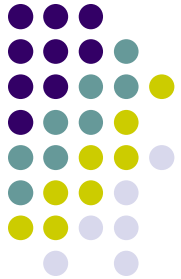
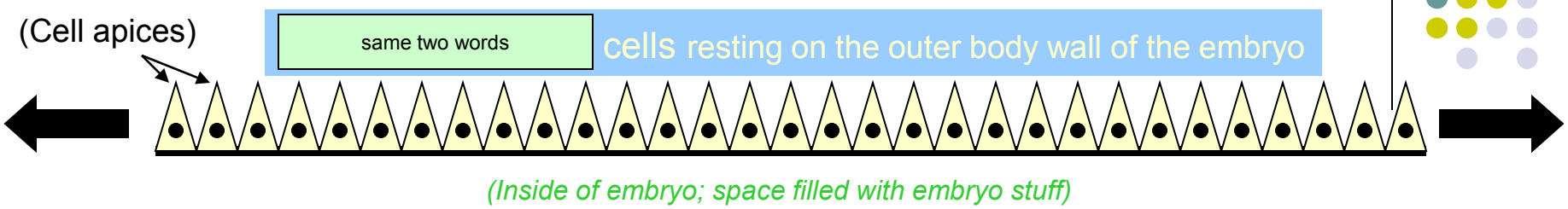
Eye embryology made simply ridiculous



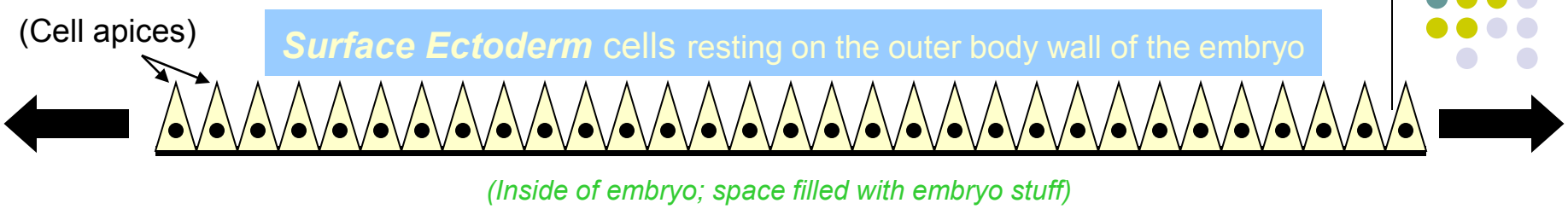
Regarding the embryology of the lens: There are two anatomic structures we must concern ourselves with…

Eye embryology made simply ridiculous



This is the ***outer body wall*** of the embryo in the region destined to become the head. The surface of the outer body wall is lined with [two words] cells.

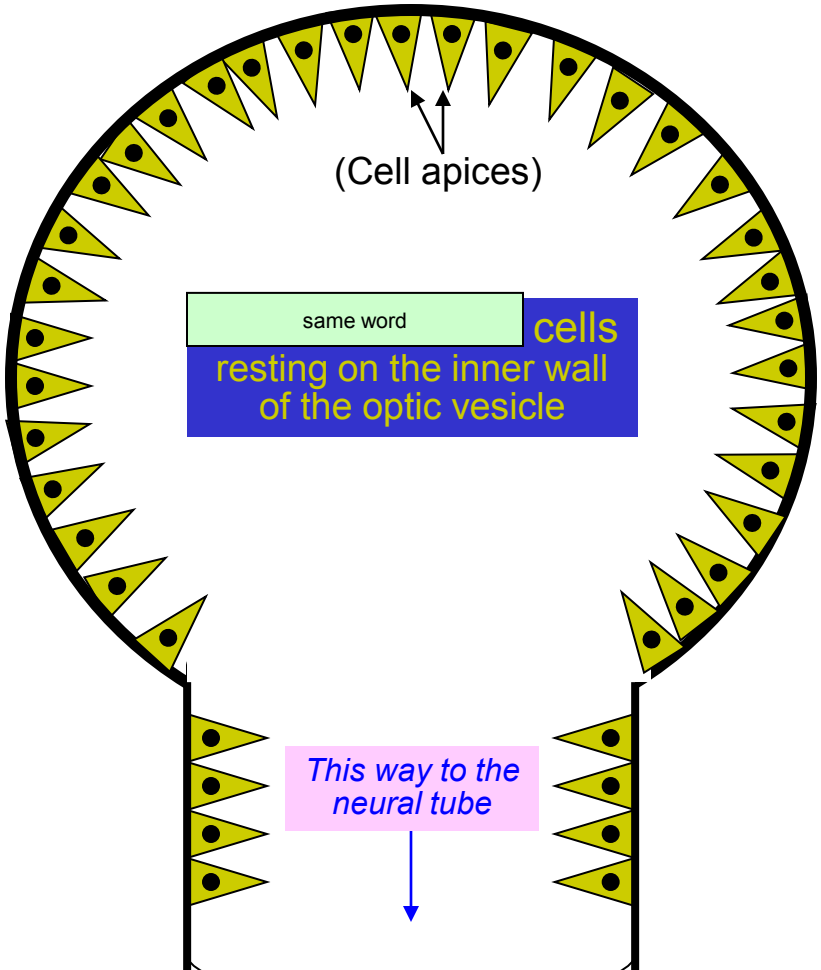
Eye embryology made simply ridiculous



This is the ***outer body wall*** of the embryo in the region destined to become the head. The surface of the outer body wall is lined with ***surface ectoderm*** cells.

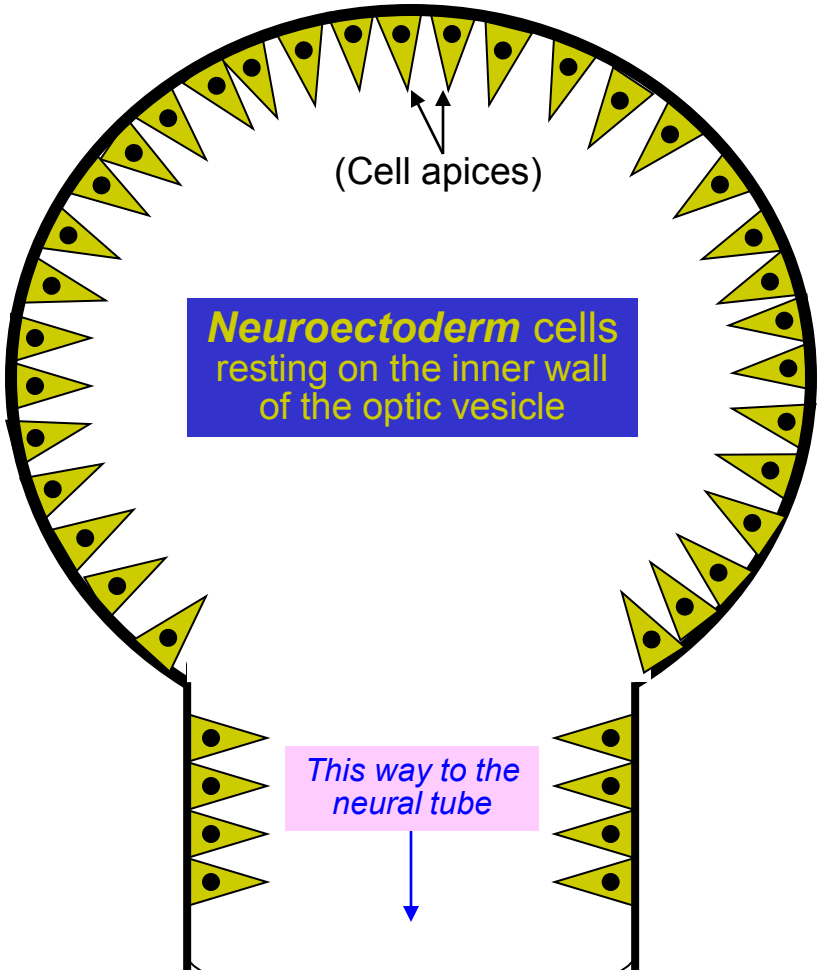
Eye embryology made simply ridiculous

This is the ***optic vesicle***, an outpouching of the neural tube. The inner surface of the optic vesicle is lined with [one word] cells.

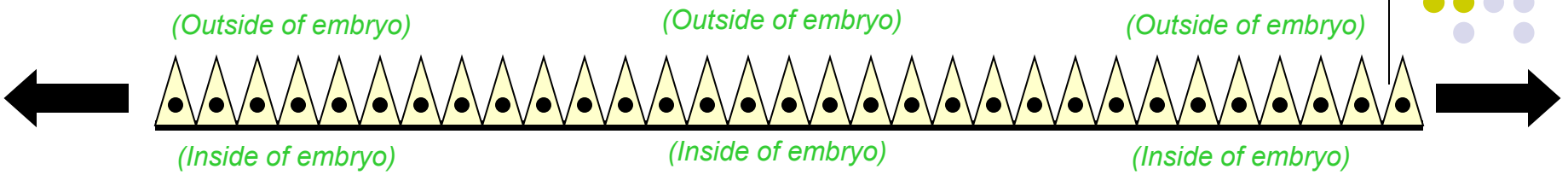


Eye embryology made simply ridiculous

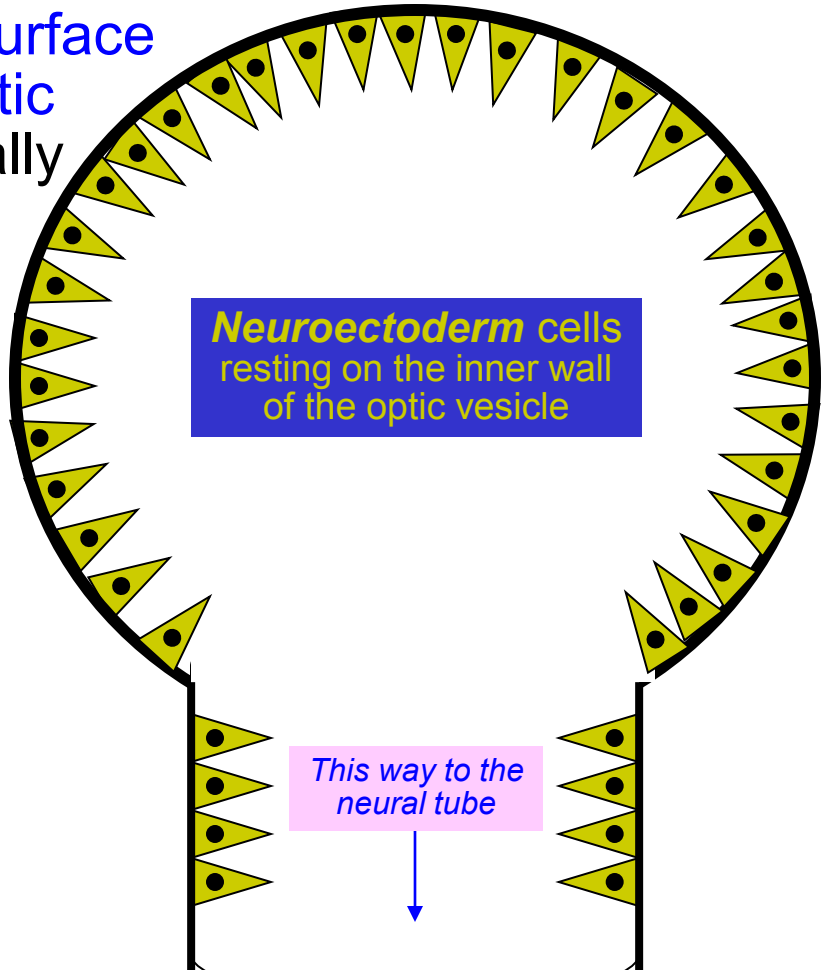
This is the ***optic vesicle***, an outpouching of the neural tube. The inner surface of the optic vesicle is lined with ***neuroectoderm*** cells.



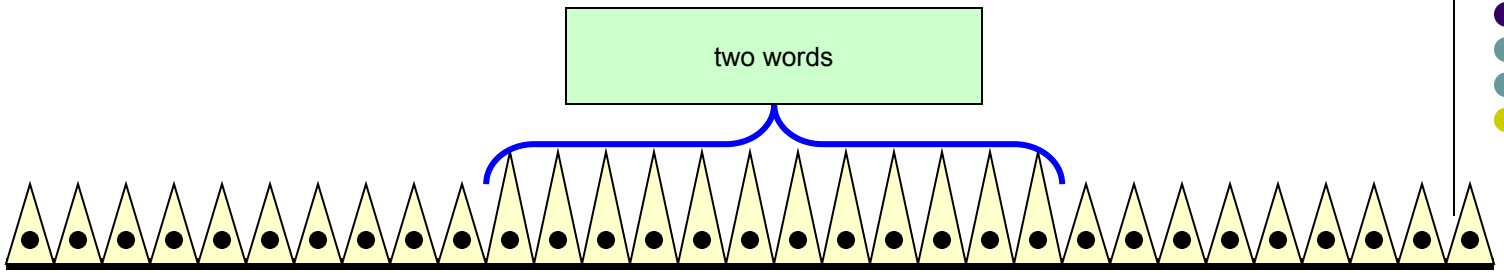
Eye embryology made simply ridiculous



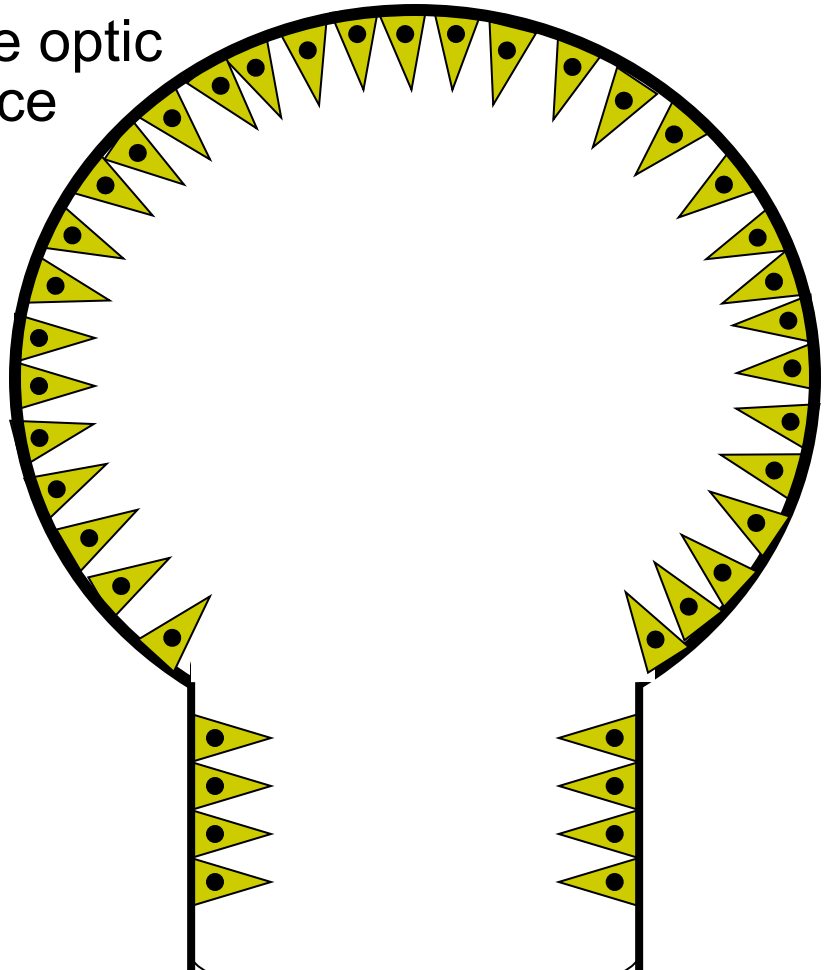
This is how the surface ectoderm and optic vesicle are spatially related early in embryogenesis.



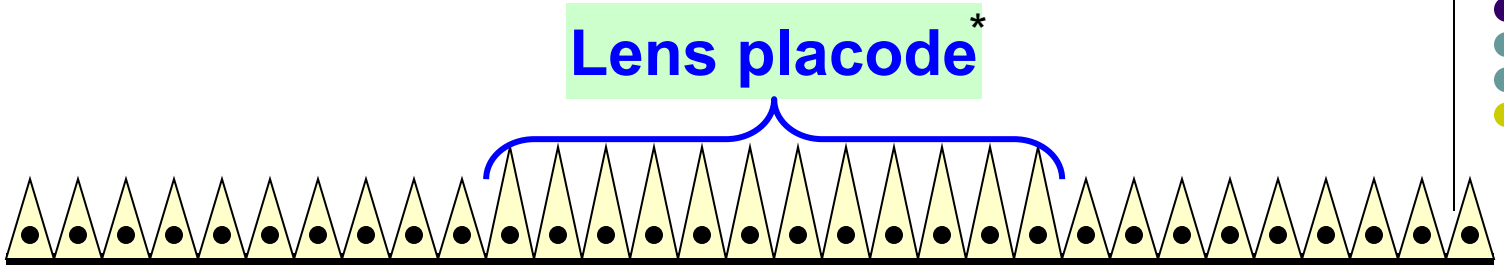
Eye embryology made simply ridiculous



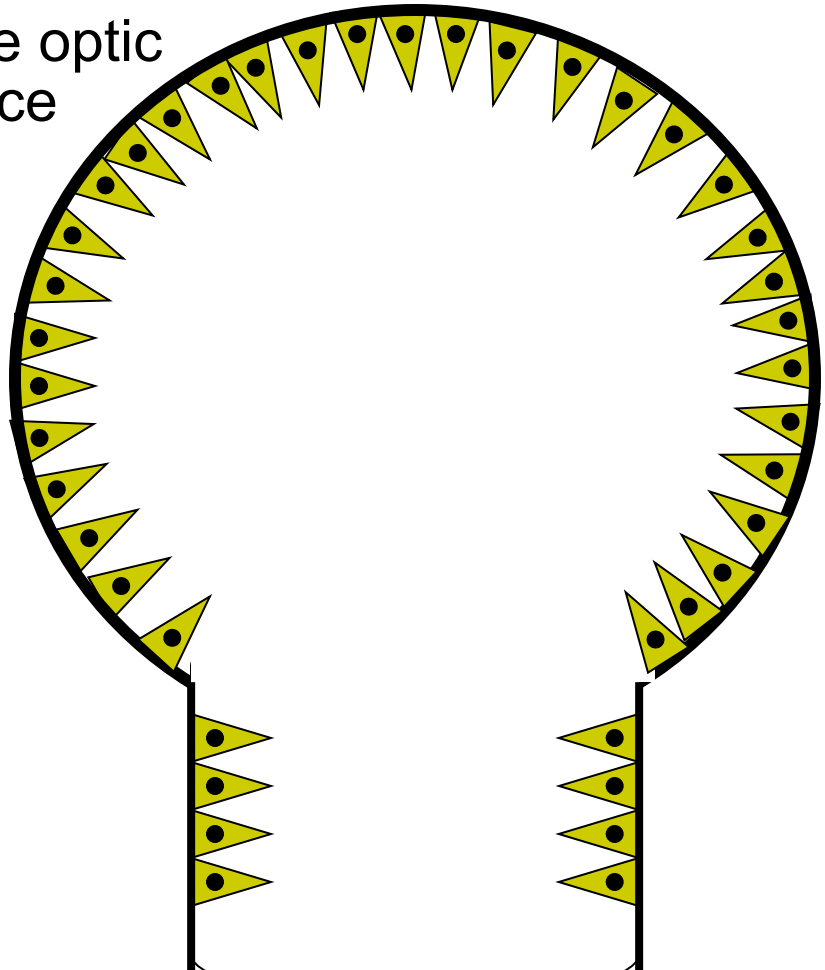
The proximity of the optic vesicle to the surface ectoderm induces those cells to grow taller, forming a structure known as the same words.



Eye embryology made simply ridiculous

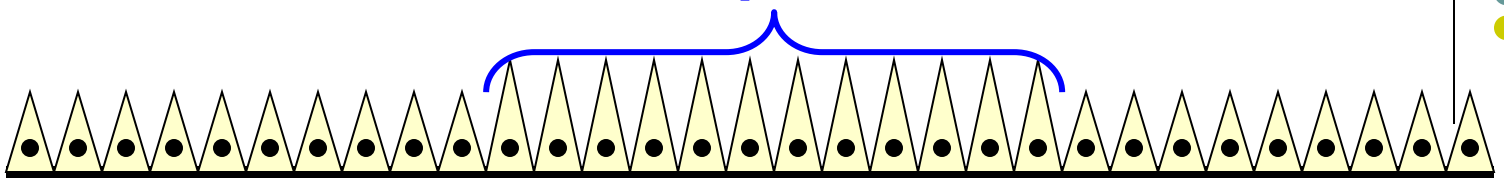


The proximity of the optic vesicle to the surface ectoderm induces those cells to grow taller, forming a structure known as the ***lens placode***.*

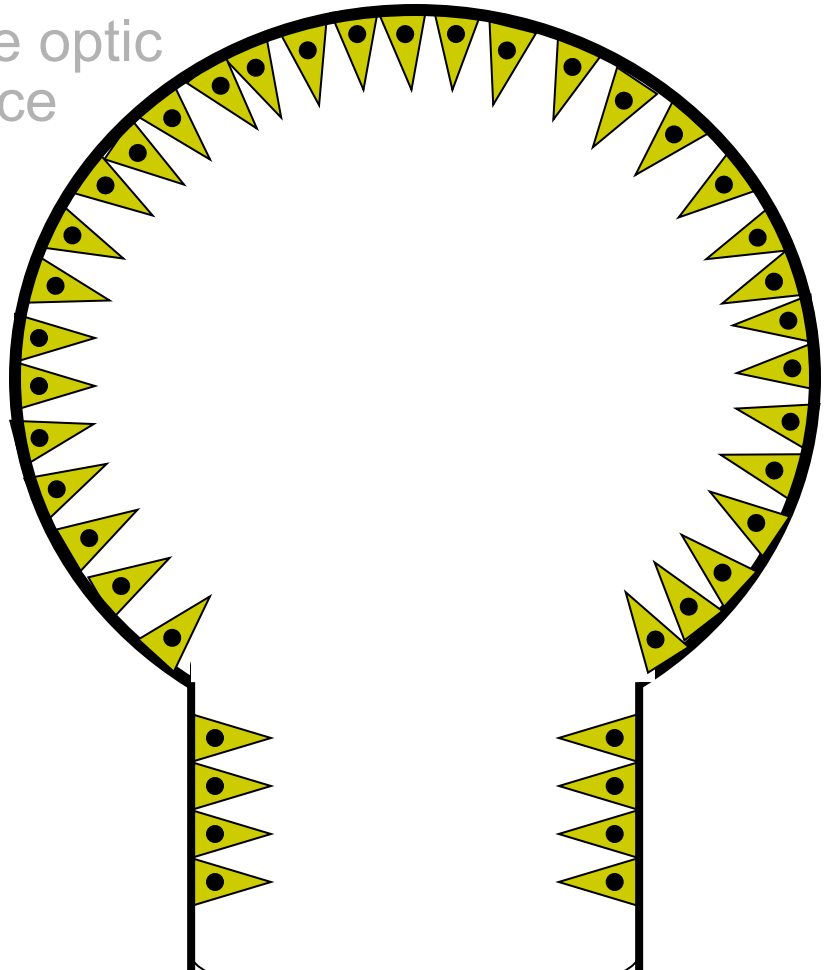


*aka *lens* ***plate***

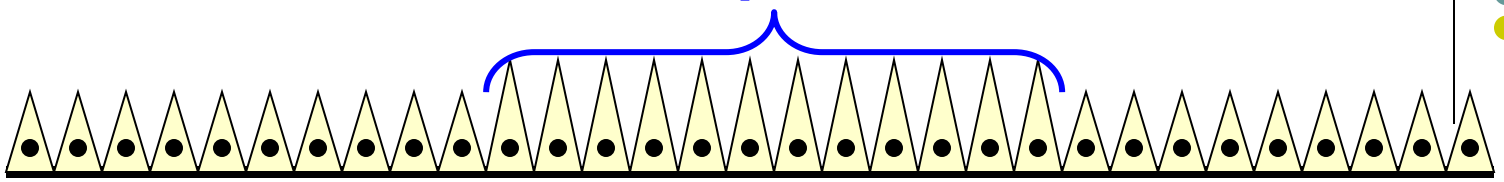
Eye embryology made simply ridiculous



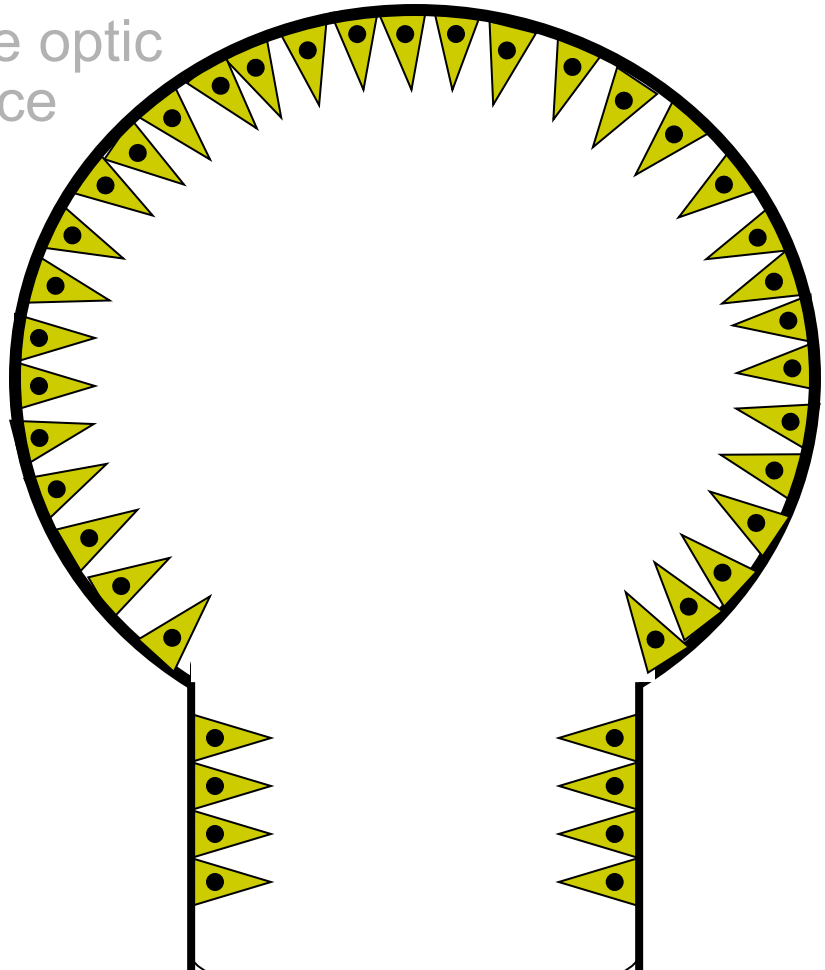
The proximity of the optic vesicle to the surface ectoderm induces those cells to grow taller, forming a structure known as the ***lens placode***. This occurs in the unit of time of embryogenesis.



