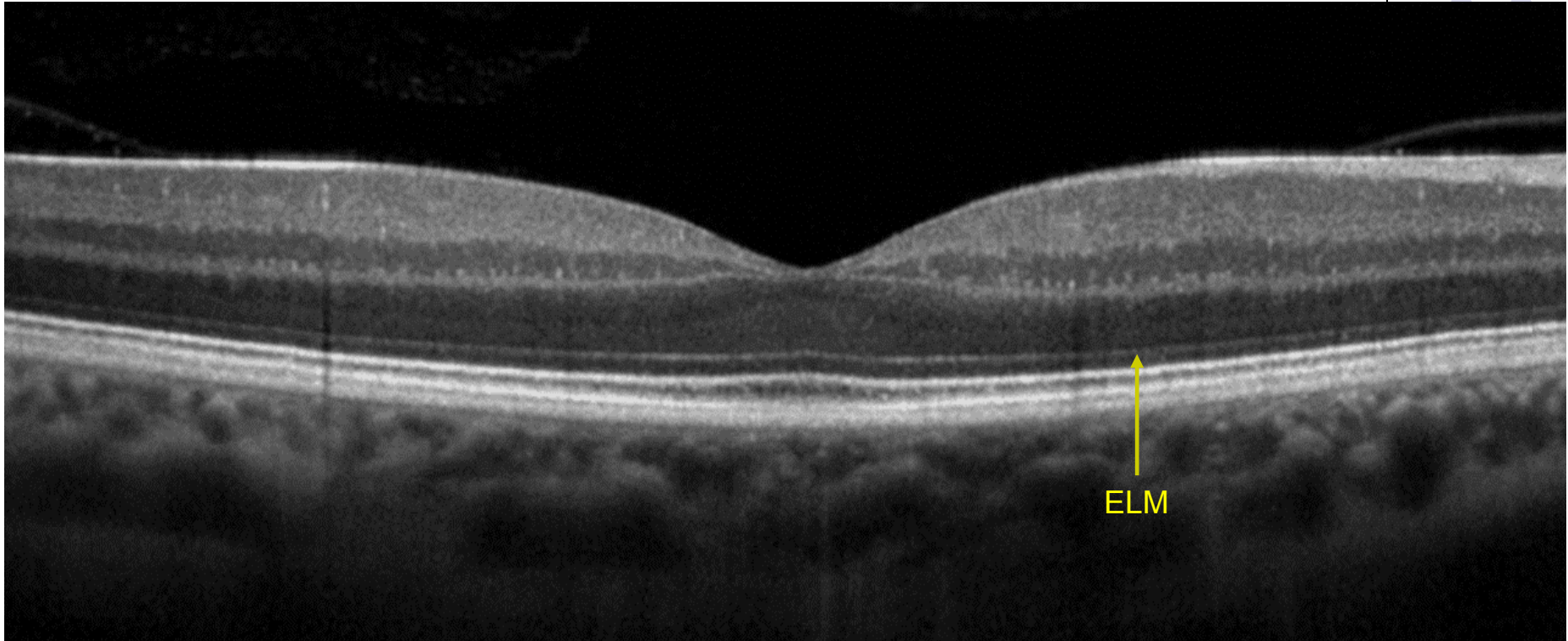


First things first: In order to 'set the floor' re how far down we need to go, [locate the ELM:](#)



Q

## Retinal Anatomy and Histology

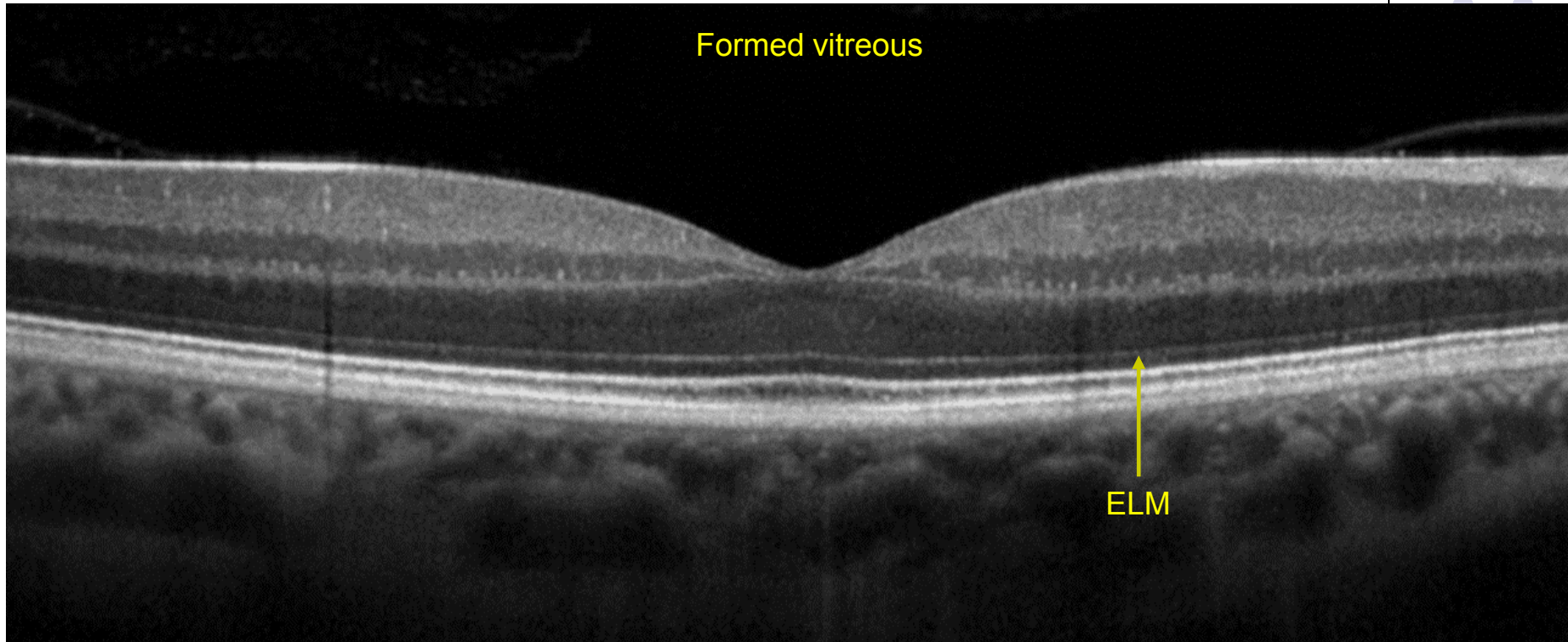


Next, identify the following preretinal structures:  
--The formed vitreous

A

## Retinal Anatomy and Histology

383

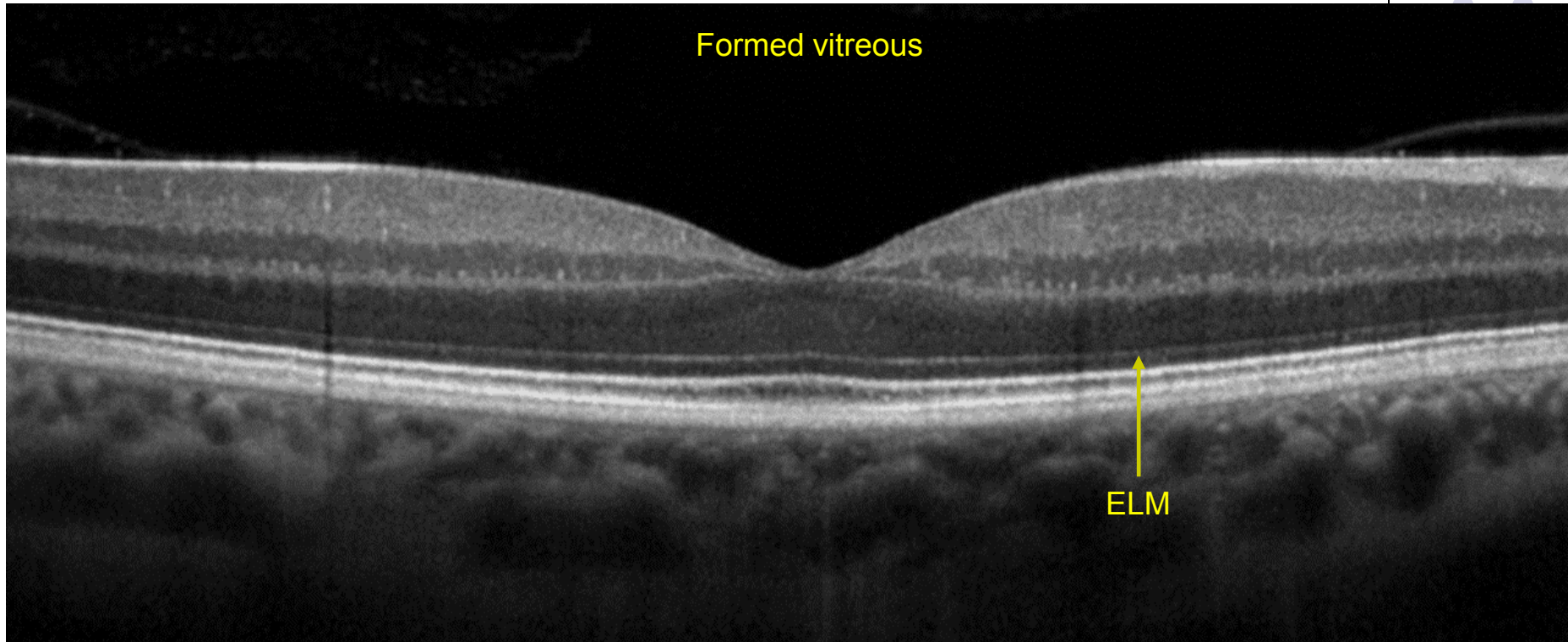


Next, identify the following preretinal structures:  
--The formed vitreous



Q

## Retinal Anatomy and Histology



Next, identify the following preretinal structures:

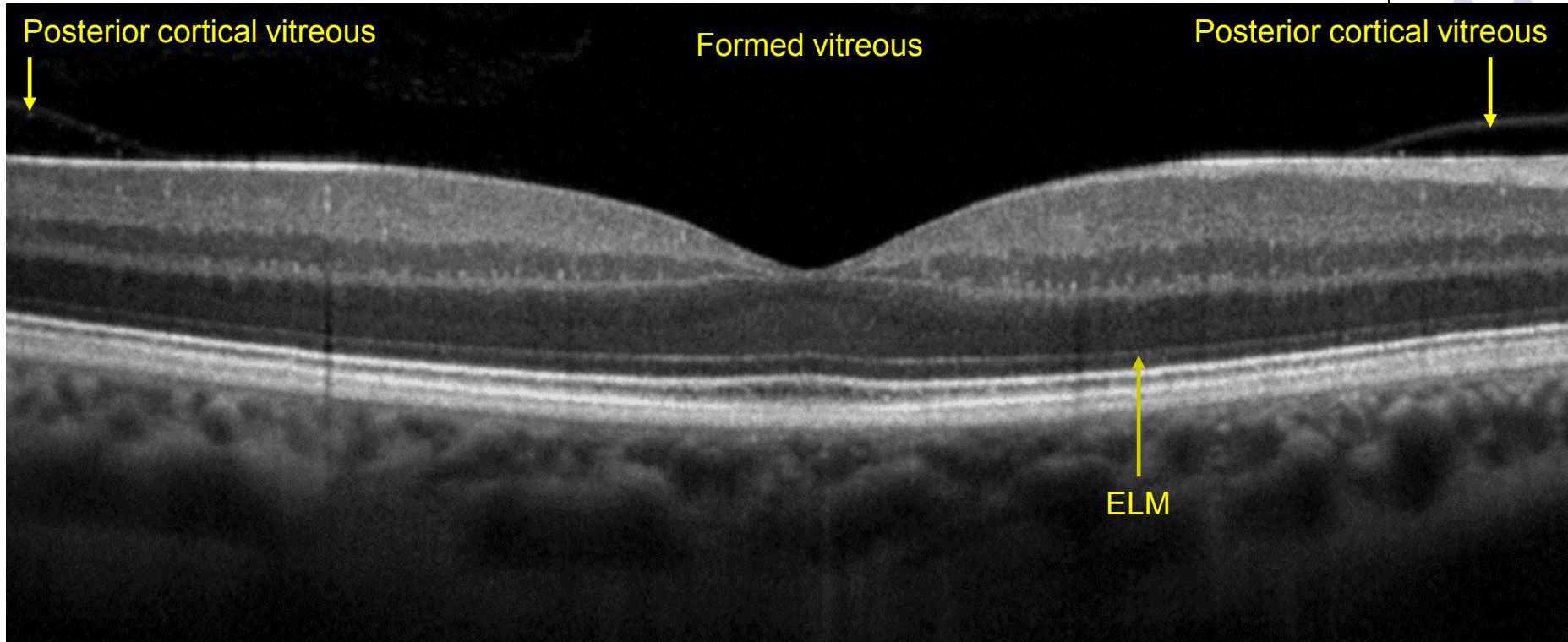
- The formed vitreous
- The posterior cortical vitreous



A

## Retinal Anatomy and Histology

385



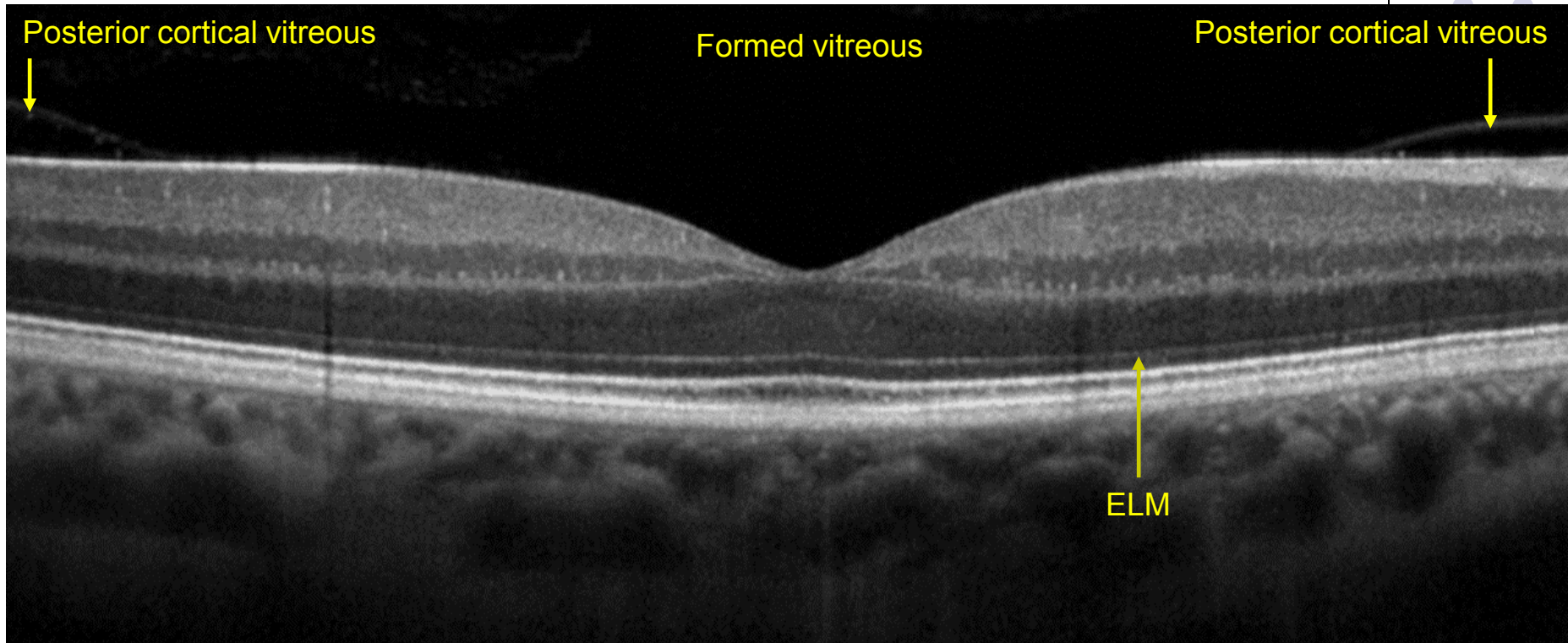
Next, identify the following preretinal structures:

- The formed vitreous
- The posterior cortical vitreous



Q

## Retinal Anatomy and Histology



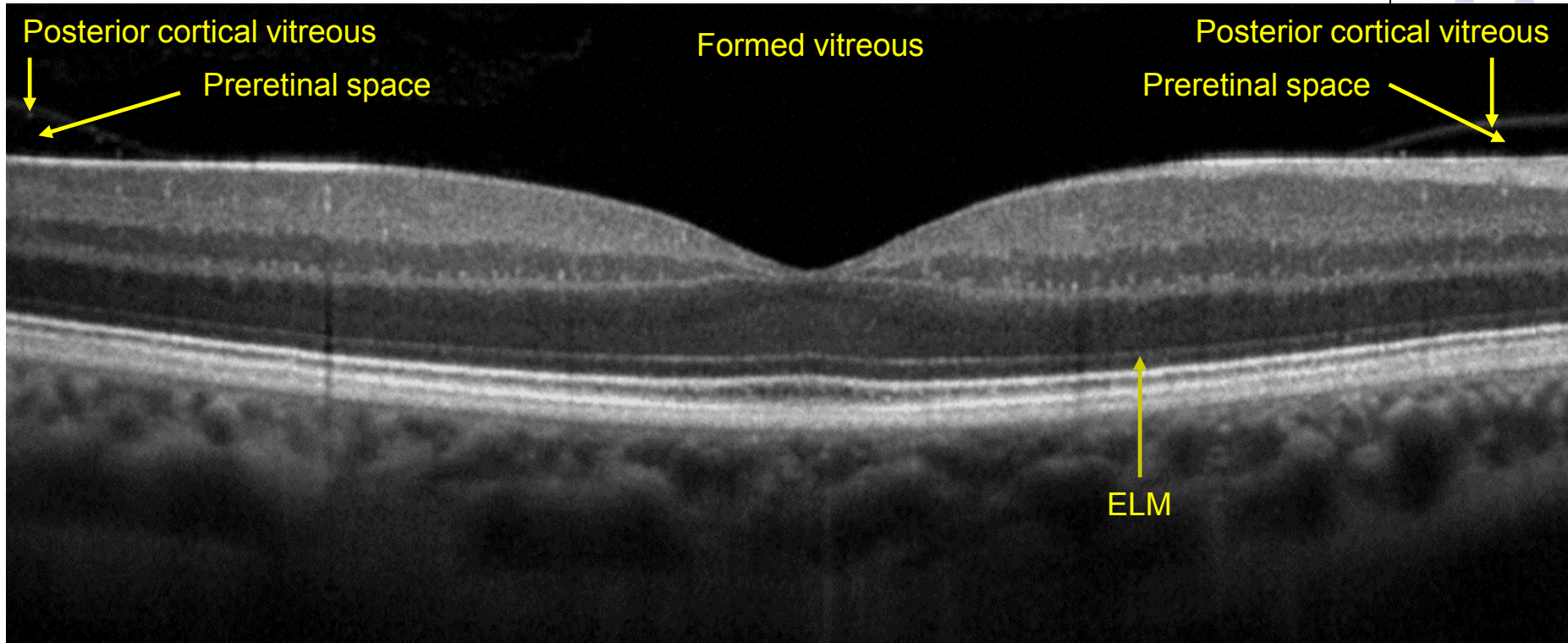
Next, identify the following preretinal structures:

- The formed vitreous
- The posterior cortical vitreous
- The preretinal space

# A

## Retinal Anatomy and Histology

387



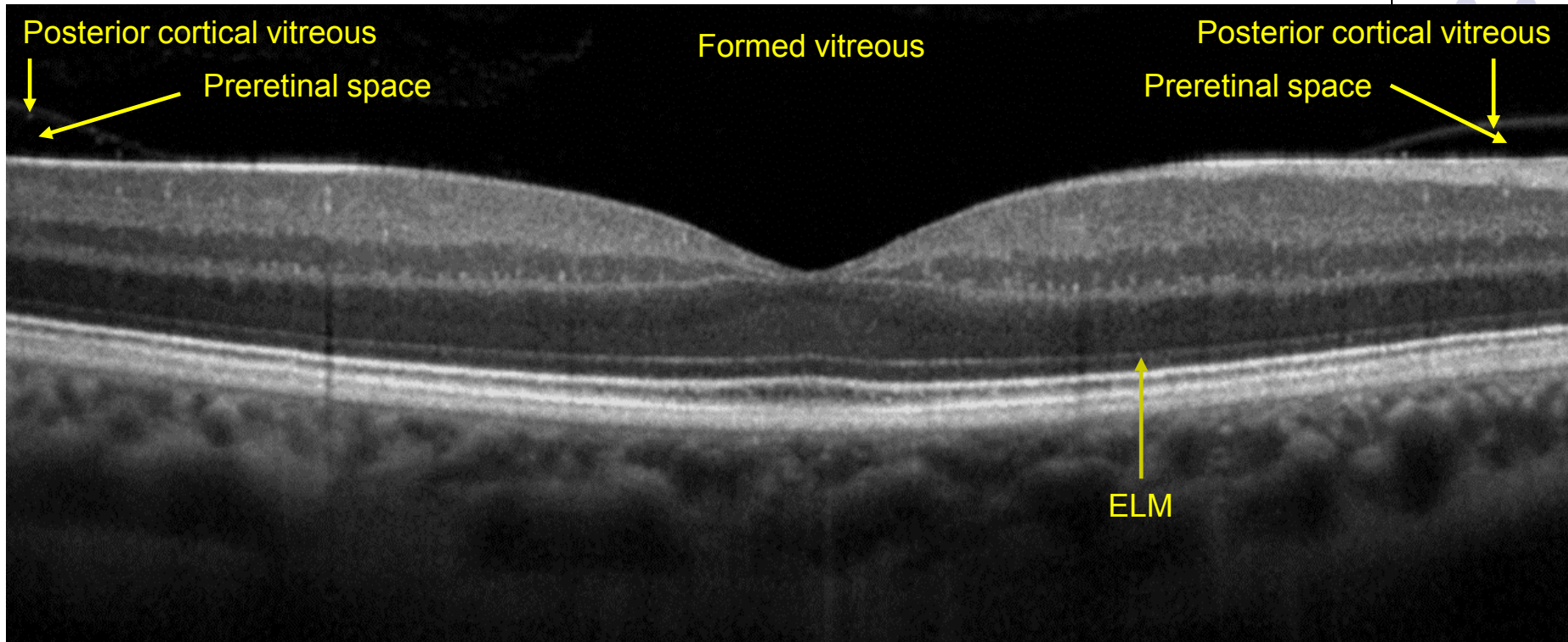
Next, identify the following preretinal structures:

- The formed vitreous
- The posterior cortical vitreous
- The preretinal space



Q

## Retinal Anatomy and Histology



Next, identify the following preretinal structures:

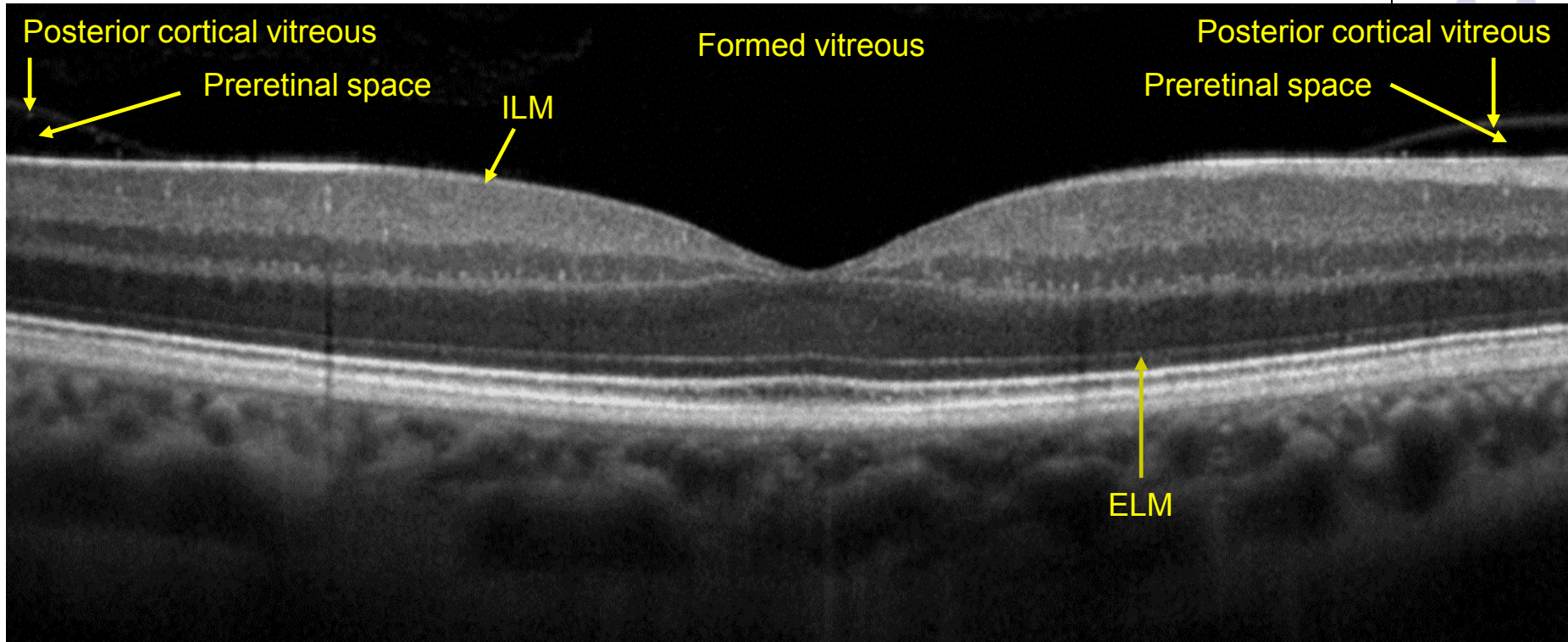
- The formed vitreous
- The posterior cortical vitreous
- The preretinal space

