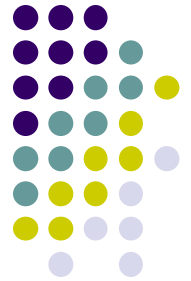


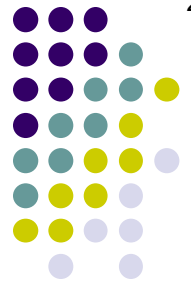
Q

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

**Phacolytic glaucoma**    **Phacoantigenic glaucoma**    **Lens-particle glaucoma**



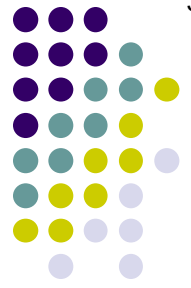
- The only one described in the *Glaucoma* book as 'rare':



A

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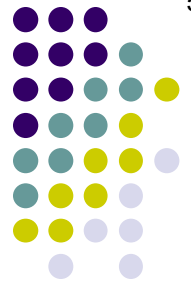
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- Mediated by inflammatory response to lens proteins in AC:  
**Phacoantigenic; phacolytic**



Q

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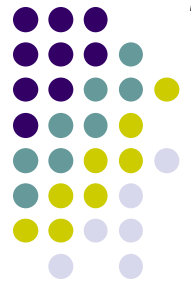
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- Mediated by IgG antibodies: **Phacoantigenic**
- TM is clogged with macrophages:

**A**

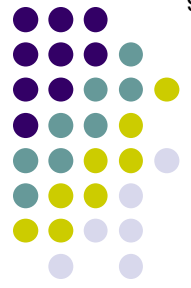
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- Mediated by IgG antibodies: **Phacoantigenic**
- TM is clogged with macrophages: **Phacolytic**





Q

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)  
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- **TM is clogged with macrophages**: Phacolytic

*‘TM clogged with macrophages’ applies also to another form of secondary OAG—which one?*



# A

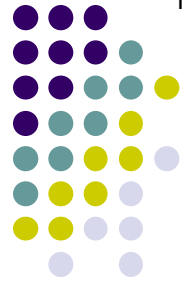
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*‘TM clogged with macrophages’ applies also to another form of secondary OAG—which one?*

Hemolytic glaucoma



Q

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Hemolytic glaucoma

*In phacolytic glaucoma, the macrophages are full of*

two words



# A

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*In phacolytic glaucoma, the macrophages are full of lens proteins .*



Q

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*In phacolytic glaucoma, the macrophages are full of lens proteins .  
What are they full of in hemolytic glaucoma?*



# A

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Hemolytic glaucoma

*In phacolytic glaucoma, the macrophages are full of lens proteins .*

*What are they full of in hemolytic glaucoma?*

Hemoglobin

**Q**

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

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- TM is clogged with macrophages: **Phacolytic**
- Chunks of cortex may be visible in AC:

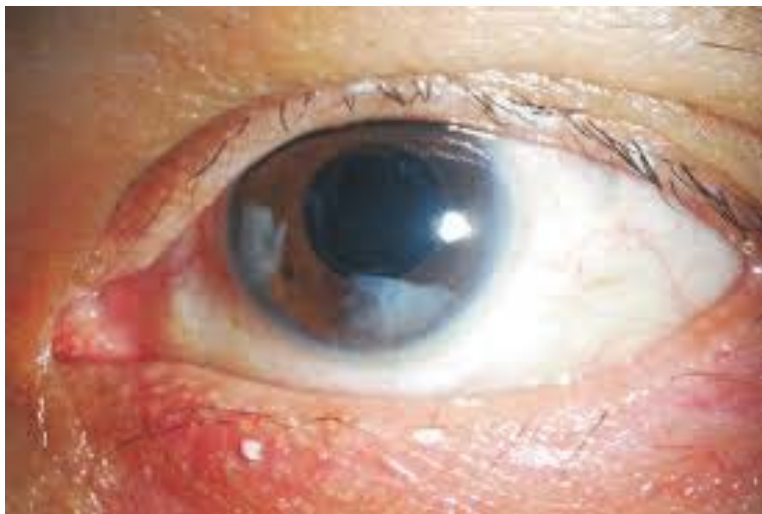
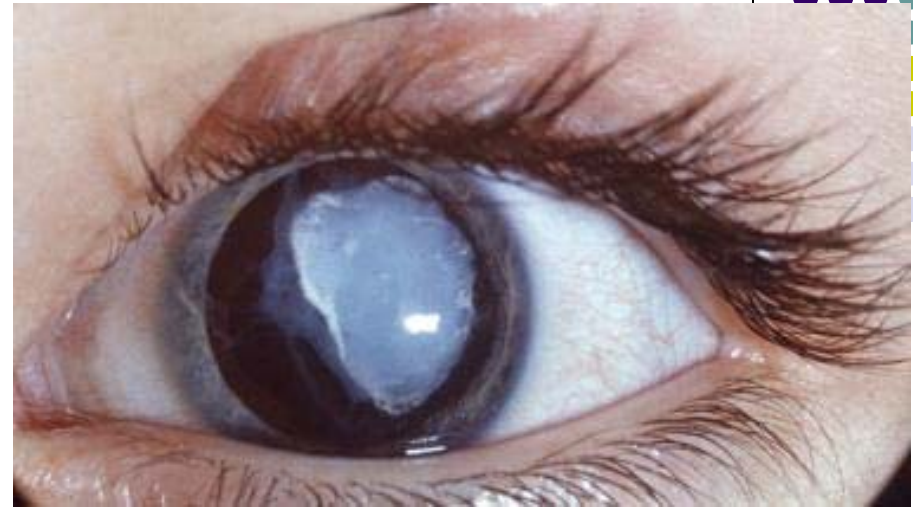
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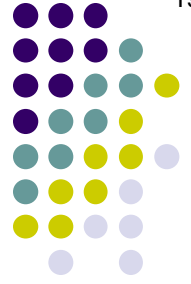
Lens-particle glaucoma

**Q**

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

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- Is also known as [condition name] *uveitis*:

**A**

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**Q**

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- Chunks of cortex may be visible in AC: **Lens particle**
- Is also known as [condition name] *uveitis*: **Phacoantigenic**
- Capsule is intact:

**A**

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*What does this imply about the status of the capsule in phacoantigenic and lens-particle glaucoma?*