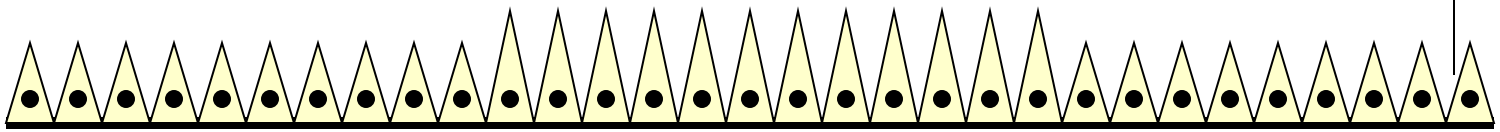
Eye embryology made simply ridiculous



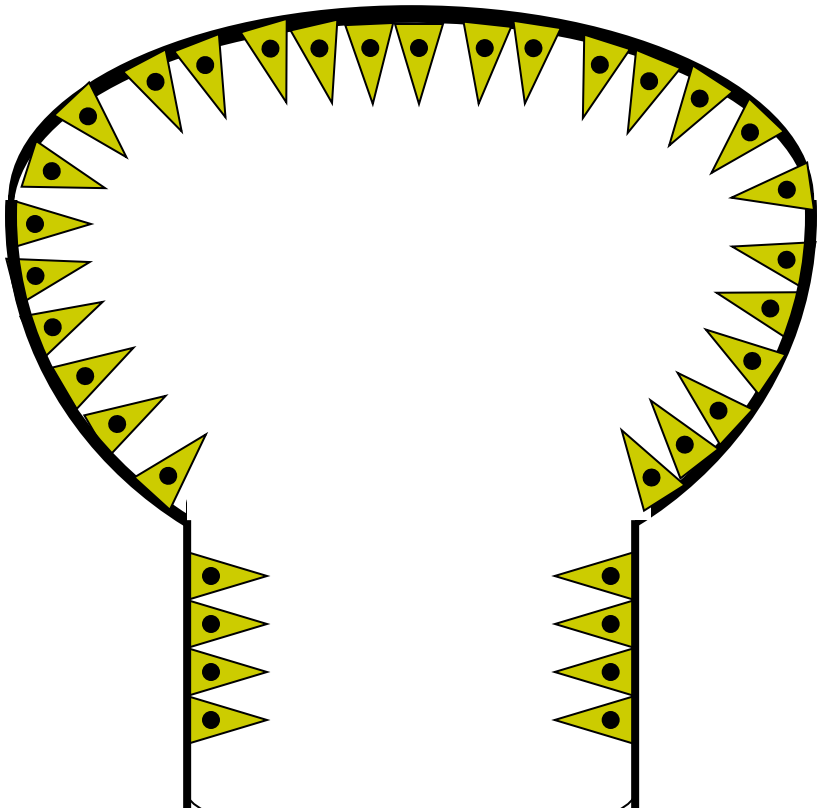
The proximity of the optic vesicle to the surface ectoderm induces those cells to grow taller, forming a structure known as the ***lens placode***. This occurs in the first month of embryogenesis.



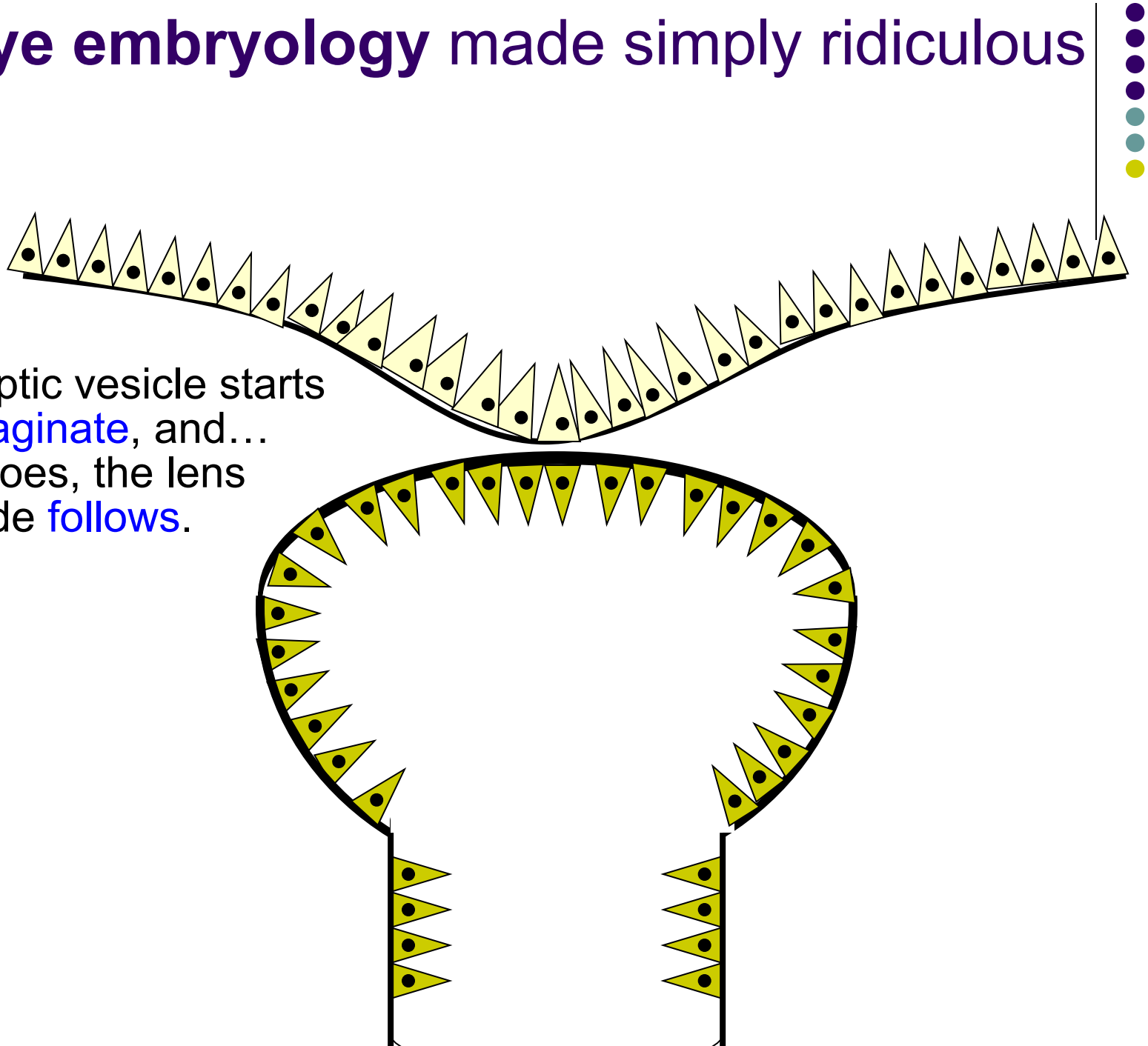
Eye embryology made simply ridiculous



The optic vesicle starts to invaginate, and…

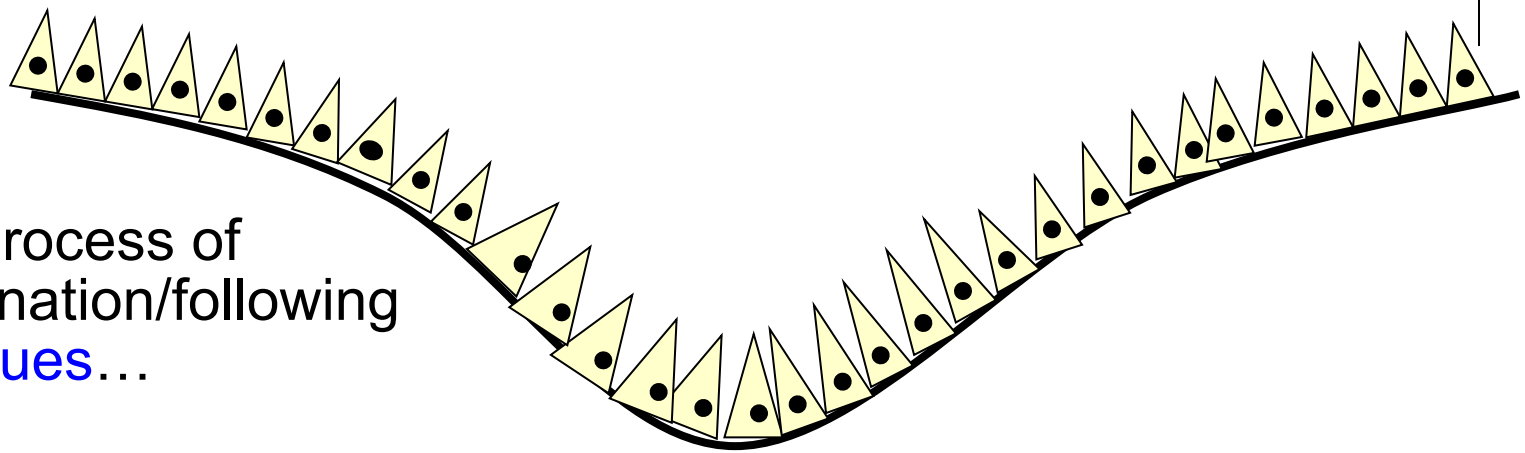


Eye embryology made simply ridiculous

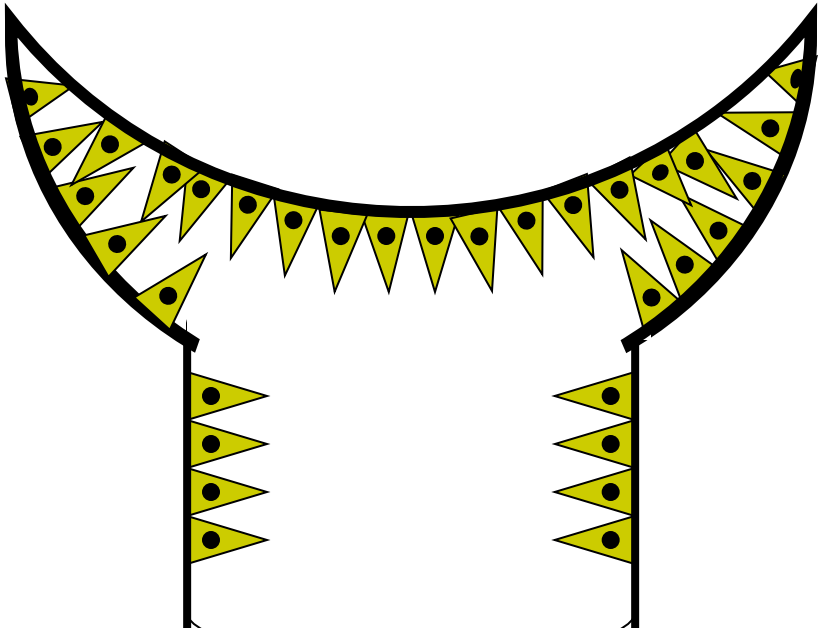


The optic vesicle starts to invaginate, and… as it does, the lens placode follows.

Eye embryology made simply ridiculous

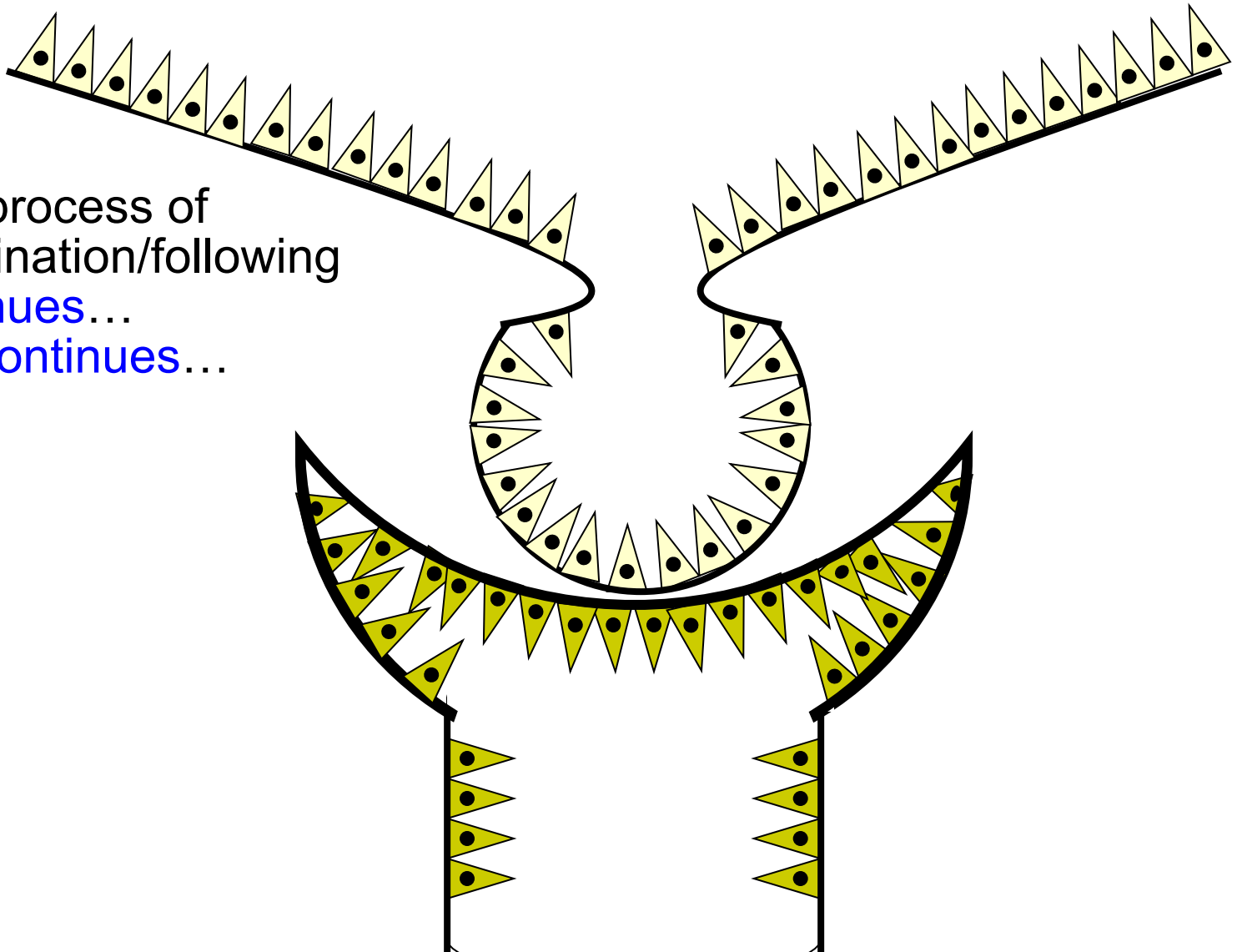


This process of invagination/following continues…

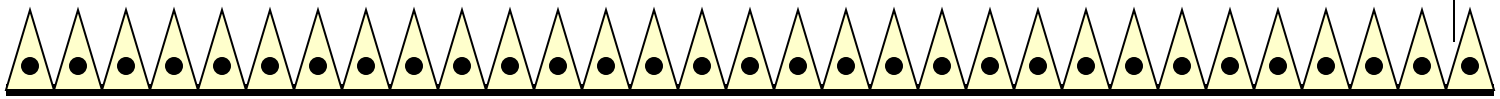


Eye embryology made simply ridiculous

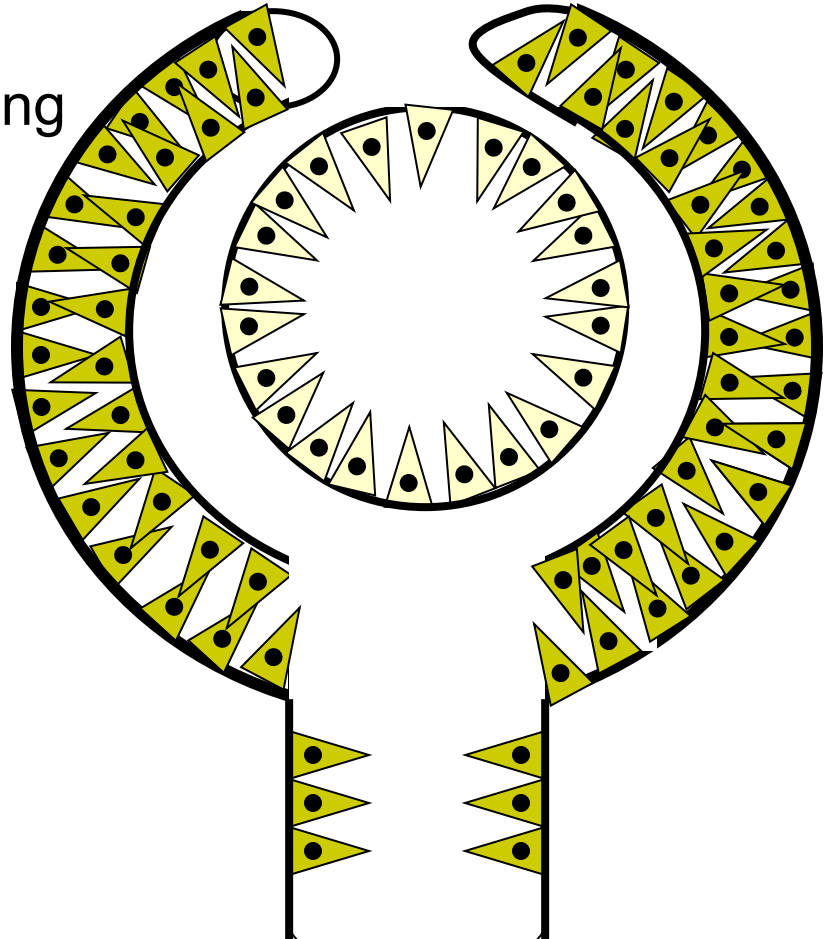
This process of invagination/following continues…
and continues…



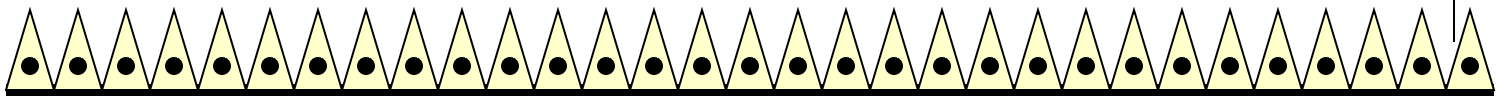
Eye embryology made simply ridiculous



This process of invagination/following continues… and continues… until the two walls of neuroectoderm are apposing, and the surface ectoderm has formed a sphere.