And now the innermost **retinal** structure, the **ILM**:

# A

## Retinal Anatomy and Histology

389



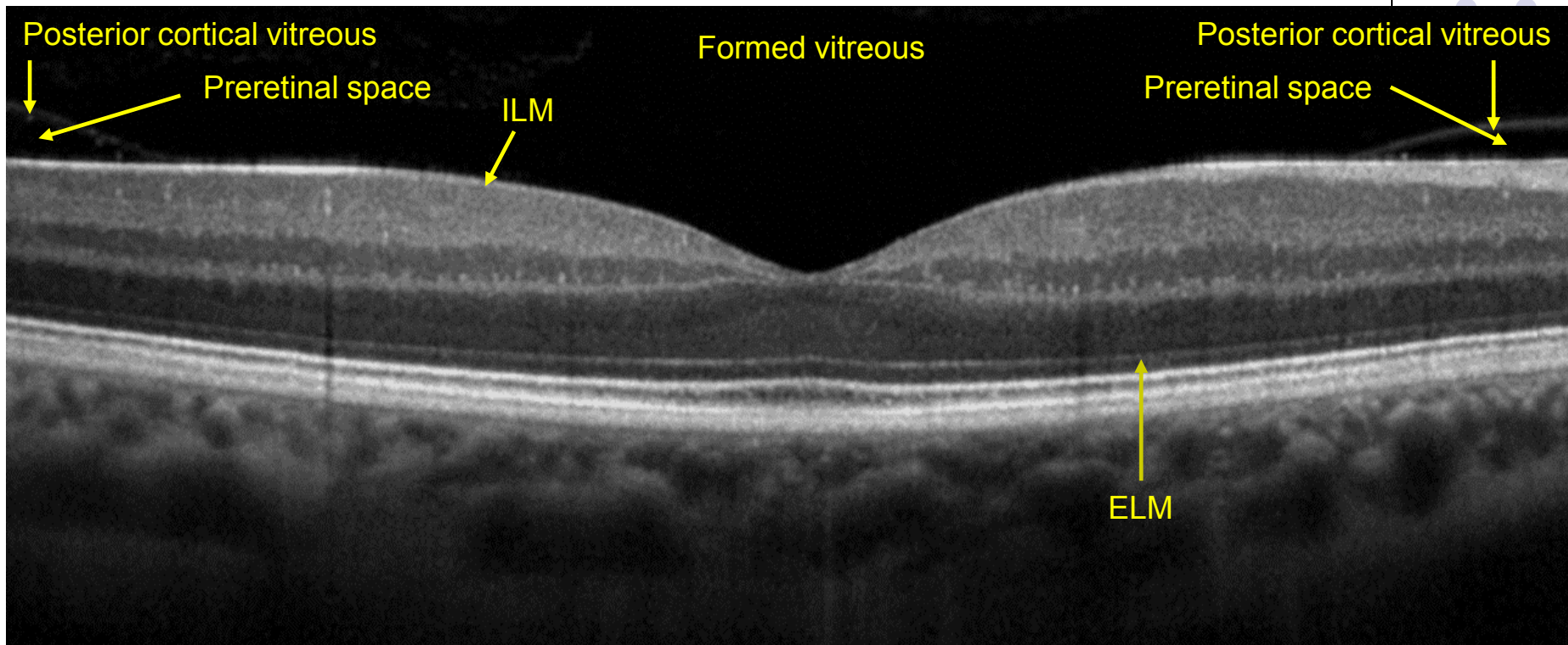
Next, identify the following preretinal structures:

- The formed vitreous
- The posterior cortical vitreous
- The preretinal space

And now the innermost **retinal** structure, the **ILM**:

Q

# Retinal Anatomy and Histology

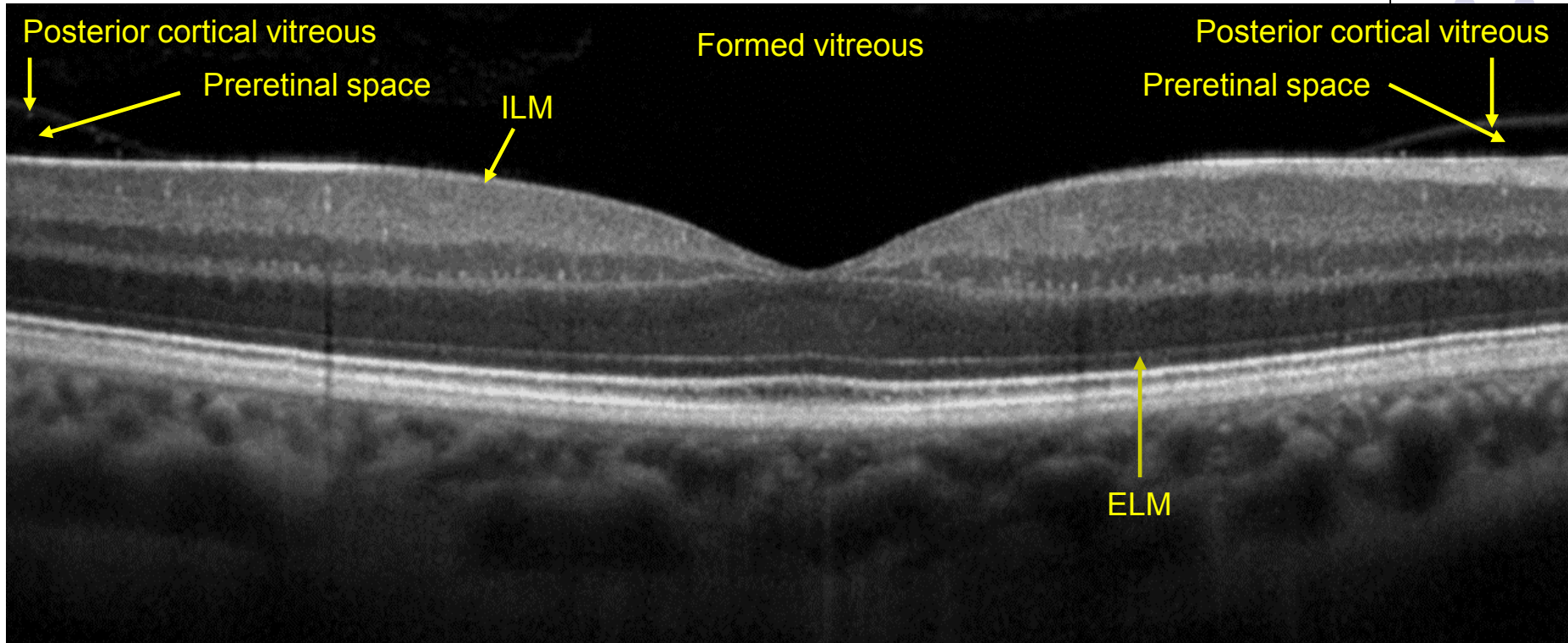


Next commences the layers of neural elements, starting with the

three words

A

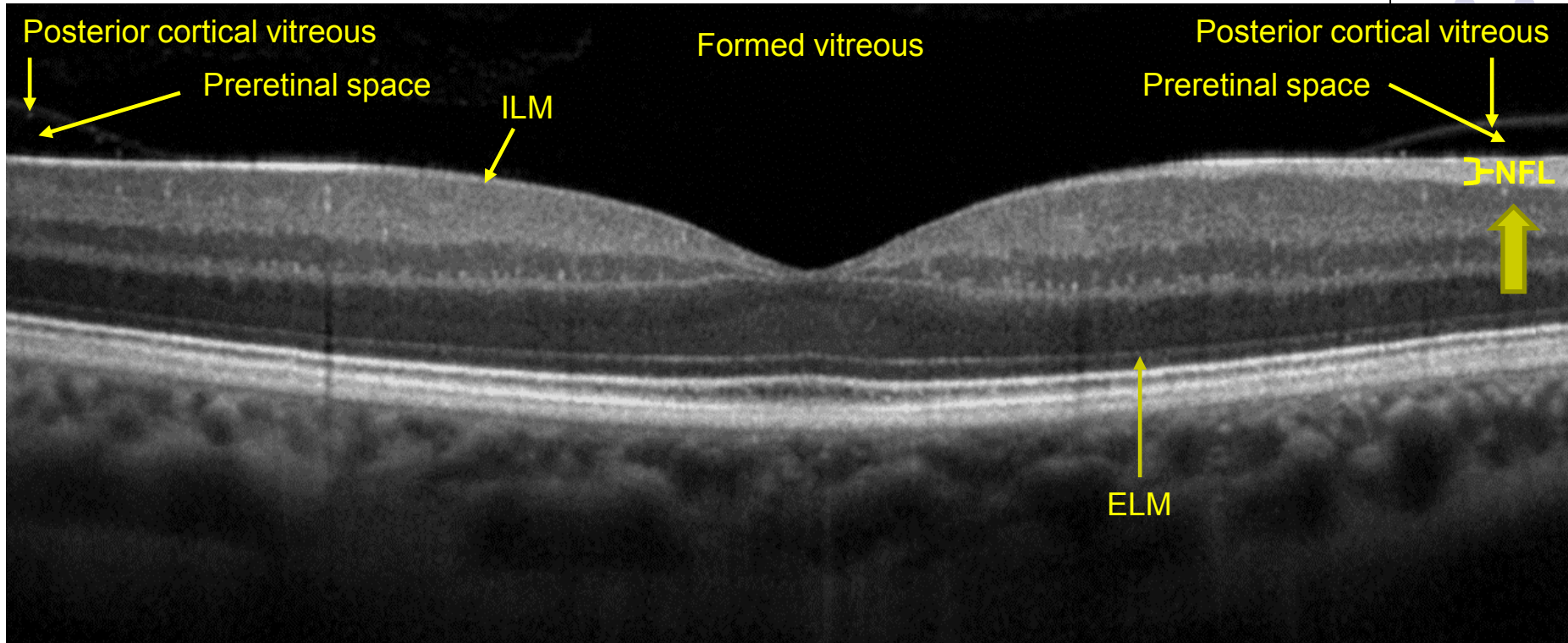
# Retinal Anatomy and Histology



Next commences the layers of neural elements, starting with the **nerve fiber layer**  
*(now locate it)*

A

# Retinal Anatomy and Histology

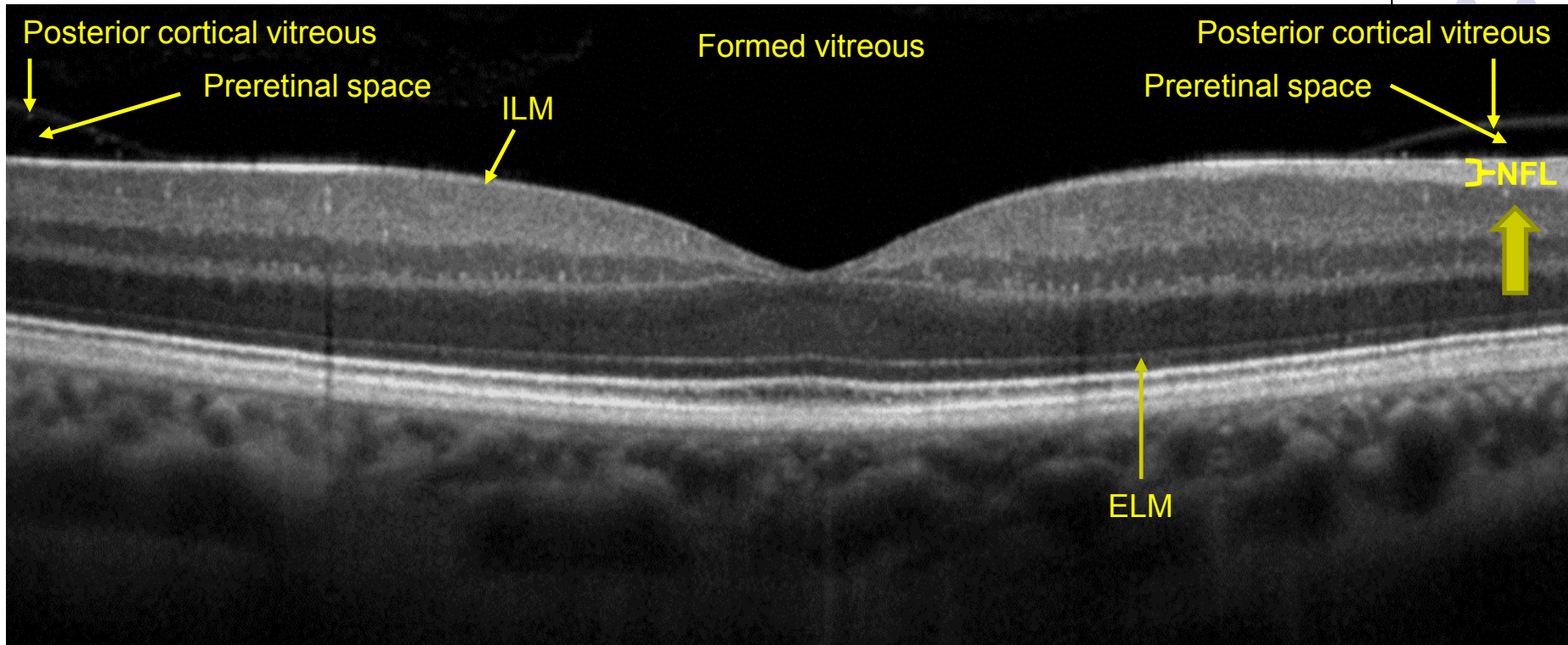


Next commences the layers of neural elements, starting with the [nerve fiber layer](#)



Q

## Retinal Anatomy and Histology



Next commences the layers of neural elements, starting with the nerve fiber layer

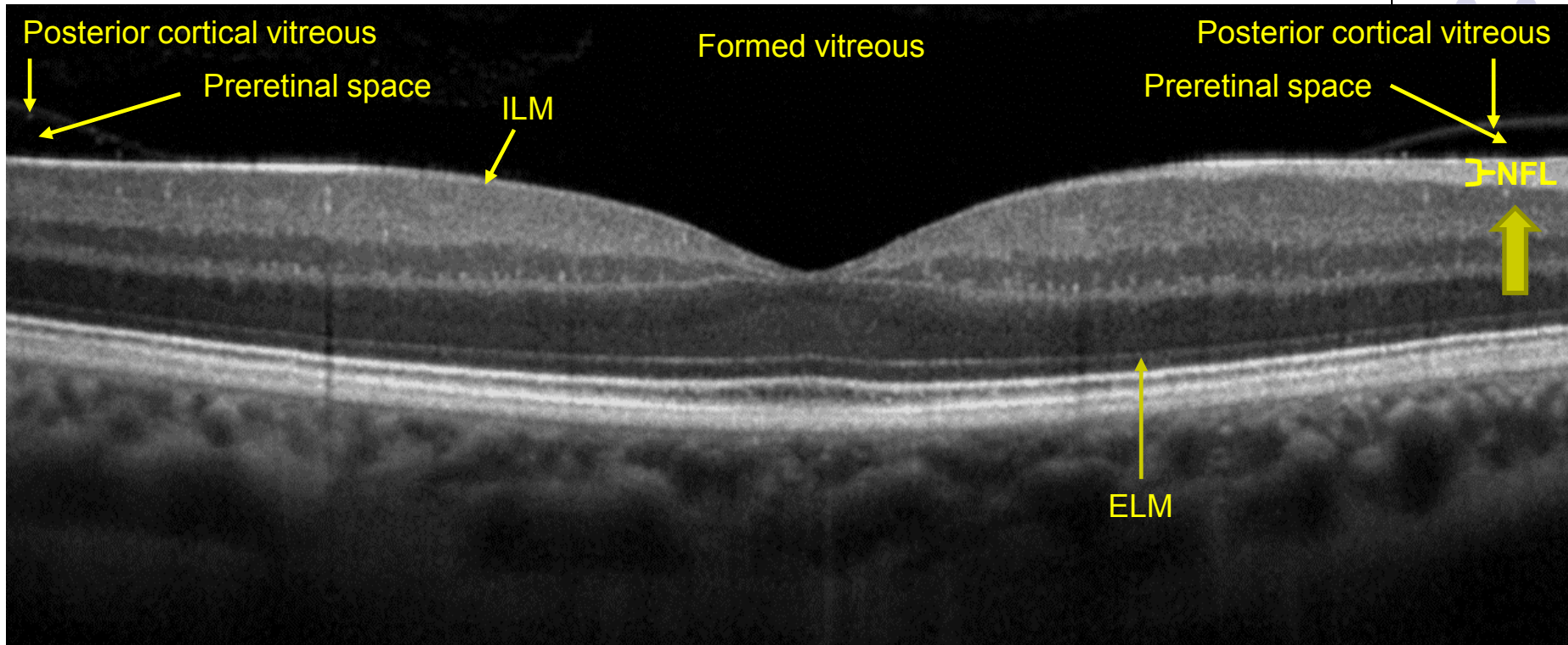
*On this scan, which side is nasal, which is temporal?*

*Temporal?  
Nasal?*

*Nasal?  
Temporal?*

A

# Retinal Anatomy and Histology



Next commences the layers of neural elements, starting with the nerve fiber layer

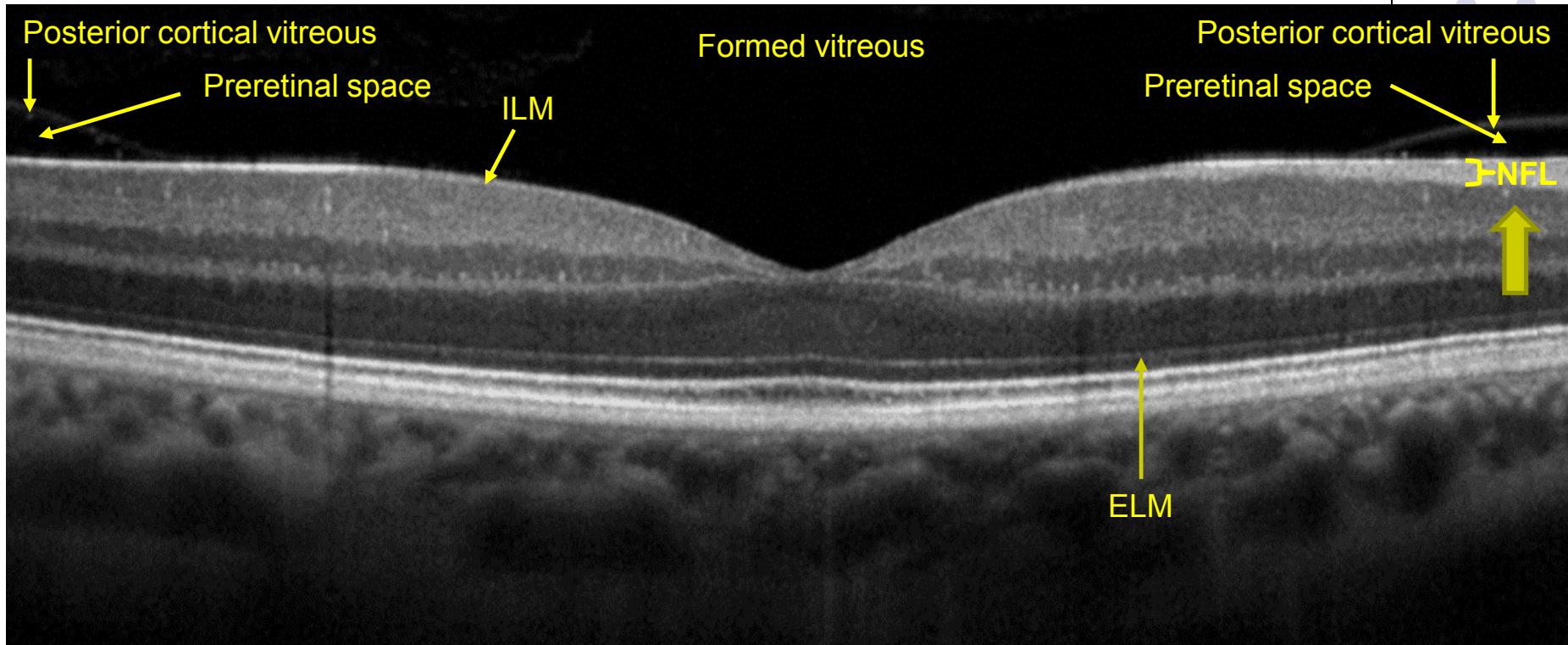
**Temporal**

On this scan, which side is nasal, which is temporal?  
This is the orientation

**Nasal**

Q

## Retinal Anatomy and Histology



Next commences the layers of neural elements, starting with the nerve fiber layer

**Temporal**

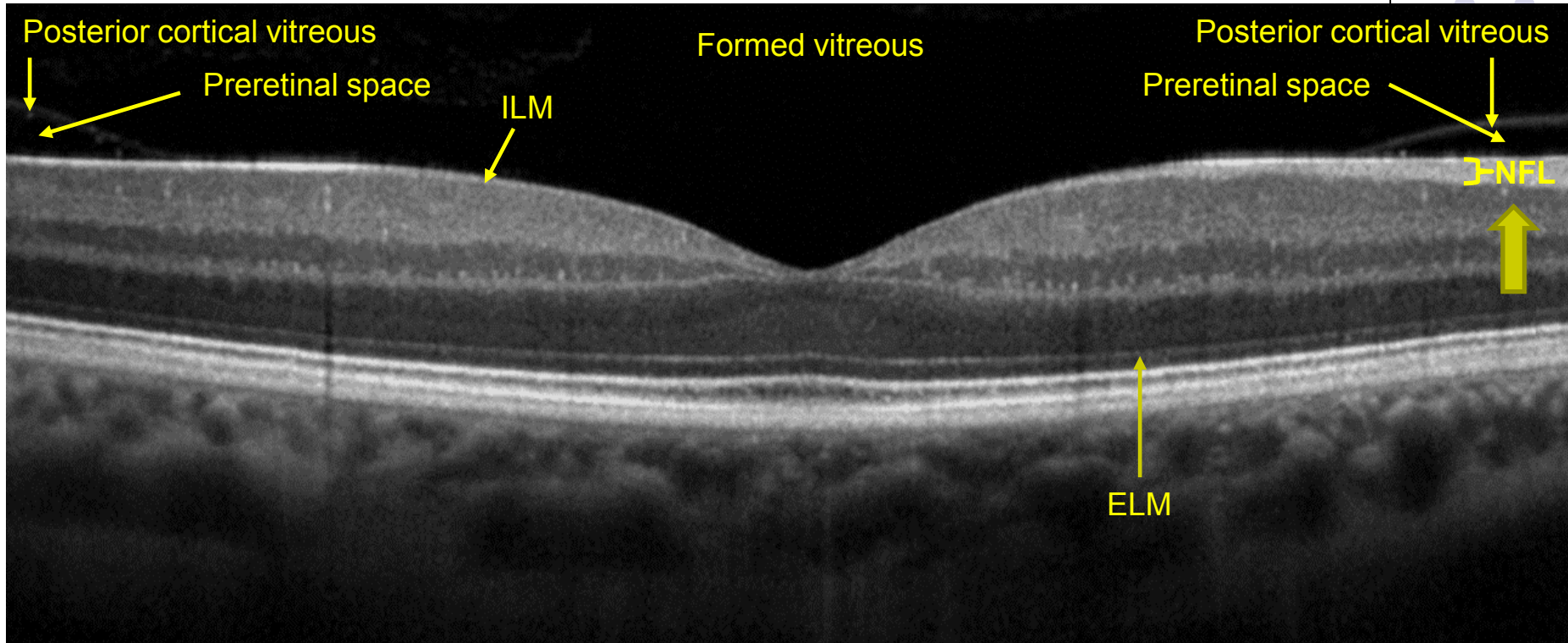
*On this scan, which side is nasal, which is temporal? How can you tell?  
This is the orientation*

**Nasal**

# A

## Retinal Anatomy and Histology

396



Next commences the layers of neural elements, starting with the nerve fiber layer

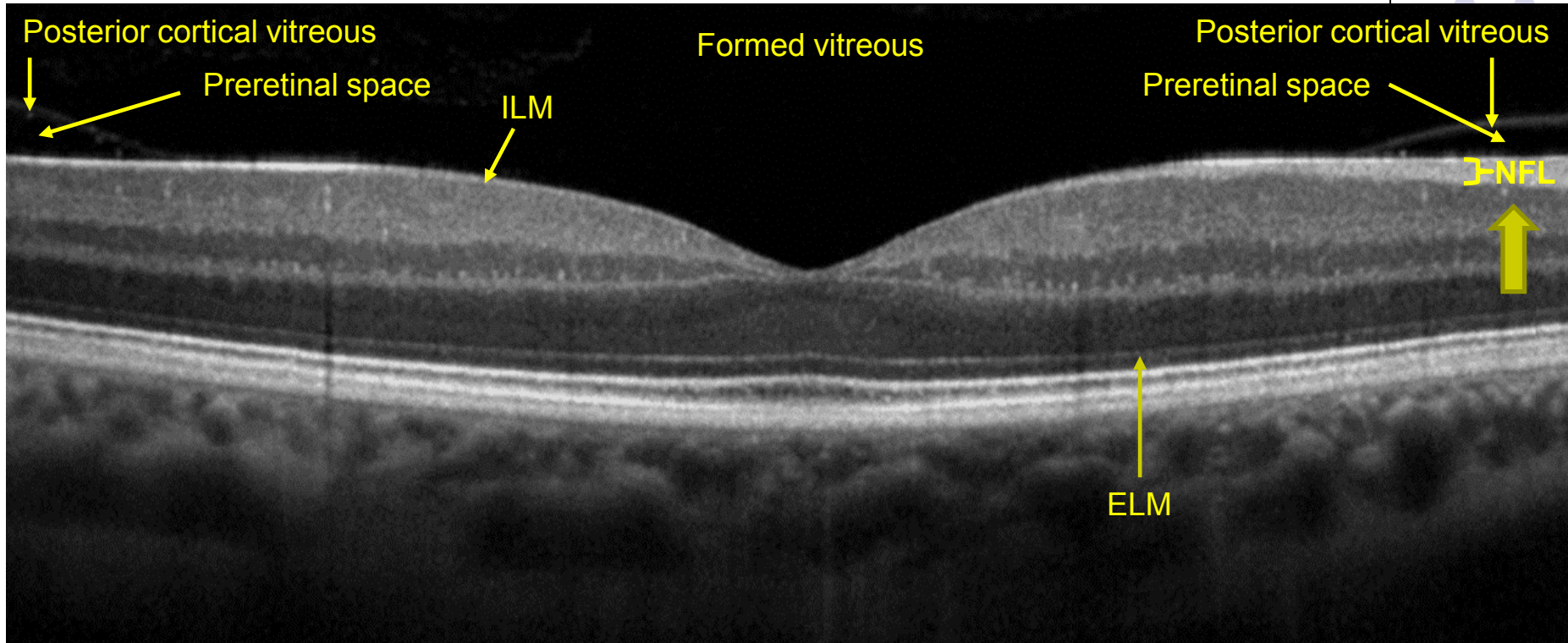
**Temporal**

*On this scan, which side is nasal, which is temporal? How can you tell?*  
This is the orientation. The NFL is always thicker on the nasal side.