**A**

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

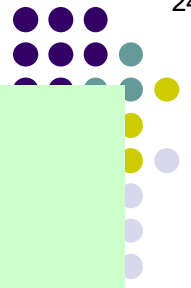
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- Chunks of cortex may be visible in AC: Lens particle
- Is also known as [condition name] *uveitis*: Phacoantigenic
- **Capsule is intact: Phacolytic**

*What does this imply about the status of the capsule in phacoantigenic and lens-particle glaucoma?*

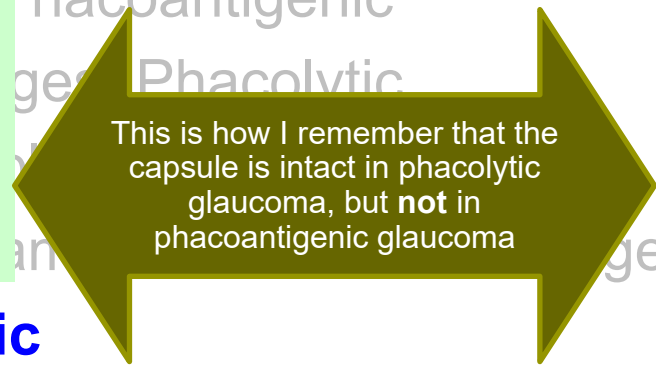
It implies (correctly) that the capsule is **open** in these conditions

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)  
Phacolytic glaucoma    Phacoantigenic glaucoma    Lens-particle glaucoma



- The only one described in the *Glaucoma* book as 'rare' Phacoantigenic
- Mediated by inflammatory response to lens proteins in Phacoantigenic; phacolytic
- Mediated by IgG antibodies Phacoantigenic
- TM is clogged with macrophages Phacolytic
- Chunks of cortex may be seen Phacolytic
- Is also known as [condensed anterior chamber angle] Phacolytic
- **Capsule is intact: Phacolytic**

Phacolytic  
through intact capsule



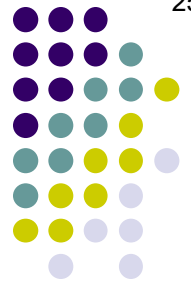
This is how I remember that the capsule is intact in phacolytic glaucoma, but **not** in phacoantigenic glaucoma

Phacoantigenic  
not intact capsule

*What does this imply about the status of the capsule in phacoantigenic and lens-particle glaucoma?*

It implies (correctly) that the capsule is **open** in these conditions

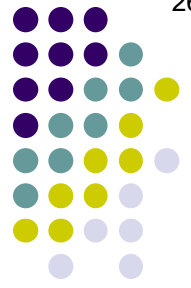


**Q**

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- Capsule is intact: **Phacolytic**
- AC reaction is granulomatous:

**A**

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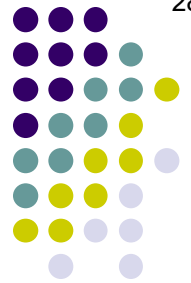
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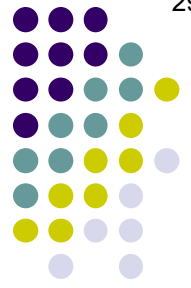
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- Is a reaction to *normal* lens proteins:

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Q

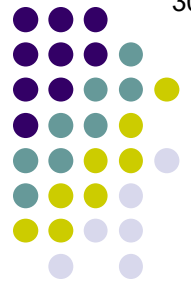
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- M
- F
- M
- T
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In phakic eyes, minute amounts of lens proteins make their way through the capsule and into the AC. Because of this, normal lens proteins enjoy a certain level of immunologic privilege and are well tolerated by the eye.

- Chunks of cortex may be visible in AC. Lens particle
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# A

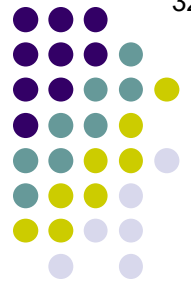
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*Why is it significant that phacoantigenic glaucoma involves an immune reaction to ‘normal’ lens proteins?*

In phakic eyes, minute amounts of lens proteins make their way through the capsule and into the AC. Because of this, normal lens proteins enjoy a certain level of immunologic privilege and are well tolerated by the eye. However, violation of the capsule results in massive amounts of lens proteins spilling into the AC. If this influx disrupts the privilege, severe inflammation, ie, phacoantigenic uveitis—and glaucoma—may result.

- Chunks of cortex may be visible in AC. Lens particle
- Is also known as [condition name] **uveitis: Phacoantigenic**
- Capsule is intact: Phacolytic
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- Is also known as [condition name] *uveitis*: **Phacoantigenic**
- Capsule is intact: **Phacolytic**
- AC reaction is granulomatous: **Phacoantigenic**
- Is a reaction to *denatured* lens proteins:



**A**

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

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**Q**

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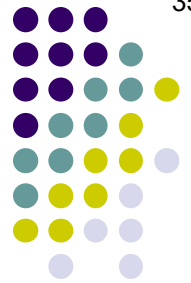
**Phacolytic glaucoma    Phacoantigenic glaucoma    Lens-particle glaucoma**

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● *What does it mean to say a protein has been 'denatured'?*

- 
- 
- 
- 
- 
- 
- 
- 
- 

- Is a reaction to *denatured* lens proteins: **Phacolytic**

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● *What does it mean to say a protein has been 'denatured'?*

It means the protein has been forced out of its native conformation. Because a protein's function is inextricably tied to its shape, denatured proteins do not behave as they do in their native form.

- Is a reaction to *denatured* lens proteins: **Phacolytic**

**Q**

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

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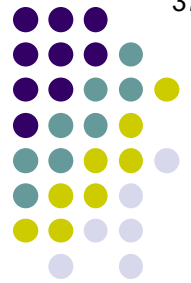
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It means the protein has been forced out of its native conformation. Because a protein's function is inextricably tied to its shape, denatured proteins do not behave as they do in their native form.

● *Can you give an example of protein denaturation?*

- Is a reaction to *denatured* lens proteins: **Phacolytic**



# A

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

**Phacolytic glaucoma      Phacoantigenic glaucoma      Lens-particle glaucoma**

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● *What does it mean to say a protein has been 'denatured'?*

It means the protein has been forced out of its native conformation. Because a protein's function is inextricably tied to its shape, denatured proteins do not behave as they do in their native form.

● *Can you give an example of protein denaturation?*

Consider egg albumin. In its native state, it's a clear liquid. But if sufficient heat is applied, it becomes a white solid. (And if sufficient salsa is applied to the white solid, it becomes delish.)