Eye embryology made simply ridiculous



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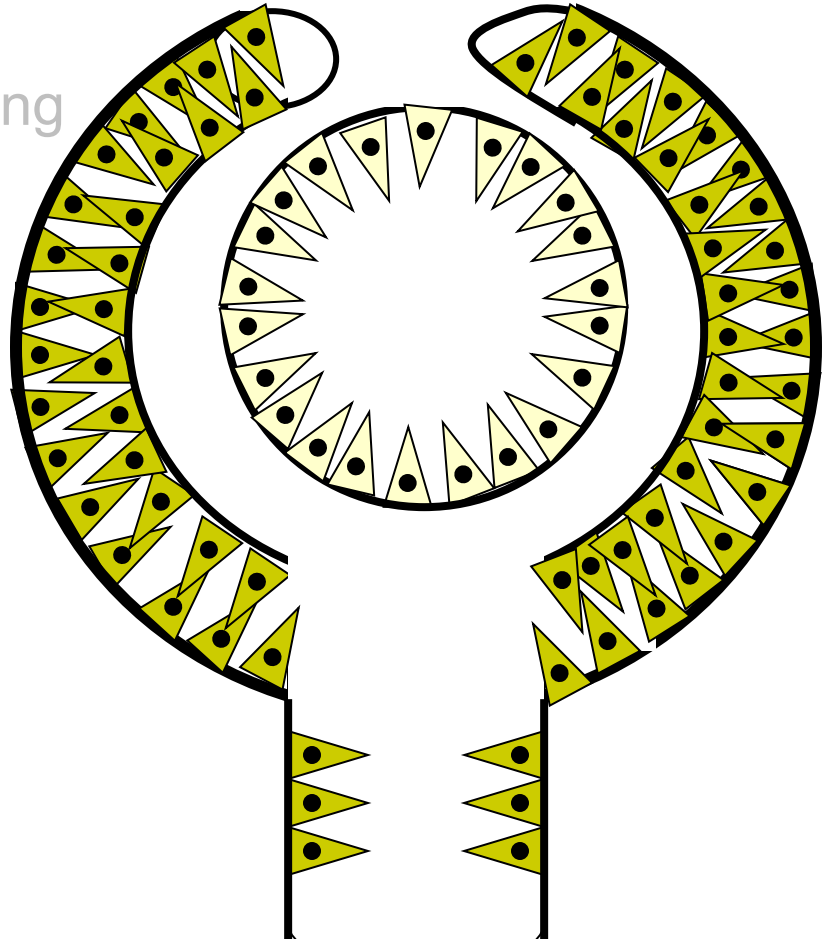
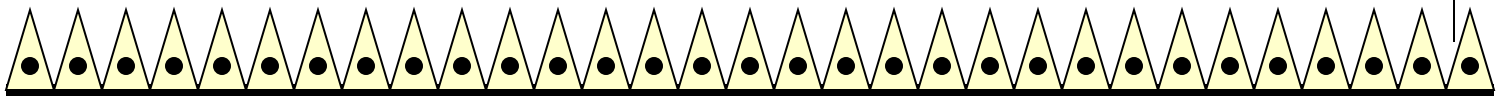


At this stage, the former optic vesicle is now called the

two words

Eye embryology made simply ridiculous



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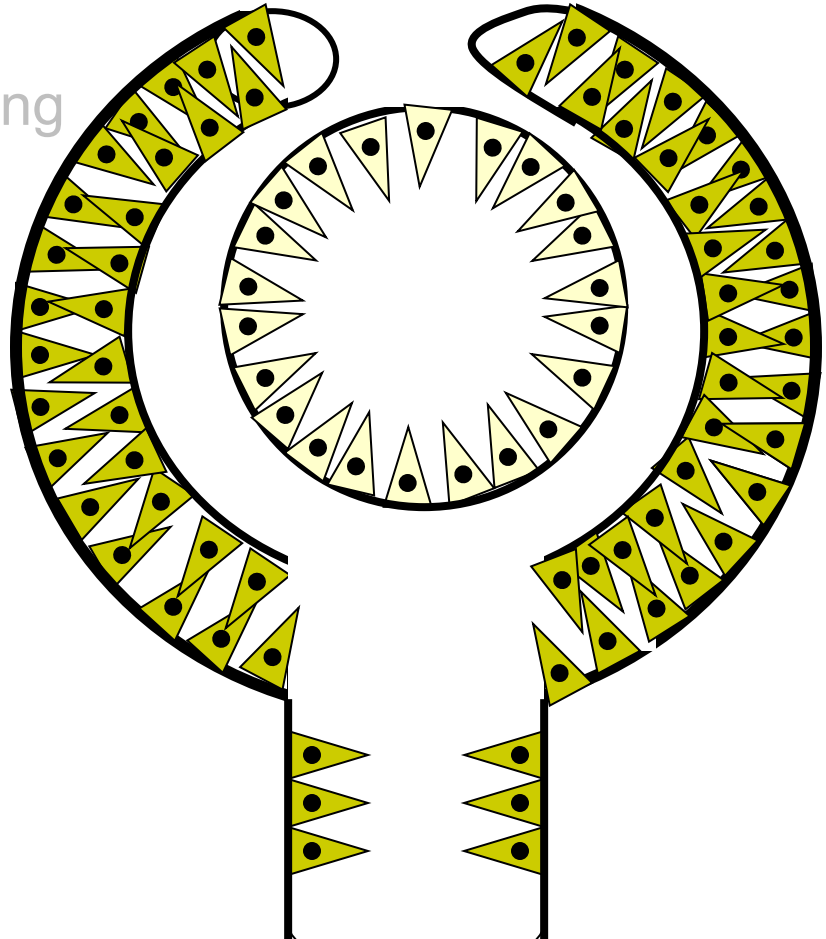
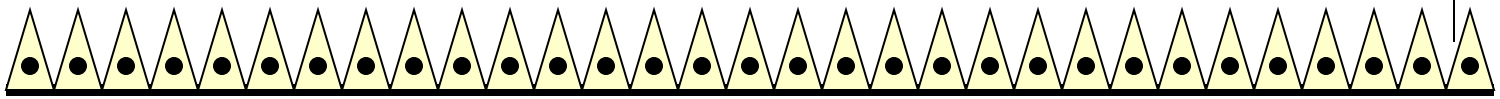


At this stage, the former optic vesicle is now called the *optic cup*.

Eye embryology made simply ridiculous

Note that the surface ectoderm re-establishes a continuous body wall



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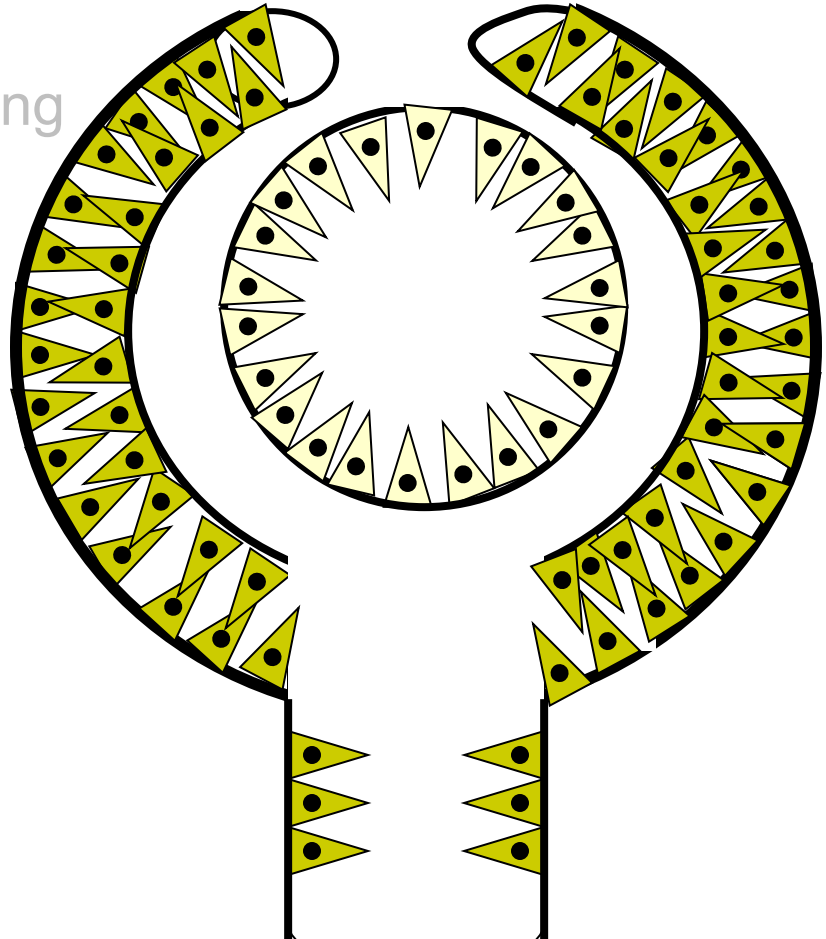

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Eye embryology made simply ridiculous

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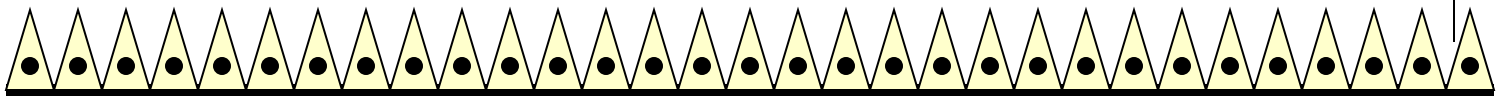
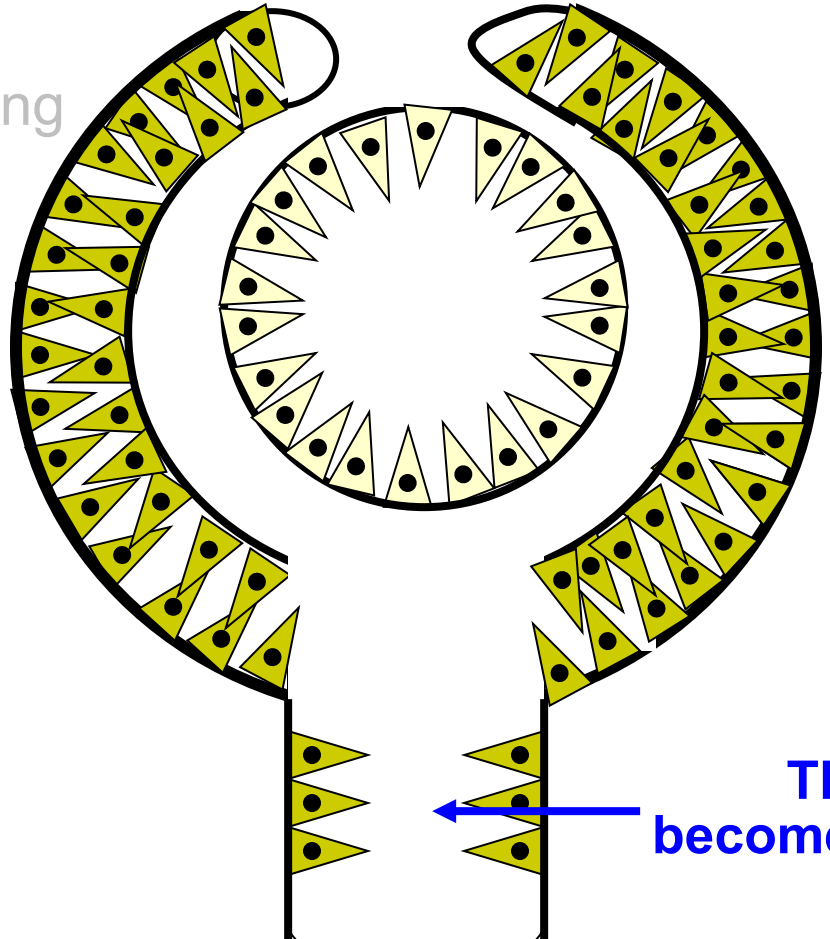


This process of invagination/following continues… and continues… until the two walls of neuroectoderm are apposing, and the surface ectoderm has formed a sphere.

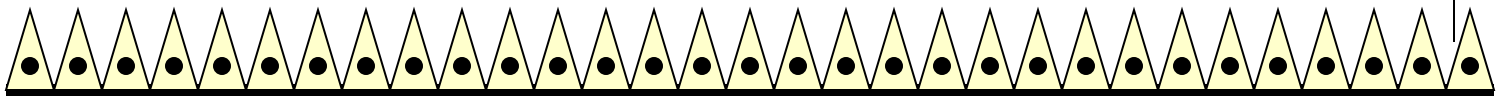


At this stage, the former optic vesicle is now called the *optic cup*.

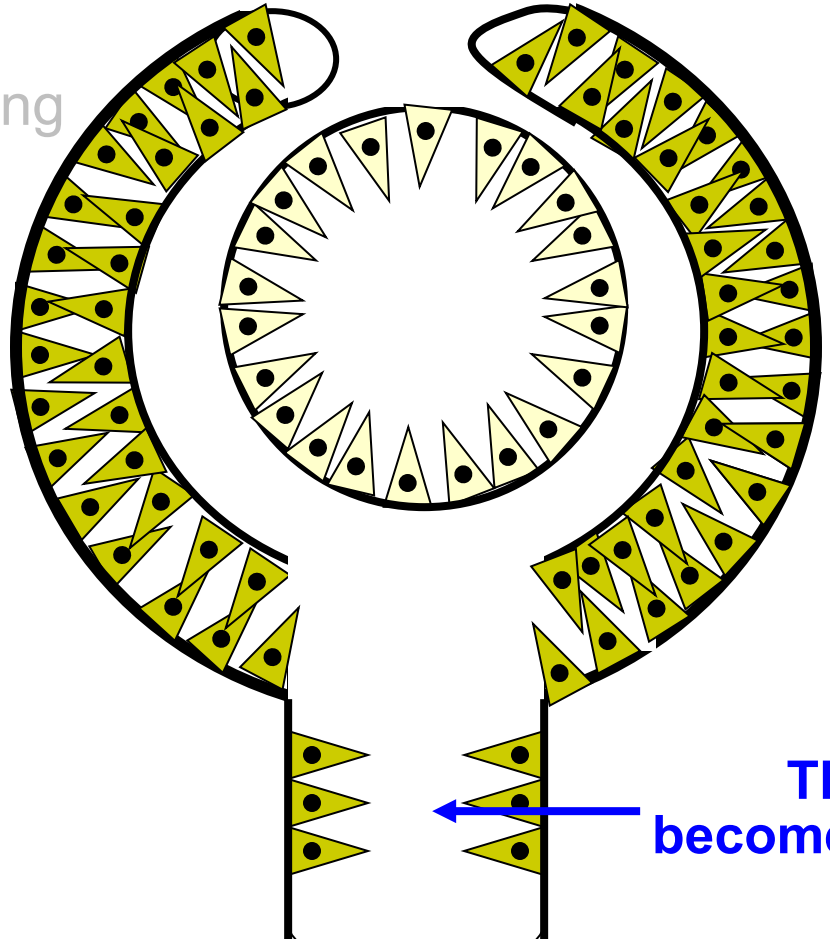
This part will become the two words

Eye embryology made simply ridiculous

Note that the surface ectoderm re-establishes a continuous body wall



This process of invagination/following continues… and continues… until the two walls of neuroectoderm are apposing, and the surface ectoderm has formed a sphere.

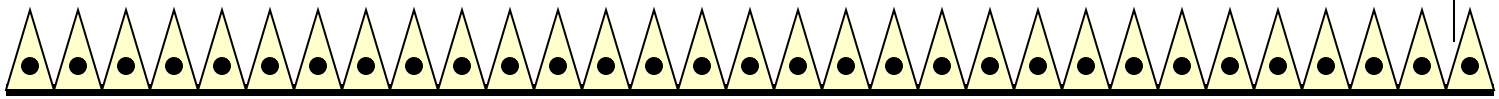


At this stage, the former optic vesicle is now called the *optic cup*.

This part will become the optic nerve

Eye embryology made simply ridiculous

Note that the surface ectoderm re-establishes a continuous body wall

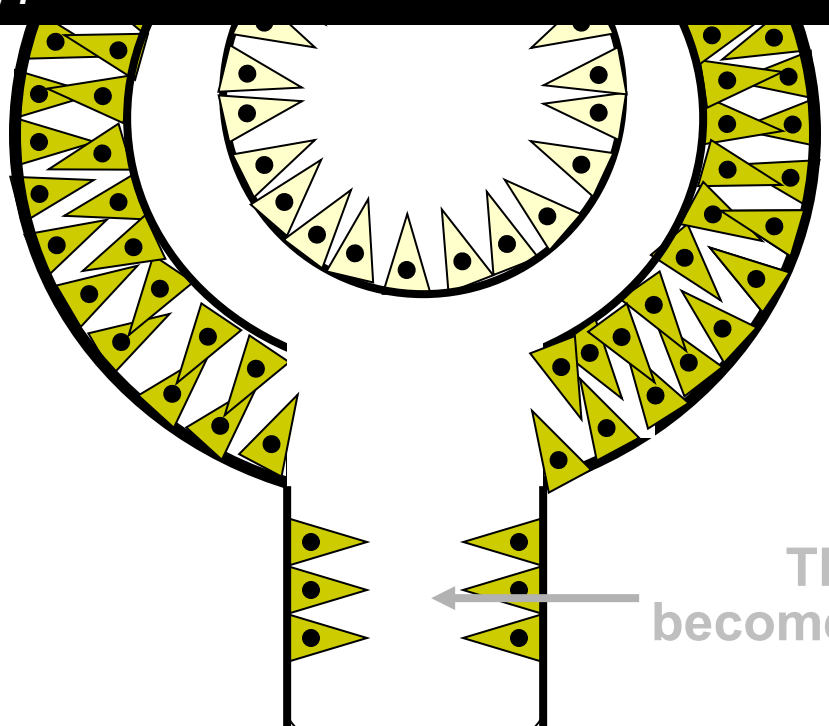


The re-established surface ectoderm will eventually give rise to a number of eye-related structures:

1) ***?***
2) ***?***
3) ***?***
4) ***?***

This process of invagination/follo
continues…
and continues…
until the two walls of neuroectoderm are apposing, and the surface ectoderm has formed a sphere.

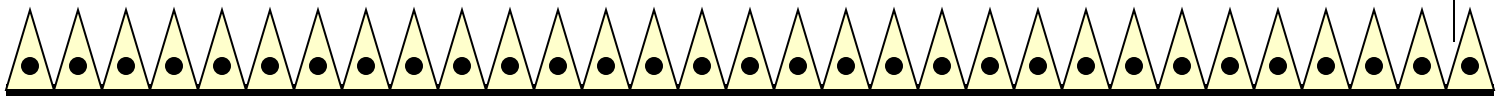
his stage, the
ner optic vesicle
is now called the
optic cup.



This part will become the optic nerve

Eye embryology made simply ridiculous

Note that the surface ectoderm re-establishes a continuous body wall

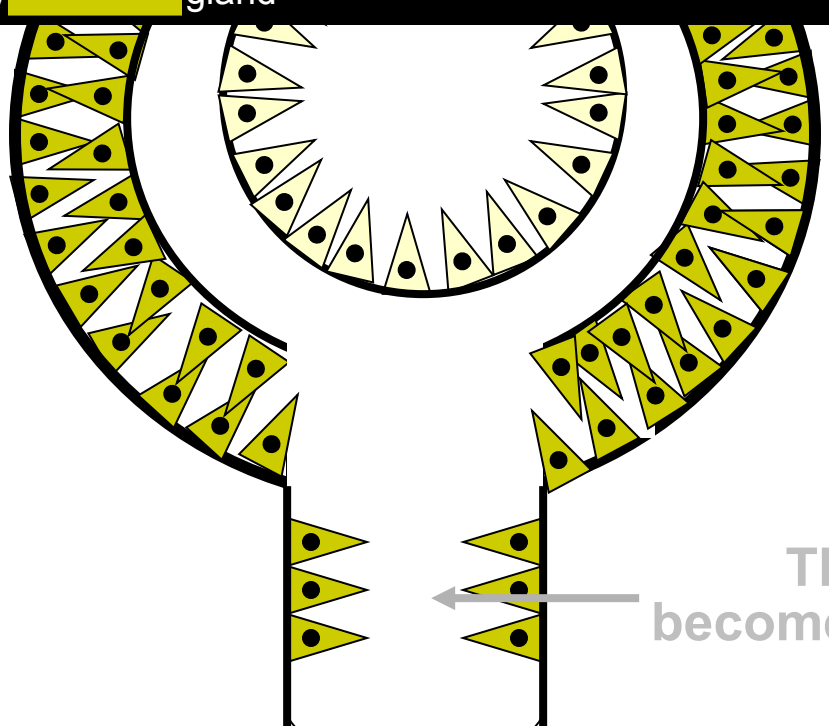


The re-established surface ectoderm will eventually give rise to a number of eye-related structures:

1) Epithelium of the [redacted]
2) Epithelium of the [redacted]
3) Eyelids
4) [redacted] gland

This process of invagination/follo continues… and continues… until the two walls of neuroectoderm are apposing, and the surface ectoderm has formed a sphere.

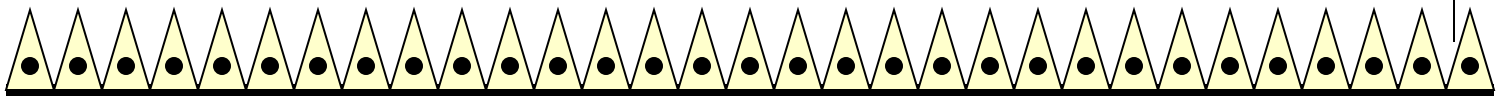
his stage, the ner optic vesicle is now called the *optic cup*.



This part will become the optic nerve

Eye embryology made simply ridiculous

Note that the surface ectoderm re-establishes a continuous body wall

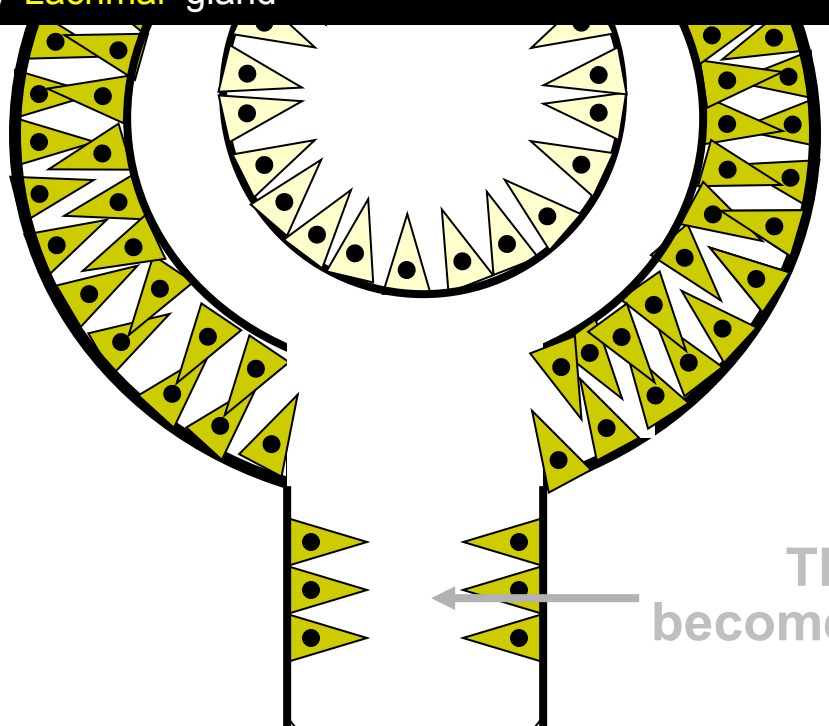


The re-established surface ectoderm will eventually give rise to a number of eye-related structures:

1) Epithelium of the conjunctiva
2) Epithelium of the cornea
3) Eyelids
4) Lacrimal gland

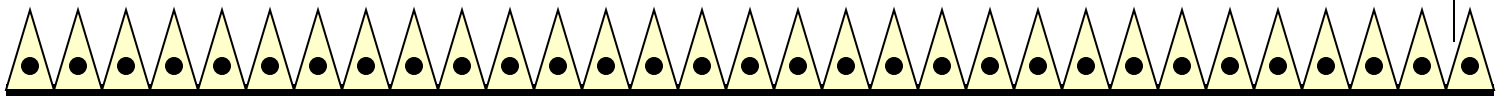
This process of invagination/follo
continues…
and continues…
until the two walls of neuroectoderm are apposing, and the surface ectoderm has formed a sphere.