**Nasal**

Q

# Retinal Anatomy and Histology



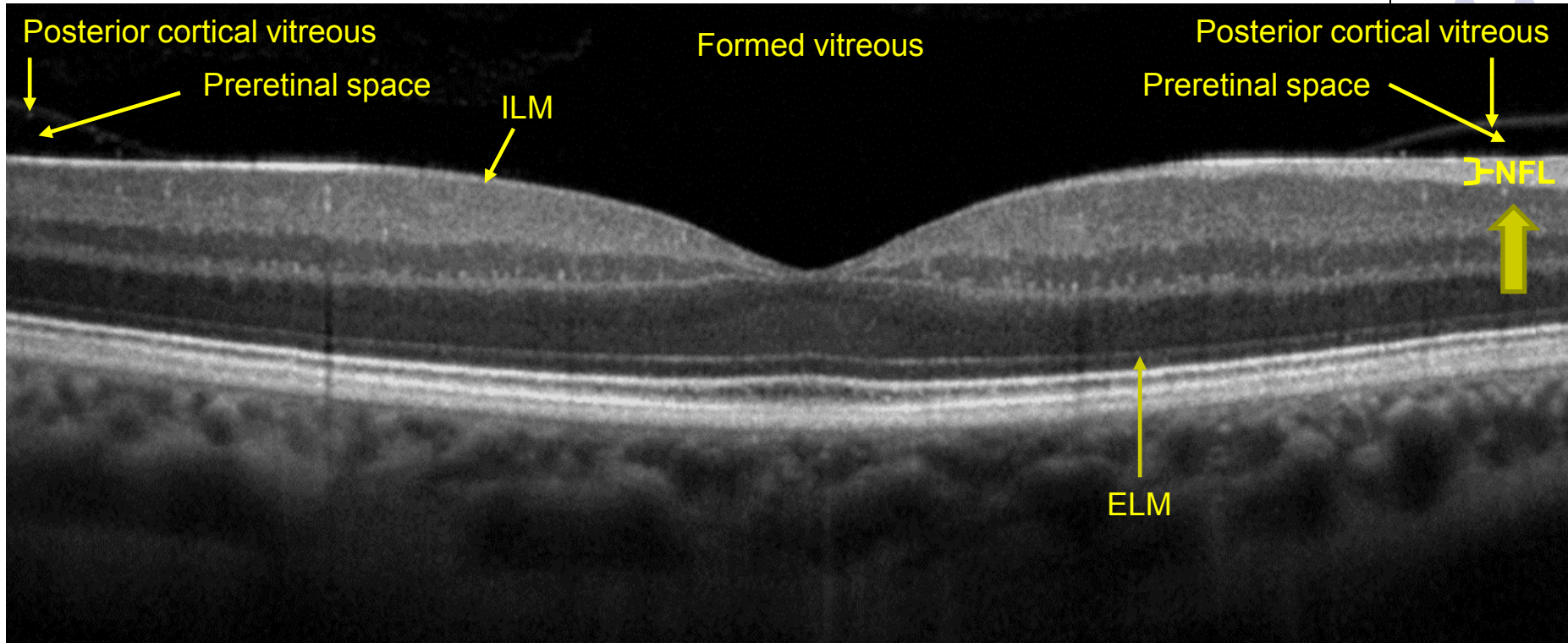
Next commences the layers of neural elements, starting with the nerve fiber layer

**Temporal**

*On this scan, which side is nasal, which is temporal? How can you tell?*  
This is the orientation. The NFL is always thicker on the nasal side.

**Nasal**

*Why is the NFL thicker on the nasal side of the fovea?*



Next commences the layers of neural elements, starting with the nerve fiber layer

**Temporal**

*On this scan, which side is nasal, which is temporal? How can you tell?*  
This is the orientation. The NFL is always thicker on the nasal side.

**Nasal**

*Why is the NFL thicker on the nasal side of the fovea?*

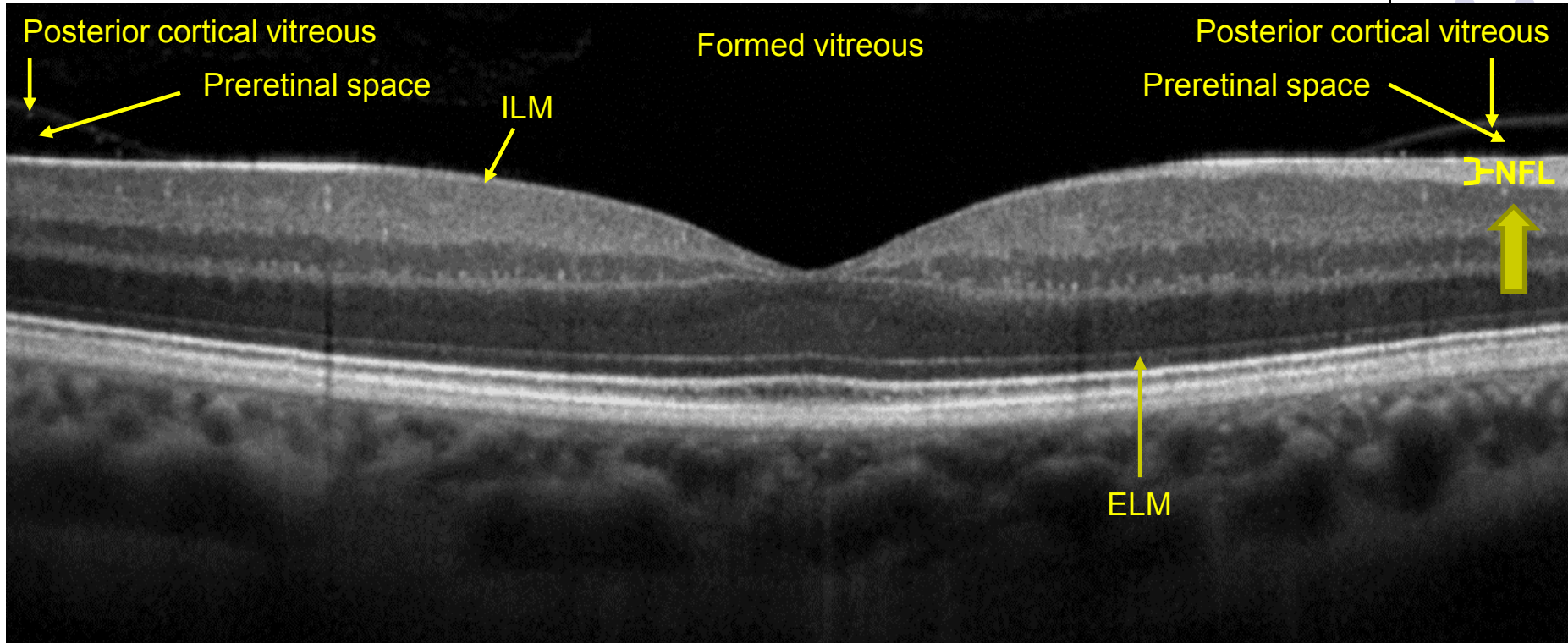
Because that's the side the  is located on

two words

# A

## Retinal Anatomy and Histology

399



Next commences the layers of neural elements, starting with the nerve fiber layer

**Temporal**

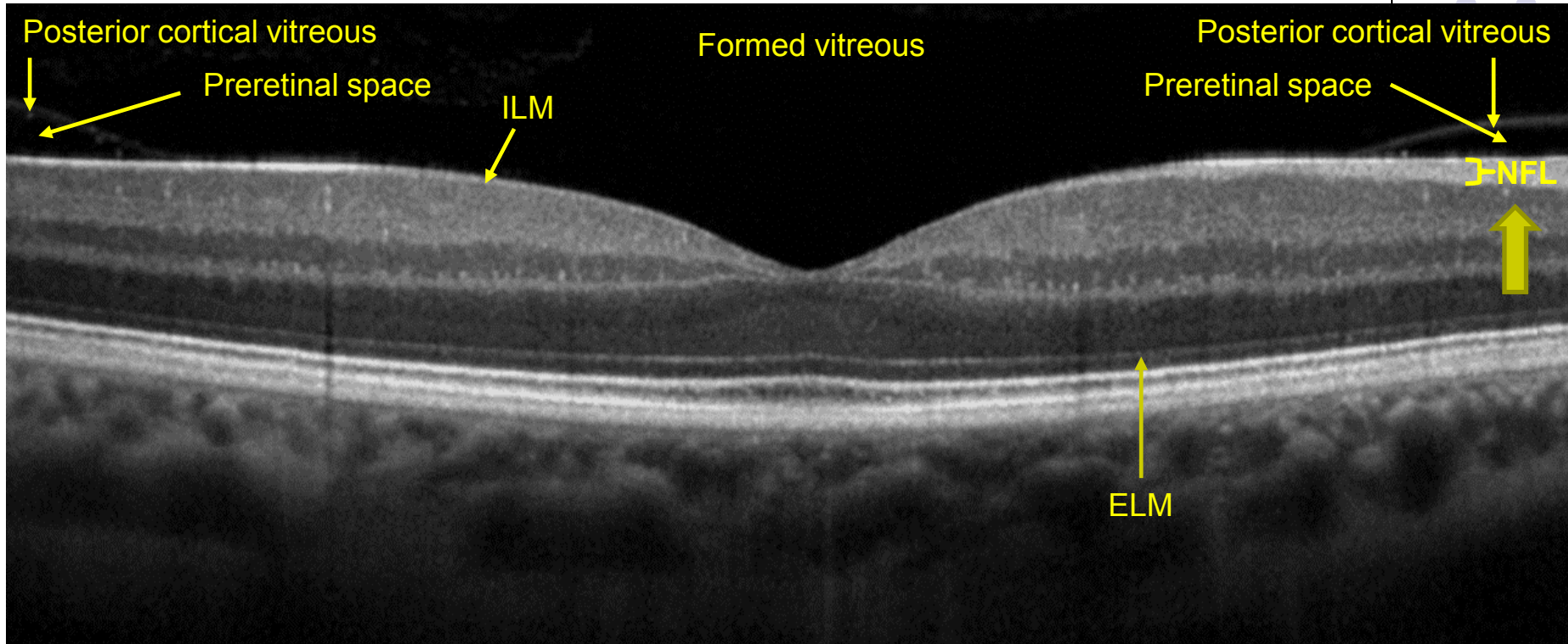
*On this scan, which side is nasal, which is temporal? How can you tell?*  
This is the orientation. The NFL is always thicker on the nasal side.

**Nasal**

*Why is the NFL thicker on the nasal side of the fovea?*  
Because that's the side the papillomacular bundle (PMB) is located on

Q

## Retinal Anatomy and Histology



Next commences the layers of neural elements, starting with the nerve fiber layer

**Temporal**

On this scan, **What is the PMB?**

This is the ori

**Nasal**

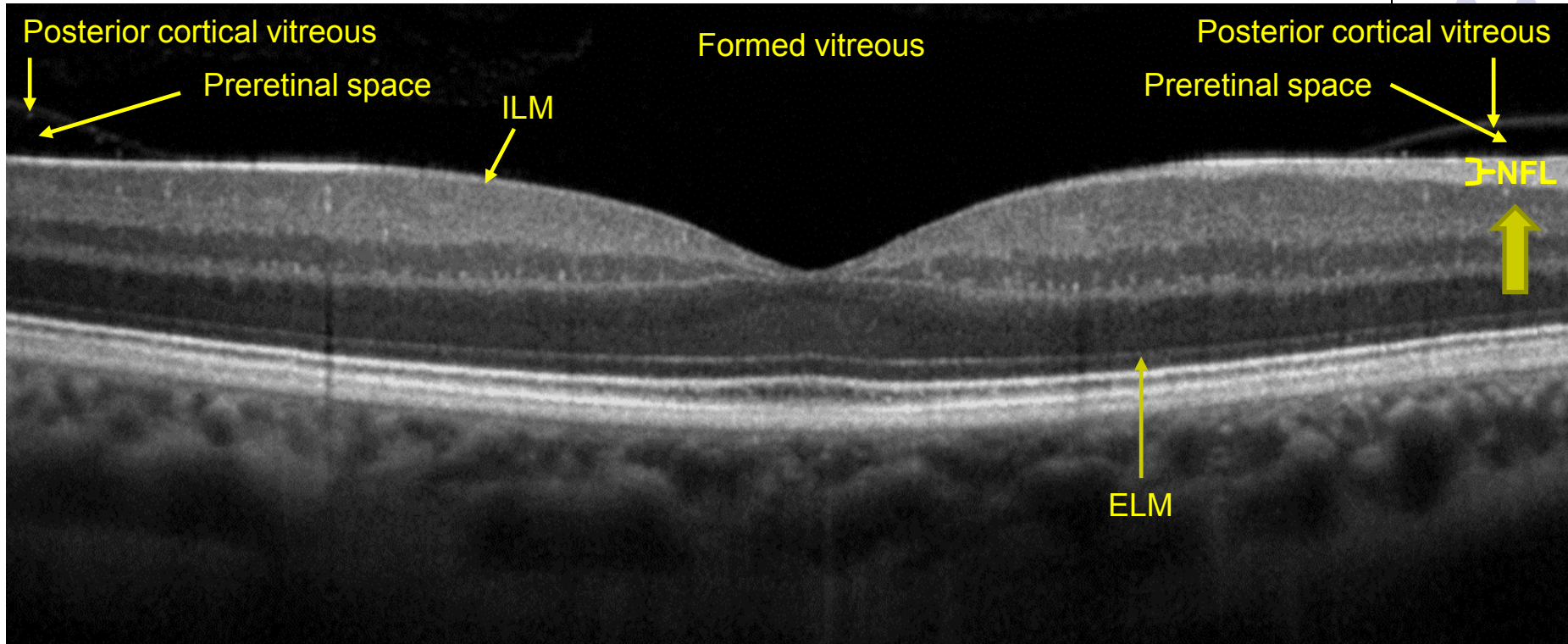
Why is the NFL thicker on the nasal side of the fovea?

Because that's the side the **papillomacular bundle (PMB)** is located on



A

# Retinal Anatomy and Histology



Next commences the layers of neural elements, starting with the nerve fiber layer

**Temporal**

On this scan, **What is the PMB?**

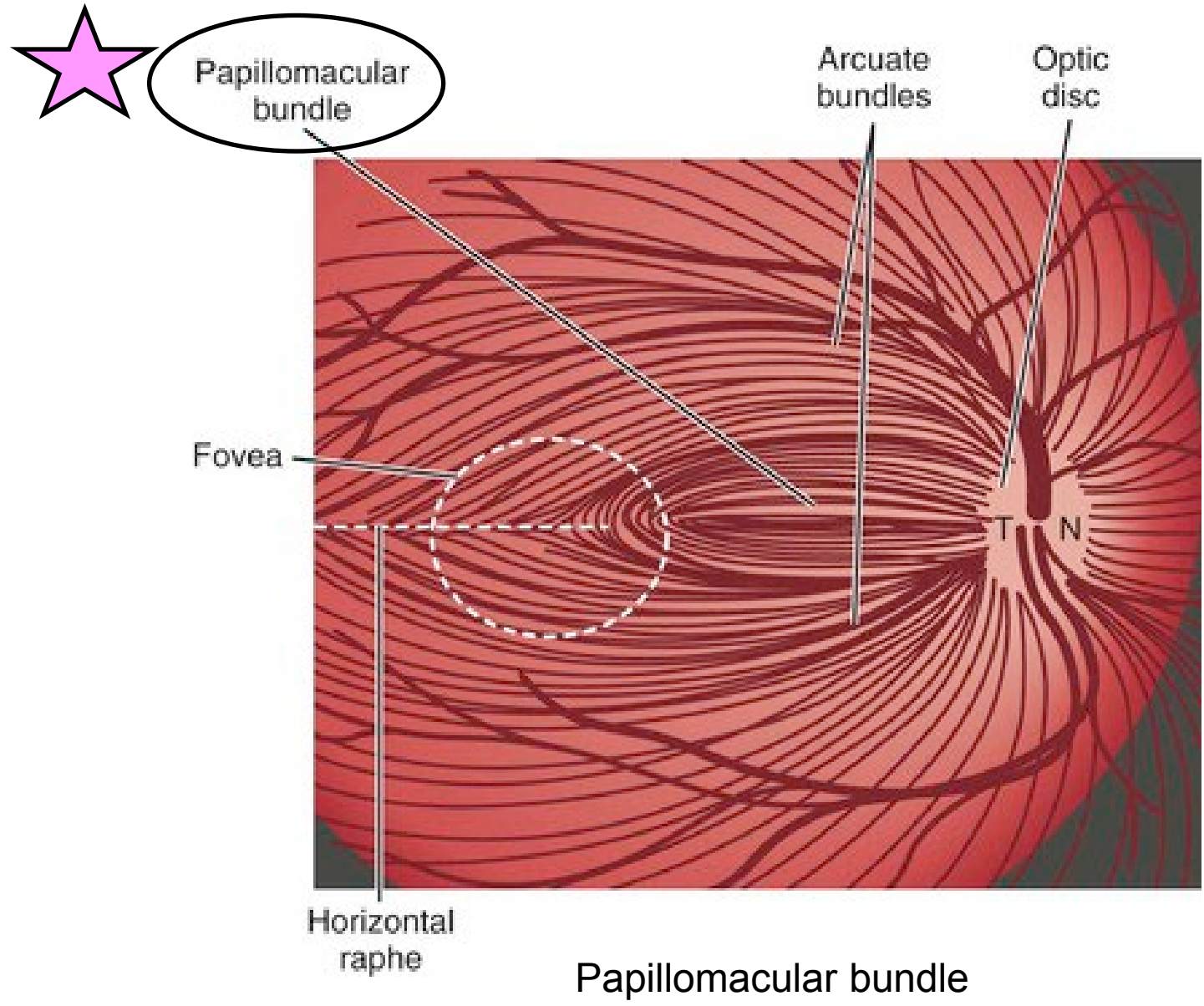
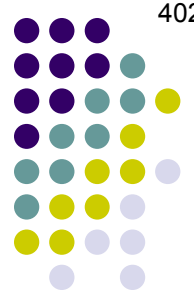
This is the origin of **The set of fibers running from the fovea directly to the ONH**

**Nasal**

Why is the NFL thicker on the nasal side of the fovea?

Because that's the side the **papillomacular bundle (PMB)** is located on

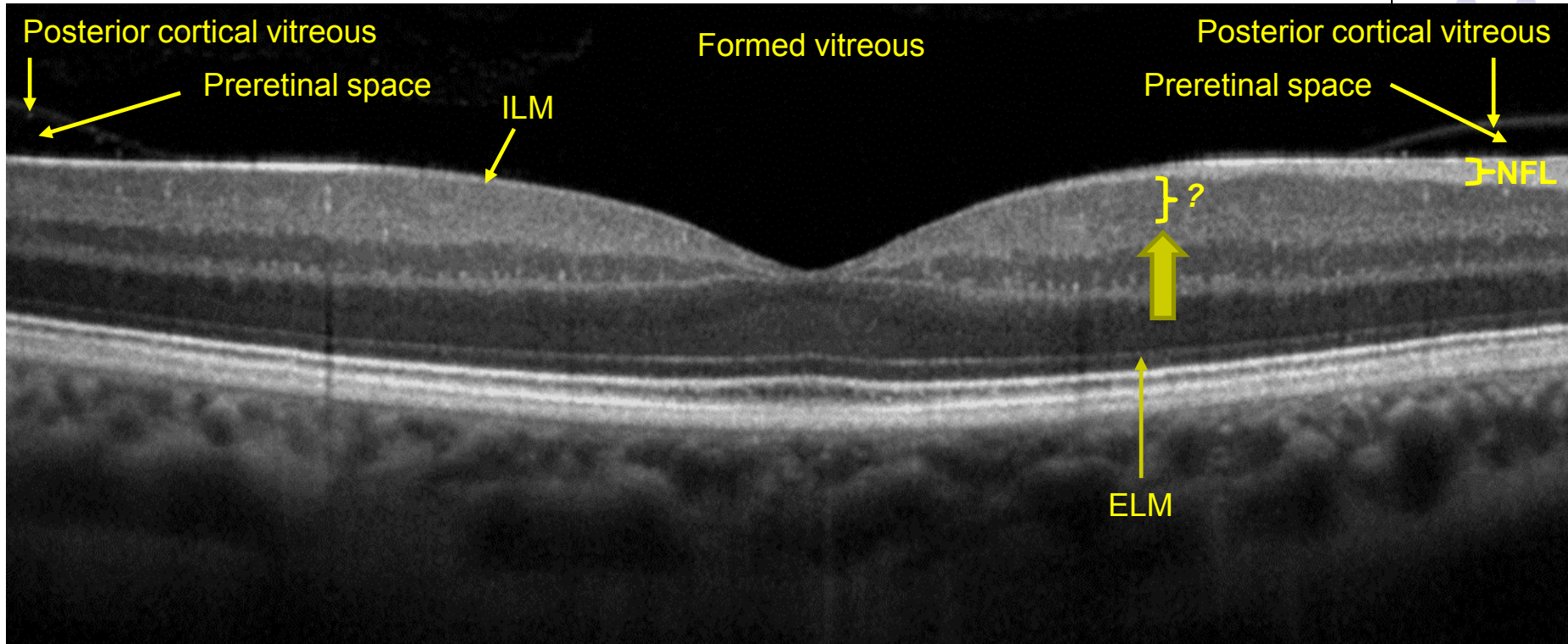
# Retinal Anatomy and Histology





Q

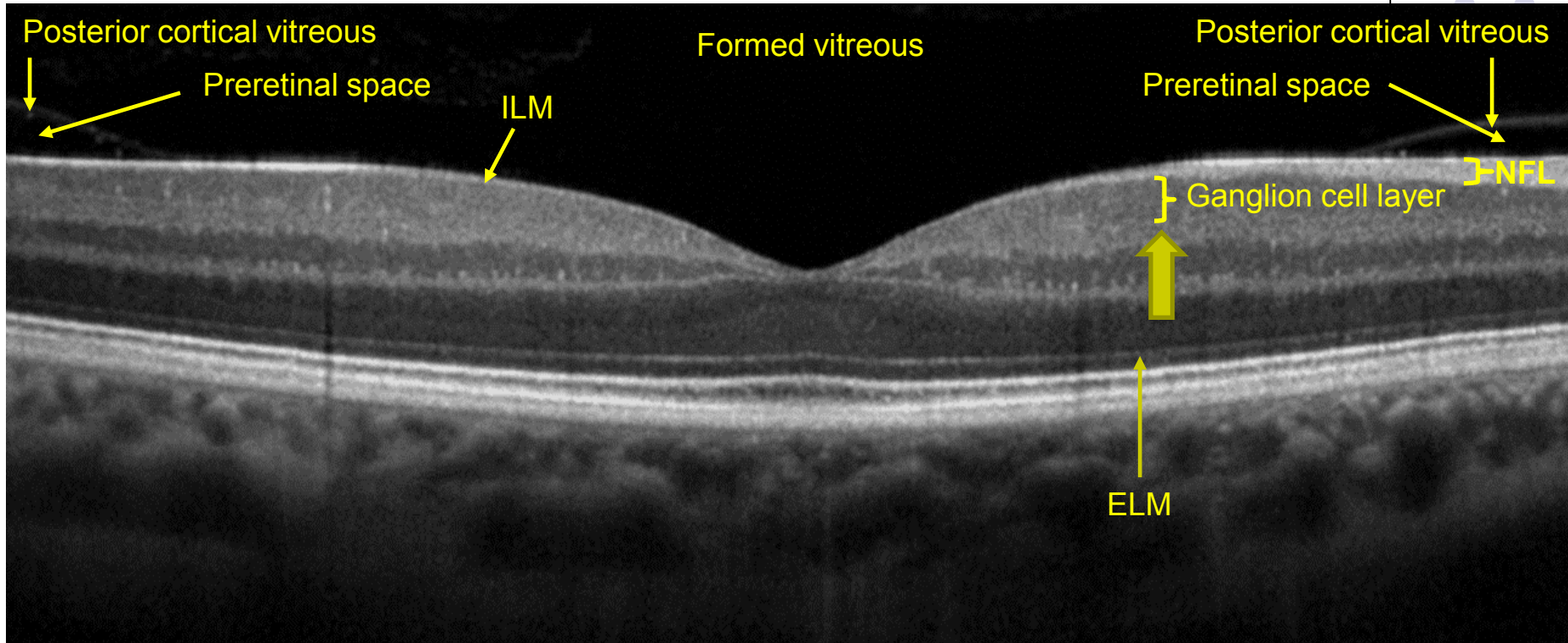
## Retinal Anatomy and Histology



Next commences the layers of neural elements, starting with the nerve fiber layer. As the composition of the layers alternate, the next one must contain cell bodies; sure enough, it is the three words