- **Is a reaction to *denatured* lens proteins: **Phacolytic****



Q

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

**Phacolytic glaucoma      Phacoantigenic glaucoma      Lens-particle glaucoma**

- The only one described in the *Glaucoma* book as 'rare':  
Phacoantigenic

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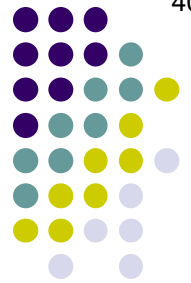


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Consider egg albumin. In its native state, it's a clear liquid. But if sufficient heat is applied, it becomes a white solid. (And if sufficient salsa is applied to the white solid, it becomes delish.)
- *What role does denaturation play in the inflammatory process?*  
Recall that normal lens proteins enjoy a degree of immunologic privilege. In contrast, *denatured* proteins enjoy no such privilege, and thus tend to attract macrophages in large numbers.
- **Is a reaction to *denatured* lens proteins: Phacolytic**

**Q**

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**Phacoantigenic; phacolytic**
- Mediated by IgG antibodies: **Phacoantigenic**
- TM is clogged with macrophages: **Phacolytic**
- Chunks of cortex may be visible in AC: **Lens particle**
- Is also known as [condition name] *uveitis*: **Phacoantigenic**
- Capsule is intact: **Phacolytic**
- AC reaction is granulomatous: **Phacoantigenic**
- Is a reaction to *normal* lens proteins: **Phacoantigenic**
- Is a reaction to *denatured* lens proteins: **Phacolytic**
- The presence of KP is a key clinical finding:



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*Are the KP granulomatous, or nongranulomatous?*



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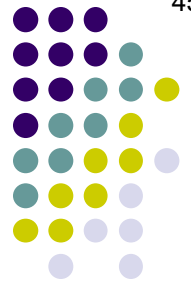
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Are the KP granulomatous, or nongranulomatous?  
Granulomatous



Phacoantigenic glaucoma: Granulomatous KP

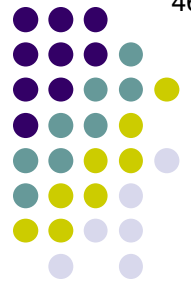


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- aka *phacoanaphylactic glaucoma*:



**A**

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**Q**

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*Why is phacoanaphylactic glaucoma actually a misnomer?*



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*Why is phacoanaphylactic glaucoma actually a misnomer?*

Because the condition is not a Type 1 (anaphylactic) reaction

**Q**

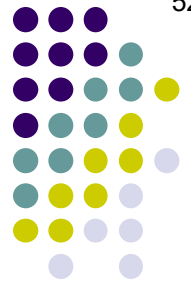
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*What characteristics inherent to true anaphylaxis are missing in phacoantigenic glaucoma?*



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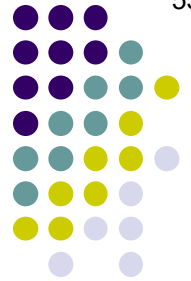
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*Why is phacoanaphylactic glaucoma actually a misnomer?*

Because the condition is not a Type 1 (anaphylactic) reaction

*What characteristics inherent to true anaphylaxis are missing in phacoantigenic glaucoma?*

The involvement of IgE, mast cells and basophils

**Q**

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*(We'll unpack the term adaptive immune response later in the slide-set)*



**Q**

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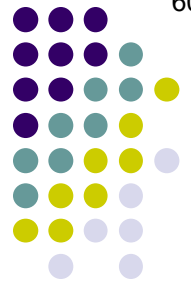
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*What is a mature cataract?*



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*What is a mature cataract?*

A cataract that has progressed to involve the entire lens

nuclear vs  
cortical vs  
PSC

nucleus vs  
cortex vs  
PC

**A**

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Mature cataract

**Q**

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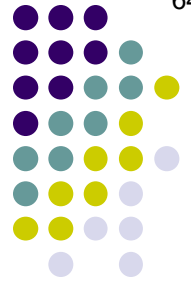
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Mature cataracts may absorb water, transforming them into an

swollen

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*What is a **mature cataract**?*

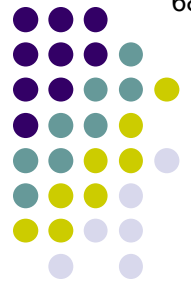
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*What is a hypermature cataract?*

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Take note of the stages:

Mature cataract  ?



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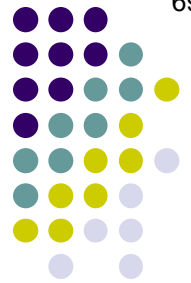
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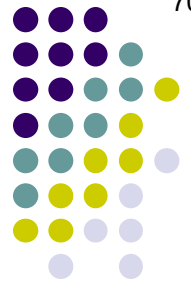
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Take note of the stages:

Mature cataract → intumescent cataract → hypermature cataract



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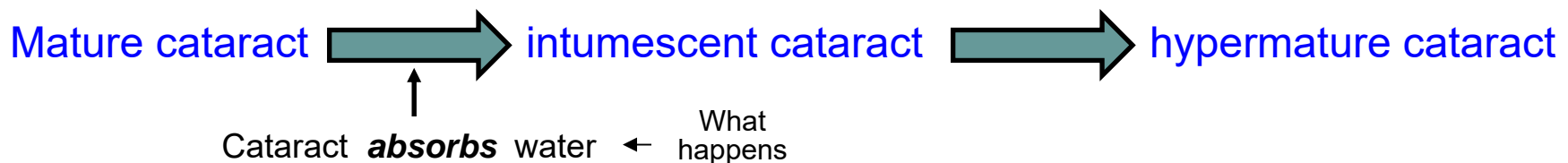
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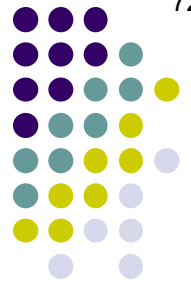
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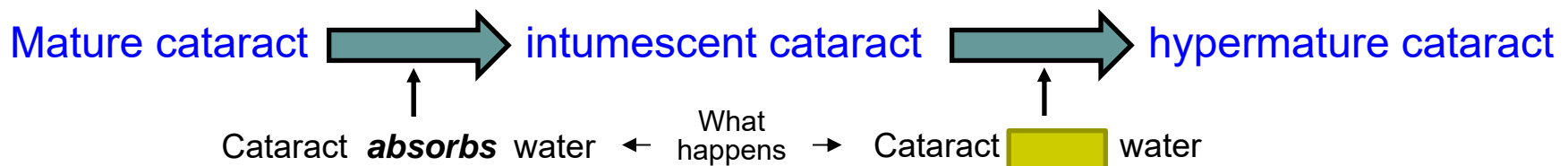
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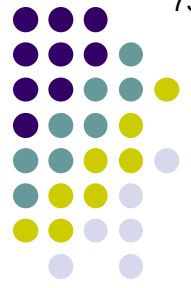
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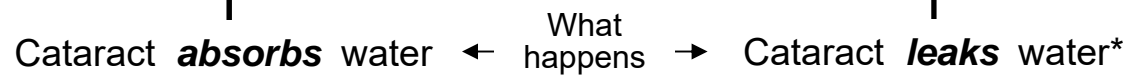
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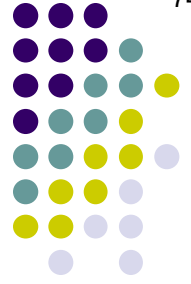
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Take note of the stages:



\*and proteins



Q

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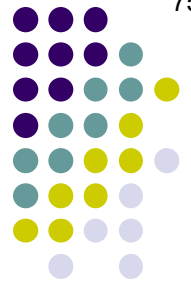
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All three of these pose a particular challenge during an early, crucial step in cataract surgery. What step, and what challenge?

Take note of the stages:

Mature cataract → intumescent cataract → hypermature cataract



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All three of these pose a particular challenge during an early, crucial step in cataract surgery. What step, and what challenge?

For all three stages, the red reflex is completely obscured. As most cataract surgeons rely on the red reflex to visualize the anterior capsule during capsulorrhexis, this step cannot be performed in a conventional manner.

Take note of the stages:





Q

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All three of these pose a particular challenge during an early, crucial step in cataract surgery. What step, and what challenge?

For all three stages, the red reflex is completely obscured. As most cataract surgeons rely on the red reflex to visualize the anterior capsule during capsulorrhexis, this step cannot be performed in a conventional manner.

What step do most surgeons take to facilitate capsulorrhexis in these cases?

Take note of the stages:

Mature cataract → intumescent cataract → hypermature cataract



**Q/A** For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)  
**Phacolytic glaucoma    Phacoantigenic glaucoma    Lens-particle glaucoma**

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
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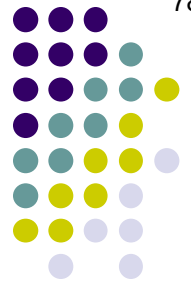
*What step do most surgeons take to facilitate capsulorrhexis in these cases?*

They stain the anterior capsule with

two words

Take note of the stages:

Mature cataract → intumescent cataract → hypermature cataract



# A

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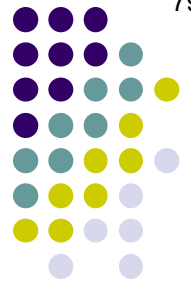
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What step do most surgeons take to facilitate capsulorrhexis in these cases?

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Take note of the stages:





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Take note of the stages:





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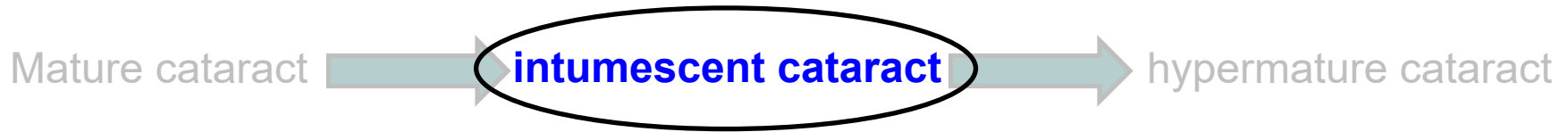
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 It means 'swollen.' As mentioned a few slides ago, the event that transforms a mature cataract into an *intumescent* cataract is absorption of water, and this absorption results in swelling of the lens.

*All the...  
 What...  
 For a...  
 the m...  
 perfor...*

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*Take note of the stages:*







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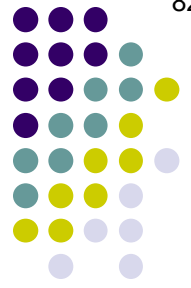
*What effect does swelling have on the internal dynamics of the lens?*

*What step do most surgeons take to facilitate capsulorrhexis in these cases?*

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Take note of the stages:





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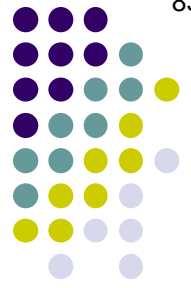
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*What effect does swelling have on the internal dynamics of the lens?*  
 It increases the pressure within the lens

*All the... very.*  
*What... y on*  
*For a... y on*  
*the m... y on*  
*perfo... y on*  
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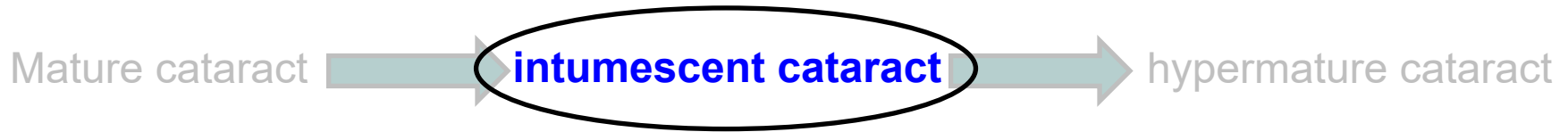
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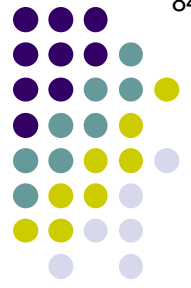
As if obscuration of the red reflex wasn't enough, the increased intralenticular pressure of an intumescent cataract poses an additional challenge during capsulorrhexis—what is it?