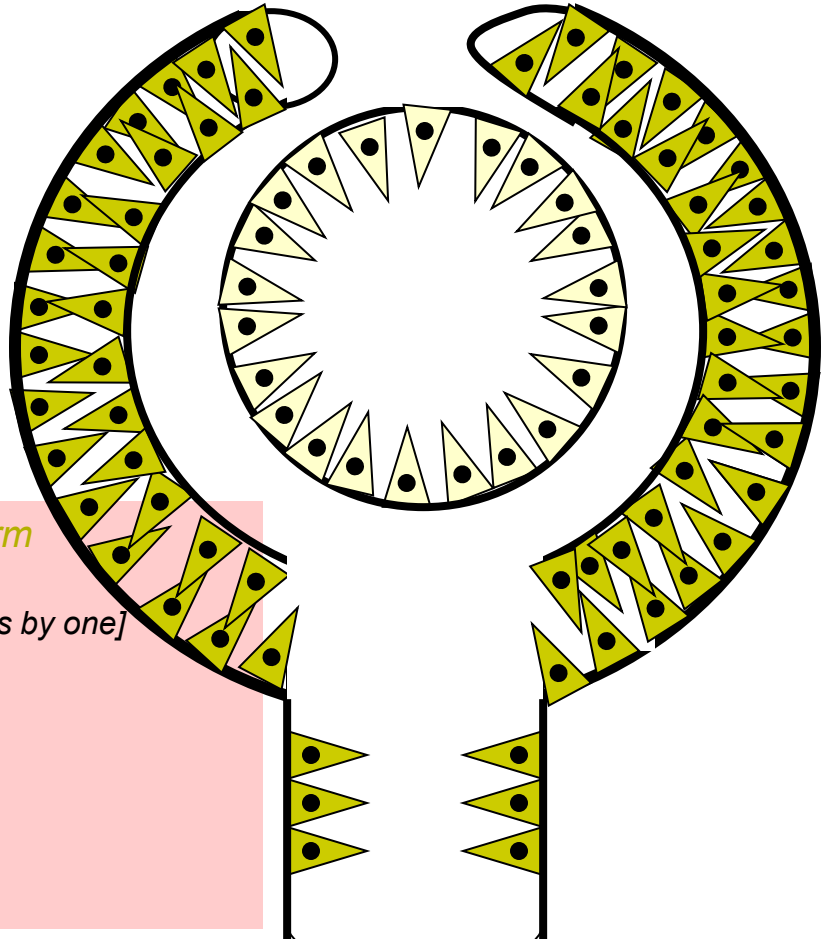
his stage, the
ner optic vesicle
is now called the
optic cup.



This part will become the optic nerve

Eye embryology made simply ridiculous



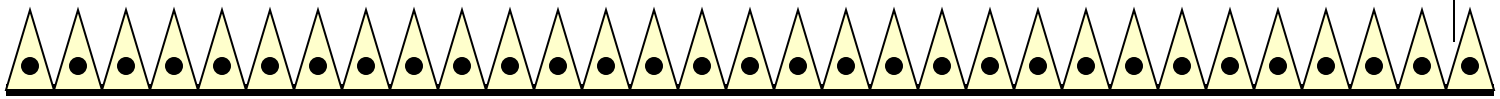


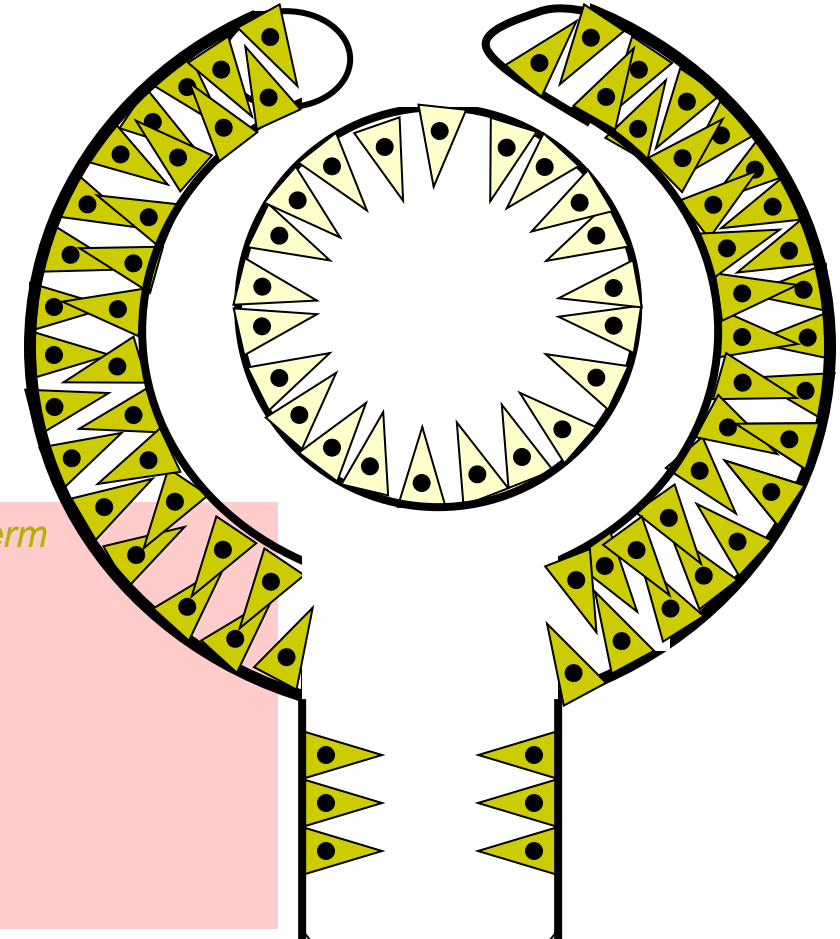
The invaginated neuroectoderm gives rise to the:

1) *[Technically two words, but goes by one]*
2)
3)

4)
5)
6)

Eye embryology made simply ridiculous



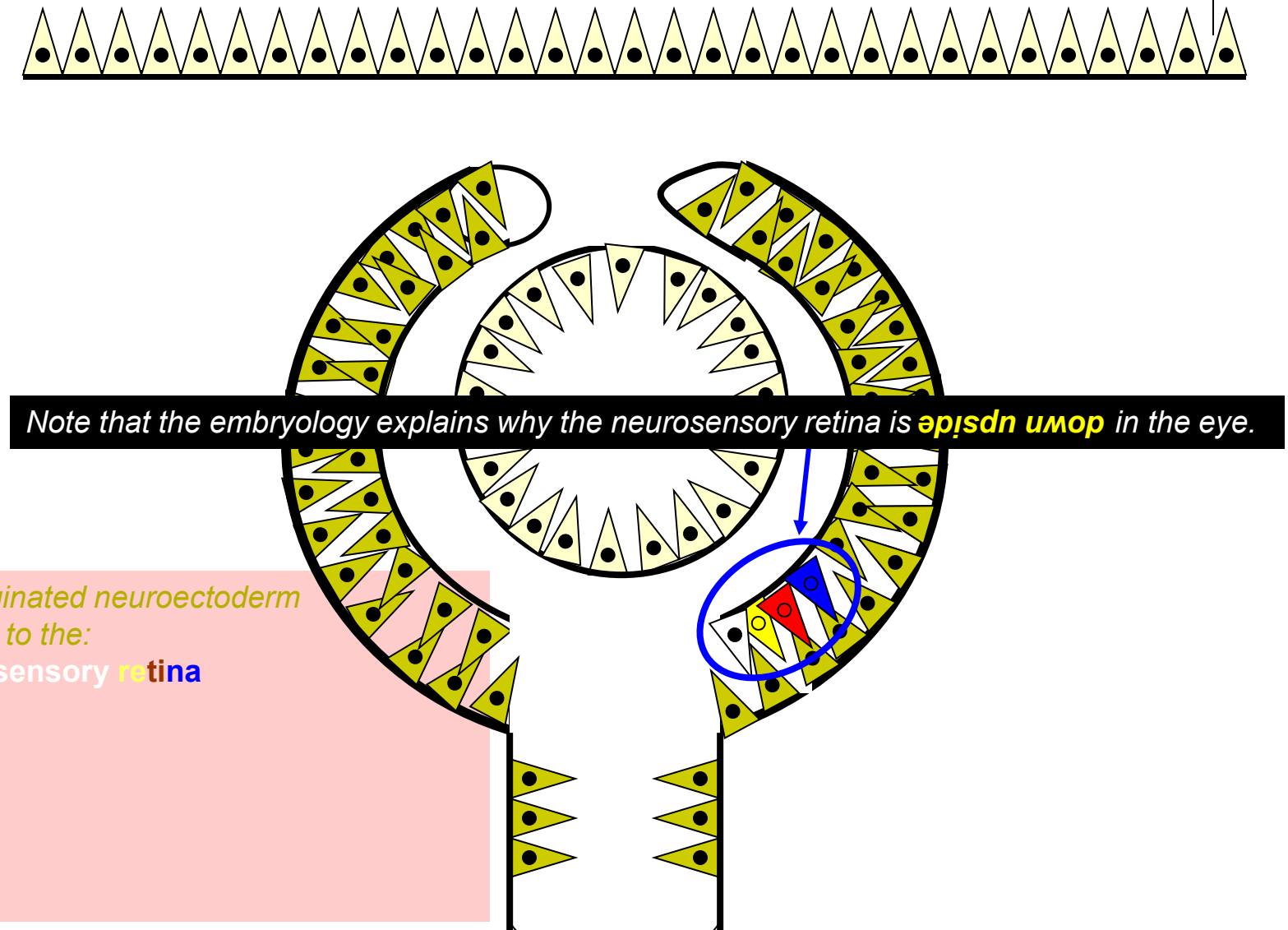


The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2)
3)

4)
5)
6)

Eye embryology made simply ridiculous

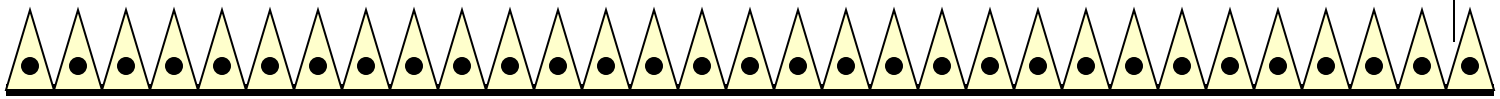


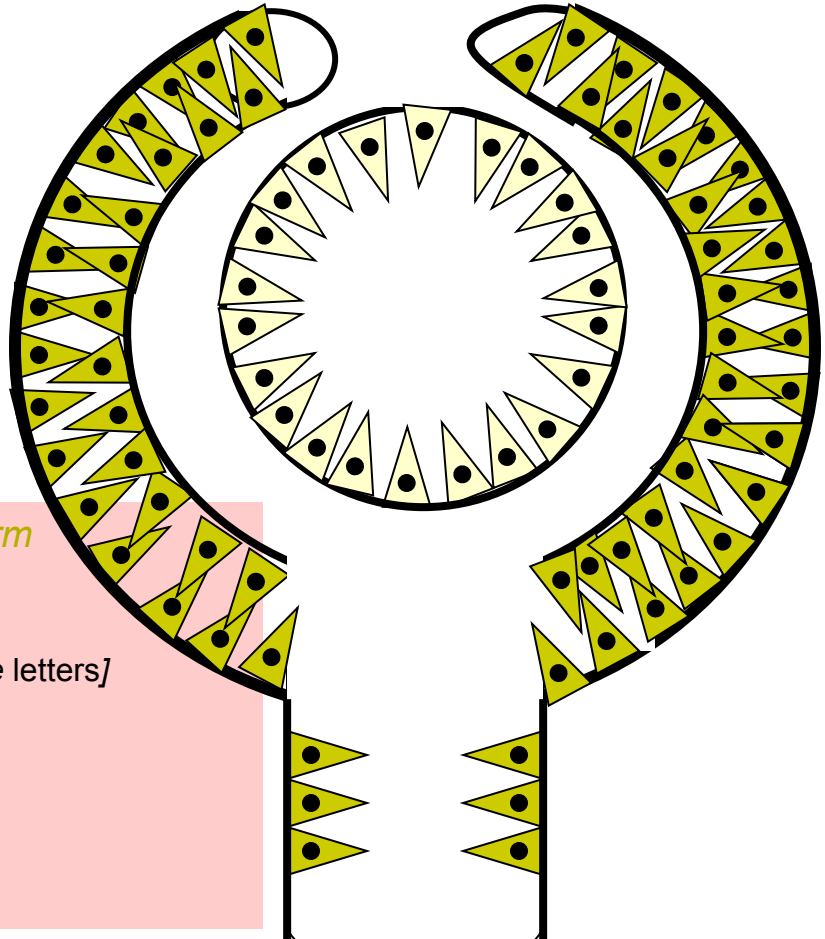
The invaginated neuroectoderm gives rise to the:

1) **Neuro**sensory retina
2)
3)

4)
5)
6)

Eye embryology made simply ridiculous



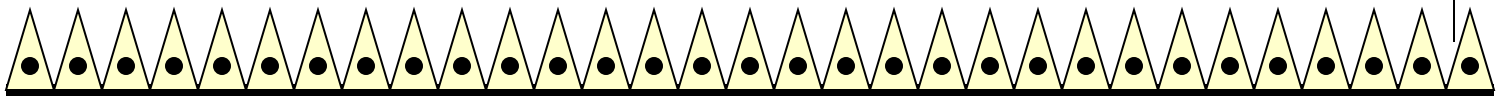


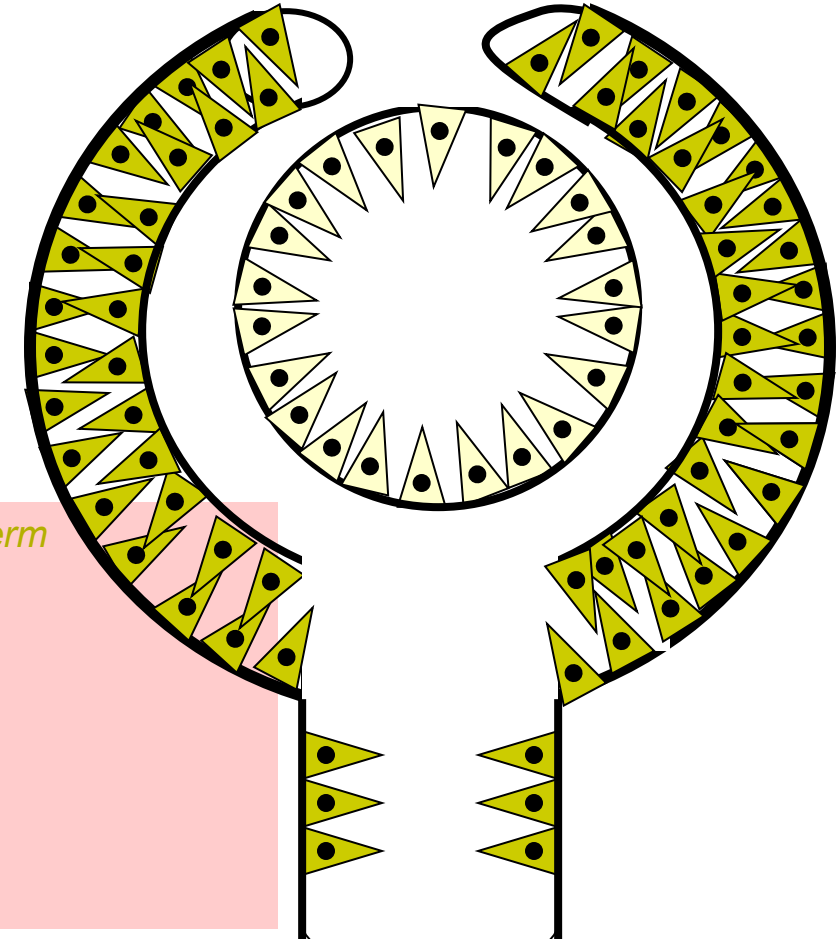
The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) *[Three words, but goes by three* letters*]*
3)

4)
5)
6)

Eye embryology made simply ridiculous



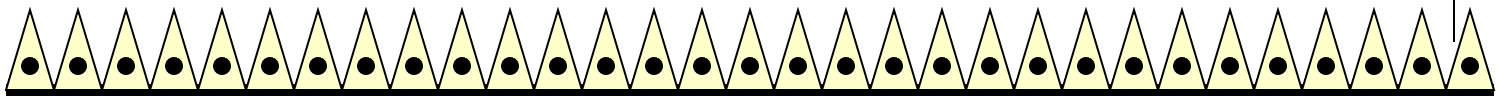


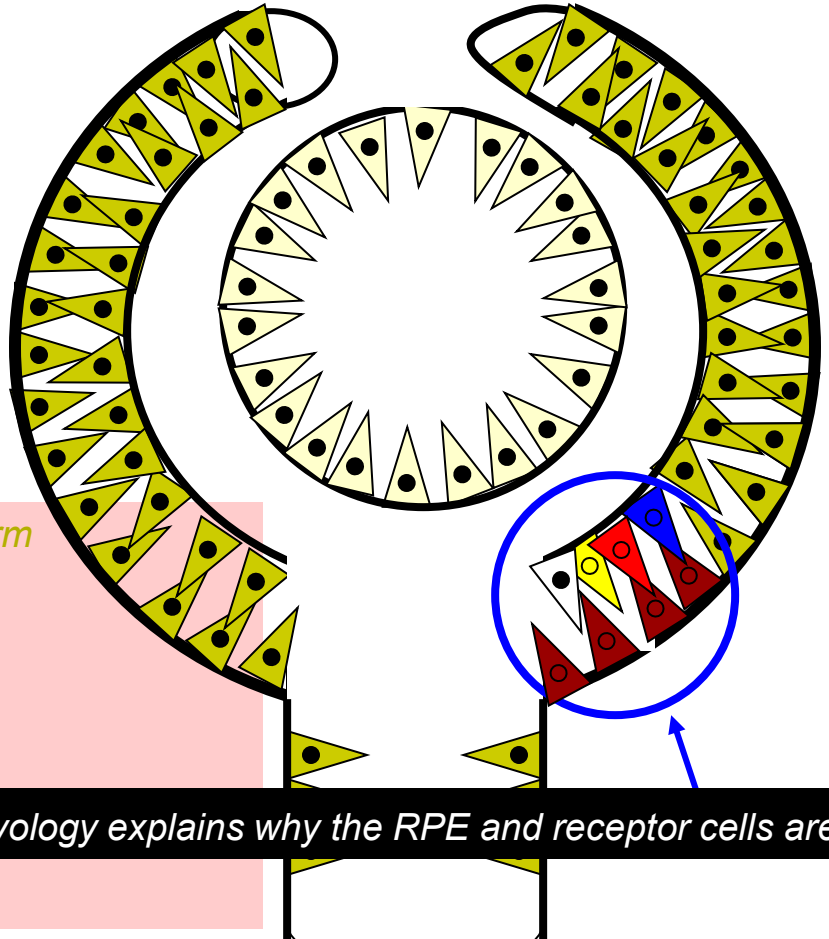
The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3)

4)
5)
6)

Eye embryology made simply ridiculous



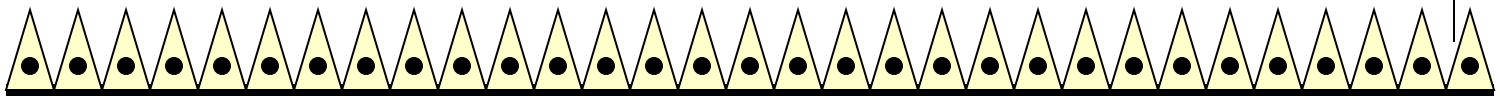


The invaginated neuroectoderm gives rise to the:

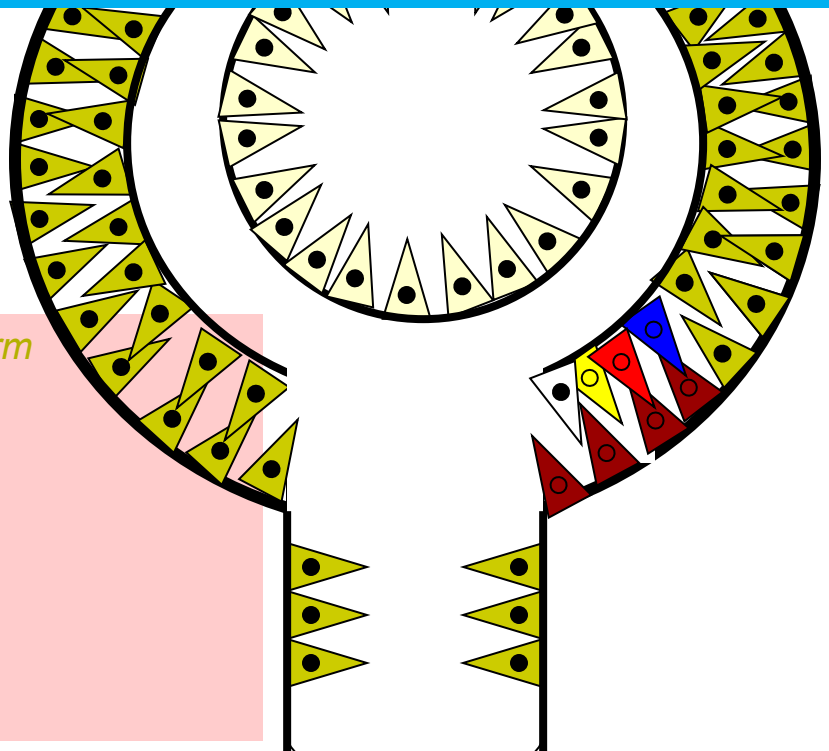
1) **Neurosensory retina**
2) **RPE**
3)
4)
5)
6)

Note also that the embryology explains why the RPE and receptor cells are arranged **apex-to-apex**

Eye embryology made simply ridiculous



*Also, the embryology explains why rhegmatogenous retinal detachments occur. The neurosensory retina and RPE are not attached to one another, but rather are separated by a **potential space**—the remnant of the space contained within the optic vesicle. Breaks in the retina allow syneretic vitreous to gain access to this space—and the result is a rhegmatogenous RD.*

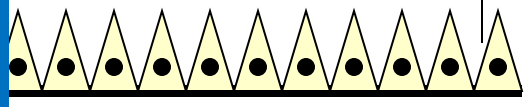


The invaginated neuroectoderm gives rise to the:

1) **Neurosensory retina**
2) **RPE**
3)
4)
5)
6)

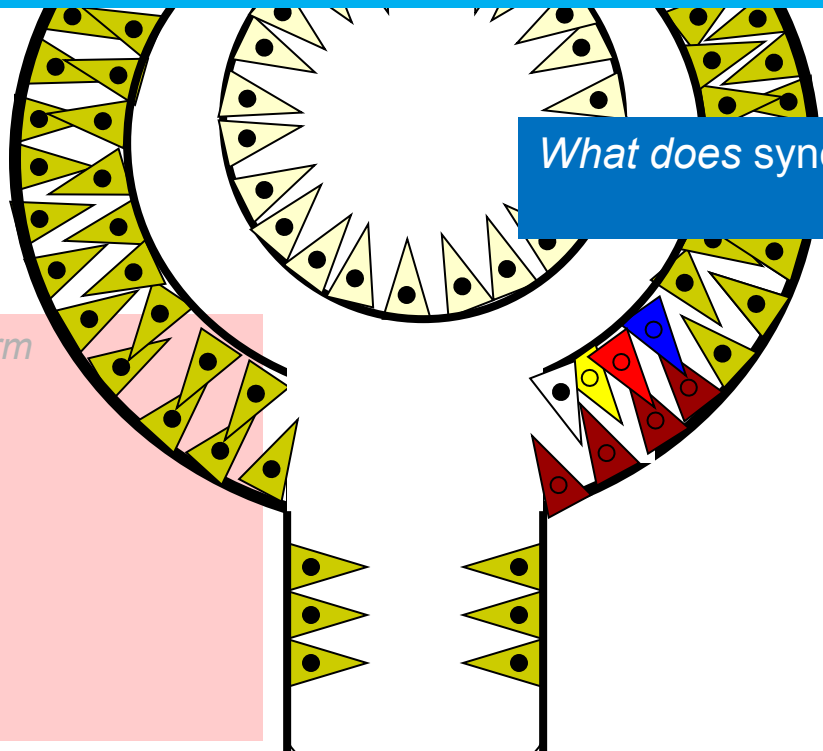
Eye embryology made simply ridiculous

What does rhegmatogenous *mean in this context?*



Also, the embryology explains why ***rhegmatogenous*** *retinal detachments occur. The neurosensory retina and RPE are not attached to one another, but rather are separated by a potential space—the remnant of the space contained within the optic vesicle. Breaks in the retina allow* ***syneretic*** *vitreous to gain access to this space—and the result is a rhegmatogenous RD.*