# A

## Retinal Anatomy and Histology

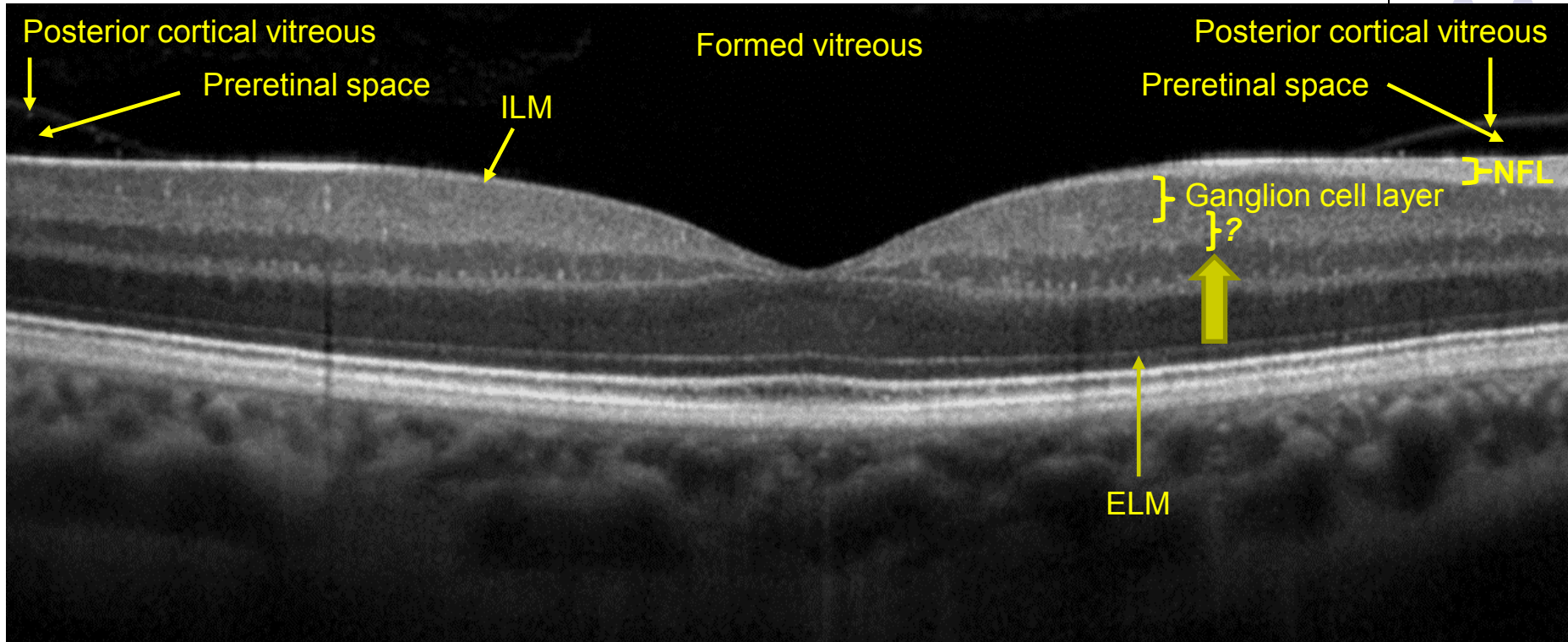


Next commences the layers of neural elements, starting with the nerve fiber layer. As the composition of the layers alternate, the next one must contain cell bodies; sure enough, it is the **ganglion cell layer**.



Q

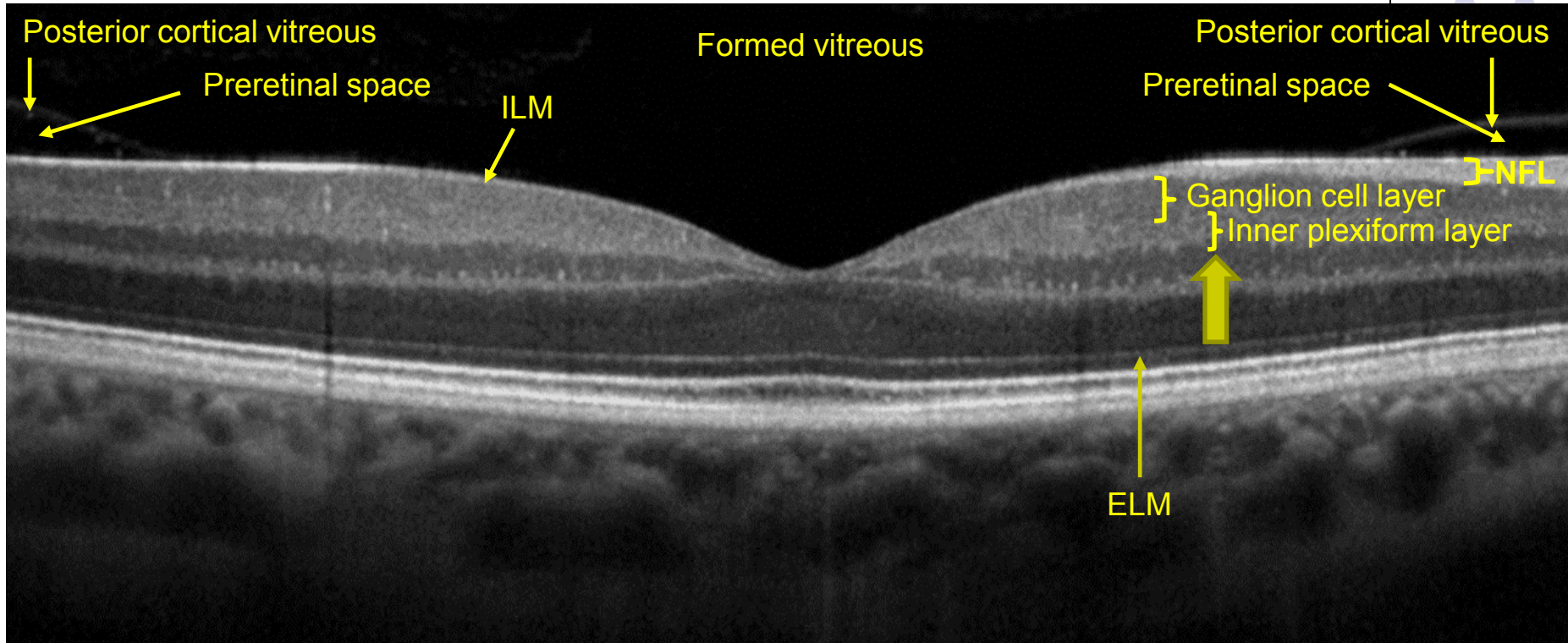
## Retinal Anatomy and Histology



Next commences the layers of neural elements, starting with the nerve fiber layer. As the composition of the layers alternate, the next one must contain cell bodies; sure enough, it is the ganglion cell layer. The next, 'processes' layer is the three words

# A

## Retinal Anatomy and Histology

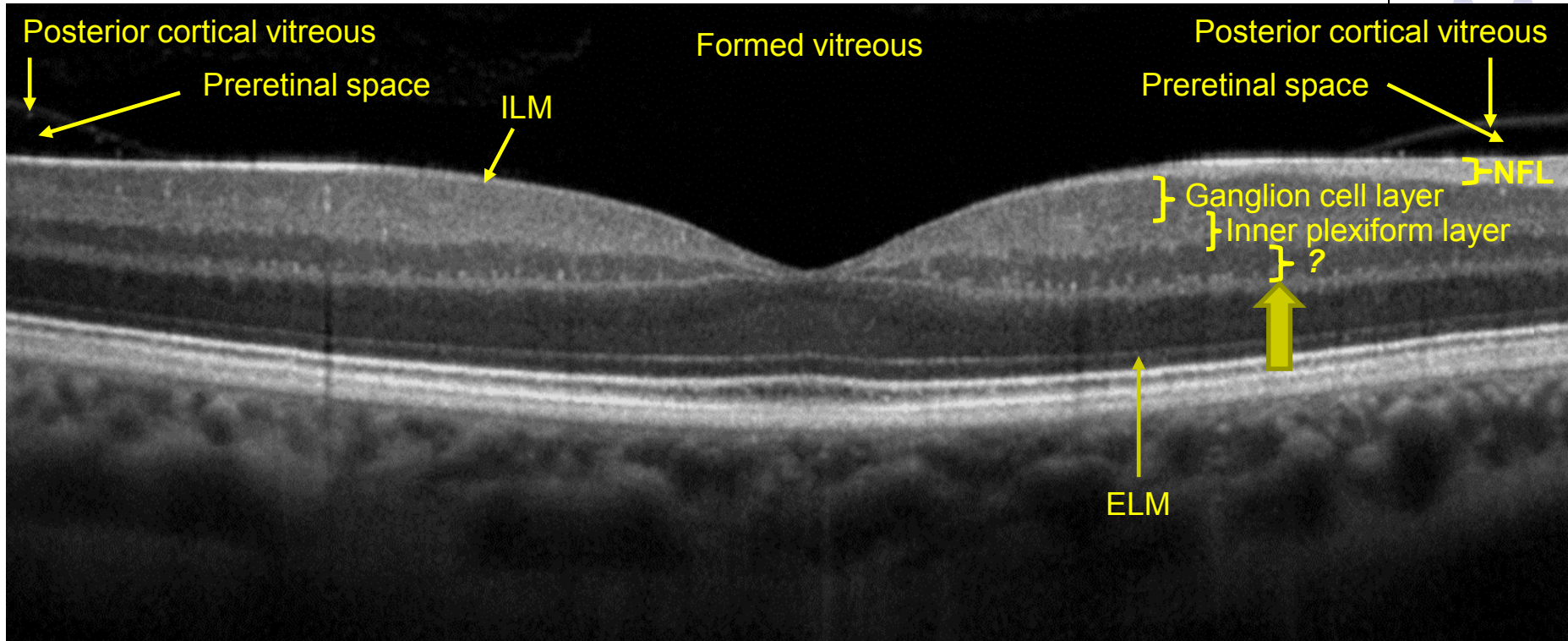


Next commences the layers of neural elements, starting with the nerve fiber layer. As the composition of the layers alternate, the next one must contain cell bodies; sure enough, it is the ganglion cell layer. The next, 'processes' layer is the **inner plexiform layer**



Q

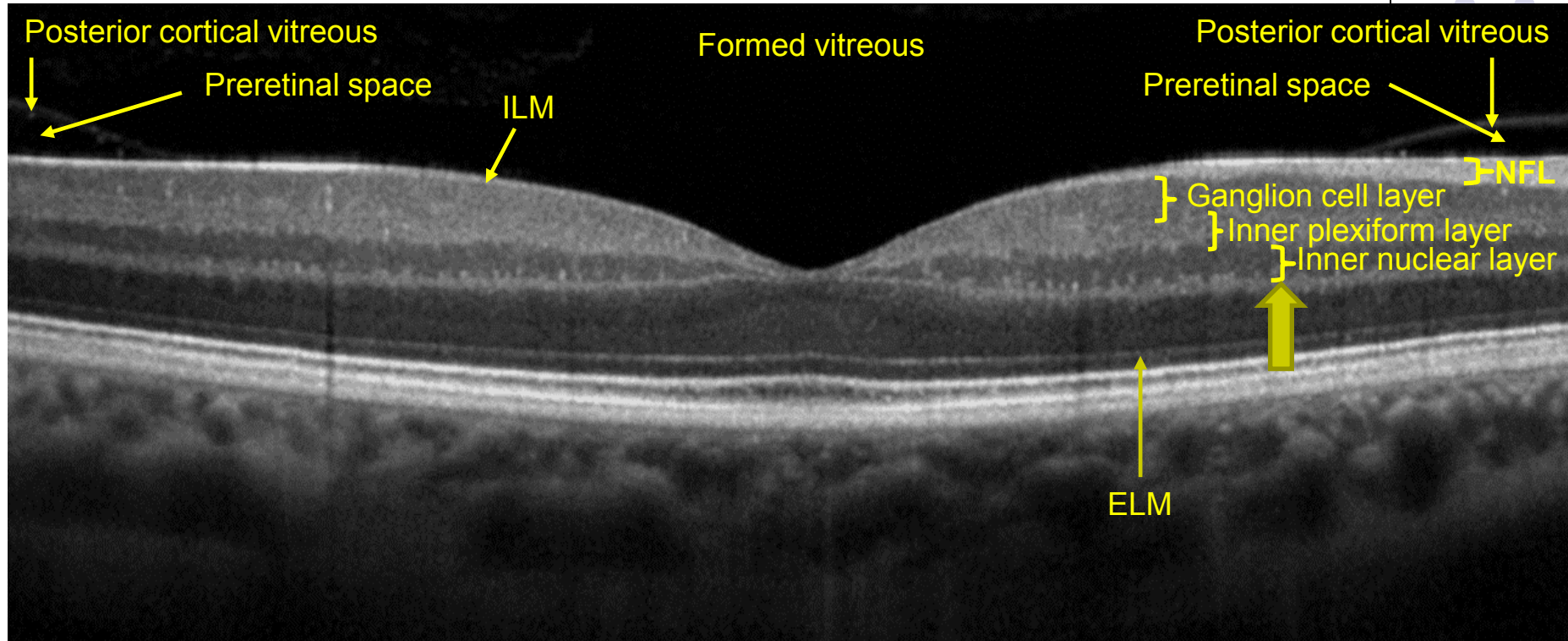
## Retinal Anatomy and Histology



Next commences the layers of neural elements, starting with the nerve fiber layer. As the composition of the layers alternate, the next one must contain cell bodies; sure enough, it is the ganglion cell layer. The next, 'processes' layer is the inner plexiform layer, followed by the next cell-body layer, the three words.

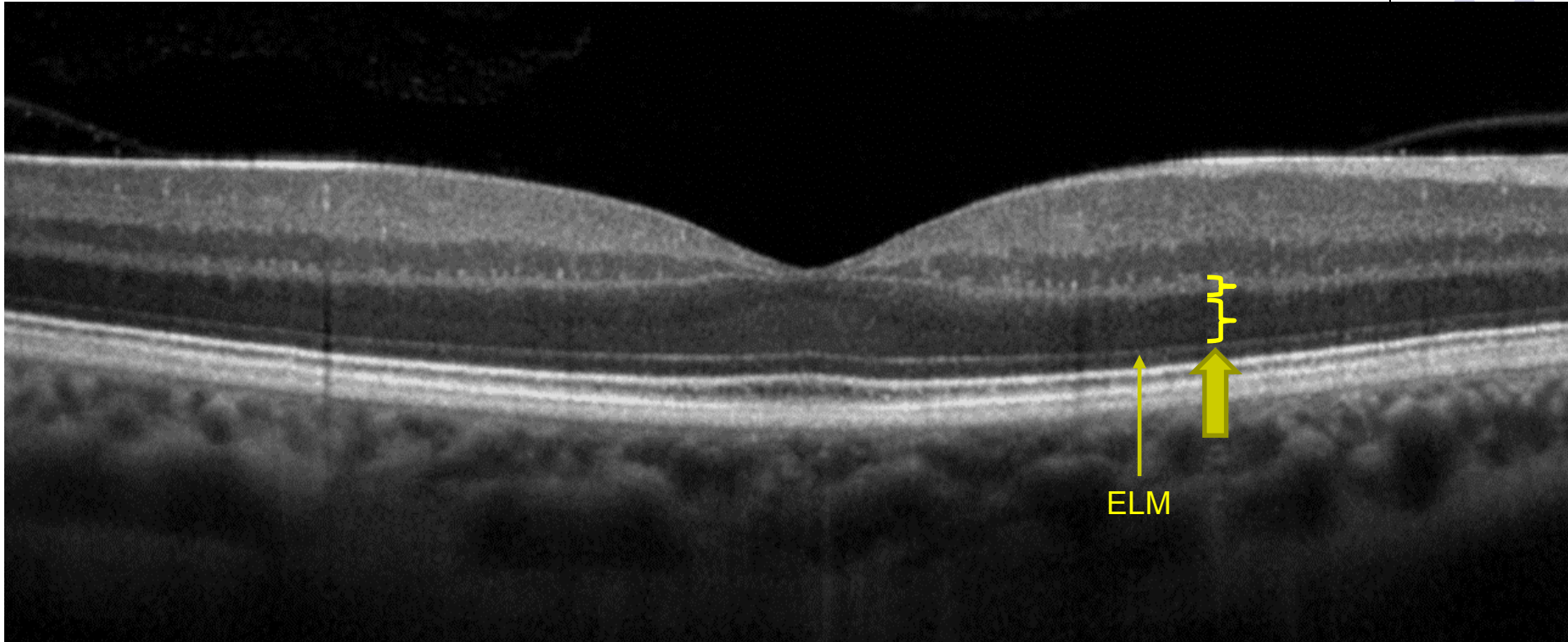
# A

## Retinal Anatomy and Histology



Next commences the layers of neural elements, starting with the nerve fiber layer. As the composition of the layers alternate, the next one must contain cell bodies; sure enough, it is the ganglion cell layer. The next, 'processes' layer is the inner plexiform layer, followed by the next cell-body layer, the **inner nuclear layer**.



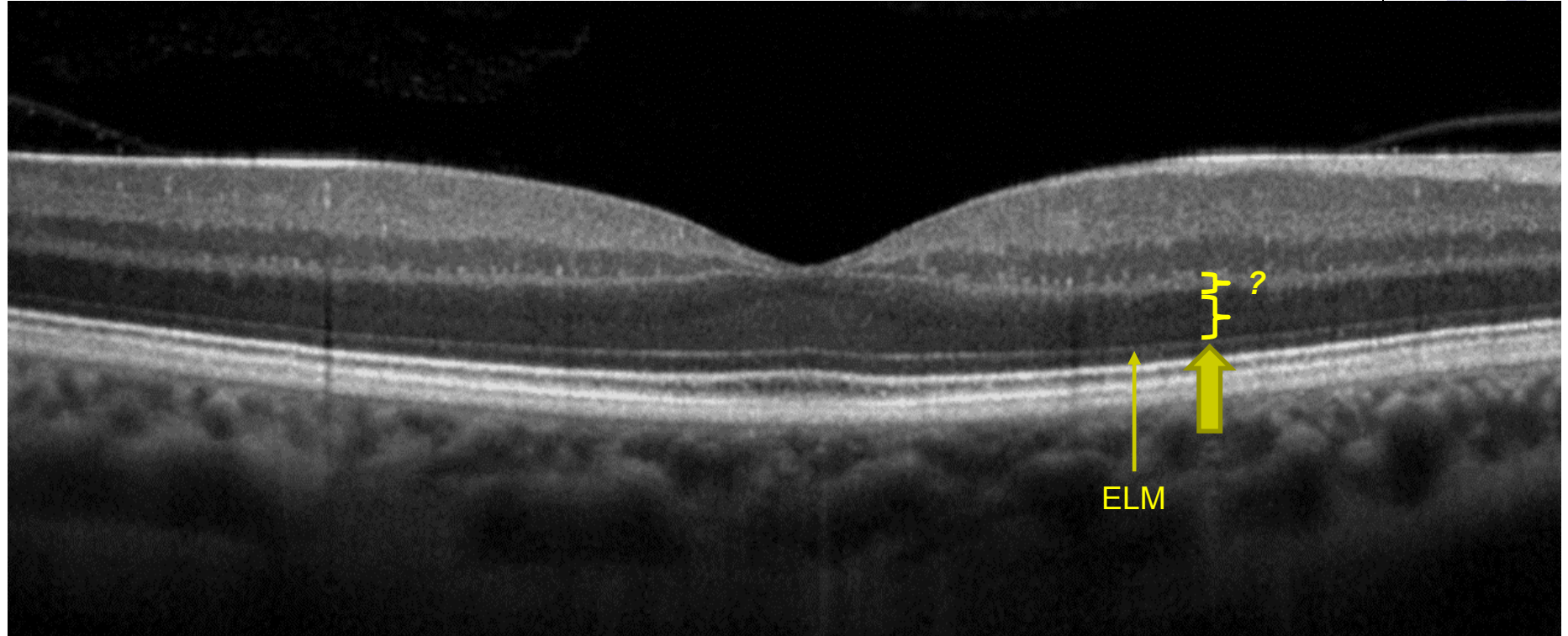


Things seem to be working out perfectly. The OCT appears to have two layers left to identify.