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It **increases the pressure within the lens**

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Take note of the stages:





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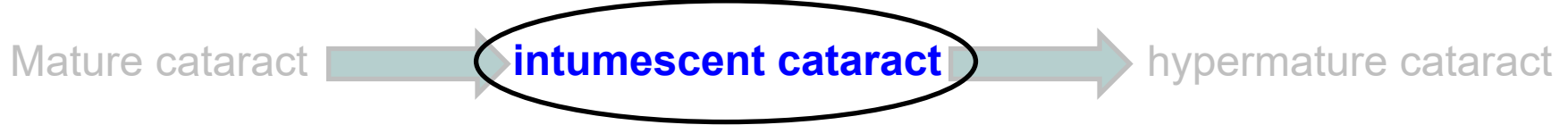
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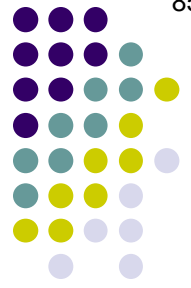
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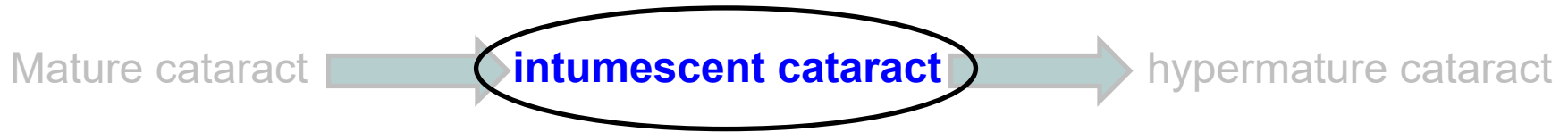
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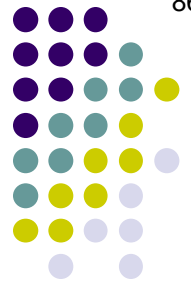
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*If/when the rent runs peripherally, what is the resulting appearance of the lens?*

*What...  
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Take note of the stages:*





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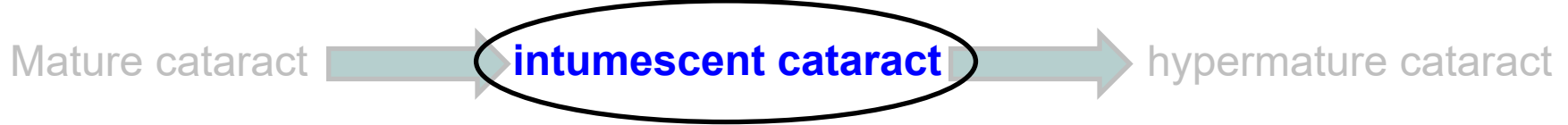
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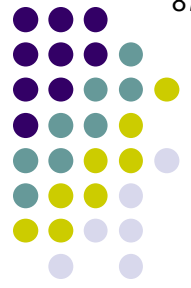
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If/when the rent runs peripherally, what is the resulting appearance of the lens? Recall that, because of red-reflex obscuration, **trypan blue** is used in all these cases.

They stain the anterior capsule with **trypan blue**

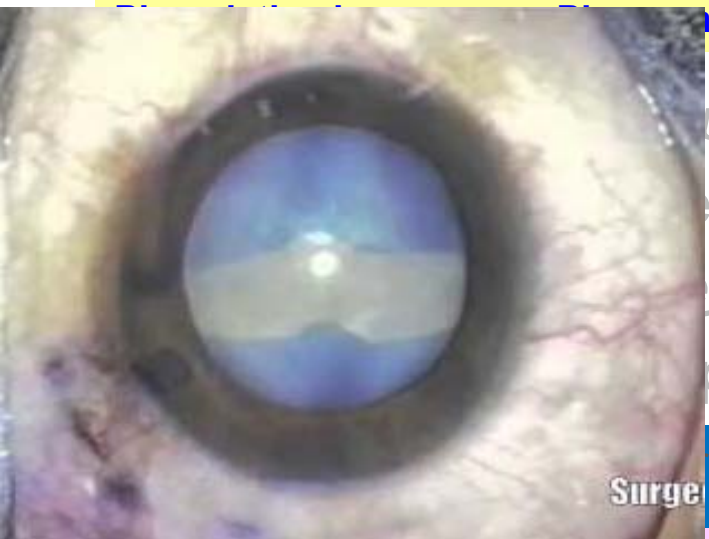
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**A**



Phacoantigenic glaucoma    **Lens-particle glaucoma**

Phacolytic glaucoma: Phacoantigenic

em

immune response: Phacoantigenic

**hypermature cataract: Phacolytic**

acts for a moment. In this context, what does

As if obscuration of the red reflex wasn't enough, the increased intralenticular pressure of an intumescent cataract poses an additional challenge during capsulorrhexis—what is it?

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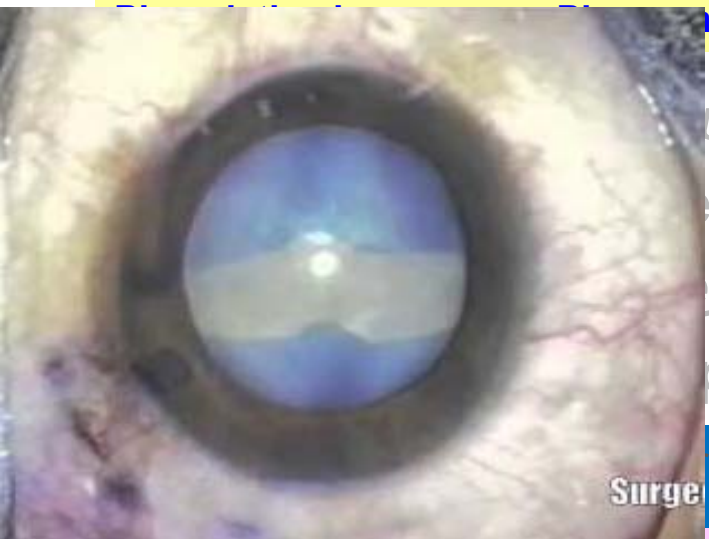
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Q



Phacolytic glaucoma    Lens-particle glaucoma

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Surgeon

As if obscuration of the red reflex wasn't enough, the increased intralenticular pressure of an

intumescent

This appearance has led to a memorable name for this finding. What is it?