What does syneretic *mean in this context?*



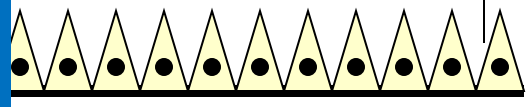
The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3)

4)
5)
6)

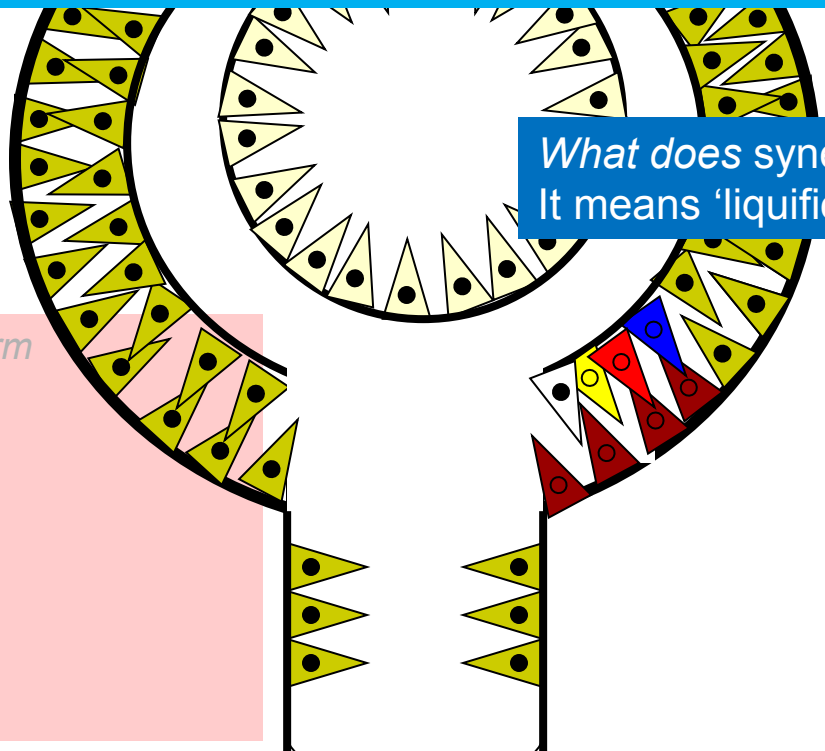
Eye embryology made simply ridiculous

What does rhegmatogenous *mean in this context?*
It means 'associated with a break or tear'



Also, the embryology explains why ***rhegmatogenous*** *retinal detachments occur. The neurosensory retina and RPE are not attached to one another, but rather are separated by a potential space—the remnant of the space contained within the optic vesicle. Breaks in the retina allow* ***syneretic*** *vitreous to gain access to this space—and the result is a rhegmatogenous RD.*

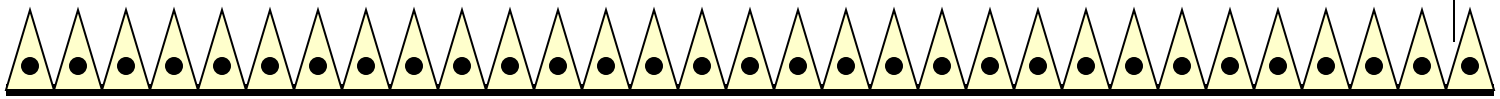
What does syneretic *mean in this context?*
It means 'liquified'

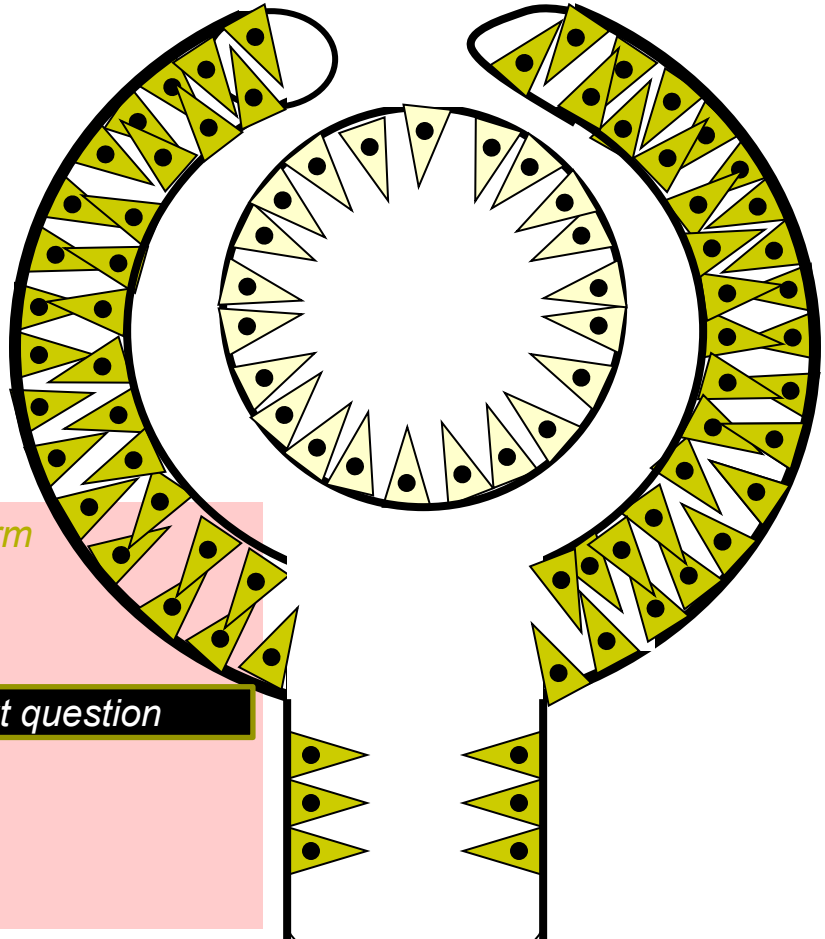


The invaginated neuroectoderm gives rise to the:
1) Neurosensory retina
2) RPE
3)

4)
5)
6)

Eye embryology made simply ridiculous





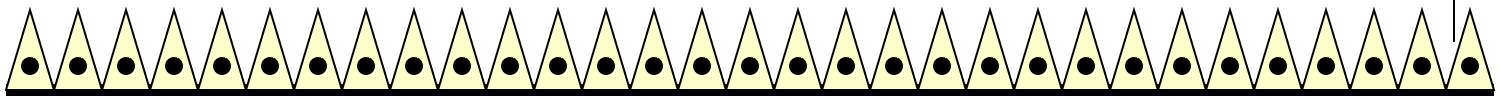
The invaginated neuroectoderm gives rise to the:

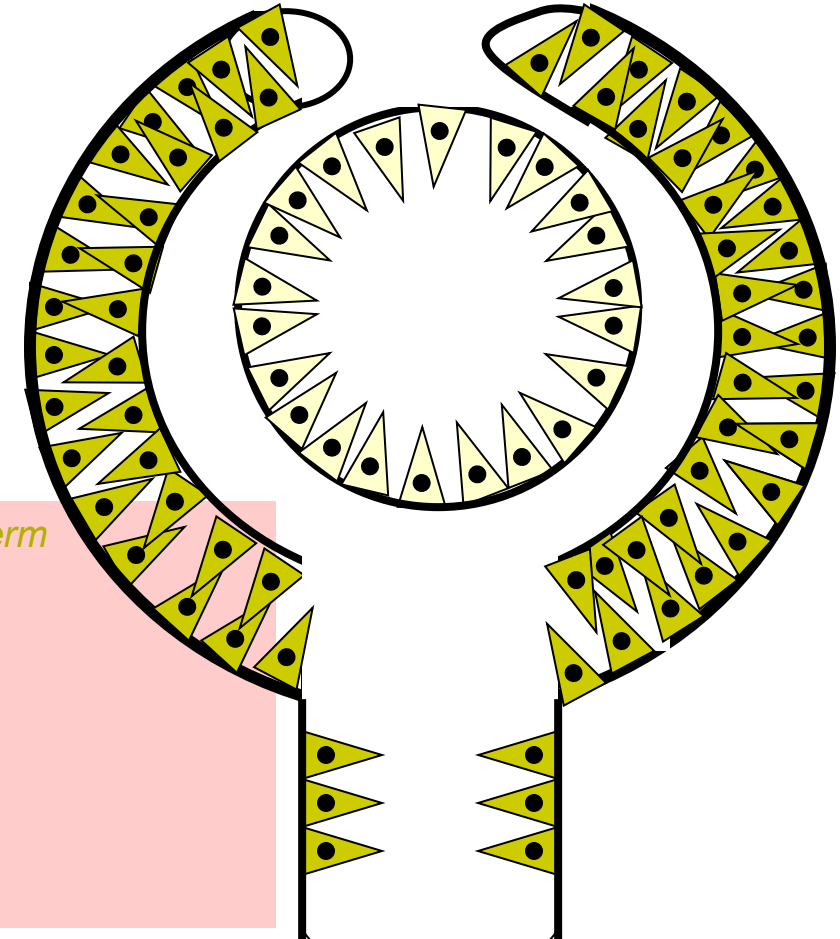
1) Neurosensory retina
2) RPE
3) *[Three words]*

Next question

4)
5)
6)

Eye embryology made simply ridiculous



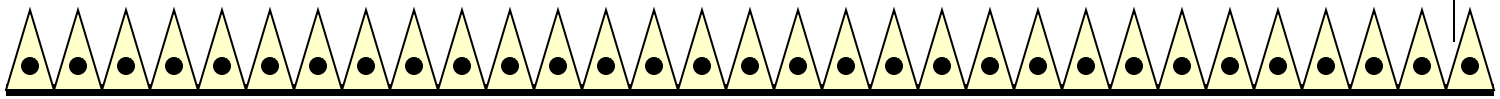


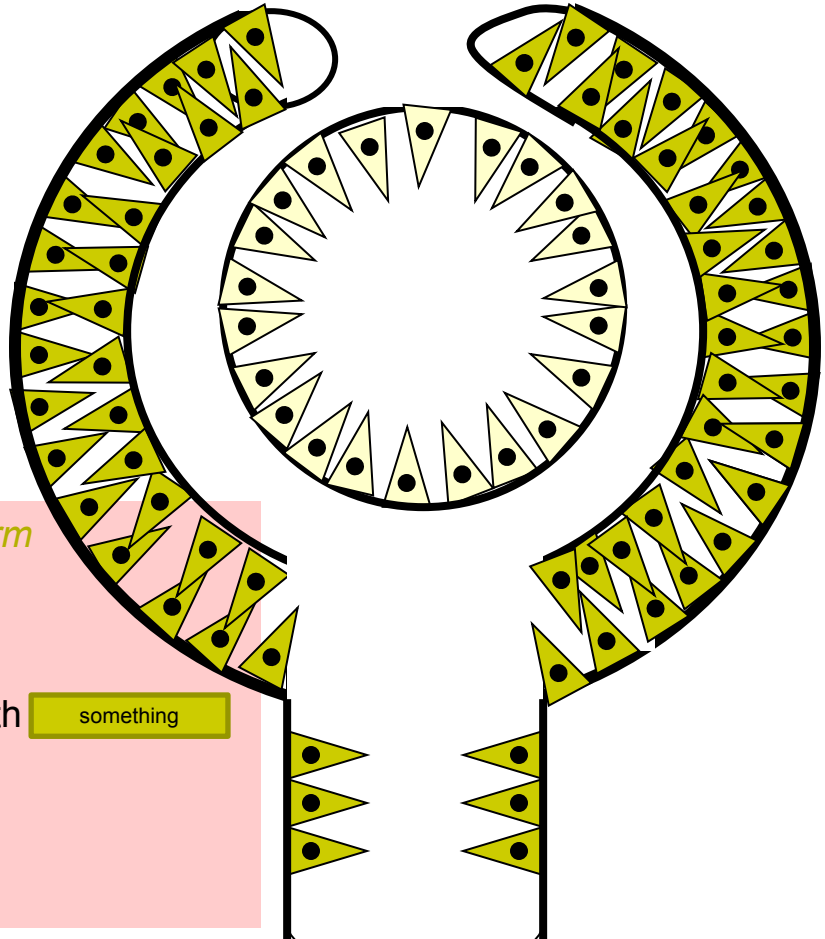
The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3) Ciliary-body epithelium

4)
5)
6)

Eye embryology made simply ridiculous

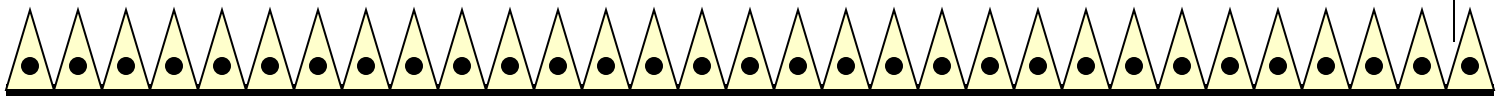


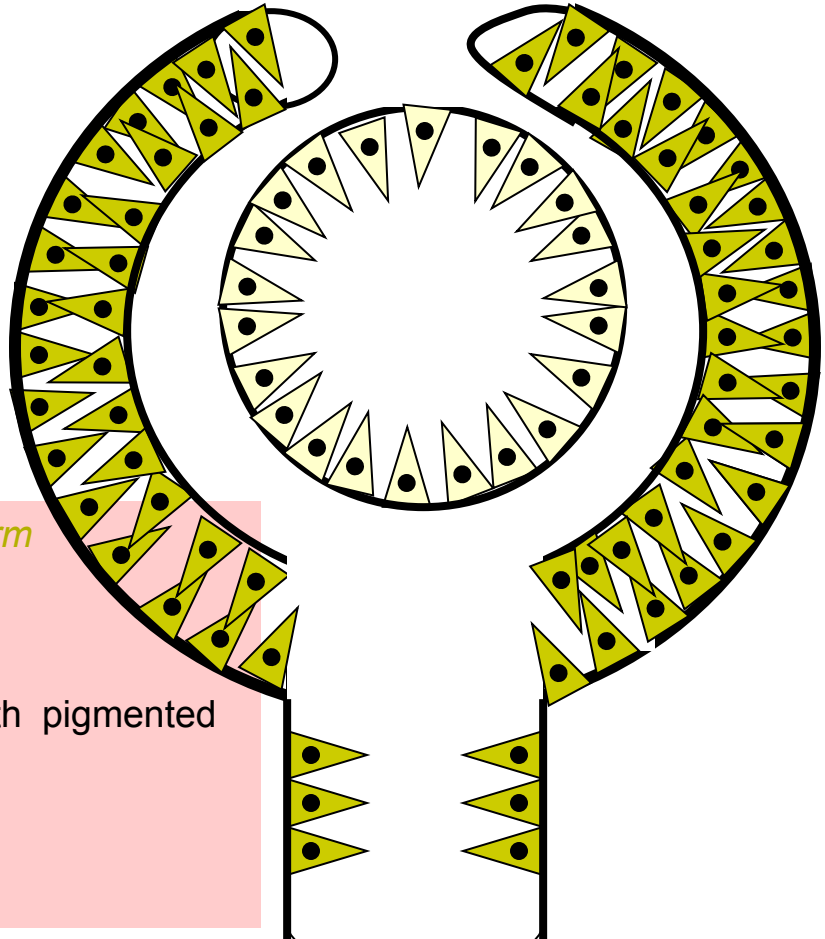


The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3) Ciliary-body epithelium (both something and its opposite layers)
4)
5)
6)

Eye embryology made simply ridiculous

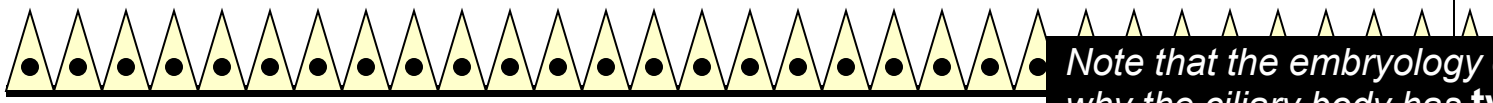


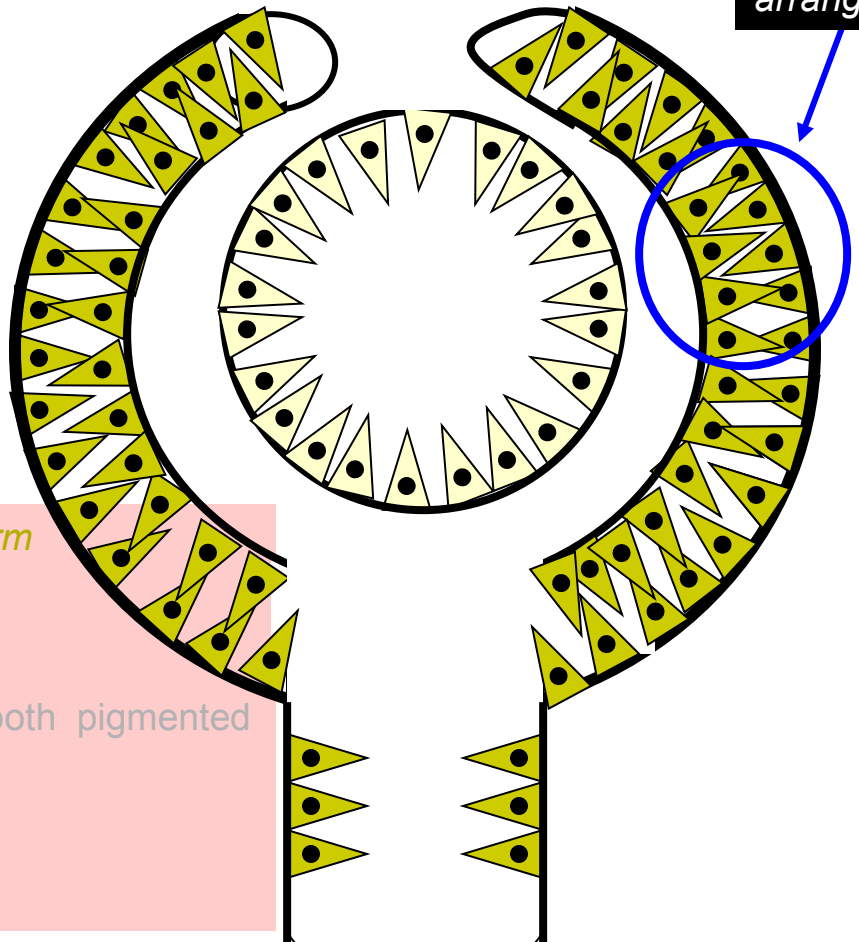


The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3) Ciliary-body epithelium (both pigmented and nonpigmented layers)
4)
5)
6)

Eye embryology made simply ridiculous



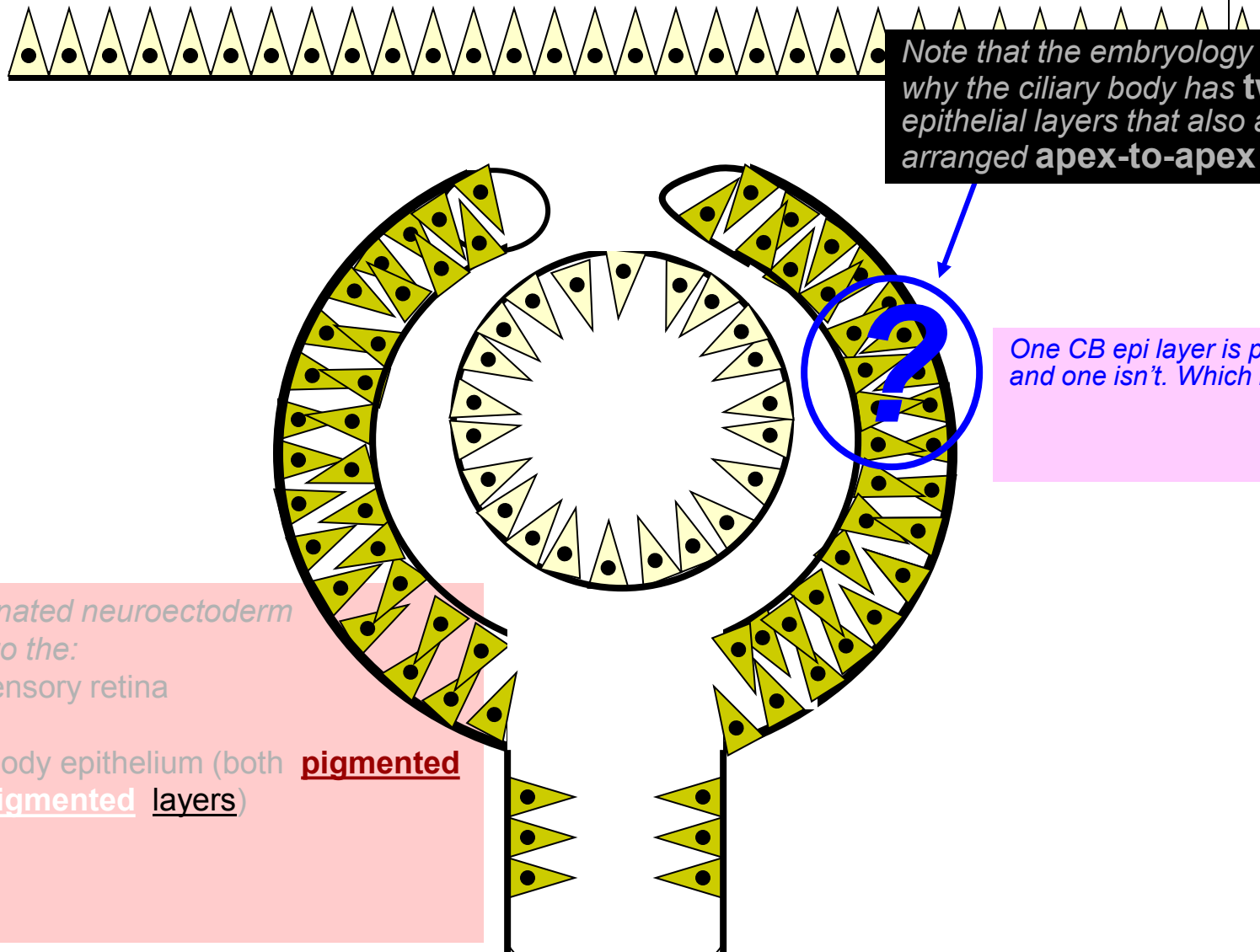


Note that the embryology explains why the ciliary body has **two** *epithelial layers that also are arranged* **apex-to-apex**

The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3) **Ciliary-body epithelium** (both pigmented and nonpigmented layers)
4)
5)
6)

Eye embryology made simply ridiculous



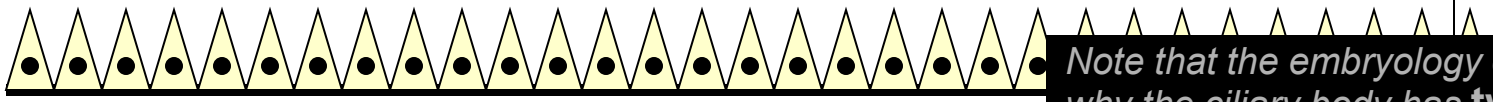
Note that the embryology explains why the ciliary body has **two** *epithelial layers that also are arranged* **apex-to-apex**

One CB epi layer is pigmented, and one isn't. Which is which?