Q

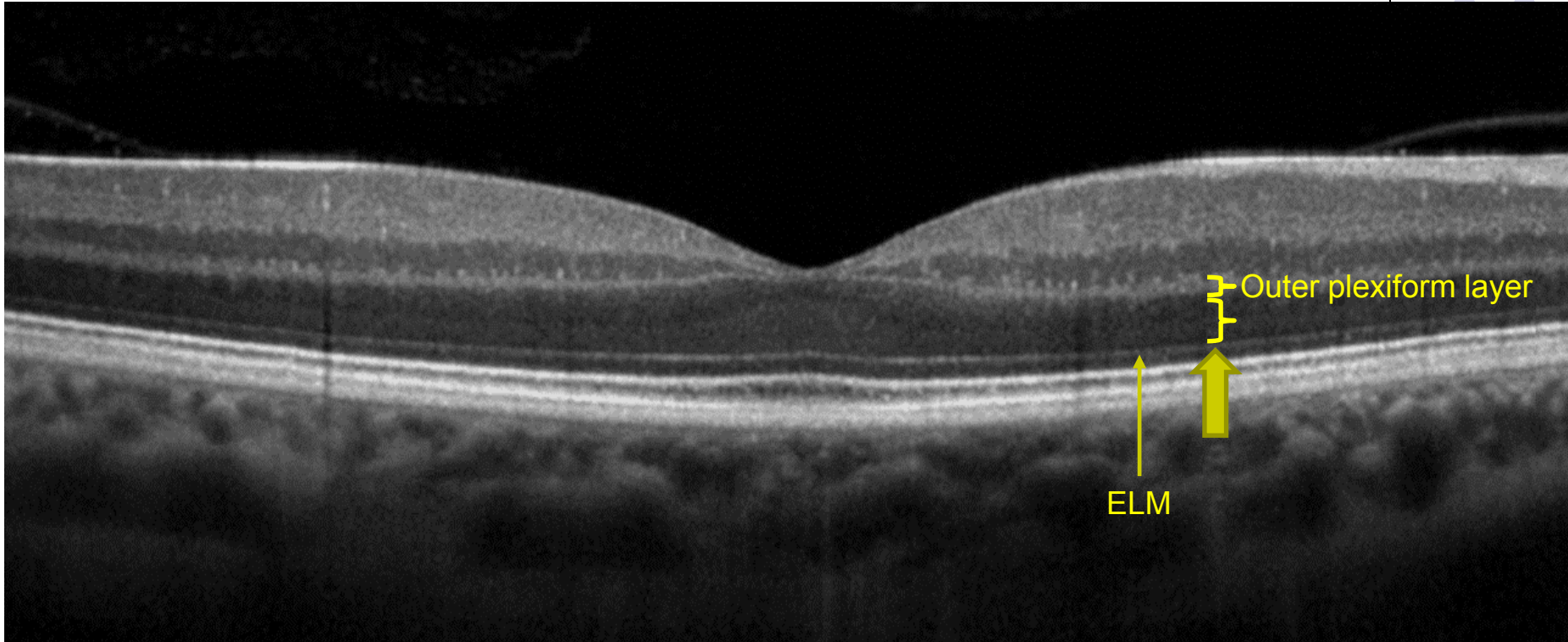
# Retinal Anatomy and Histology



Things seem to be working out perfectly. The OCT appears to have two layers left to identify. Conveniently, there are two yet-unassigned layers—a processes layer (the

three words )

A

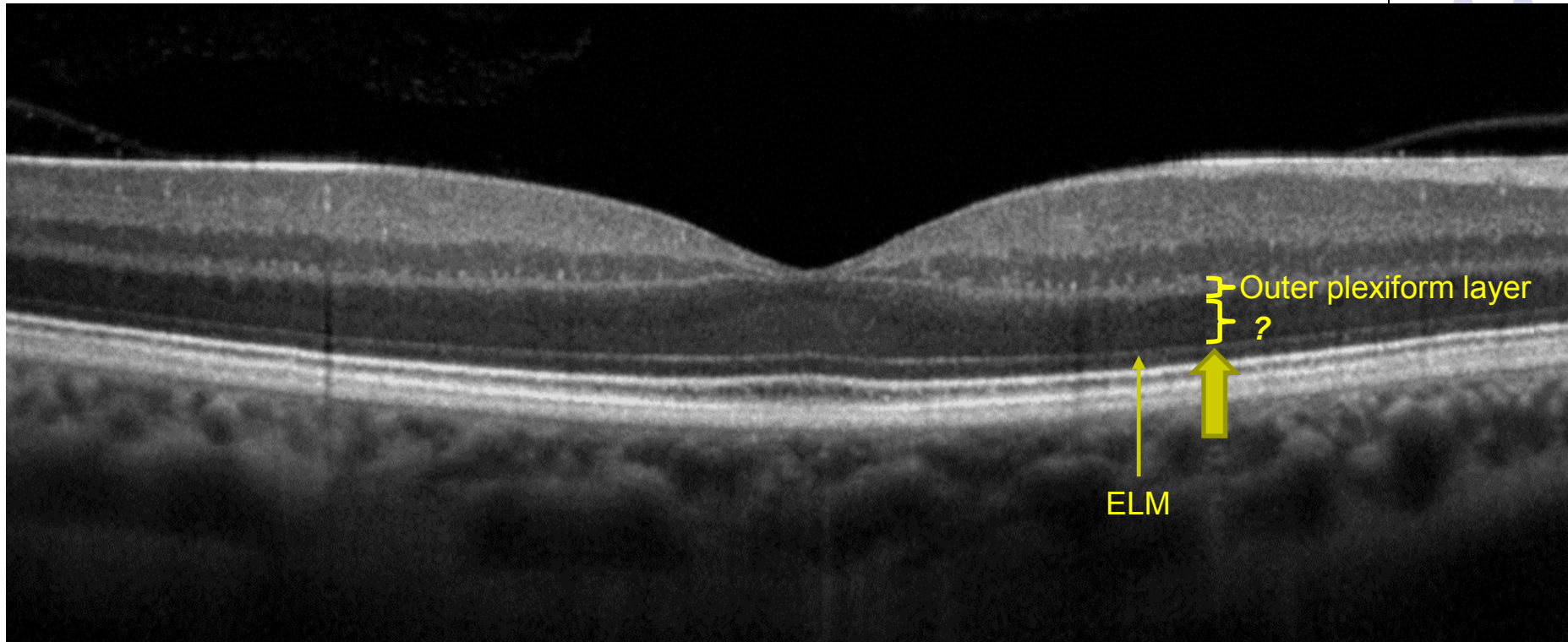


Things seem to be working out perfectly. The OCT appears to have two layers left to identify. Conveniently, there are two yet-unassigned layers—a processes layer (the outer plexiform layer )



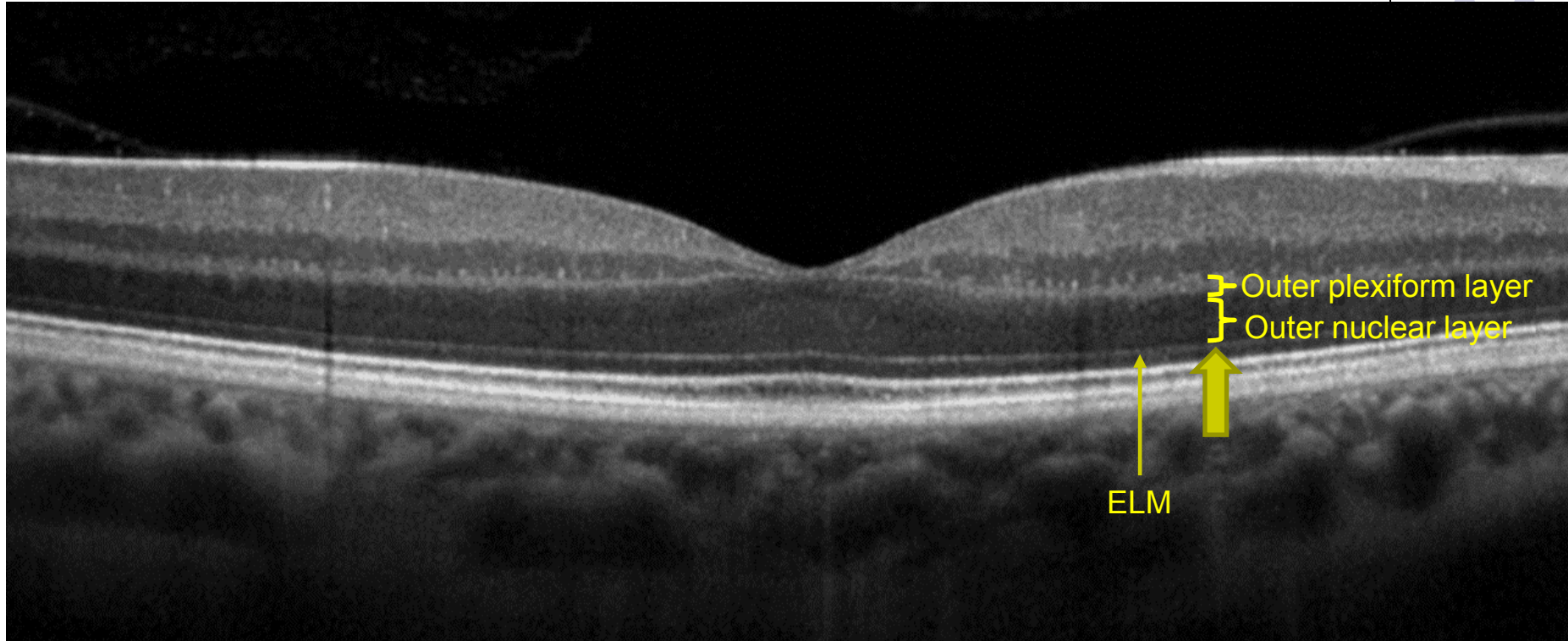
Q

## Retinal Anatomy and Histology



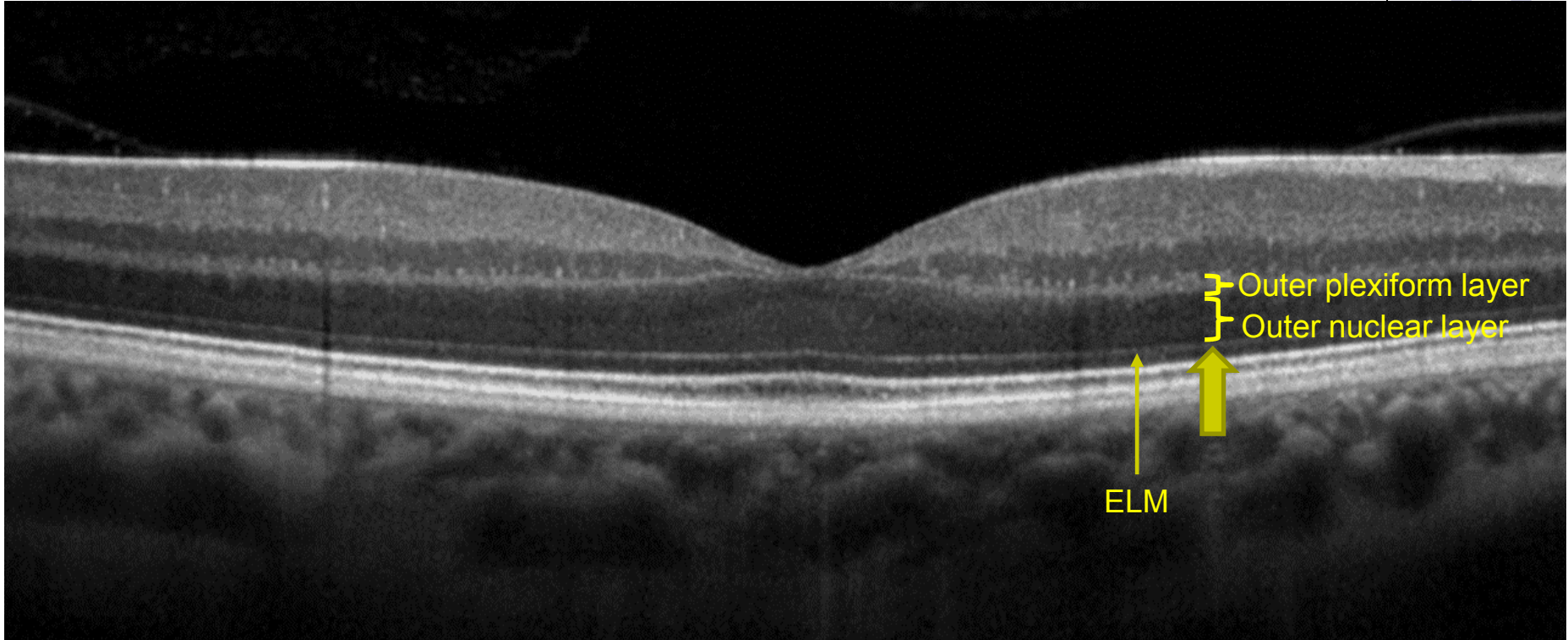
Things seem to be working out perfectly. The OCT appears to have two layers left to identify. Conveniently, there are two yet-unassigned layers—a processes layer (the outer plexiform layer), and a cell-bodies layer (the three words).

# A

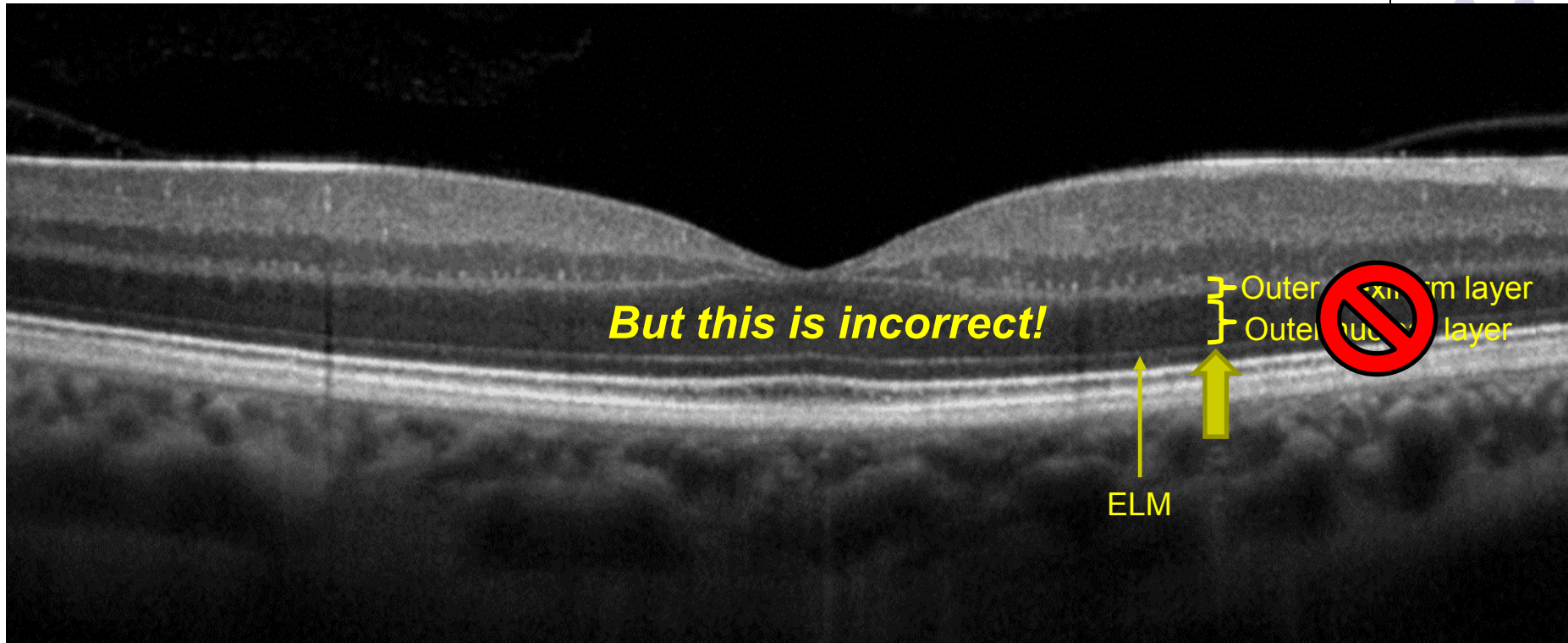


Things seem to be working out perfectly. The OCT appears to have two layers left to identify. Conveniently, there are two yet-unassigned layers—a processes layer (the outer plexiform layer), and a cell-bodies layer (the outer nuclear layer).

# A

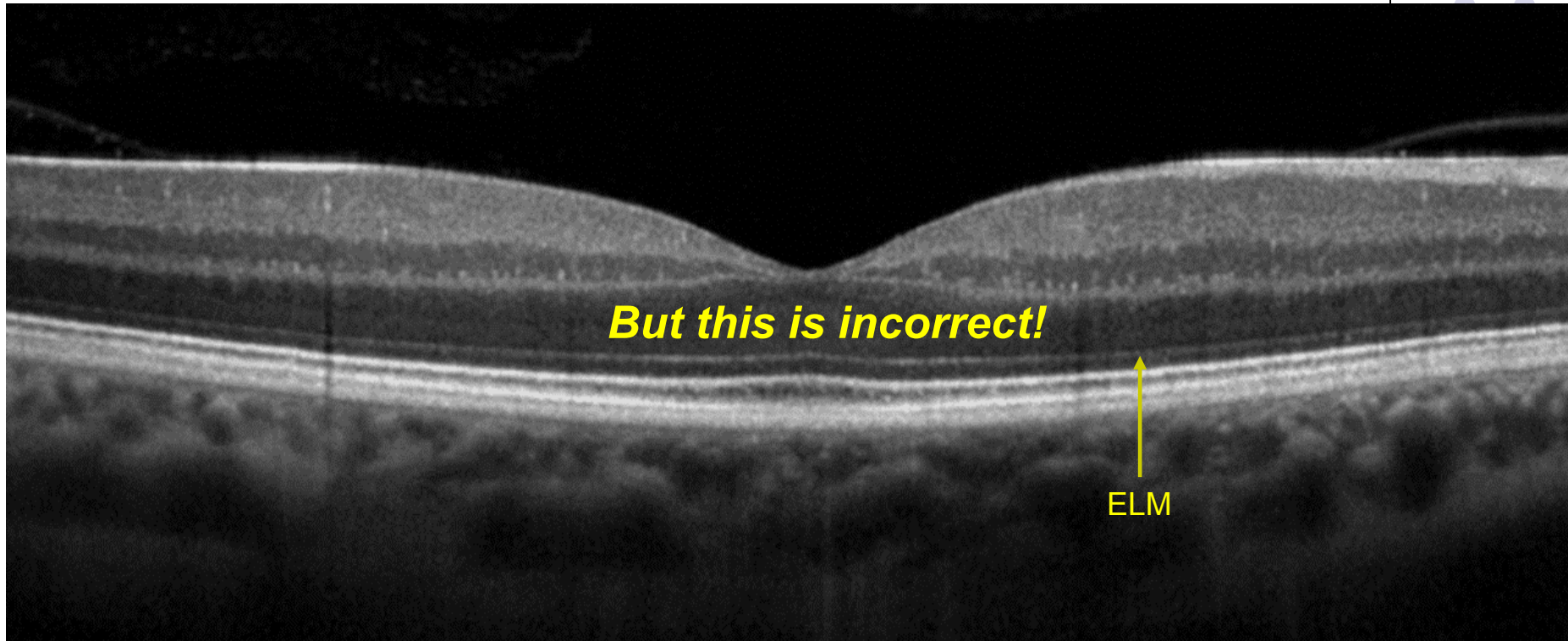


Things seem to be working out perfectly. The OCT appears to have two layers left to identify. Conveniently, there are two yet-unassigned layers—a processes layer (the outer plexiform layer), and a cell-bodies layer (the outer nuclear layer). Not uncommonly, you will see OCTs labeled in just this fashion.



Things seem to be working out perfectly. The OCT appears to have two layers left to identify. Conveniently, there are two yet-unassigned layers—a processes layer (the outer plexiform layer), and a cell-bodies layer (the outer nuclear layer). Not uncommonly, you will see OCTs labeled in just this fashion.

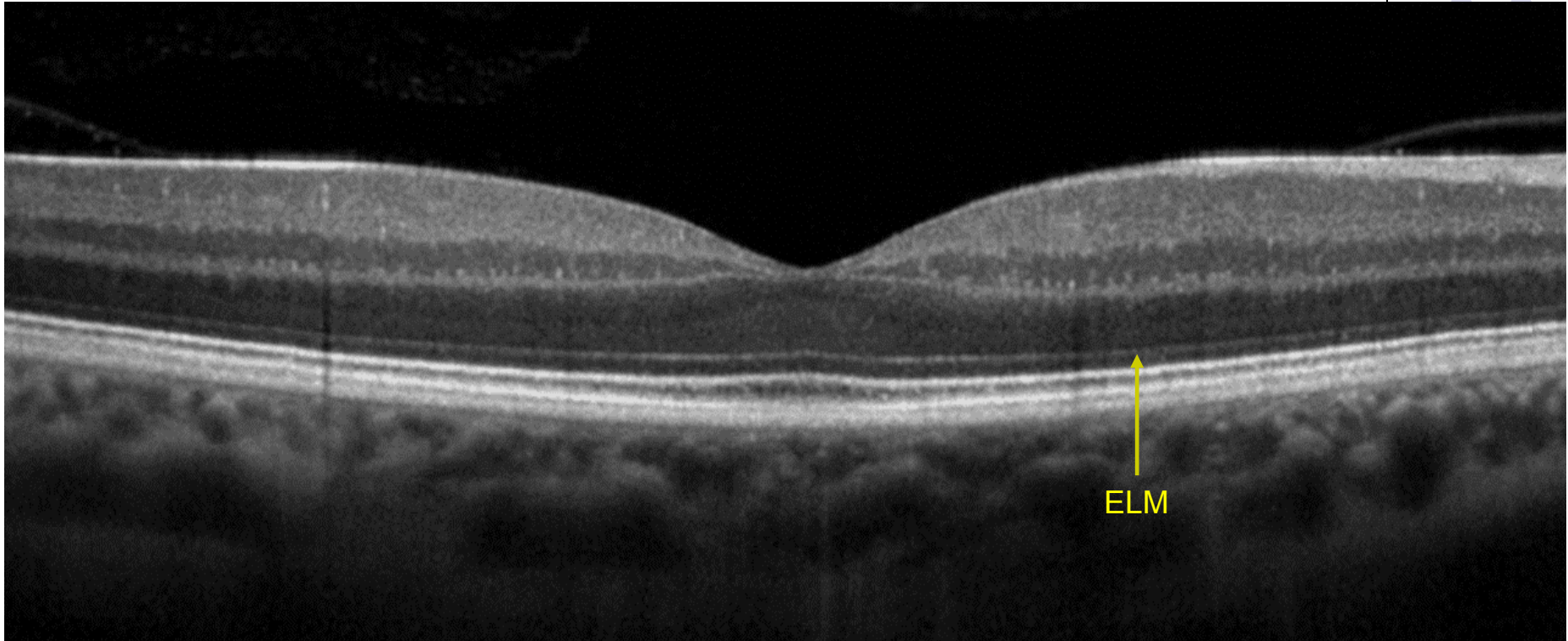
***But this is incorrect!***



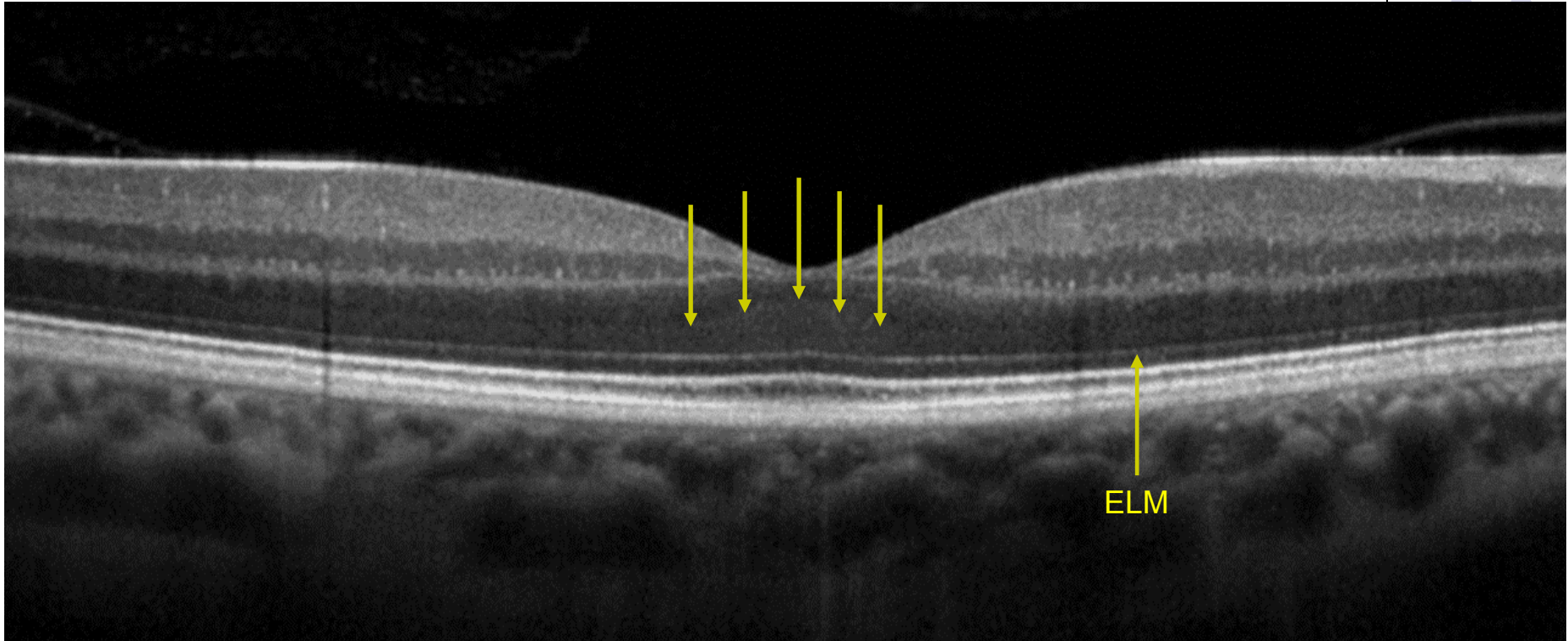
Things seem to be working out perfectly. The OCT ~~appears to have two~~ <sup>has three</sup> layers left to identify. Conveniently, there are two yet-unassigned layers—a processes layer (the outer plexiform layer), and a cell-bodies layer (the outer nuclear layer). Not uncommonly, you will see OCTs labeled in just this fashion.

Why is it incorrect? Because the OCT has **three** layers left—not two!