When the

intumescent cataract may cause the lens to gradually and asymmetrically extend to the periphery

very.

ly on

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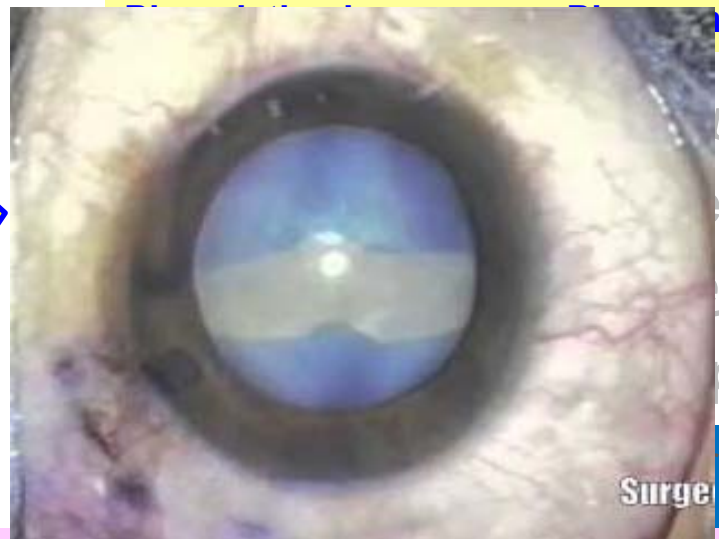
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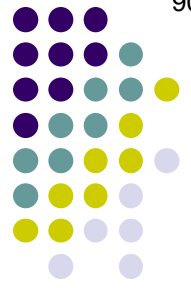
As if obscuration of the red reflex wasn't enough, the increased intralenticular pressure of an intumescent cataract... This appearance has led to a memorable name for this finding. What is it? It is known as '**Argentinian flag sign**'

...two areas of blue... white stripe... Recall that, because of red-reflex obscuration, trypan blue is used in all these cases. Thus, after the rent runs out, the surgeon sees a white stripe (the cataract) between two areas of blue (the undisturbed, trypan blue-stained capsule).

They stain the anterior capsule with **trypan blue**

Take note of the stages:





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*When faced with an intumescent cataract, what can the surgeon do to minimize the likelihood of seeing an Argentinian flag?*

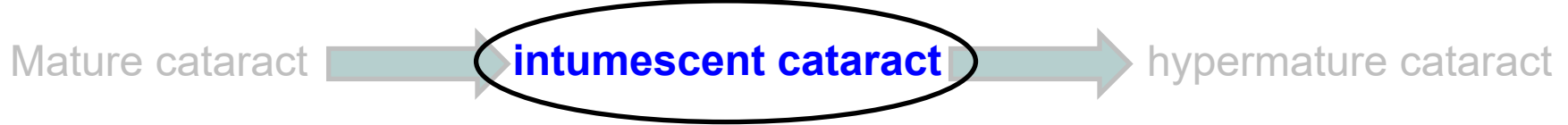
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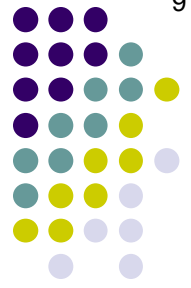
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*When faced with an intumescent cataract, what can the surgeon do to minimize the likelihood of seeing an Argentinian flag?*

--Counteract the positive pressure within the lens by filling the AC with a high-viscosity OVD

--Reduce intralenticular pressure by aspirating cortical material immediately upon creating the initial rent

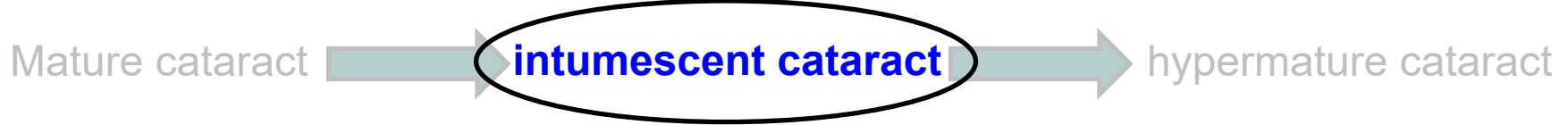
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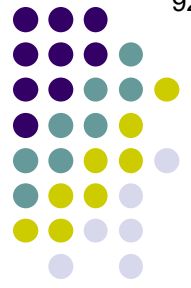
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*What is a mature cataract?*

A cortical cataract that has progressed to involve the entire lens cortex

*What is a hypermature cataract?*

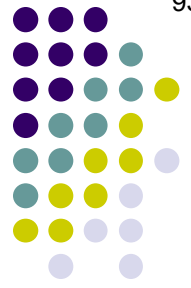
Mature cataracts may absorb water, transforming them into an *intumescent cortical cataract*. A *hypermature cataract* results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.



**Finally: What stage occurs after the hypermature stage?**

Take note of the stages:





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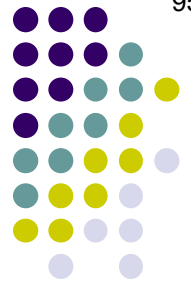
What change occurs as a cortical cataract progresses from the hypermature to the morgagnian stage?

Take note of the stages

Mature cataract

Morgagnian cataract

hypermature cataract



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What change occurs as a cortical cataract progresses from the hypermature to the morgagnian stage?

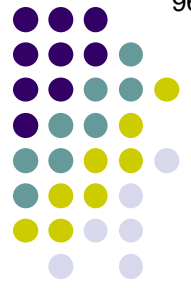
Further and extensive liquefaction of the cortical material

Morgagnian cataract

Take note of the stages

Mature cataract

hypermature cataract



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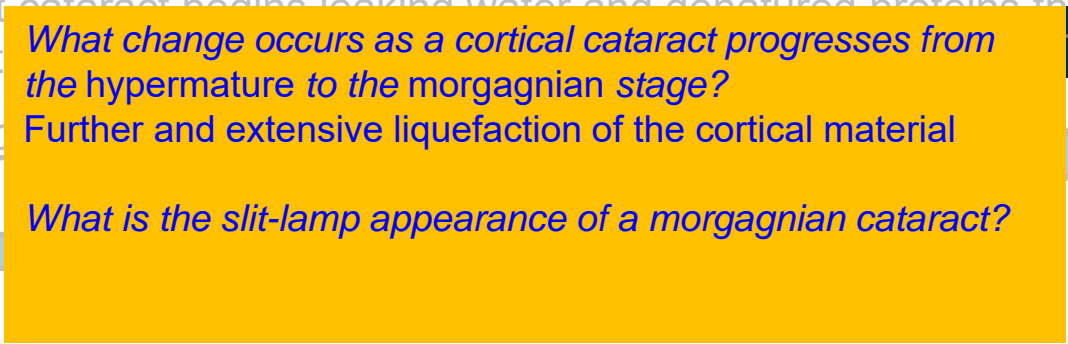
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What change occurs as a cortical cataract progresses from the hypermature to the morgagnian stage?

Take note of the stage: Further and extensive liquefaction of the cortical material

Morgagnian cataract

Mature cataract: What is the slit-lamp appearance of a morgagnian cataract?