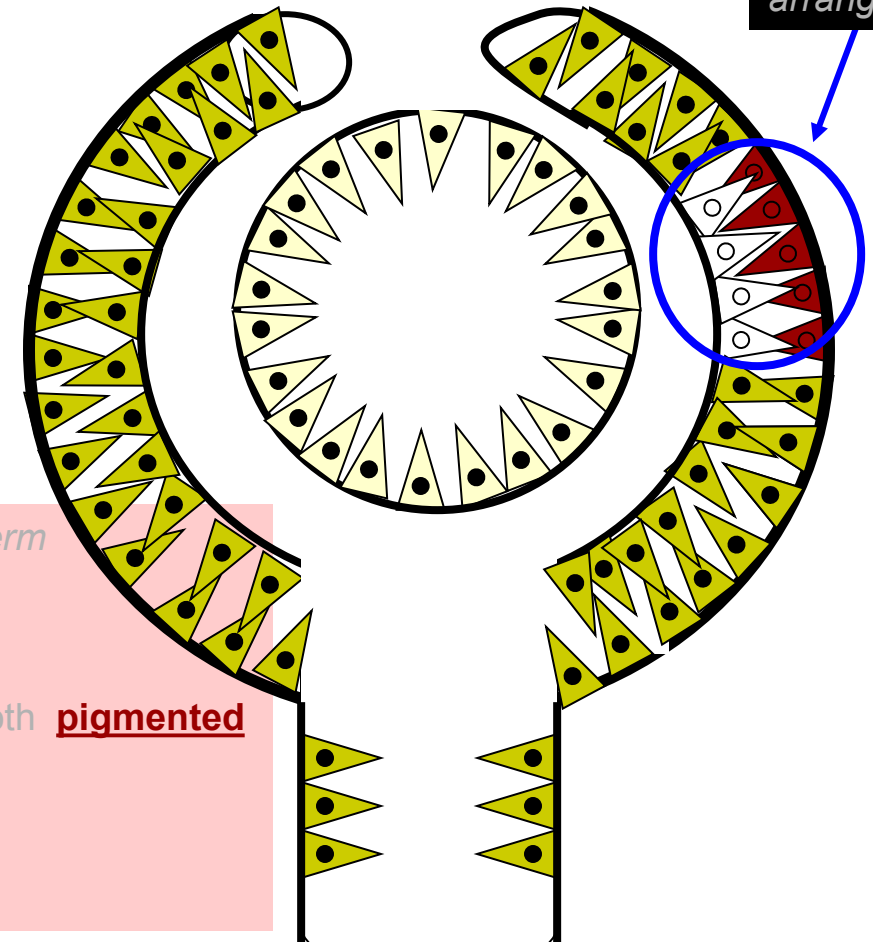
The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3) Ciliary-body epithelium (both **pigmented** and **nonpigmented** layers)
4)
5)
6)

Eye embryology made simply ridiculous



Note that the embryology explains why the ciliary body has **two** *epithelial layers that also are arranged* **apex-to-apex**

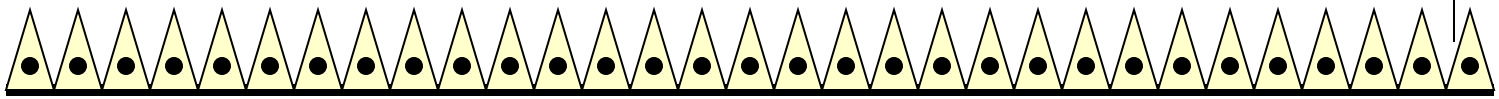


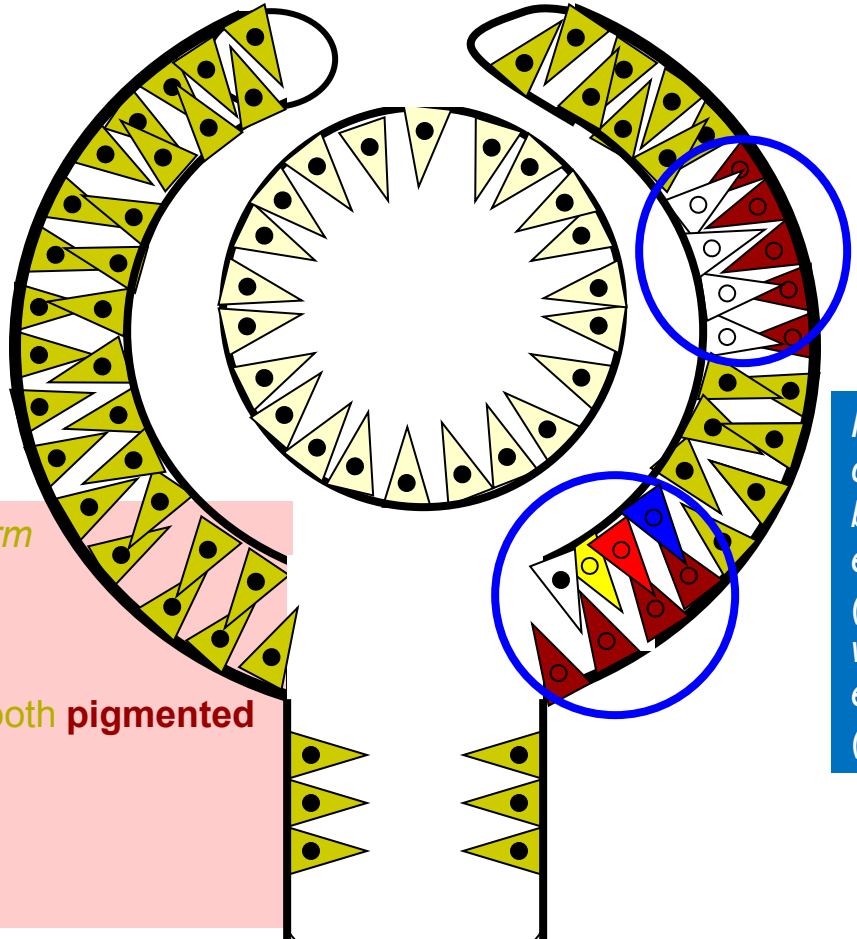
One CB epi layer is pigmented, and one isn't. Which is which? The inner (nearest the lens) layer is nonpigmented; the outer (next to the CB stroma) is pigmented.

The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3) Ciliary-body epithelium (both **pigmented** and **nonpigmented** layers)
4)
5)
6)

Eye embryology made simply ridiculous





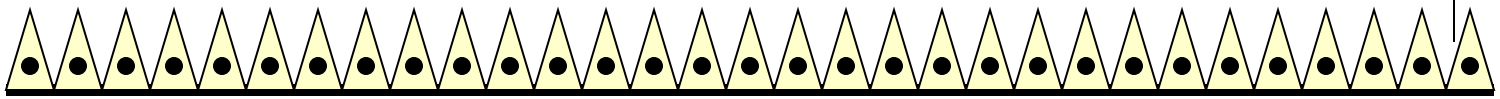
The invaginated neuroectoderm gives rise to the:

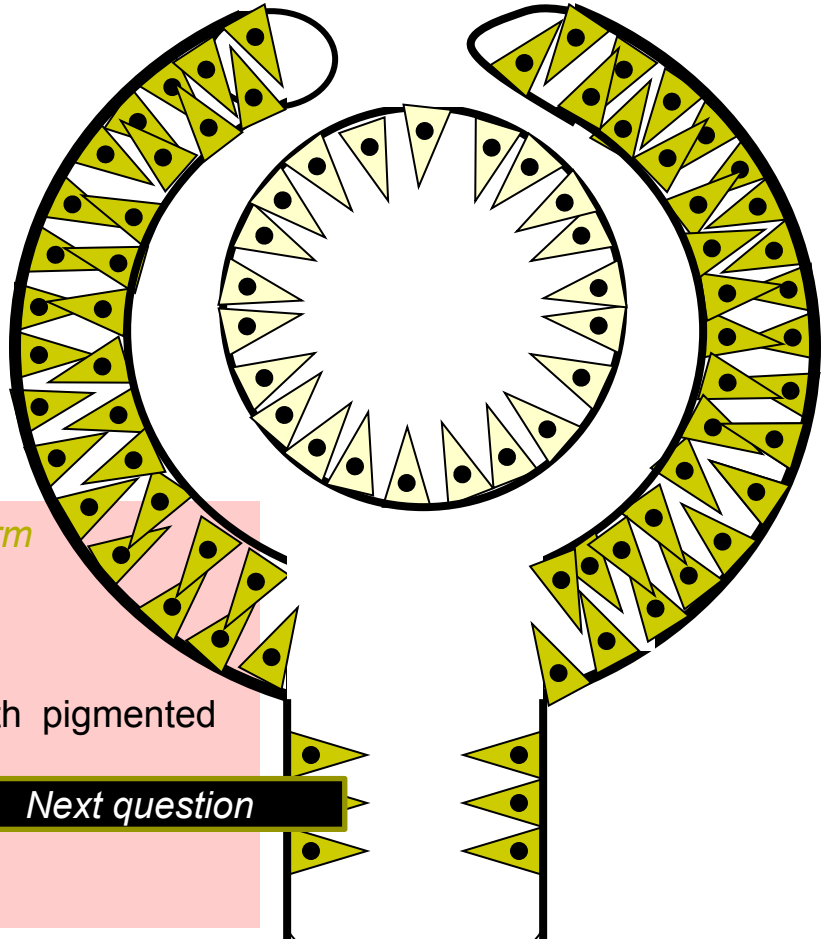
1) **Neurosensory retina**
2) **RPE**
3) **Ciliary-body epithelium** (both **pigmented** and **nonpigmented** layers)
4)
5)
6)

One CB epi layer is pigmented, and one isn't. Which is which?
The inner (nearest the lens) layer is nonpigmented; the outer (next to the CB stroma) is pigmented.

Note how the embryology can help you remember this, because the pigmented CB epi is continuous with the (heavily pigmented) RPE, while the nonpigmented CB epi is continuous with the (largely nonpigmented) retina.

Eye embryology made simply ridiculous



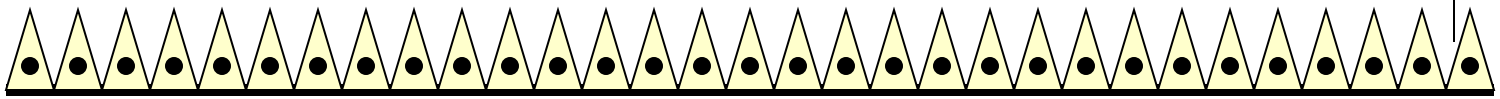


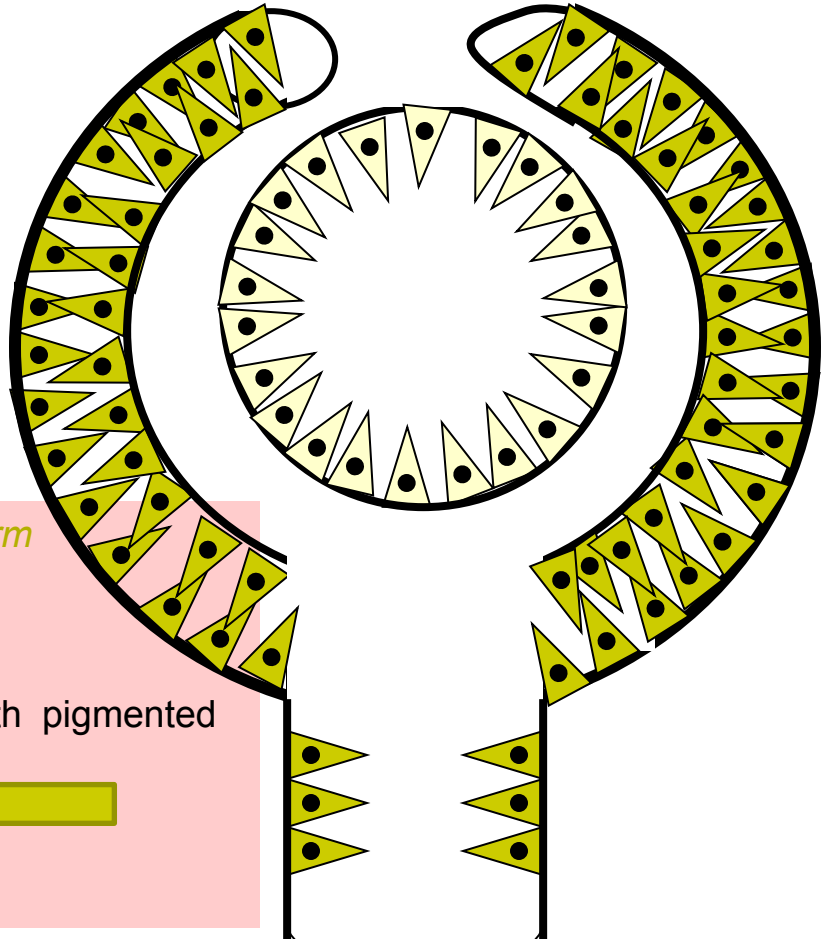
The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3) Ciliary-body epithelium (both pigmented and nonpigmented layers)
4) *[Another epithelium]*
5)
6)

Next question

Eye embryology made simply ridiculous

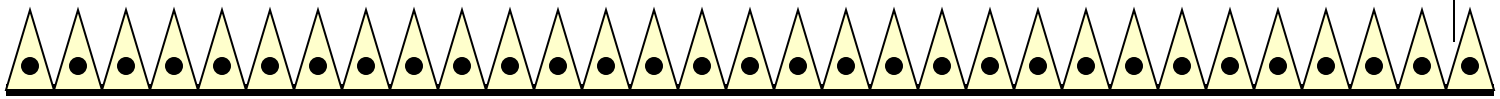


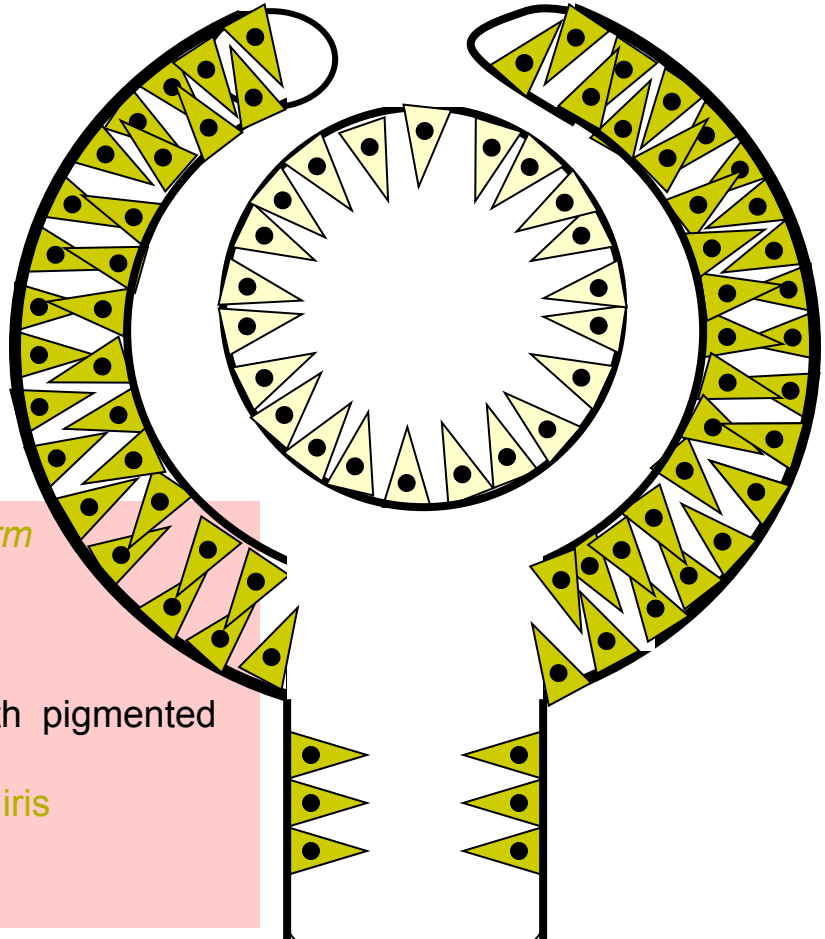


The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3) Ciliary-body epithelium (both pigmented and nonpigmented layers)
4) Posterior epithelium of the
5)
6)

Eye embryology made simply ridiculous



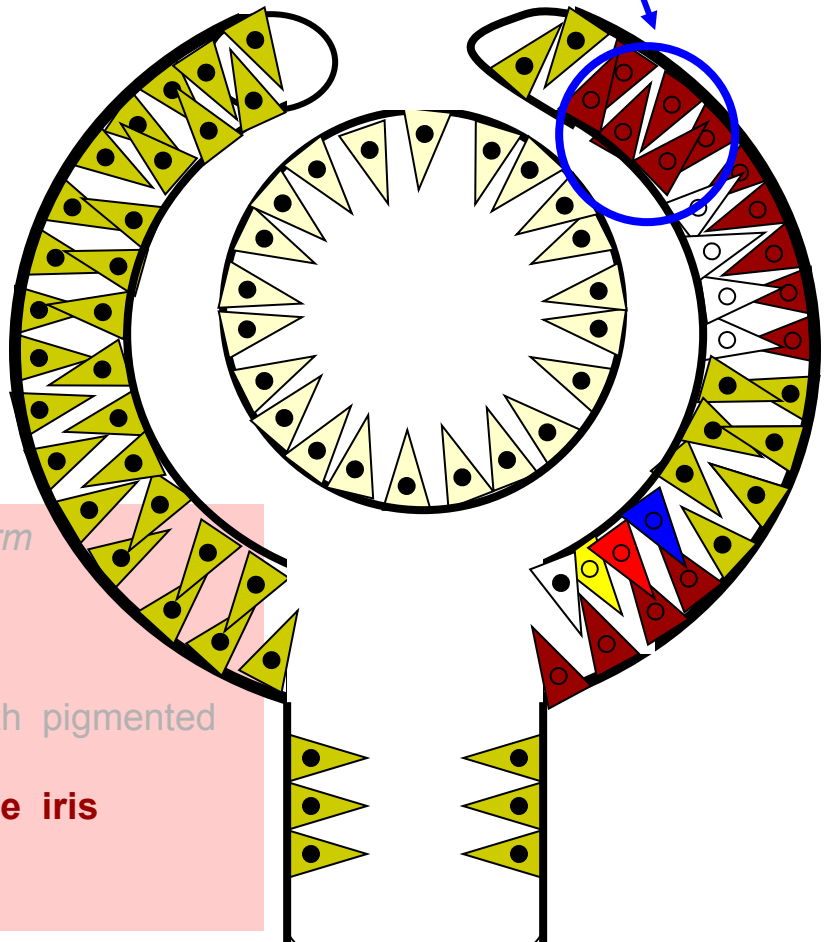


The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3) Ciliary-body epithelium (both pigmented and nonpigmented layers)
4) Posterior epithelium of the iris
5)
6)

Eye embryology made simply ridiculous

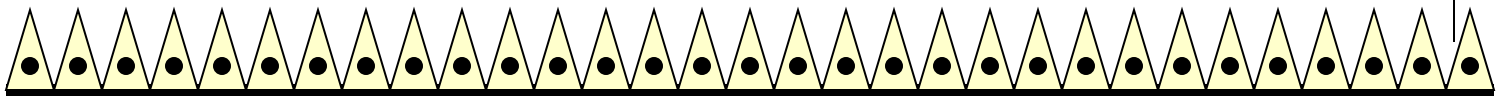
Note that the embryology explains why the iris has **two** *epithelial layers that are arranged* **apex-to-apex,** but it is **less** helpful for remembering that ***both*** epithelial layers are **pigmented** (you're on your own for that fact!).

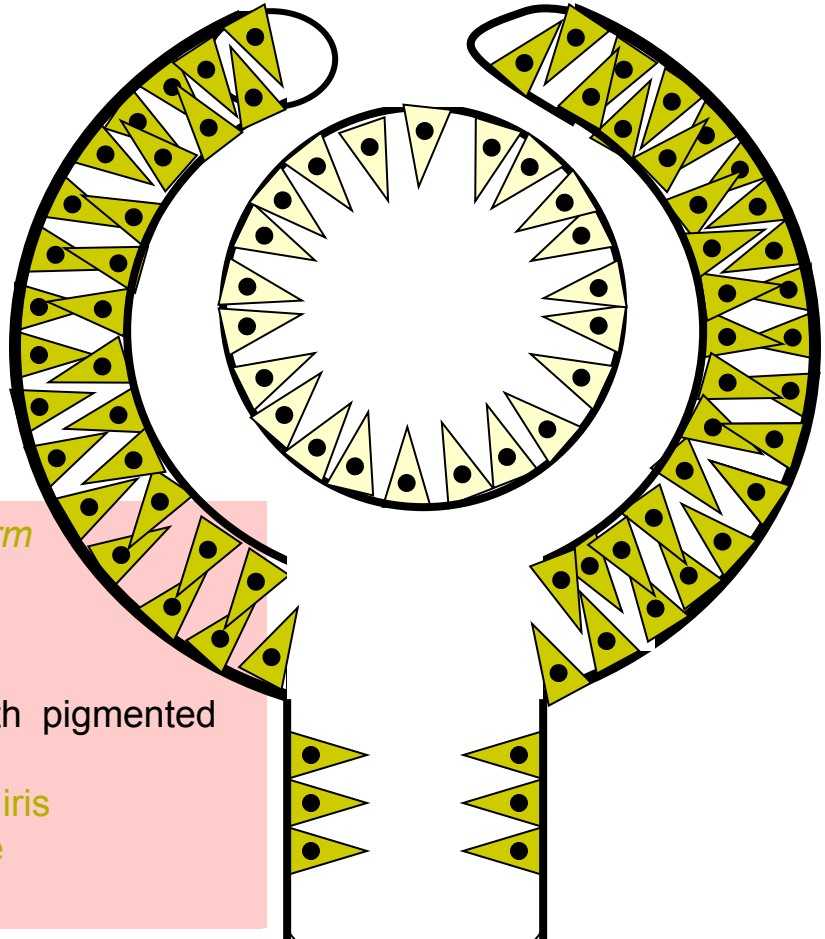


The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3) Ciliary-body epithelium (both pigmented and nonpigmented layers)
4) **Posterior epithelium of the iris**
5)
6)

Eye embryology made simply ridiculous

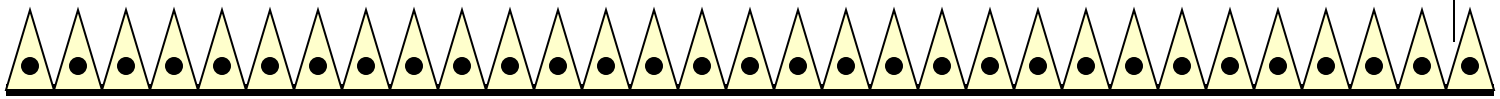


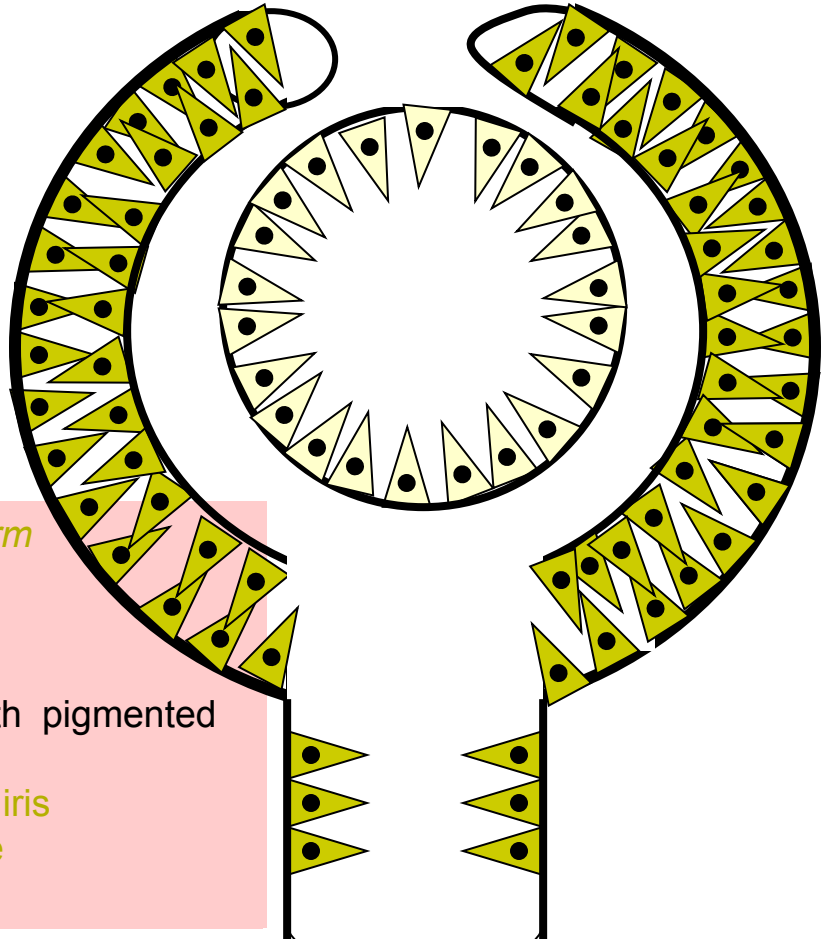


The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3) Ciliary-body epithelium (both pigmented and nonpigmented layers)
4) Posterior epithelium of the iris
5) Pupillary [redacted] muscle
6) Pupillary [redacted] muscle