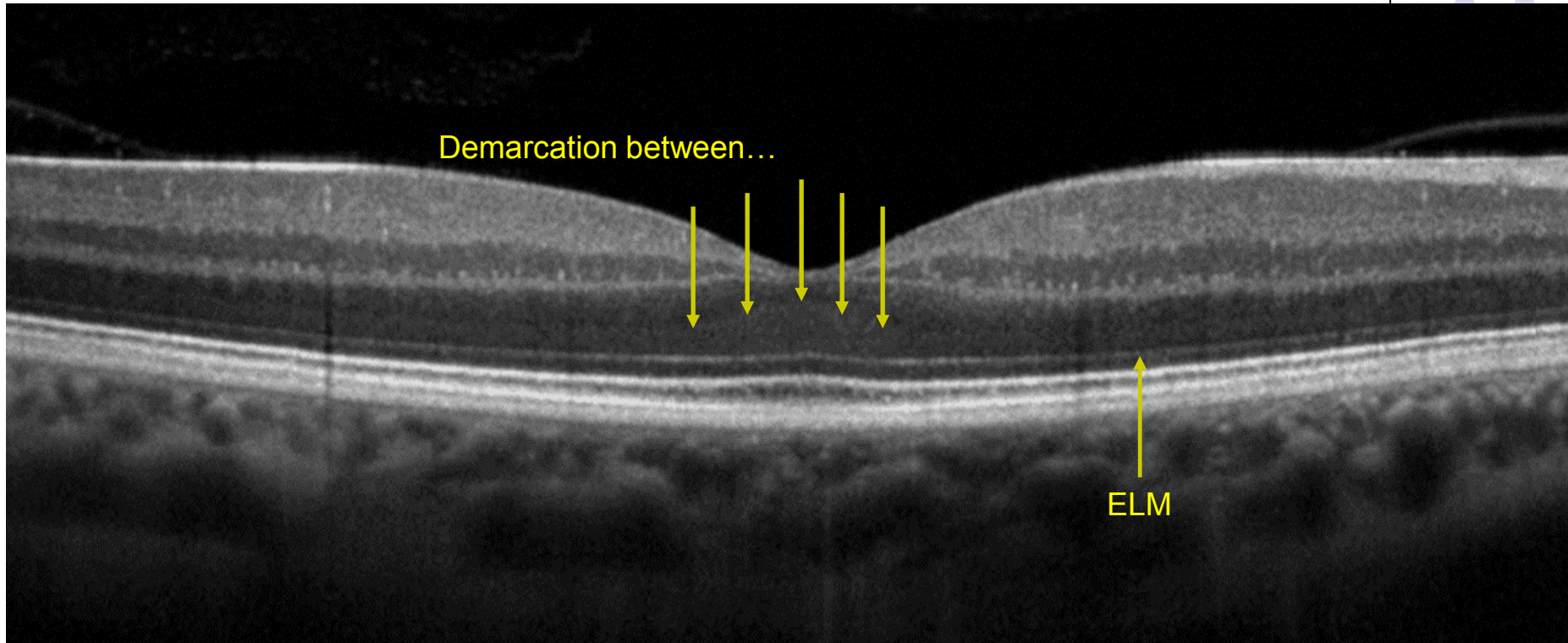




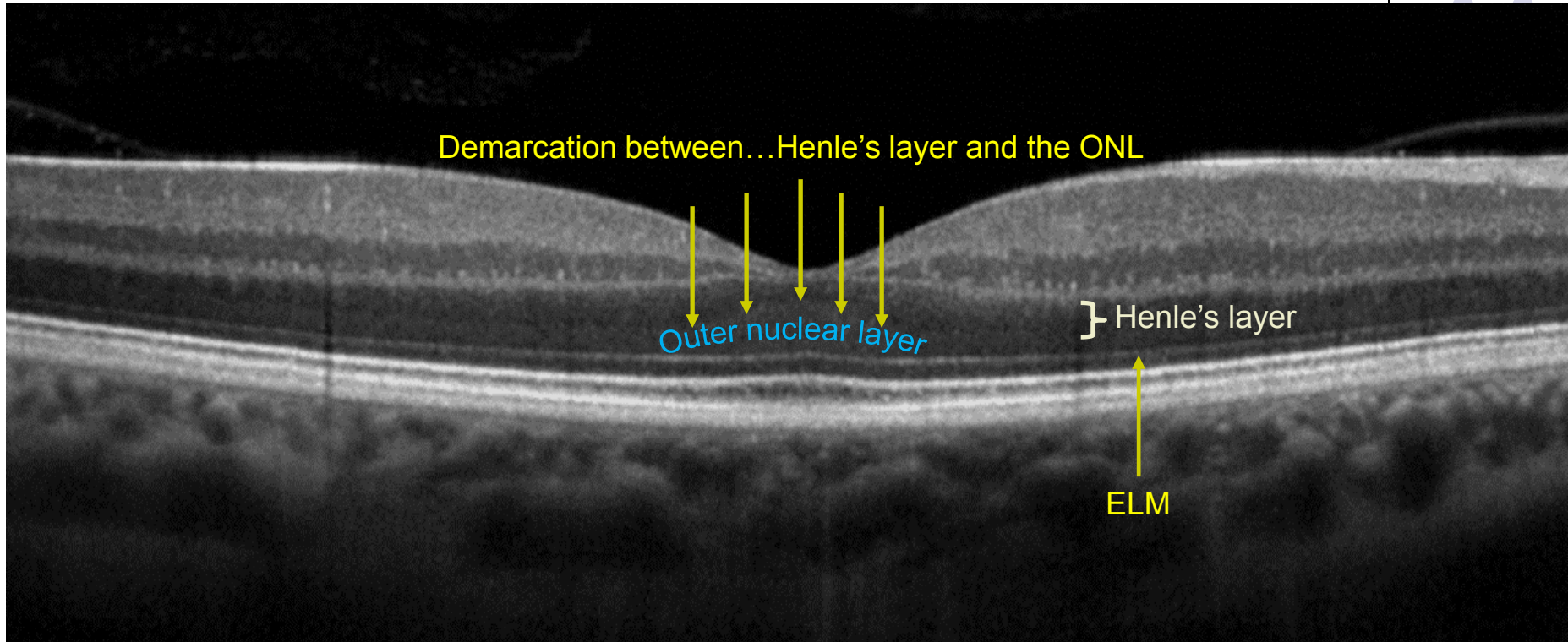
Look carefully at the remaining darker portion, and you will note the presence of a subtle demarcation line within it. (I will point it out on the next slide.)



Look carefully at the remaining darker portion, and you will note the presence of a subtle demarcation line within it. (I will point it out on the next slide.)



Look carefully at the remaining darker portion, and you will note the presence of a subtle demarcation line within it. (I will point it out on the next slide.) This line demarcates between the  and .

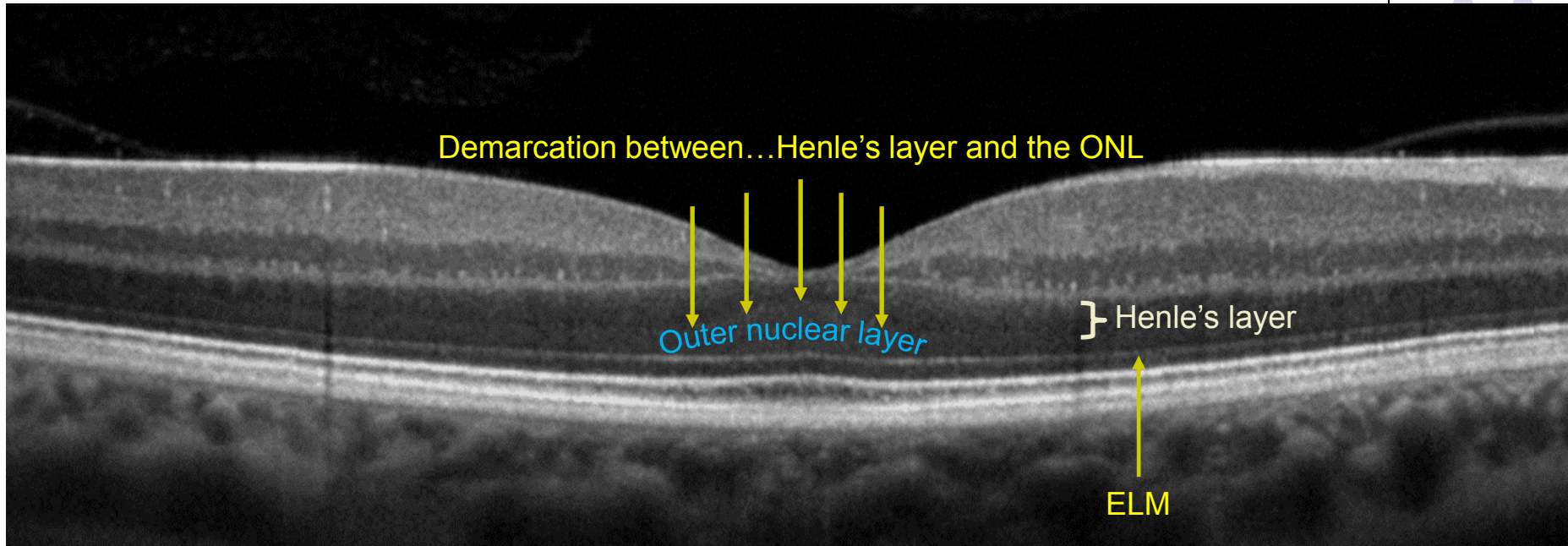


Look carefully at the remaining darker portion, and you will note the presence of a subtle demarcation line within it. (I will point it out on the next slide.) This line demarcates between the outer nuclear layer and *Henle's layer*.



Q

## Retinal Anatomy and Histology

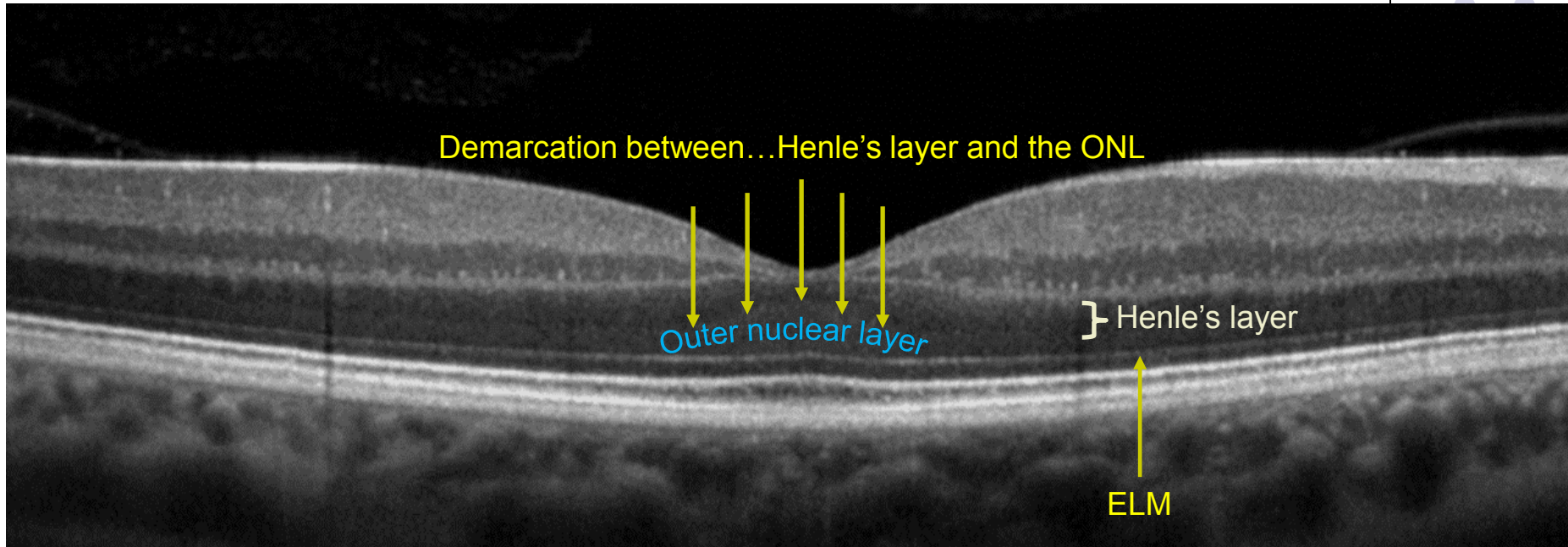


We mentioned Henle's layer earlier in the context of the abb., when we noted that the terms were often (and erroneously) treated as synonyms.

the outer nuclear layer and **Henle's layer**.

# A

## Retinal Anatomy and Histology



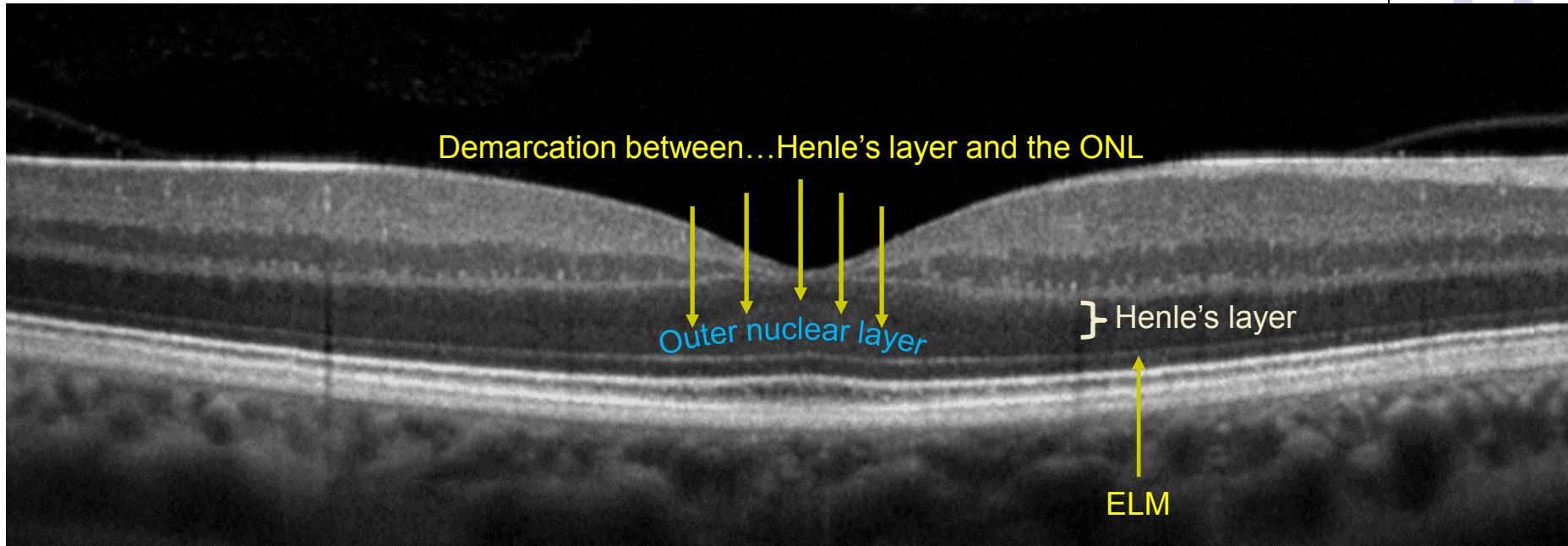
We mentioned Henle's layer earlier in the context of the OPL , when we noted that the terms were often (and erroneously) treated as synonyms.

the outer nuclear layer and **Henle's layer**



Q

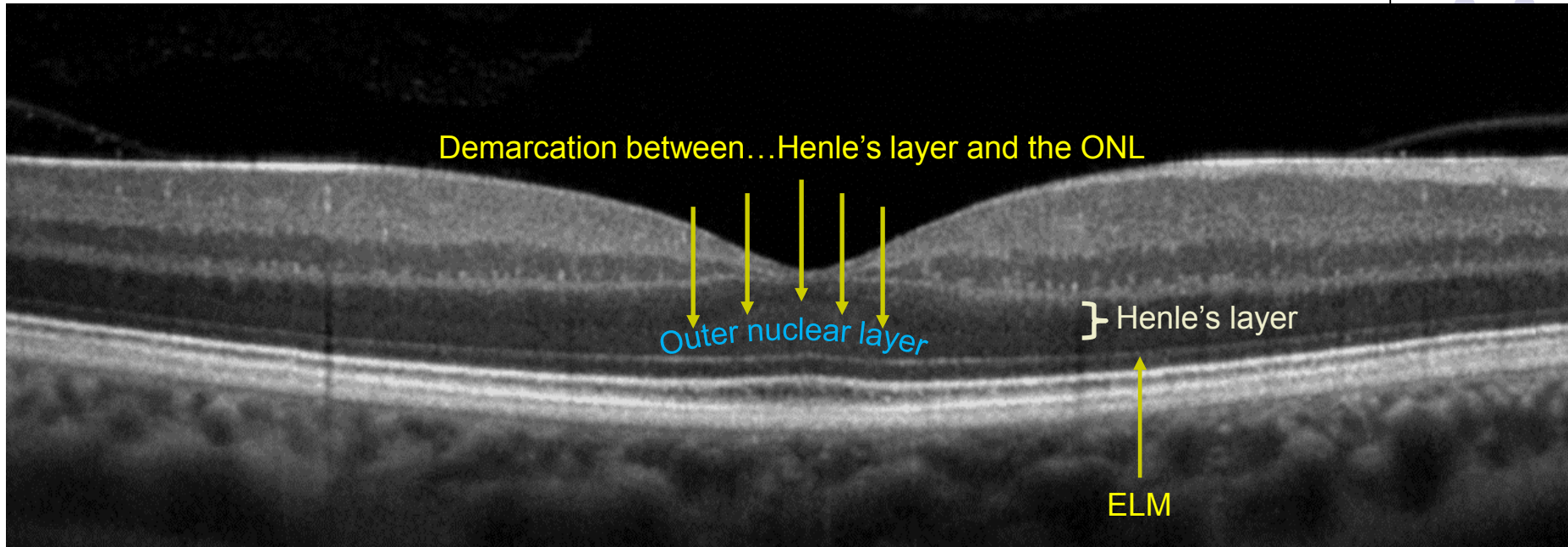
## Retinal Anatomy and Histology



We mentioned Henle's layer earlier in the context of the OPL, when we noted that the terms were often (and erroneously) treated as synonyms. Here's why they're not synonymous. Recall that the OPL consists of the axonal processes of the  and the dendritic processes of the  cells. (There's some  processes in there as well.)

the outer nuclear layer and **Henle's layer**.

# A

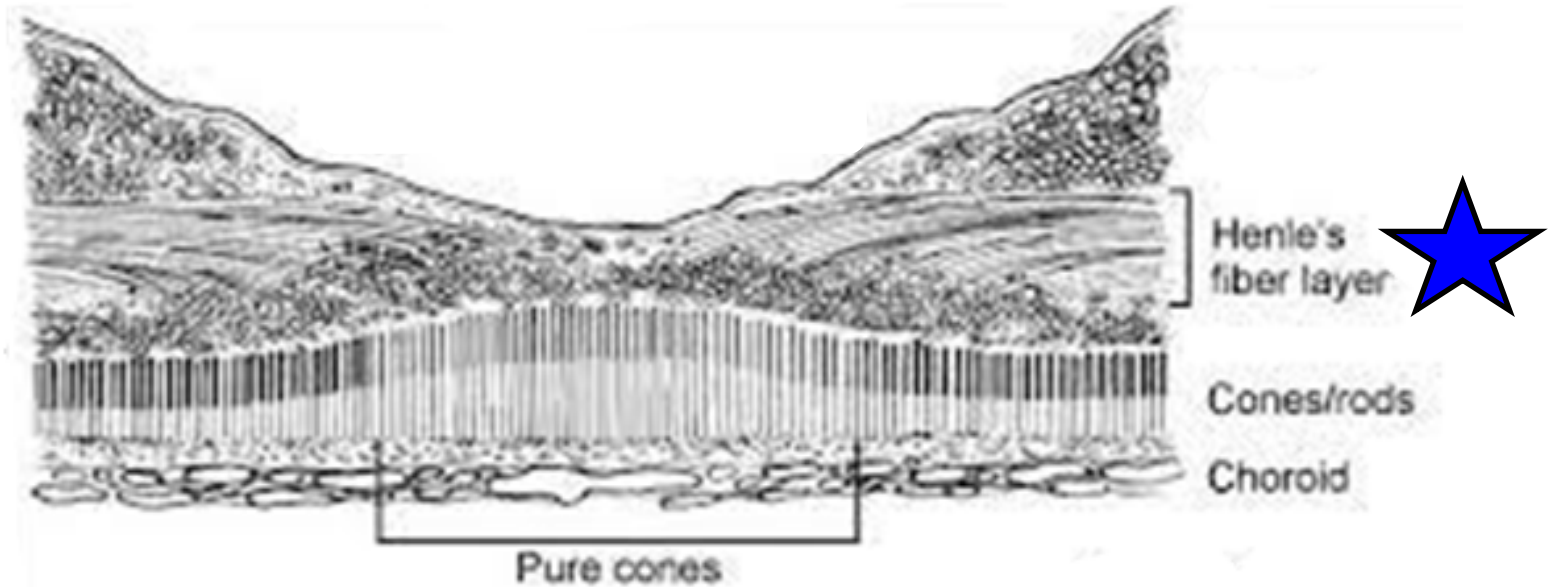


We mentioned Henle's layer earlier in the context of the OPL, when we noted that the terms were often (and erroneously) treated as synonyms. Here's why they're not synonymous. Recall that the OPL consists of the axonal processes of the PRs and the dendritic processes of the bipolar cells. (There's some horizontal-cell processes in there as well.)

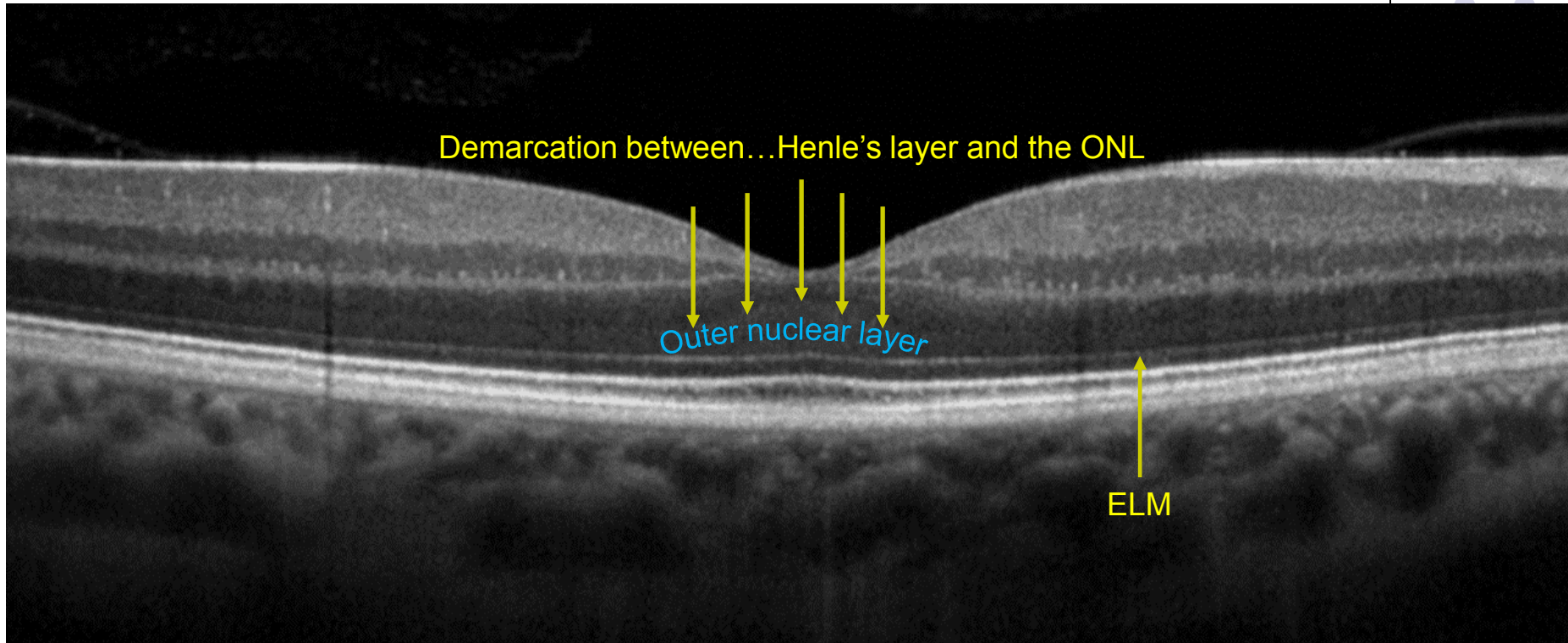
the outer nuclear layer and **Henle's layer**.