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*mature stage?*

Take note of the stages

Further and extensive liquefaction of the cortical material

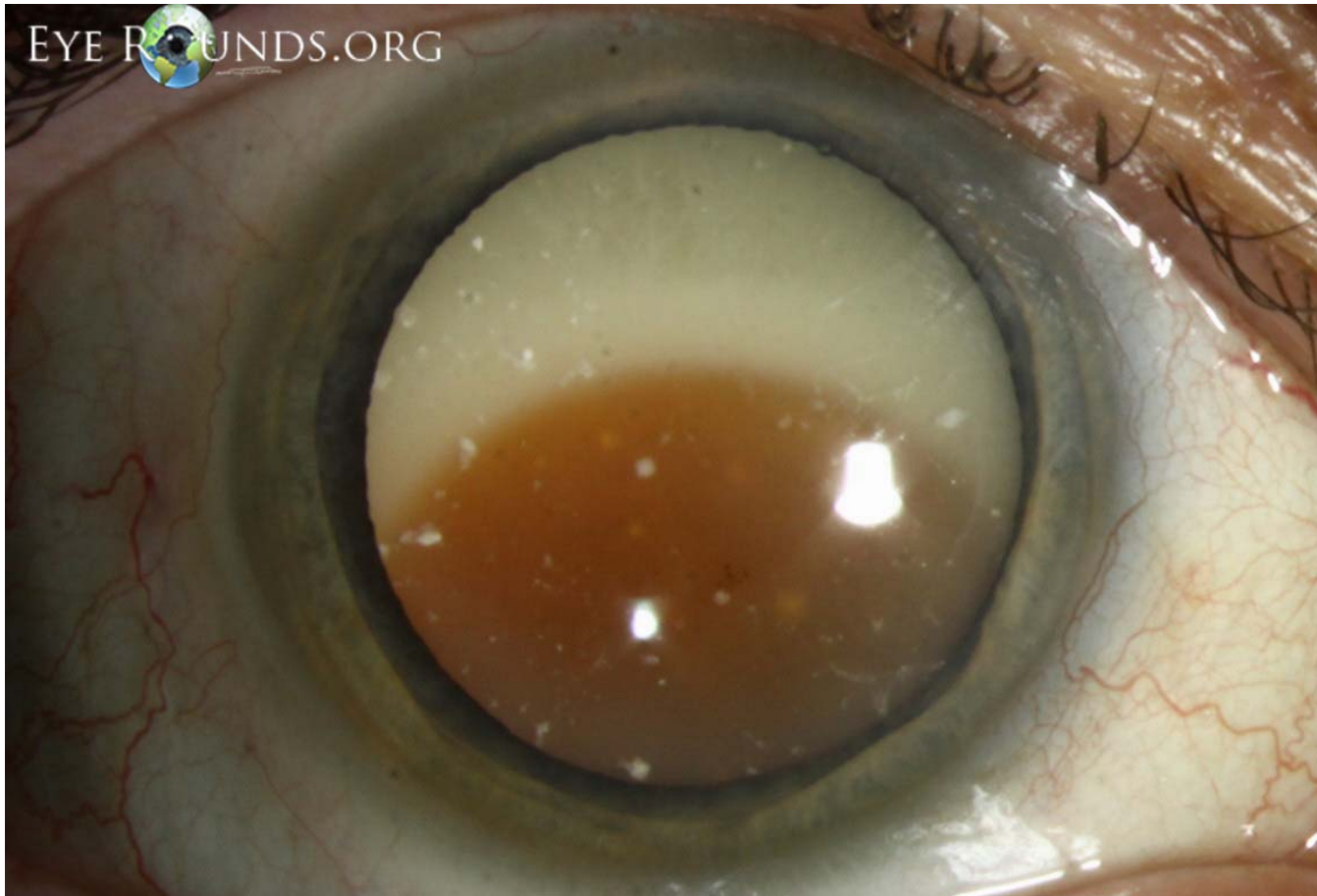
*Morgagnian cataract*

Mature cataract

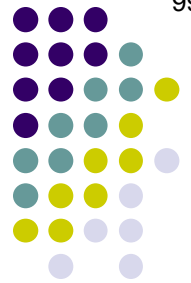
*What is the slit-lamp appearance of a morgagnian cataract?*

The dense brown nuclear cataract is observed to be freely mobile within the liquified remnants of the cortical cataract

*re cataract ^*



Morgagnian cataract



Q

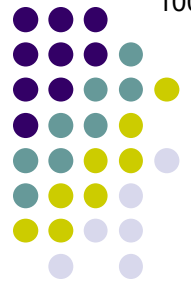
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*What effect does the leaking of water and proteins have on the volume of the cataract?*

*intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins **leaking water and denatured proteins through its intact anterior capsule.***



# A

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

**Phacolytic glaucoma      Phacoantigenic glaucoma      Lens-particle glaucoma**

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*What effect does the leaking of water and proteins have on the volume of the cataract?*  
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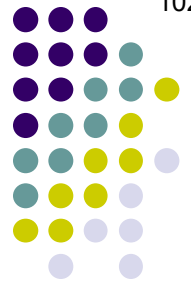
*What effect does the leaking of water and proteins have on the volume of the cataract?*

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*This reduction in cataract volume is responsible for a classic finding in hypermature cataracts.*

*What is it?*

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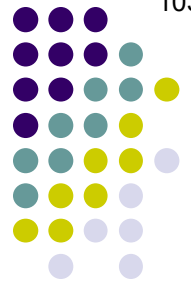
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The anterior capsule is sign and sign

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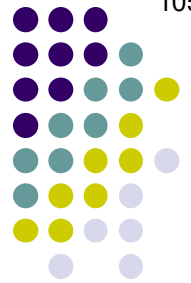
The anterior capsule is shrunken and wrinkled

*intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins **leaking water and denatured proteins through its intact anterior capsule.***



Hypermature cataract. Note the capsular wrinkling



**Q**

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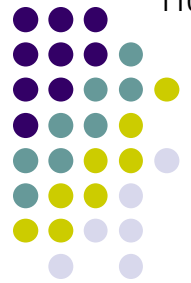
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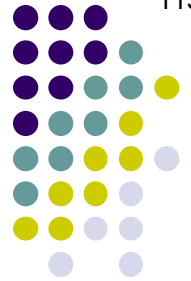
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Surgical removal of the offending material