Eye embryology made simply ridiculous

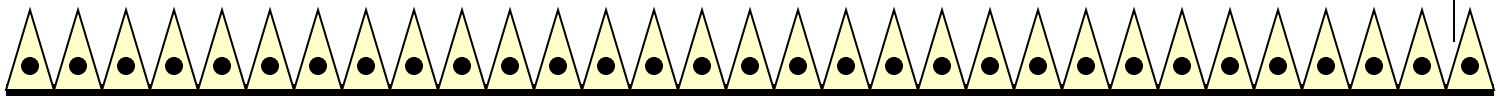


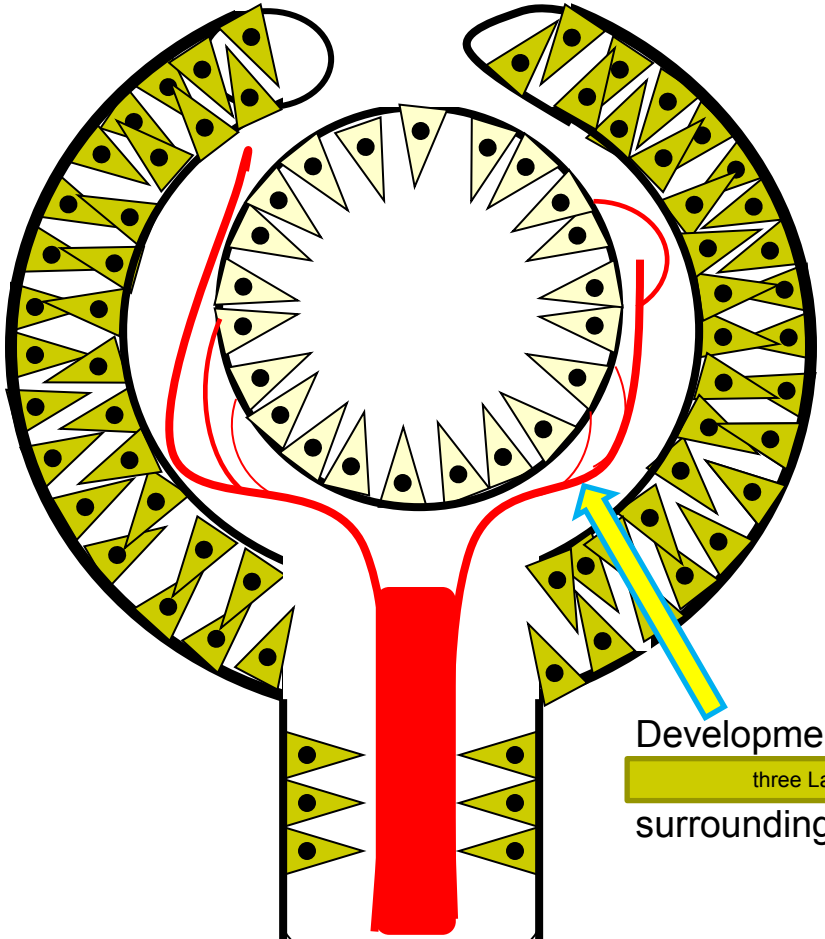


The invaginated neuroectoderm gives rise to the:

1) Neurosensory retina
2) RPE
3) Ciliary-body epithelium (both pigmented and nonpigmented layers)
4) Posterior epithelium of the iris
5) Pupillary sphincter muscle
6) Pupillary dilator muscle

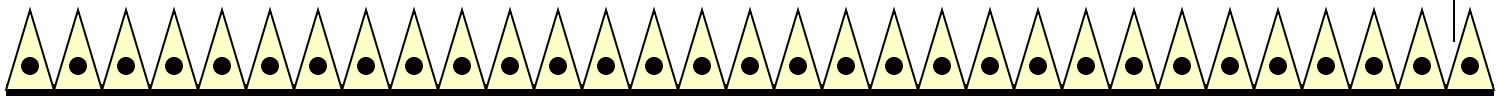
Eye embryology made simply ridiculous

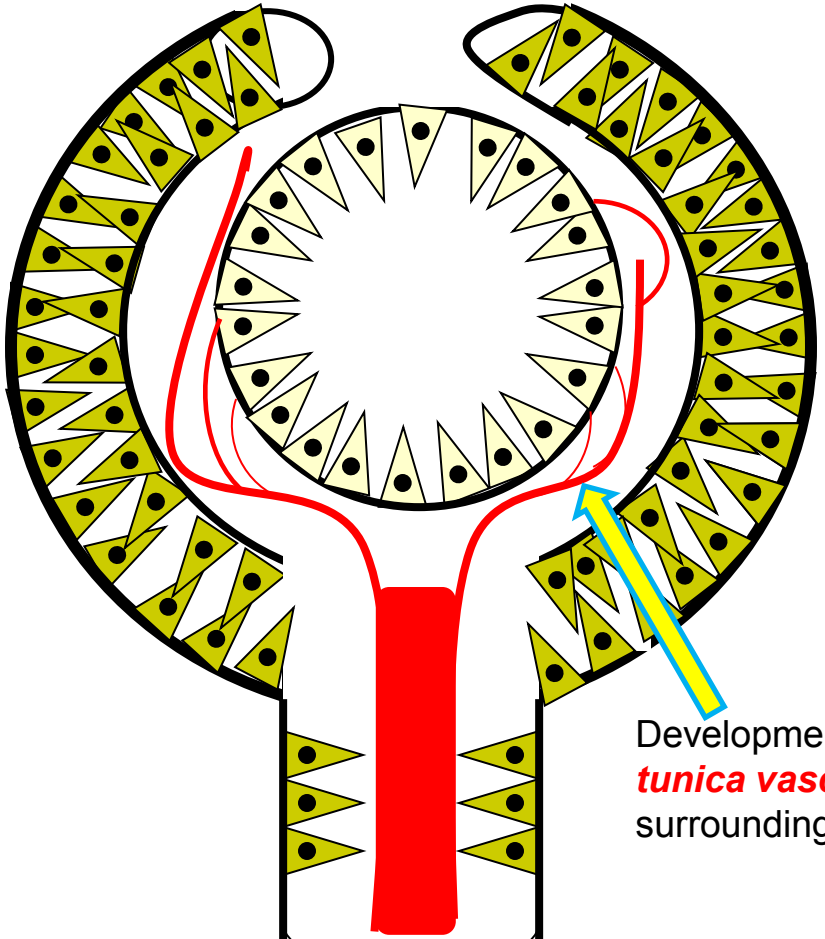




Development of the lens is supported by the three Latin words, a vascular web surrounding the lens vesicle.

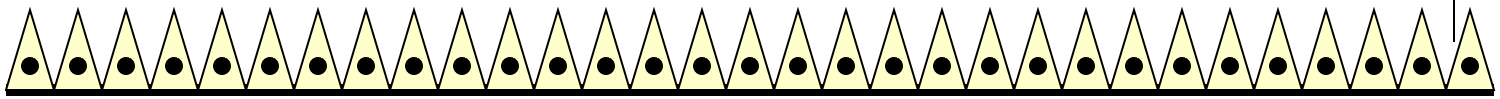
Eye embryology made simply ridiculous

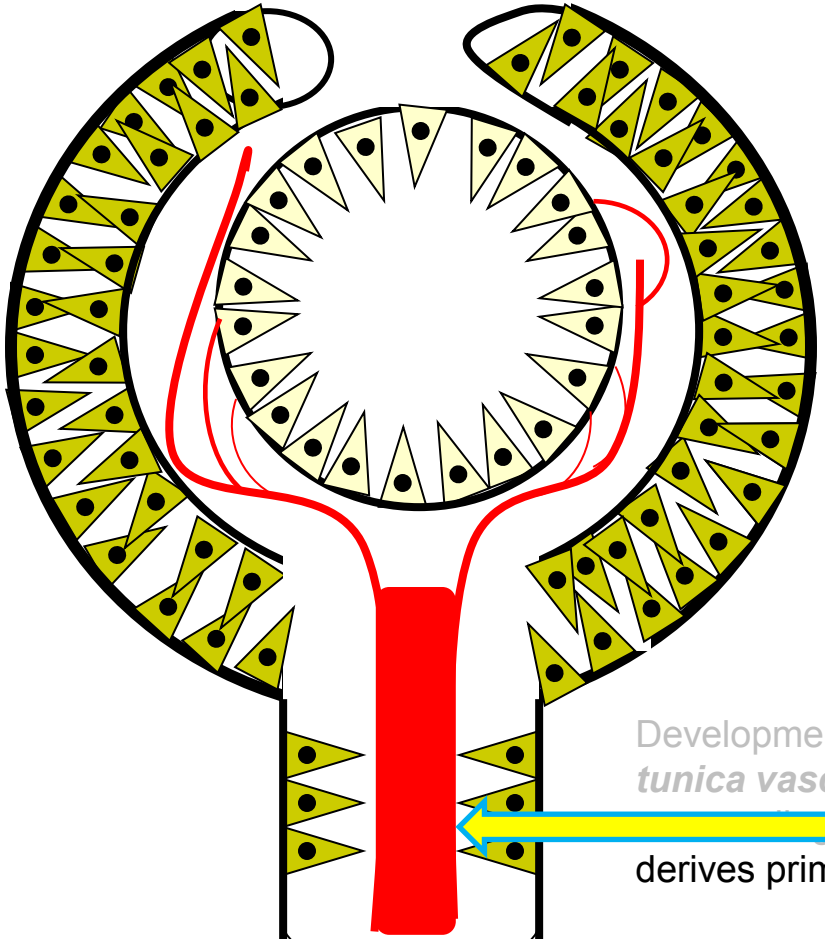




Development of the lens is supported by the ***tunica vasculosa lentis*** , a vascular web surrounding the lens vesicle.

Eye embryology made simply ridiculous

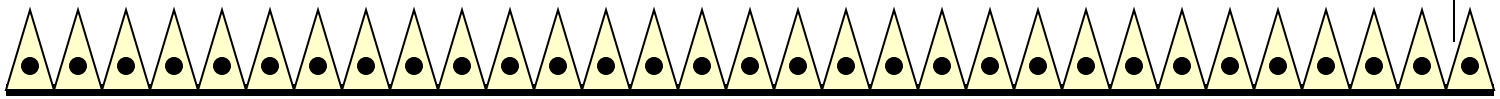


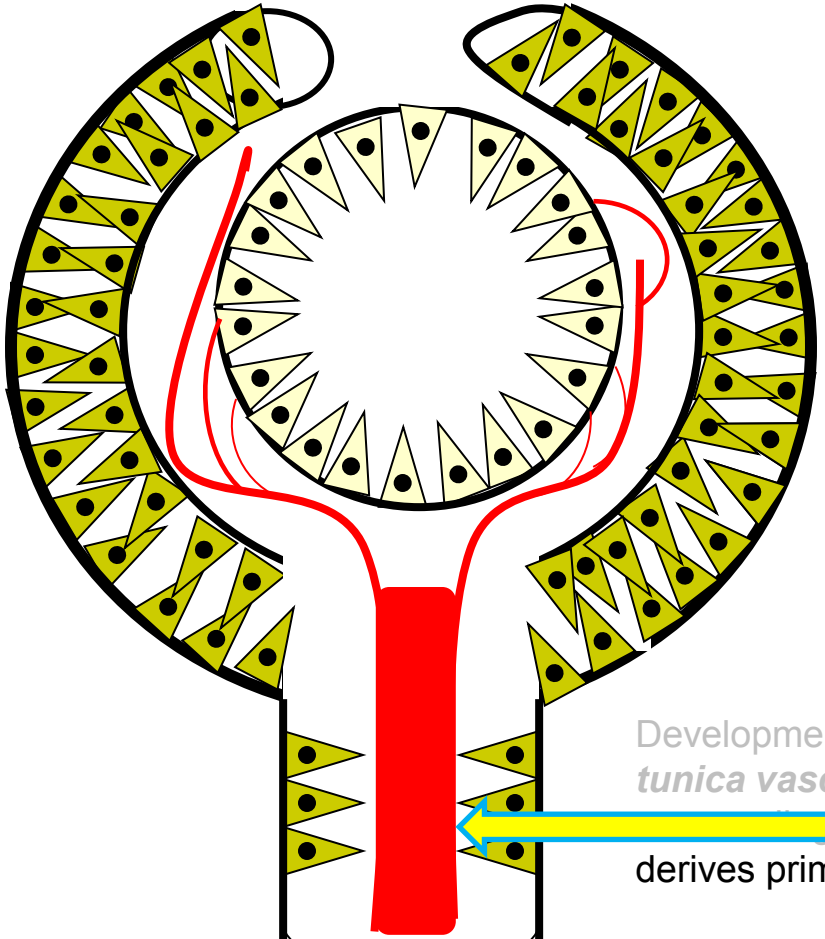


Development of the lens is supported by the ***tunica vasculosa lentis*** , a vascular web

The tunica derives primarily from the [redacted] artery.

Eye embryology made simply ridiculous

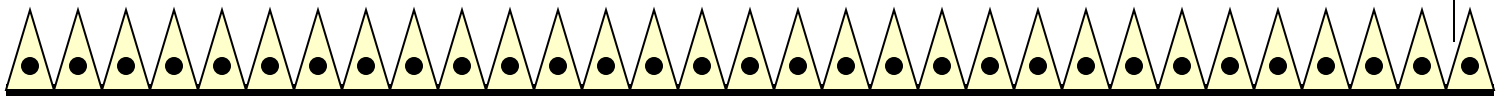


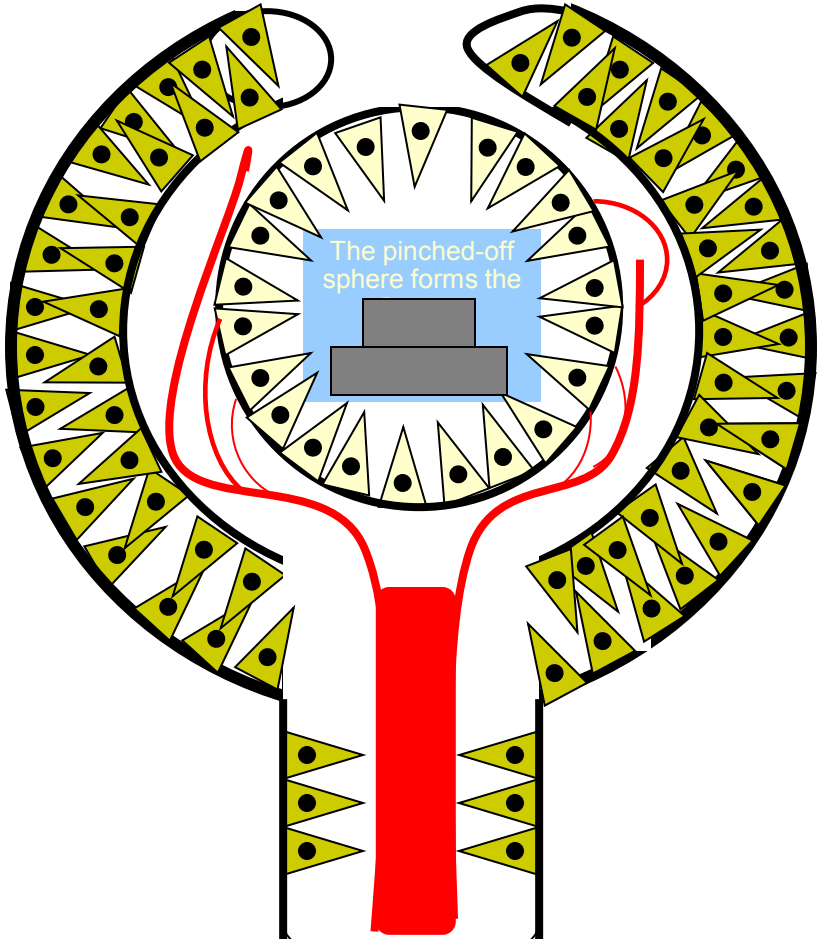


Development of the lens is supported by the ***tunica vasculosa lentis*** , a vascular web

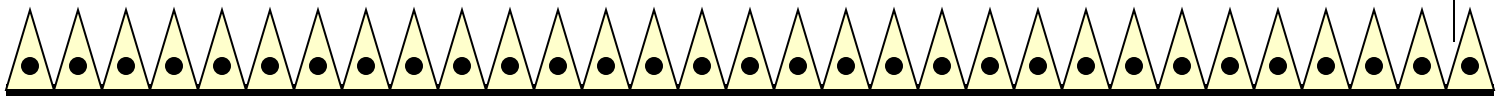
The tunica derives primarily from the **hyaloid** artery.

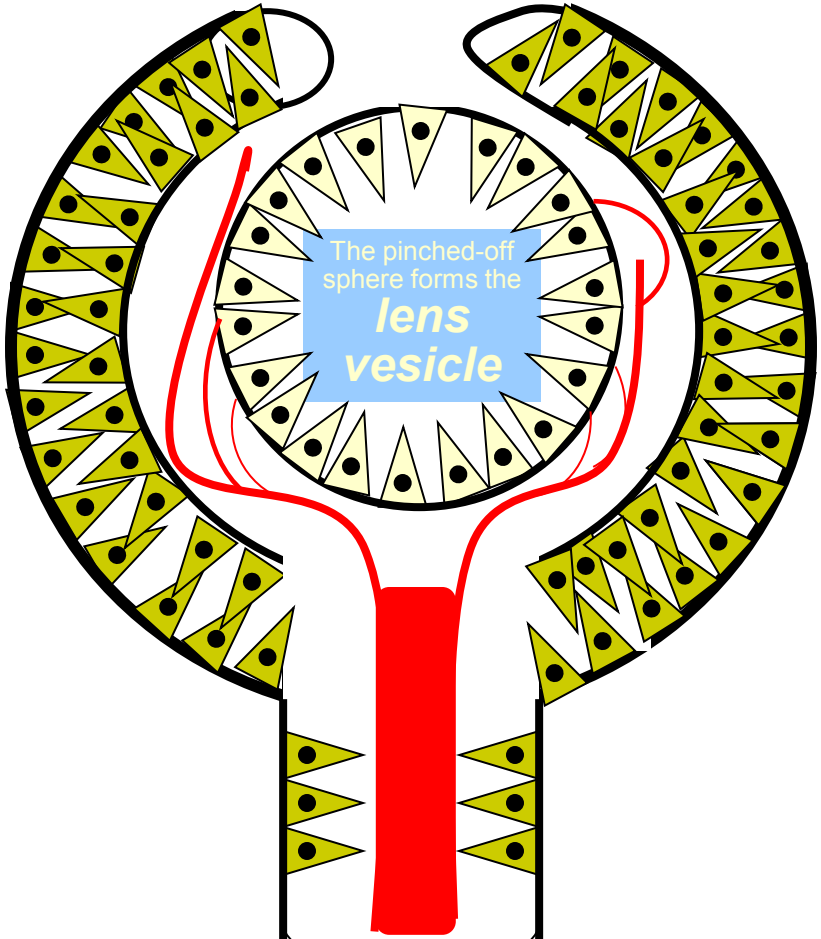
Eye embryology made simply ridiculous



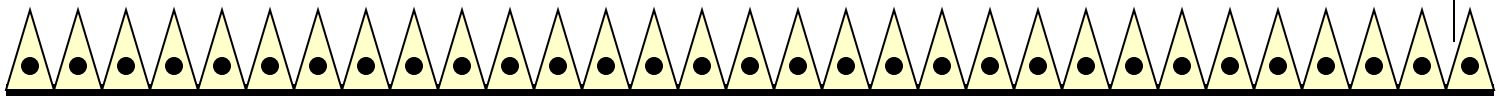


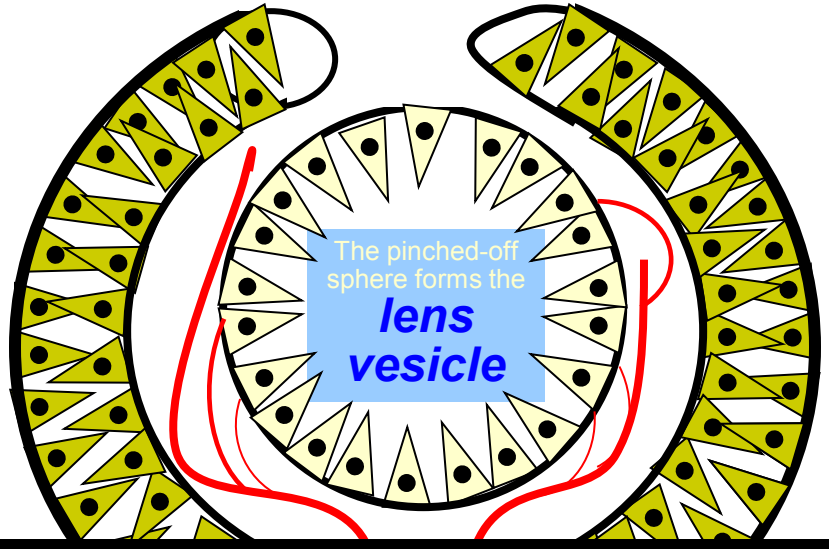
Eye embryology made simply ridiculous



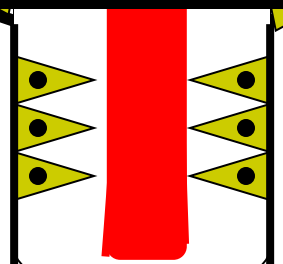


Eye embryology made simply ridiculous





Note that embryology explains why the lens is composed of epithelial cells **on the inside** *with their basement membrane* **on the outside.**