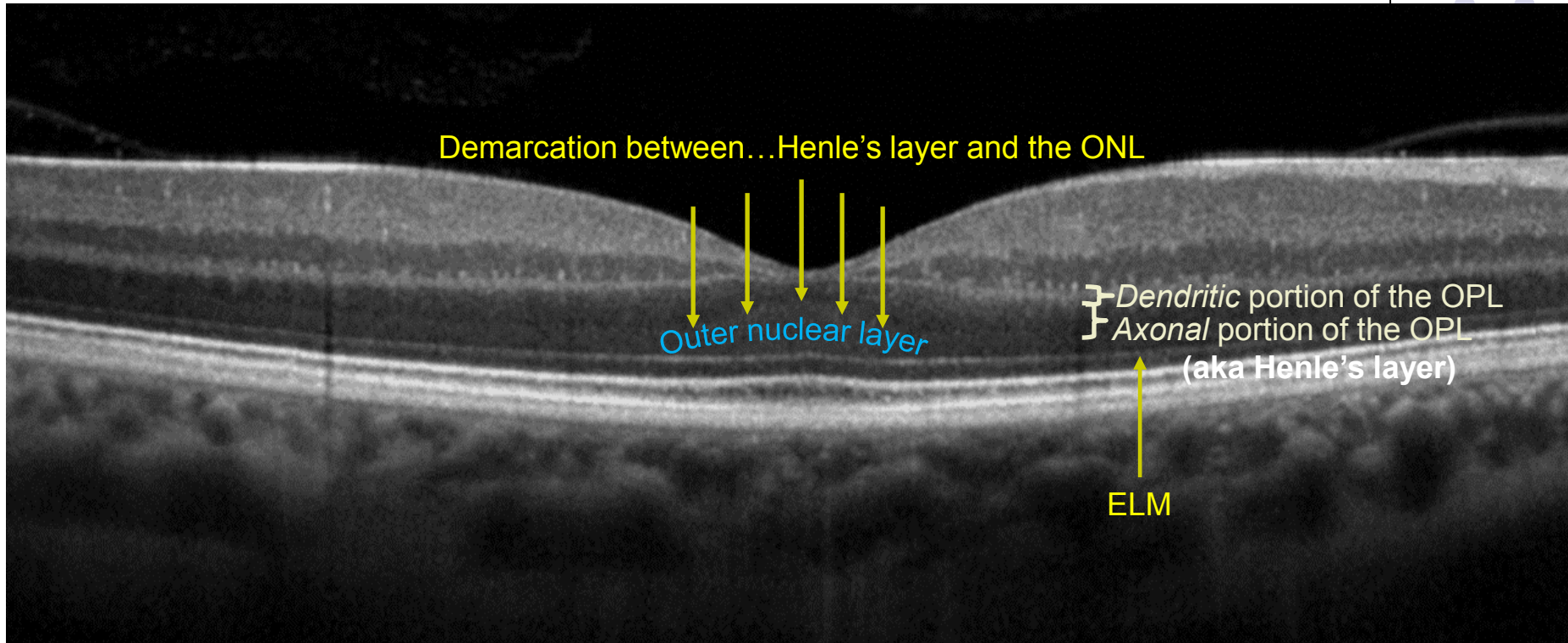
# Retinal Anatomy and Histology



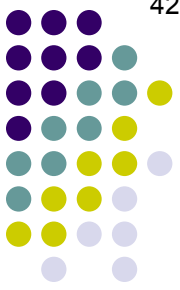
However, in the fovea/parafoveal region, the axonal processes of the PRs are elongated, and radiate directly away from the foveal center in all directions, running almost parallel to the retinal surface (see above). *These long, radially oriented axonal fibers comprise the Henle's layer portion of the OPL.*



You can now appreciate the appearance of the OCT in the foveal region. The orientation of the PR axons leads the OCT to 'see' them as a layer separate and distinct from that of the bipolar-cell dendrites with which they form the outer plexus.

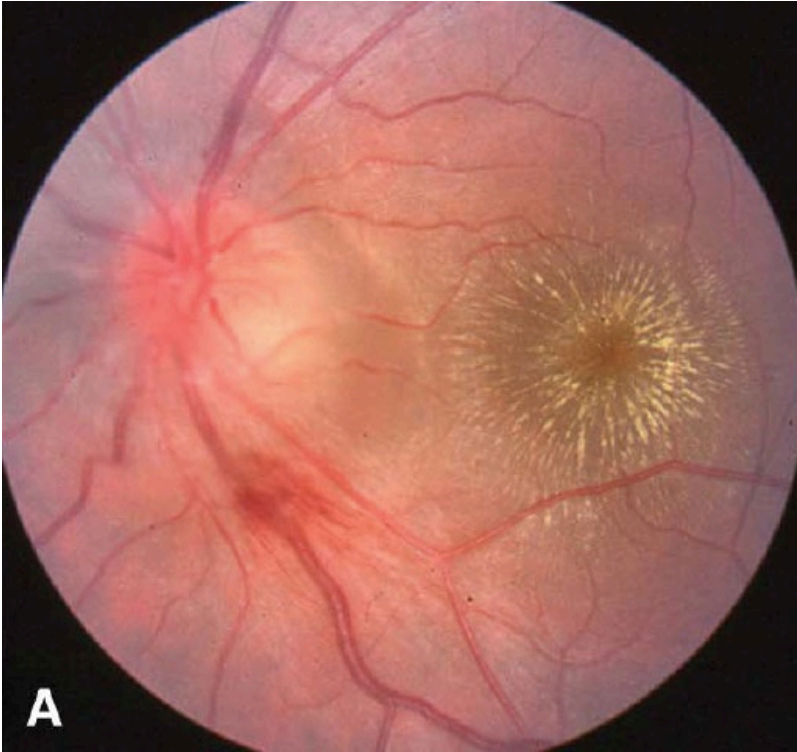


You can now appreciate the appearance of the OCT in the foveal region. The orientation of the PR axons leads the OCT to 'see' them as a layer separate and distinct from that of the bipolar-cell dendrites with which they form the outer plexus. This is why it's misleading to treat the terms *Henle's layer* and *OPL* as synonyms: Technically speaking, Henle's layer is the axonal portion of the OPL in the foveal and parafoveal region.

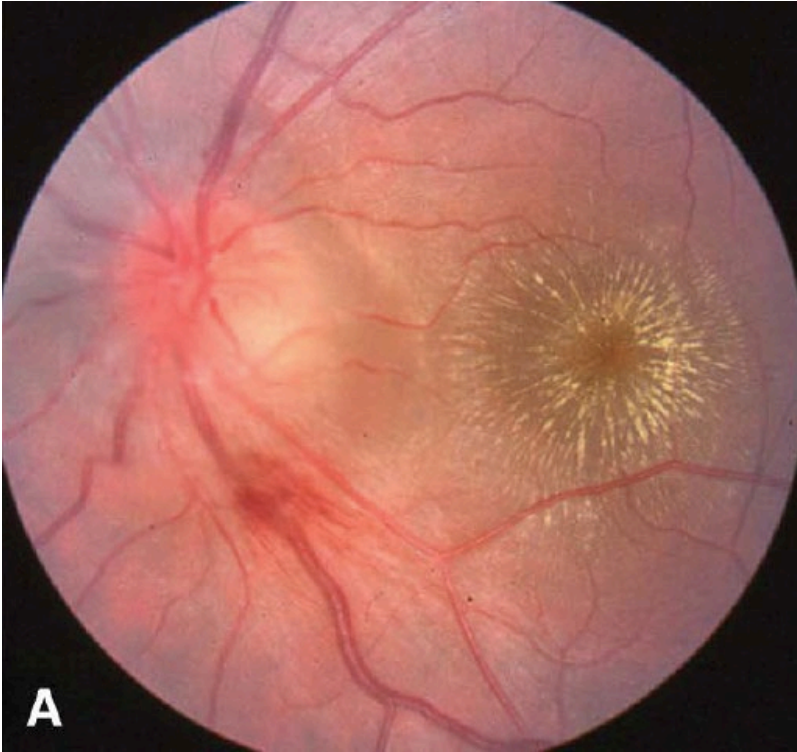
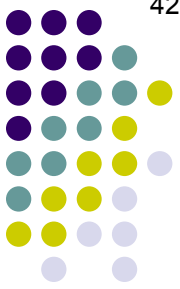


## Retinal Anatomy and Histology

Q

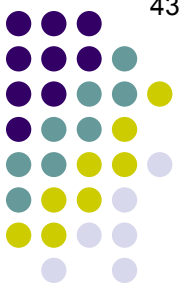


*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

**A****Retinal Anatomy and Histology****A**

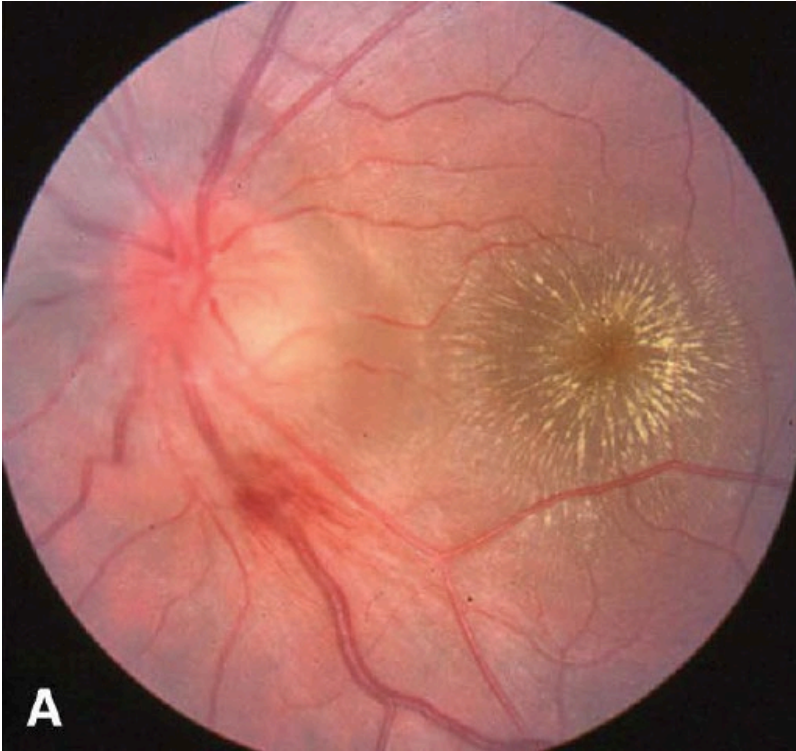
*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

Neuroretinitis (the *neuro-* part refers to the disc swelling)



## Retinal Anatomy and Histology

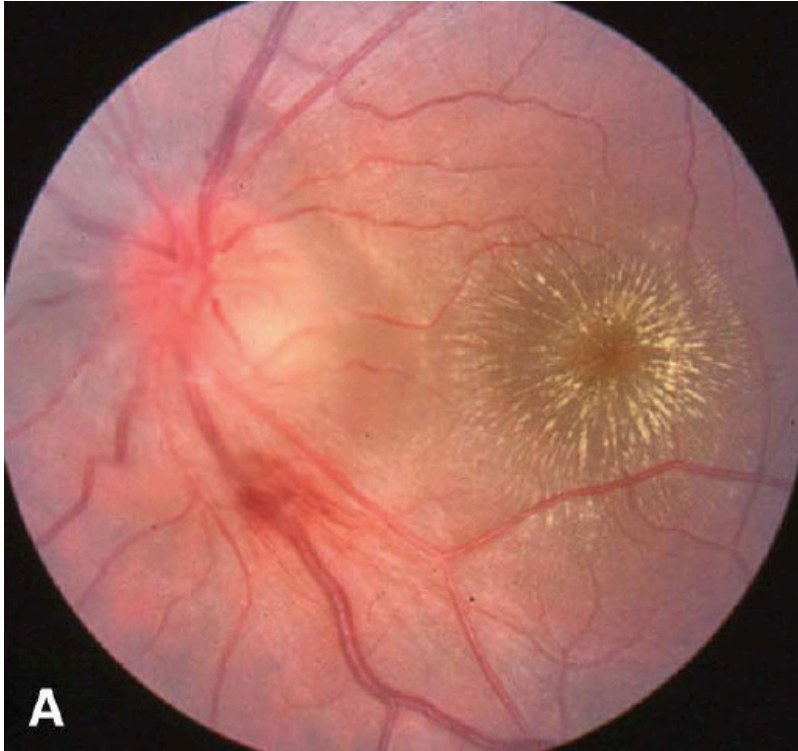
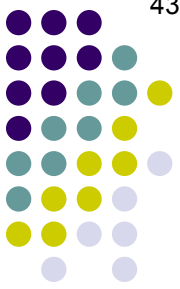
# Q



*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

Neuroretinitis (the *neuro-* part refers to the disc swelling)

*What is the classic cause? (Now I'm looking for a specific etiology.)*



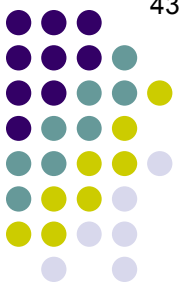
A

*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

Neuroretinitis (the *neuro-* part refers to the disc swelling)

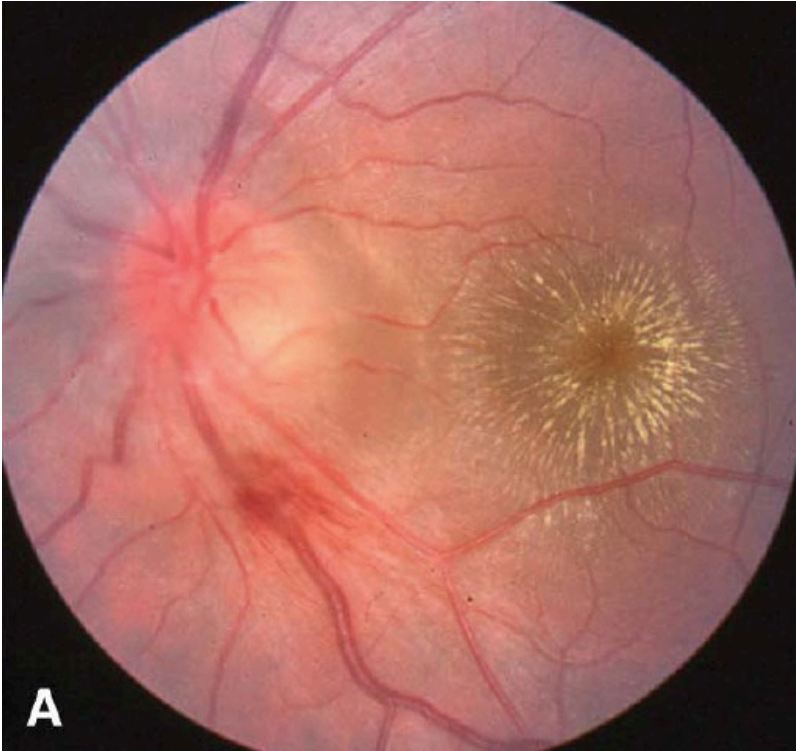
*What is the classic cause? (Now I'm looking for a specific etiology.)*

Infection with



## Retinal Anatomy and Histology

# A



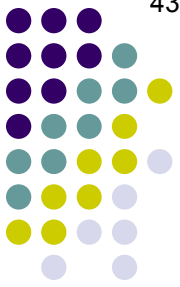
*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

Neuroretinitis (the *neuro-* part refers to the disc swelling)

*What is the classic cause? (Now I'm looking for a specific etiology.)*

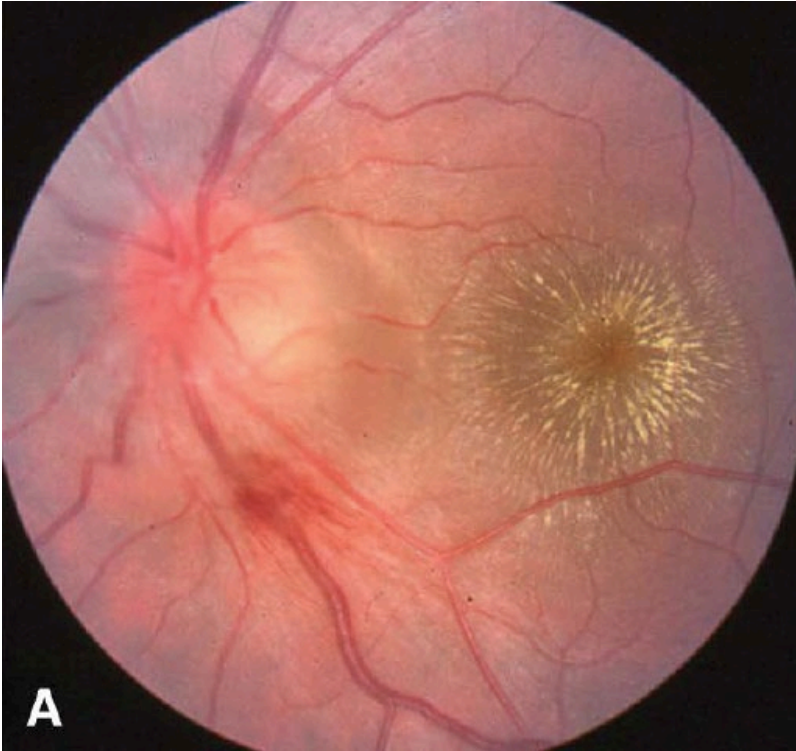
Infection with *Bartonella henslae*





## Retinal Anatomy and Histology

Q



*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

Neuroretinitis (the *neuro-* part refers to the disc swelling)

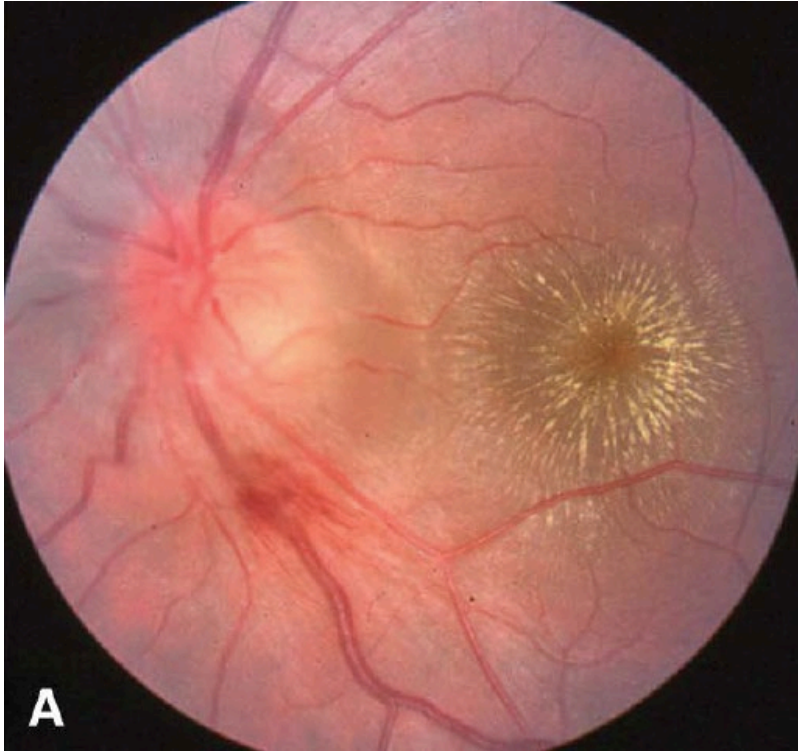
*What is the classic cause? (Now I'm looking for a specific etiology.)*

Infection with *Bartonella henslae* (aka two words disease)



## Retinal Anatomy and Histology

# A



*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

Neuroretinitis (the *neuro-* part refers to the disc swelling)

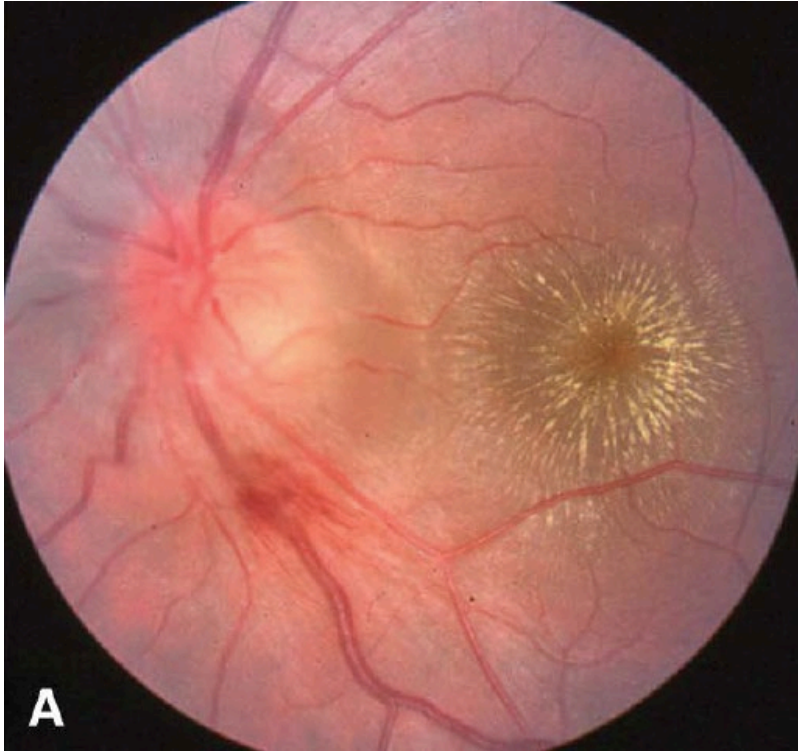
*What is the classic cause? (Now I'm looking for a specific etiology.)*

Infection with *Bartonella henselae* (aka *cat-scratch disease*)



## Retinal Anatomy and Histology

# Q



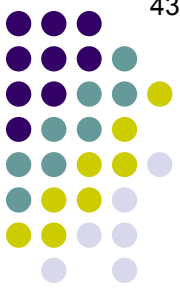
What is the descriptive term for the appearance of the macula?

*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

Neuroretinitis (the *neuro-* part refers to the disc swelling)

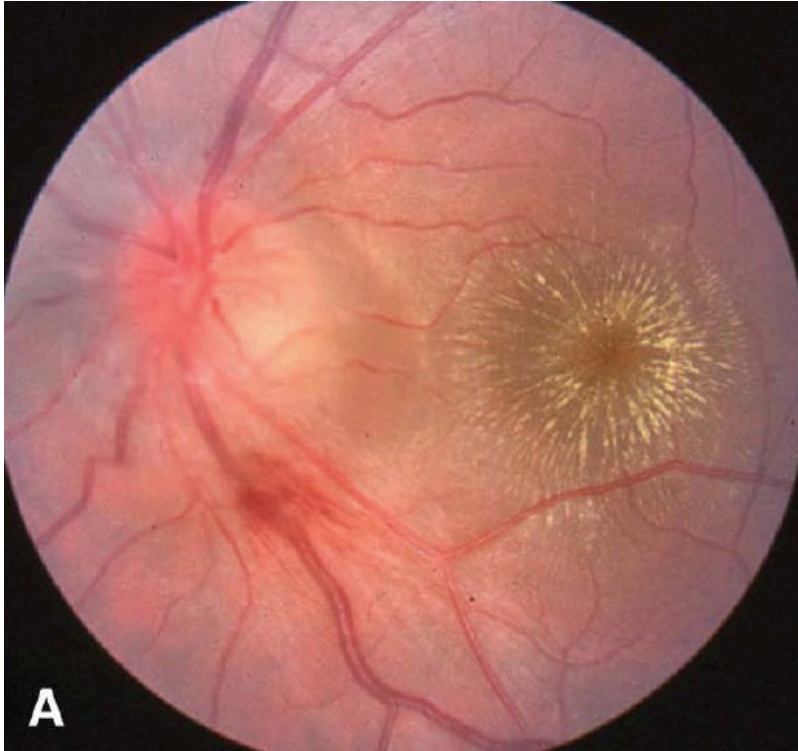
*What is the classic cause? (Now I'm looking for a specific etiology.)*

Infection with *Bartonella henselae* (aka *cat-scratch disease*)



## Retinal Anatomy and Histology

# A



What is the descriptive term for the appearance of the macula?  
'Macular star'

*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

Neuroretinitis (the *neuro-* part refers to the disc swelling)

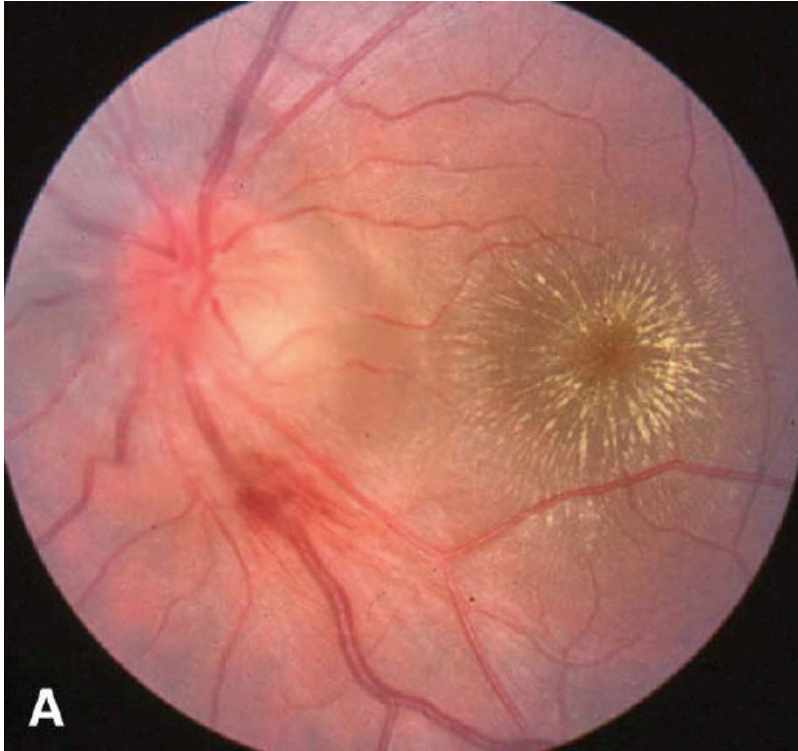
*What is the classic cause? (Now I'm looking for a specific etiology.)*

Infection with *Bartonella henslae* (aka *cat-scratch disease*)



## Retinal Anatomy and Histology

Q



What is the descriptive term for the appearance of the macula?  
'Macular star'

At long last, the point of this sidebar: Why does a macular star look the way it does?