**Q**

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

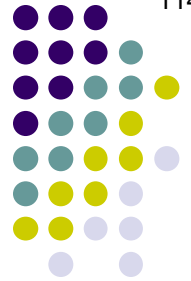
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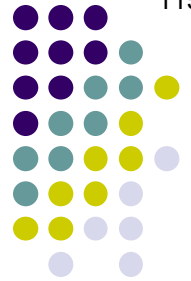
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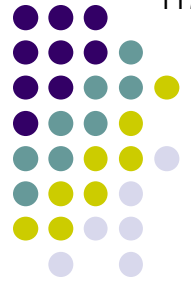
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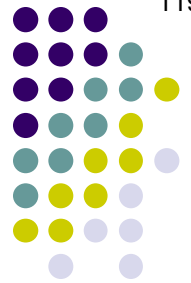
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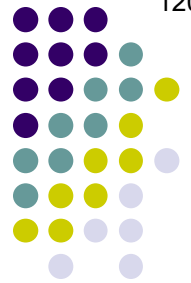
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The adaptive immune response involves 'education,' with surveillance cells learning to recognize and remember foreign material. **OTOH, the innate (or *natural*) immune response does not require education—it relies on 'preprogrammed' immune cells to recognize foreign material encountered in tissue or blood.**

- Is mediated by an **innate** immune response: Phacolytic



Q

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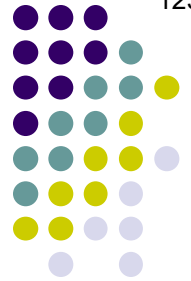
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*What are the two main effector cell types of innate immunity?*



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*What are the two main effector cell types of innate immunity?*

**Neutrophils and macrophages**

For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)



*And now, an overly-long sidebar regarding immunology and the lens-related OAGs:*



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Some clinicians reserve the term *immune response* for clinical situations in which only **adaptive** immunity is involved; if the clinical situation involves only an **innate** response, such clinicians opt to use the more general term *inflammation* in describing the clinical picture.

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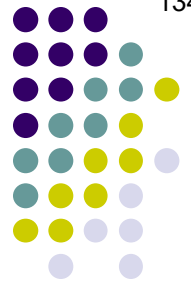
**And now, an overly-long sidebar regarding immunology and the lens-related OAGs:**

Some clinicians reserve the term *immune response* for clinical situations in which only **adaptive** immunity is involved; if the clinical situation involves only an **innate** response, such clinicians opt to use the more general term *inflammation* in describing the clinical picture. That said, the signs and symptoms produced by both adaptive and innate immune responses are recognized clinically as ‘inflammation,’ and despite their underlying differences in mechanism, are usually indistinguishable at the slit lamp.

I’m going on about this because it explains what may seem to be inconsistencies among the *BCSC* books with regard to *phacolytic*, *phacoantigenic*, and *lens-particle* glaucomas. Take the *Lens* book. It states that “phacoantigenic uveitis” (it does not use the term phacoantigenic *glaucoma*) is “immune-mediated.” However, it pointedly states that phacolytic glaucoma does **not** elicit an immune response. In a similar fashion, the *Path* book puts phacoantigenic uveitis in a section entitled *Inflammations*, but not phacolytic glaucoma—it is discussed under *Secondary Glaucoma with Material in the Trabecular Meshwork*. These characterizations exemplify the *immune response = adaptive response* viewpoint described above. (The term *lens-particle glaucoma* does not appear in the *Path* book’s index.)

In contrast, the *Uveitis* book eschews the term *phacoantigenic uveitis/glaucoma* entirely, using instead the term *lens-induced uveitis*. It goes on to describe phacolytic glaucoma in a manner consistent with the other books. *Lens-particle glaucoma* does not appear in its index either. Finally, the *Glaucoma* book groups all three conditions together under the heading *Lens-Induced Glaucoma*, and does not address the issue of innate vs adaptive immunity. Instead, it refers simply to ‘inflammation’ in the description of all three conditions. The term phacoantigenic *uveitis* does not appear.

TLDR When studying the lens-related secondary OAGs, you really should read about them in all four of the *BCSC* books that address them—*Glaucoma*, *Uveitis*, *Lens* and *Path*. But be prepared to grapple with inconsistencies in terminology when doing so.

**Q**

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

**Phacolytic glaucoma**      **Phacoantigenic glaucoma**      **Lens-particle glaucoma**

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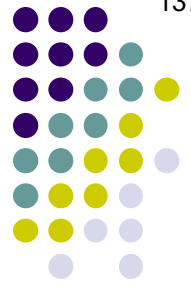
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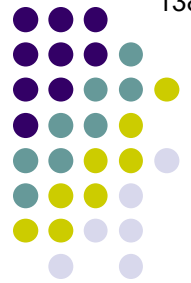


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Given that their cataracts can't get much worse, what accounts for the fact that phacolytic glaucoma pts c/o an acute worsening of VA coinciding with the onset of their pain and ocular injection?



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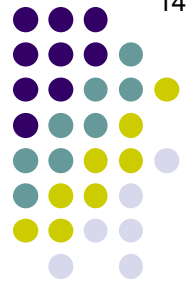
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Given that their cataracts can't get much worse, what accounts for the fact that phacolytic glaucoma pts c/o an acute worsening of VA coinciding with the onset of their pain and ocular injection? The IOP spike smashes their corneal endothelium, resulting in corneal edema which renders bad VA even worse



Phacolytic glaucoma: Corneal edema

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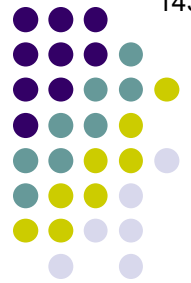
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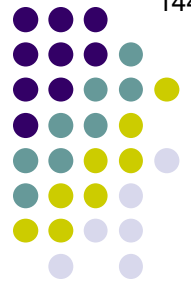
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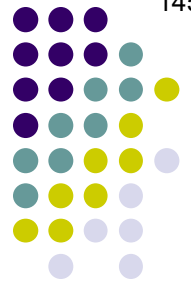
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Recall that it is normal for minute amounts of lens protein to be found in the AC of a phakic eye.

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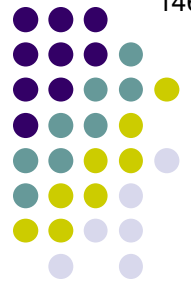
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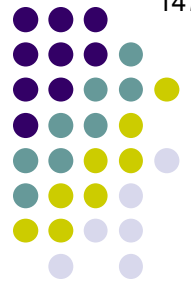
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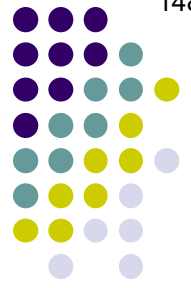
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