*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

Neuroretinitis (the *neuro-* part refers to the disc swelling)

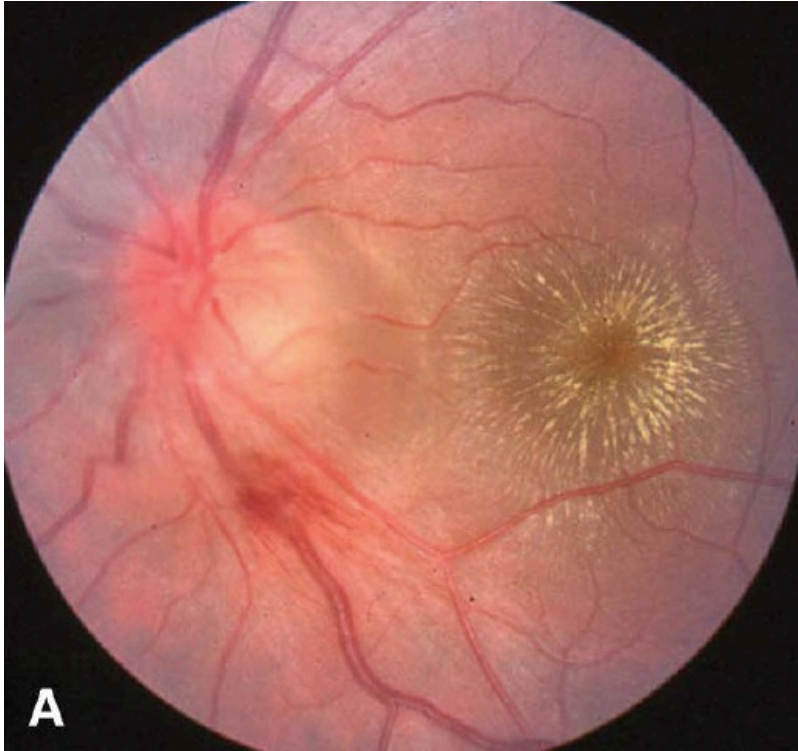
*What is the classic cause? (Now I'm looking for a specific etiology.)*

Infection with *Bartonella henslae* (aka *cat-scratch disease*)

A

# Q/A

## Retinal Anatomy and Histology



What is the descriptive term for the appearance of the macula?  
'Macular star'

At long last, the point of this sidebar: Why does a macular star look the way it does?  
Two words:

*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

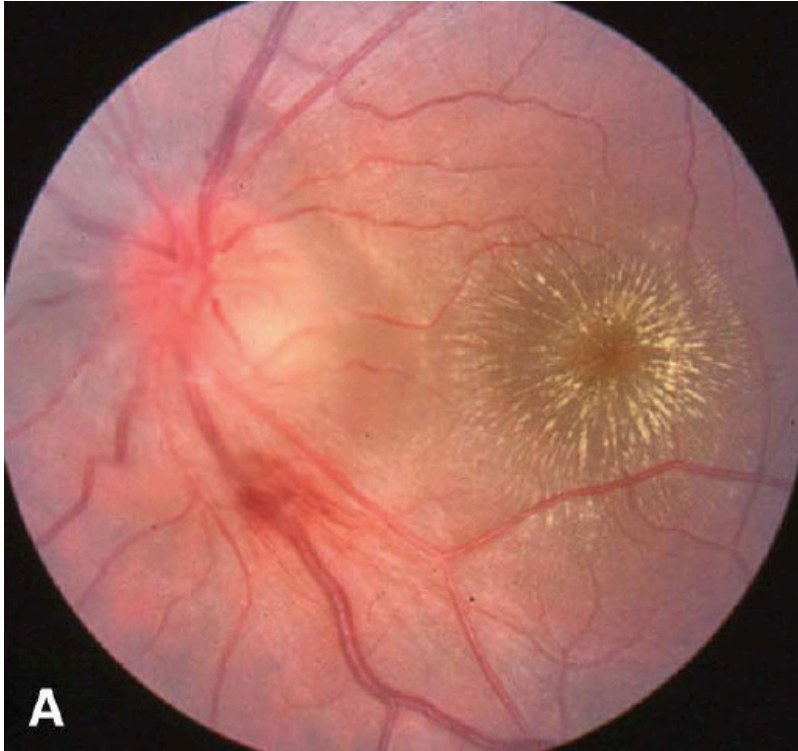
Neuroretinitis (the *neuro-* part refers to the disc swelling)

*What is the classic cause? (Now I'm looking for a specific etiology.)*

Infection with *Bartonella henslae* (aka *cat-scratch disease*)

A

## Retinal Anatomy and Histology



What is the descriptive term for the appearance of the macula?  
'Macular star'

At long last, the point of this sidebar: Why does a macular star look the way it does?  
Two words: **Henle's layer**

*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

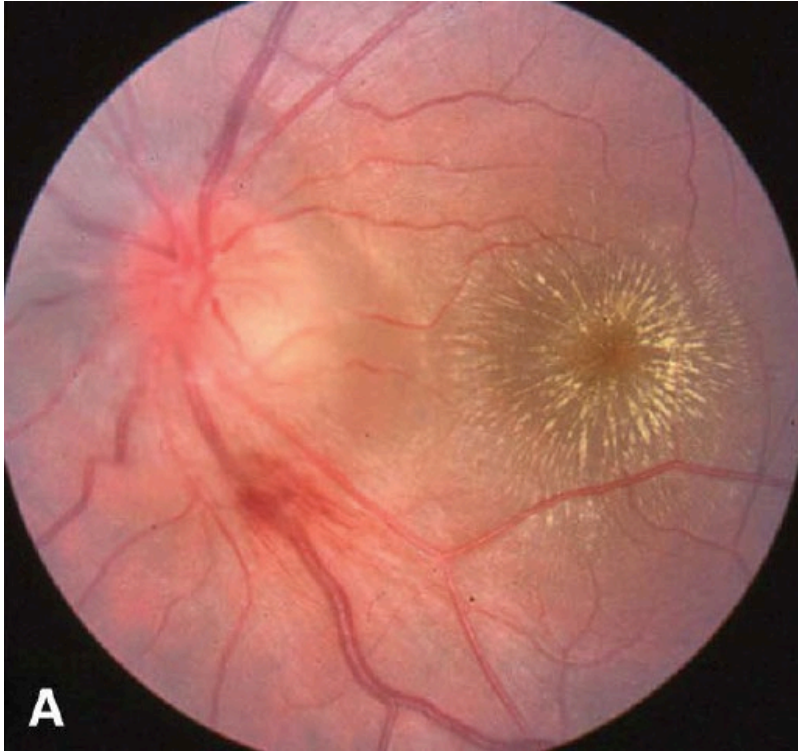
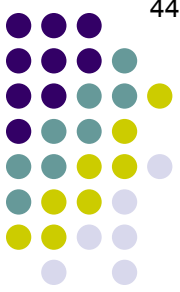
Neuroretinitis (the *neuro-* part refers to the disc swelling)

*What is the classic cause? (Now I'm looking for a specific etiology.)*

Infection with *Bartonella henslae* (aka *cat-scratch disease*)

A

## Retinal Anatomy and Histology



What is the descriptive term for the appearance of the macula?  
'Macular star'

At long last, the point of this sidebar: Why does a macular star look the way it does?  
Two words: **Henle's layer**. The exudate is located within it, and thus mirrors Henle's radial orientation.

*Highly relevant sidebar: What condition is depicted here? (Looking for a general term, not a specific etiology.)*

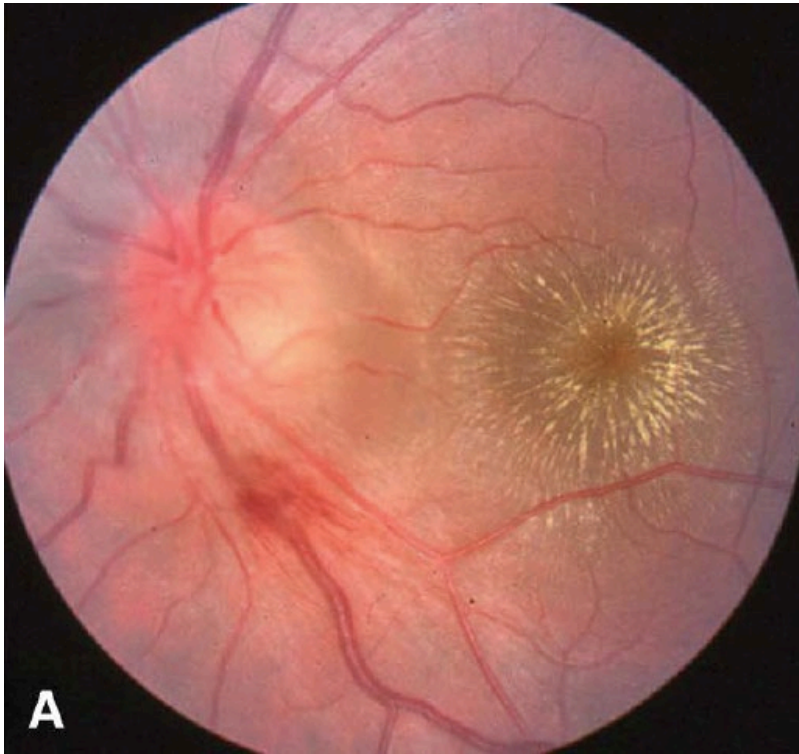
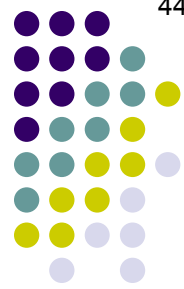
Neuroretinitis (the *neuro-* part refers to the disc swelling)

*What is the classic cause? (Now I'm looking for a specific etiology.)*

Infection with *Bartonella henslae* (aka **cat-scratch disease**)



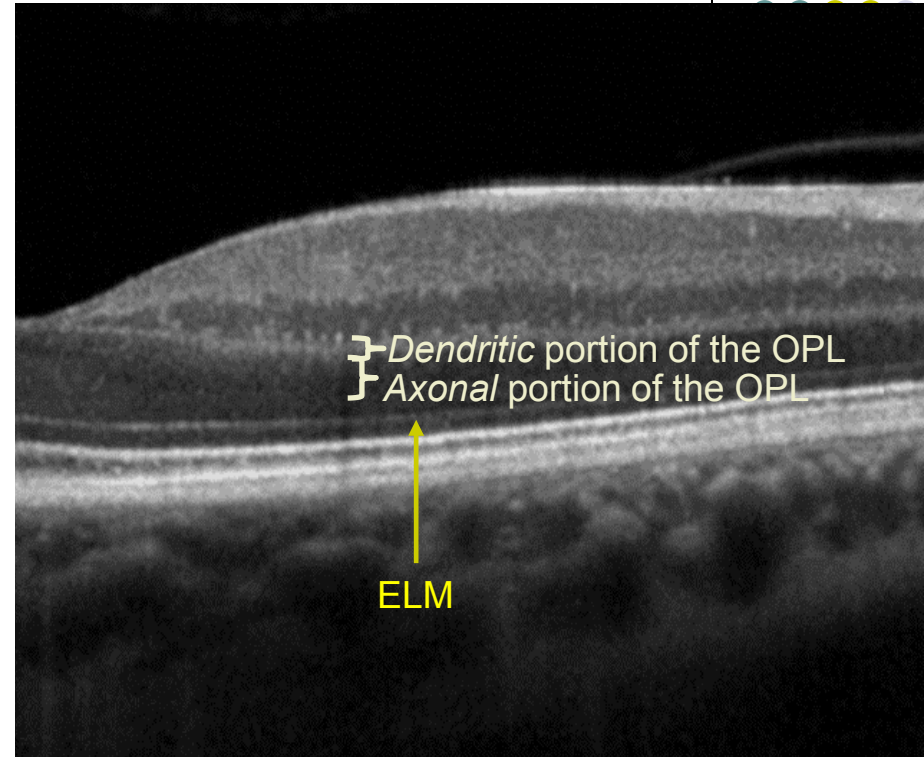
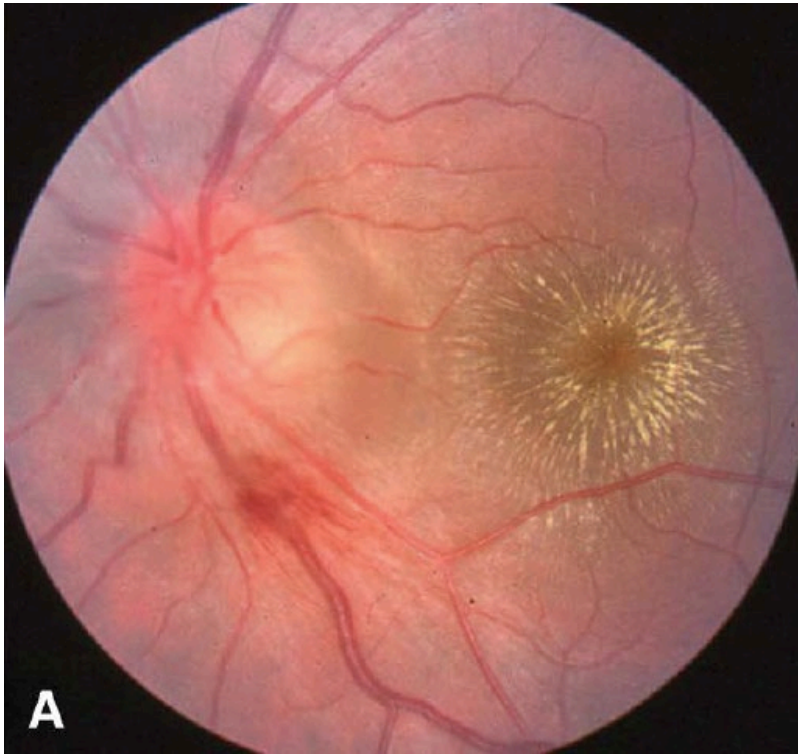
# Retinal Anatomy and Histology



A

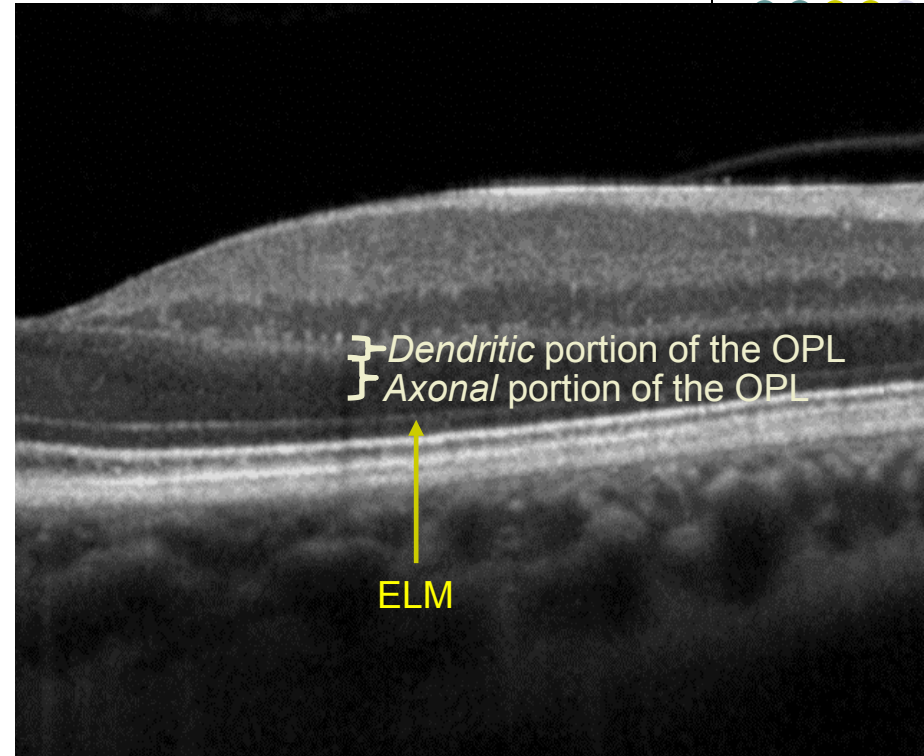
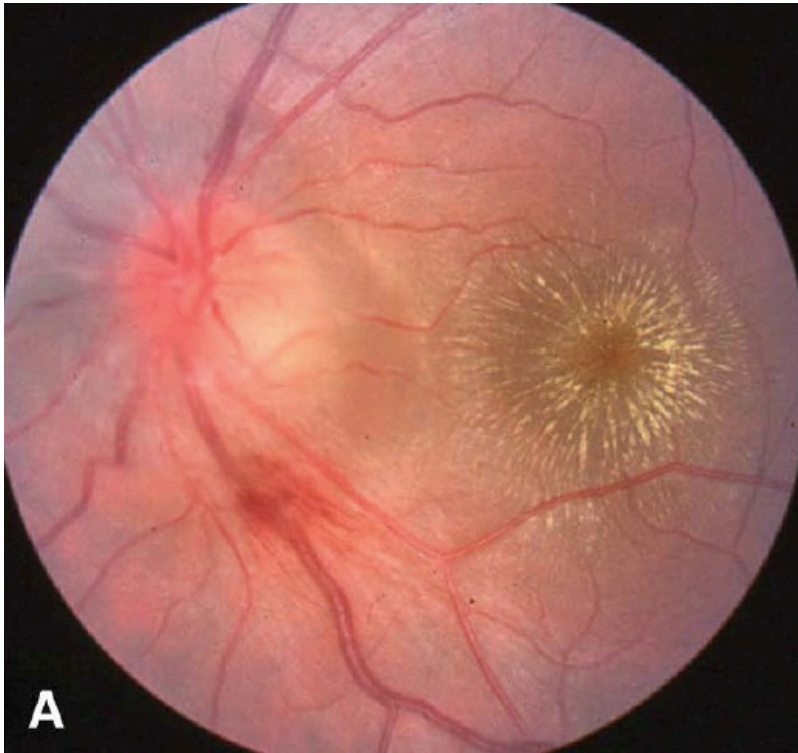
*Make a connection in your head between the clinical appearance of a macular star...*

## Retinal Anatomy and Histology



*Make a connection in your head between the clinical appearance of a macular star... and the OCT appearance of Henle's layer.*

## Retinal Anatomy and Histology

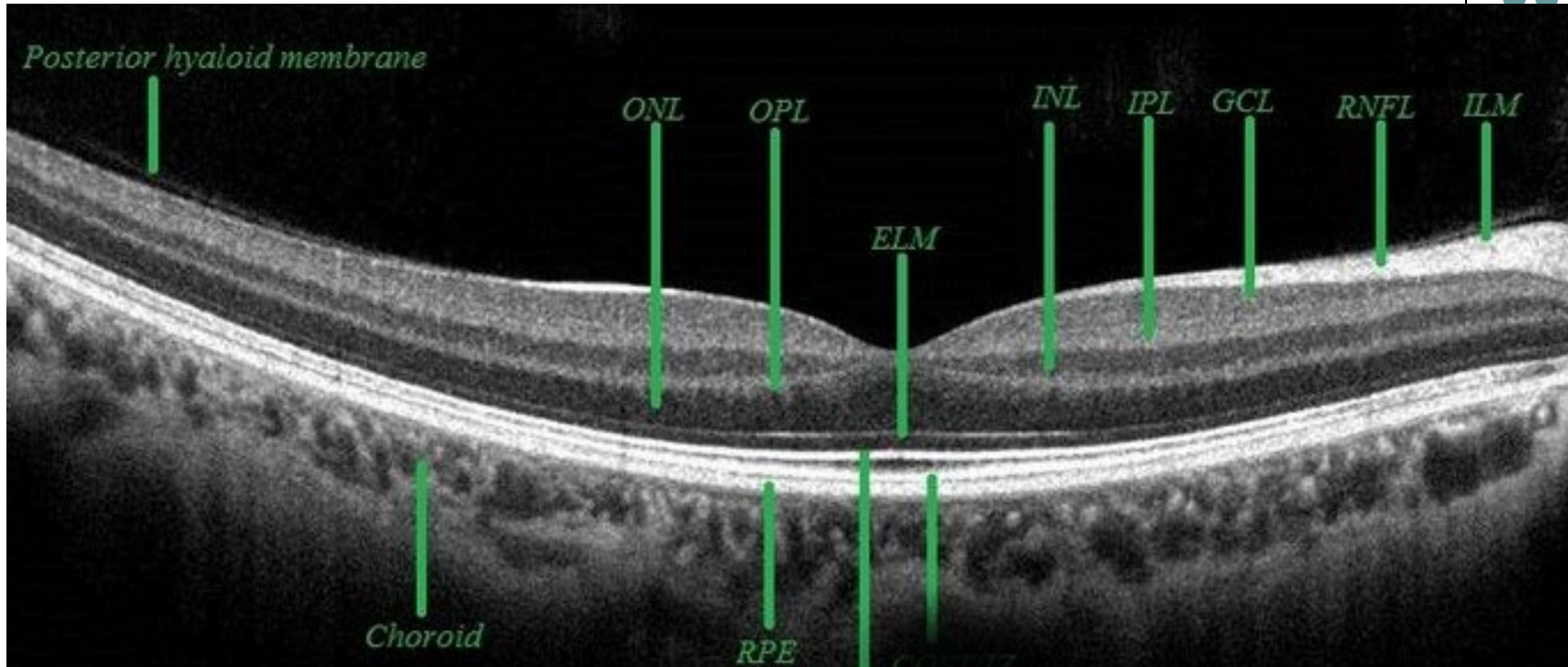


*Make a connection in your head between the clinical appearance of a macular star... and the OCT appearance of Henle's layer. While they look nothing like one another, each arises from the same fundamental fact of retinal anatomy/histology!*



One last word about this OPL/Henle's layer issue—you will find that the *BCSC* books are not consistent in how they use these terms. (For example, the *Retina* book uses them as synonyms on one page, and as referring to separate layers two pages later.)

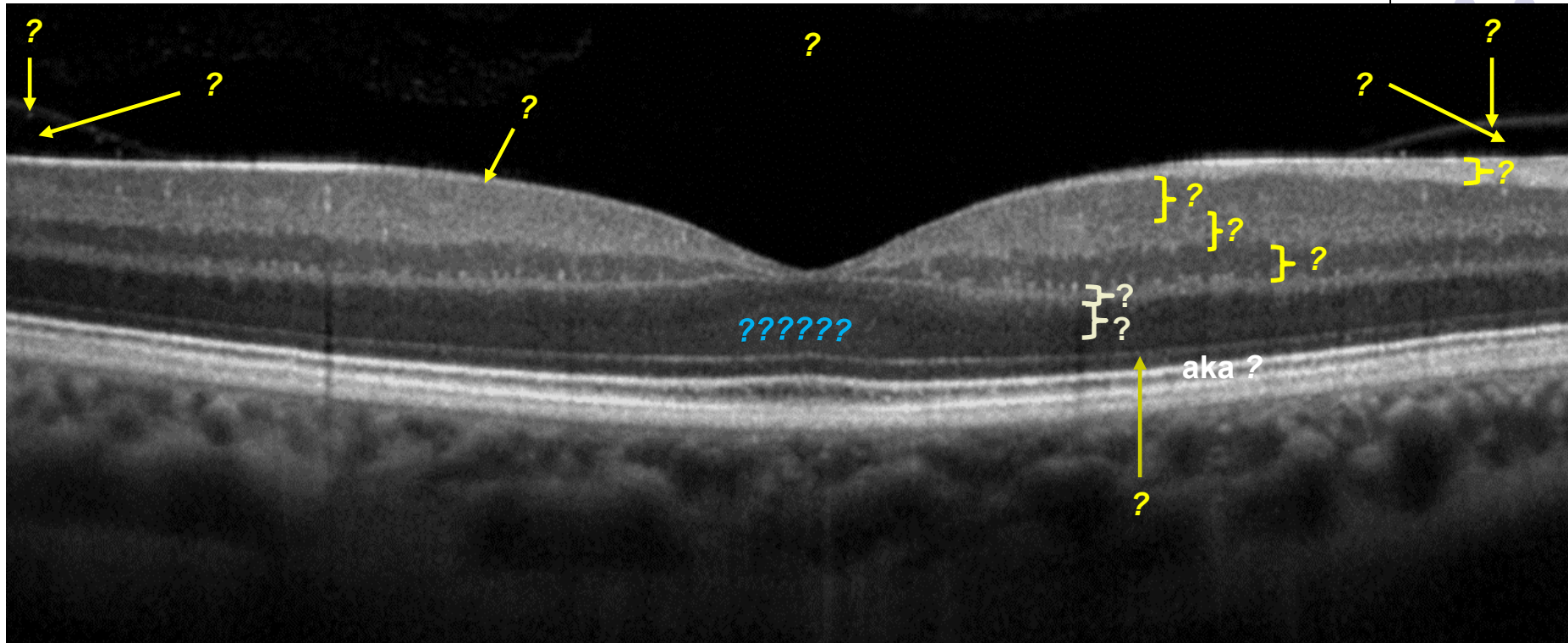
## Retinal Anatomy and Histology



One last word about this OPL/Henle's layer issue—you will find that the *BCSC* books are not consistent in how they use these terms. (For example, the *Retina* book uses them as synonyms on one page, and as referring to separate layers two pages later.) Likewise, you will frequently encounter OCT images labeled in a manner that is unclear or misleading regarding what is the OPL, what is Henle's, and what is the ONL (eg, the above). You may also find that your program's retina specialist disagrees with how I've laid things out here. **Caveat emptor.**

Q

# Retinal Anatomy and Histology



*Quiz yourself by toggling back and forth between this slide and the next.  
When you've got it, you're done!*

A

# Retinal Anatomy and Histology