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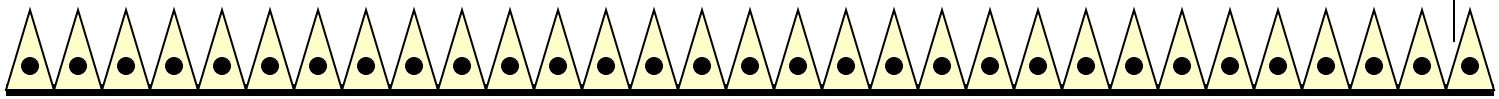
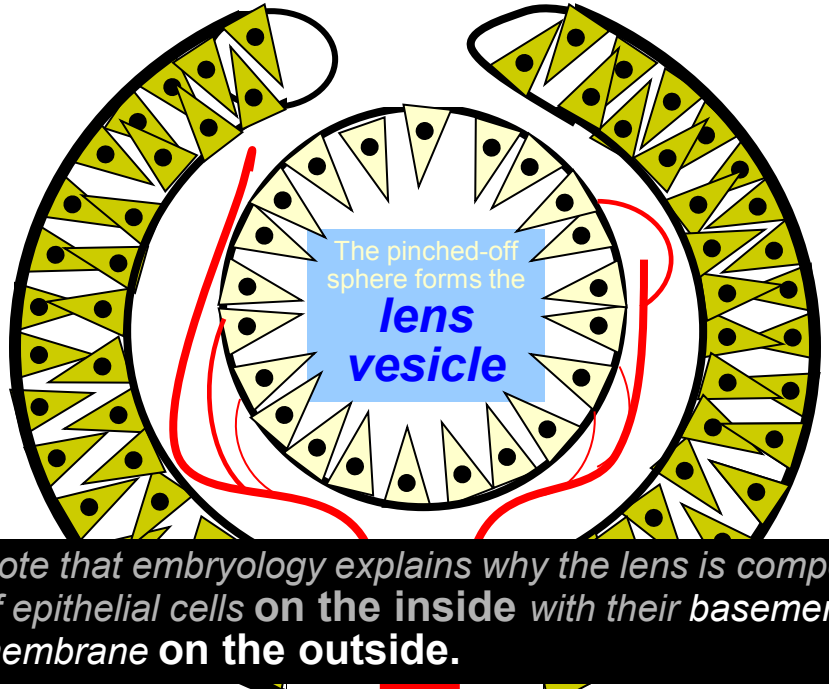
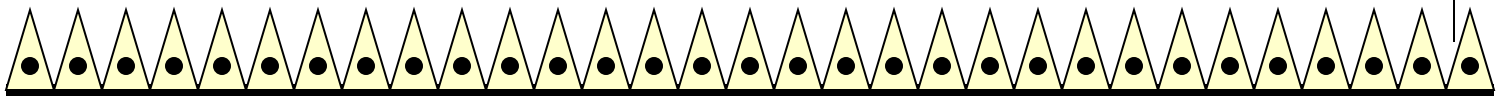


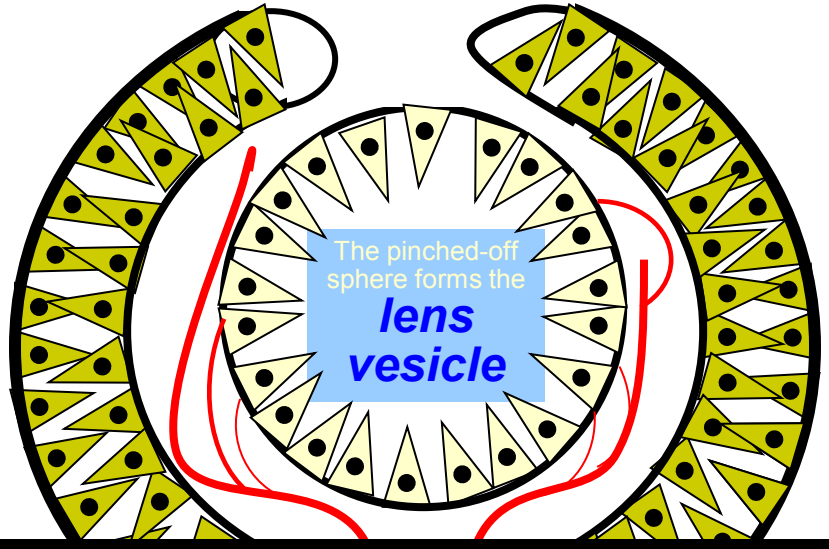


Note that embryology explains why the lens is composed of epithelial cells **on the inside** *with their* ***basement membrane*** **on the outside.**

What structure of the adult lens derives from this basement membrane?

Eye embryology made simply ridiculous

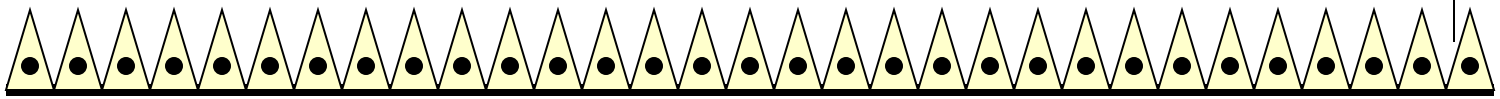


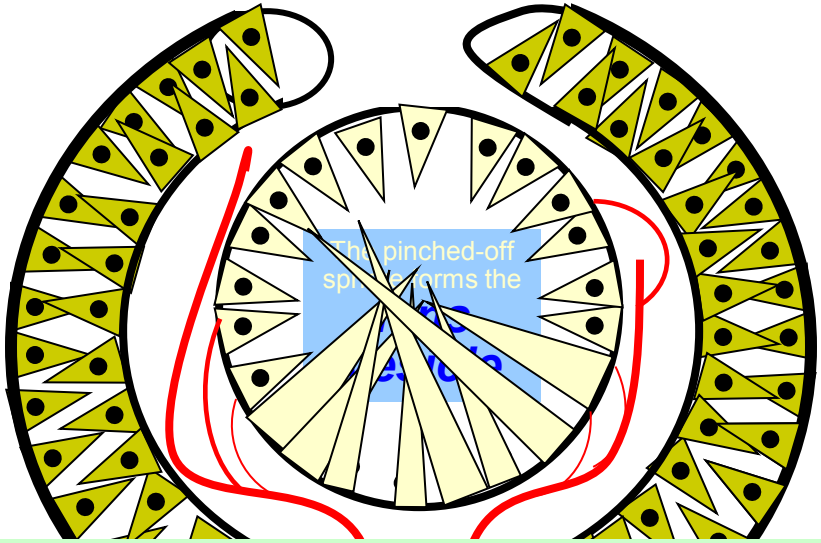


Note that embryology explains why the lens is composed of epithelial cells **on the inside** *with their* ***basement membrane*** **on the outside.**

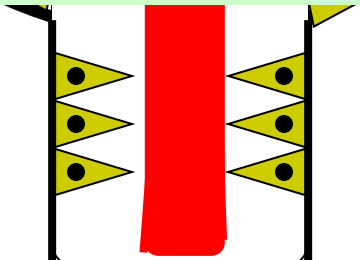
What structure of the adult lens derives from this basement membrane?
Your surgical nemesis—the **lens capsule**

Eye embryology made simply ridiculous



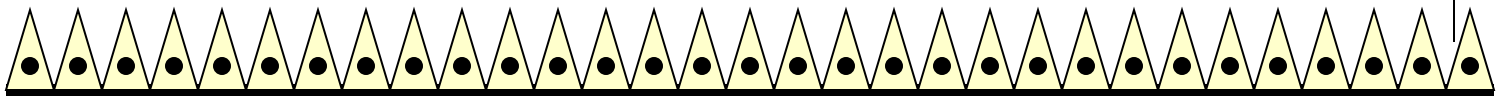


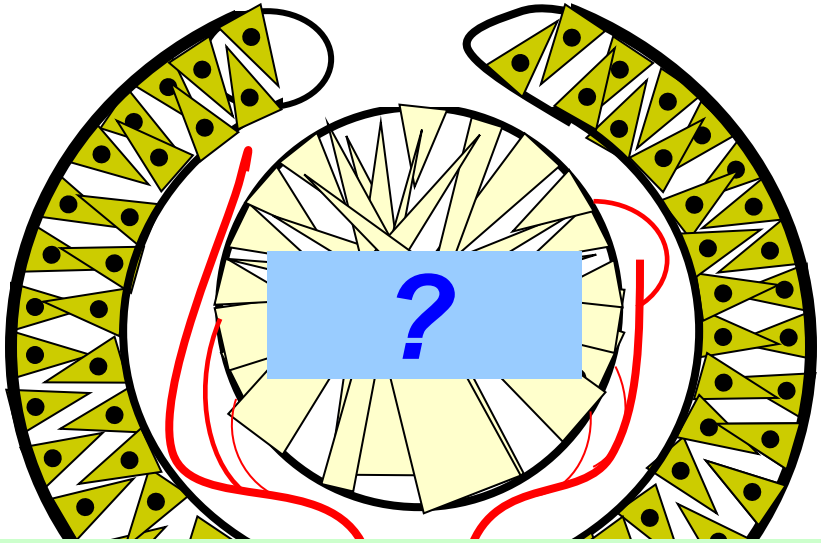
Soon the cells on the posterior aspect of the lens vesicle start to grow anteriorly, eventually obliterating the lumen entirely.



(No question yet—advance when ready)

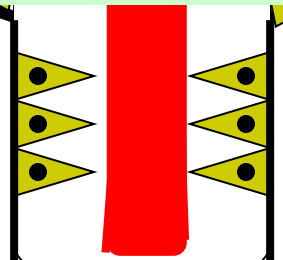
Eye embryology made simply ridiculous



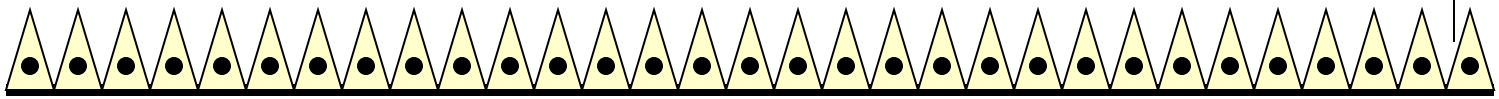


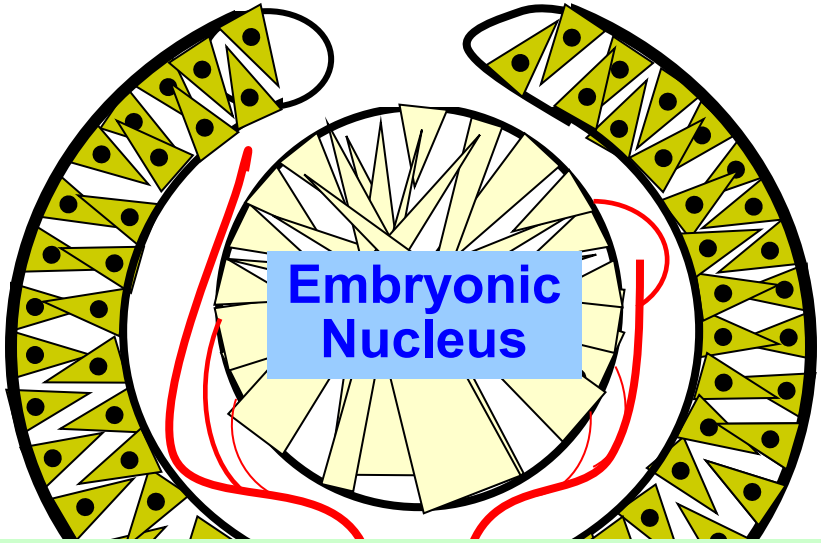
Soon the cells on the posterior aspect of the lens vesicle start to grow anteriorly, eventually obliterating the lumen entirely. The structure thus formed is called the

two words

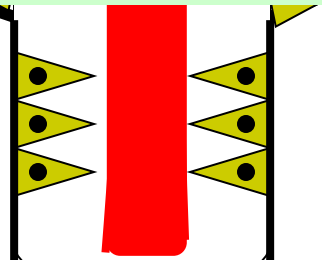


Eye embryology made simply ridiculous





Soon the cells on the posterior aspect of the lens vesicle start to grow anteriorly, eventually obliterating the lumen entirely. The structure thus formed is called the **embryonic nucleus**



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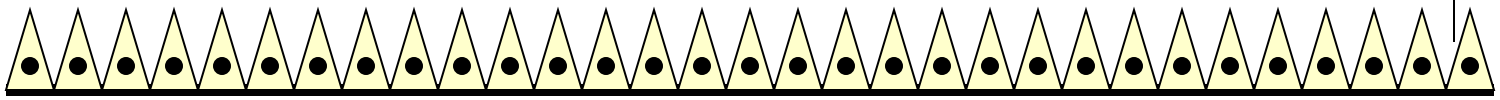
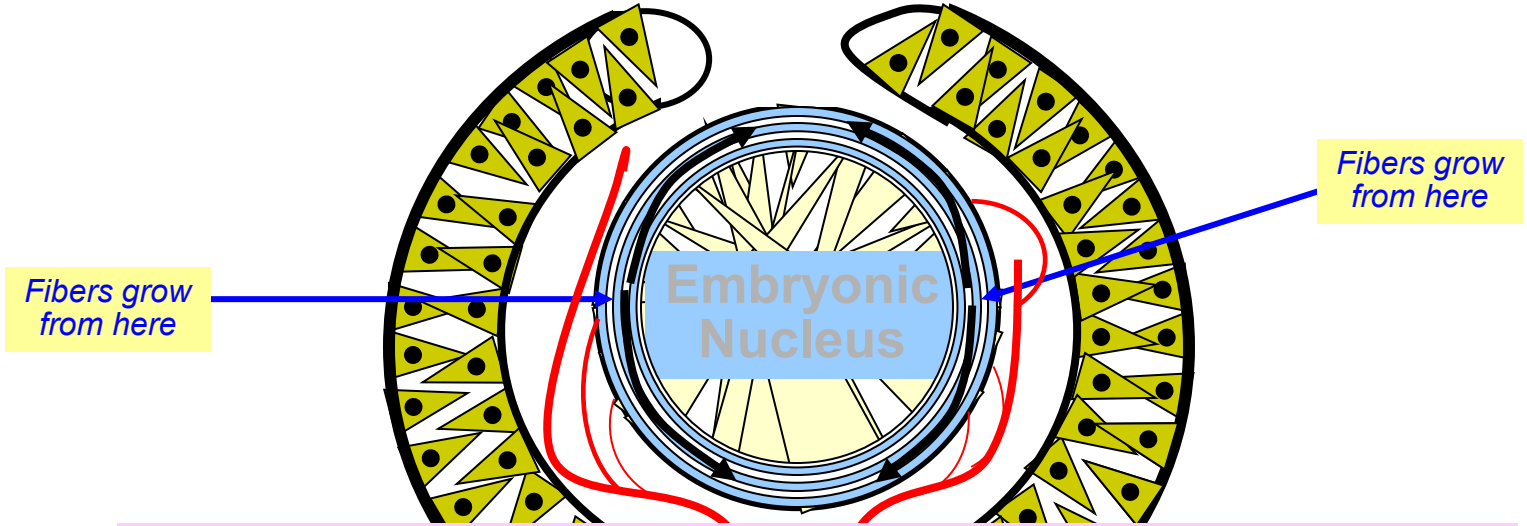
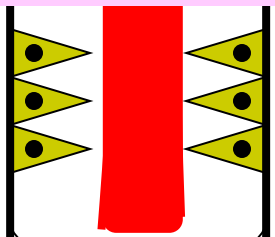




The equatorial cells of the embryonic lens will then grow anteriorly and posteriorly, insinuating themselves between the fetal fibers and the lens capsule.



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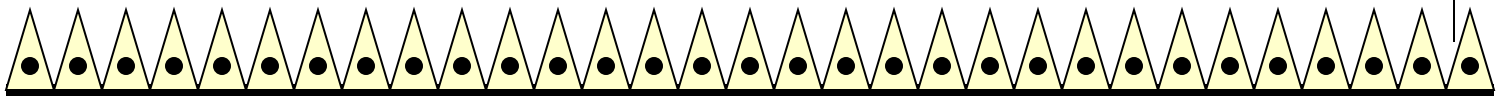
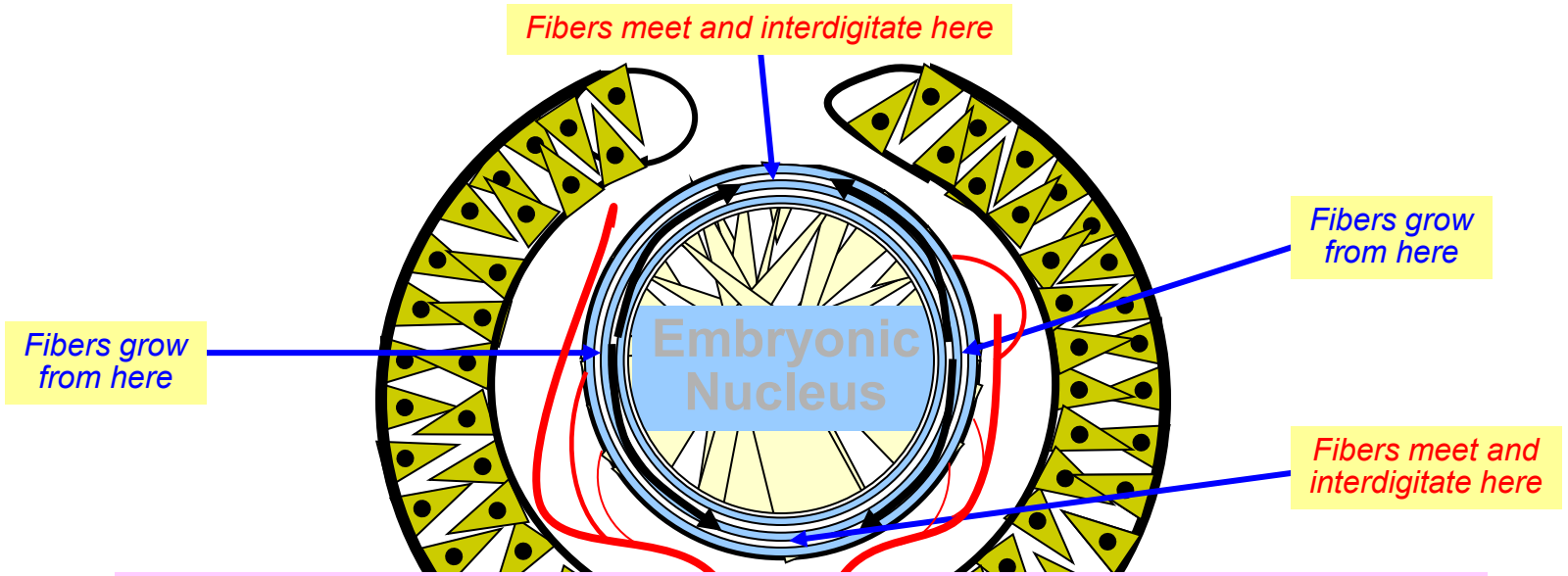
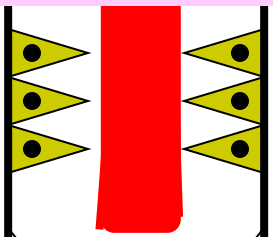
Eye embryology made simply ridiculous





The equatorial cells of the embryonic lens will then grow anteriorly and posteriorly, insinuating themselves between the fetal fibers and the lens capsule. These fibers meet and interdigitate at the anterior and posterior poles of the lens.



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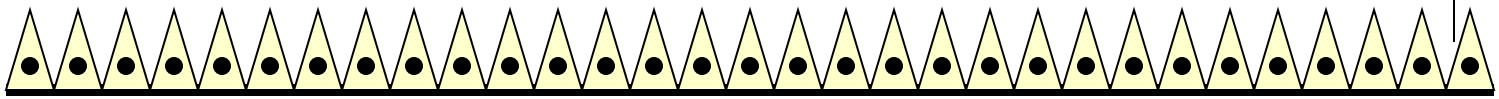

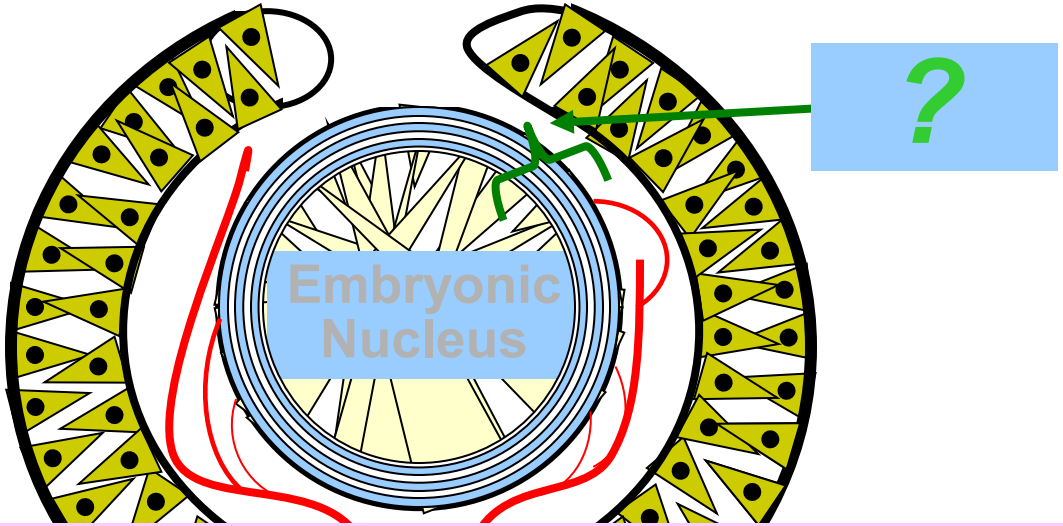

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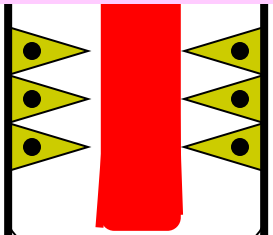

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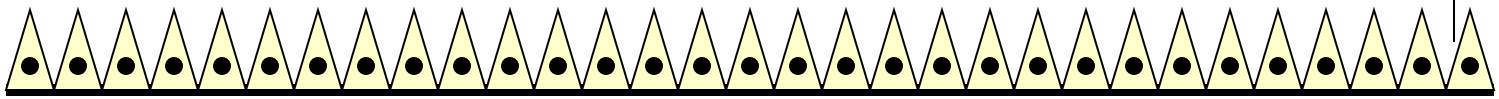
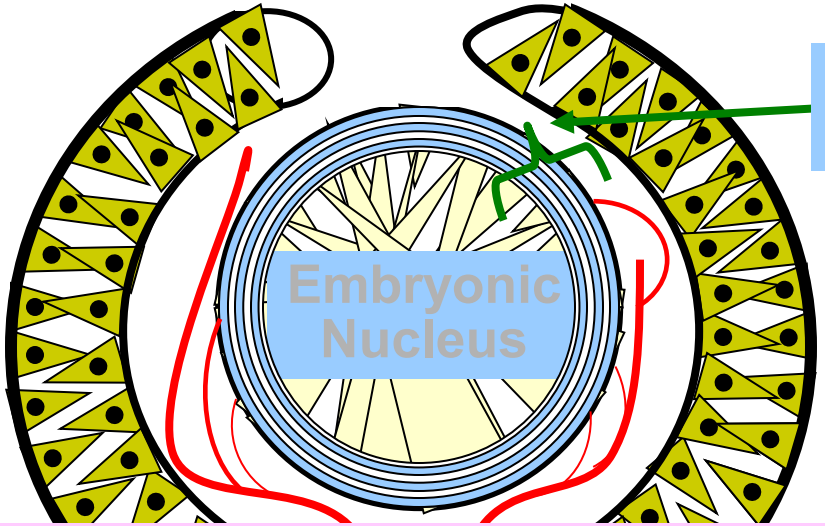
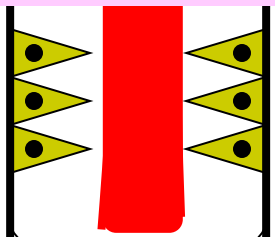




The equatorial cells of the embryonic lens will then grow anteriorly and posteriorly, insinuating themselves between the fetal fibers and the lens capsule. These fibers meet and interdigitate at the anterior and posterior poles of the lens. *This entire structure is known as the* **fetal nucleus**



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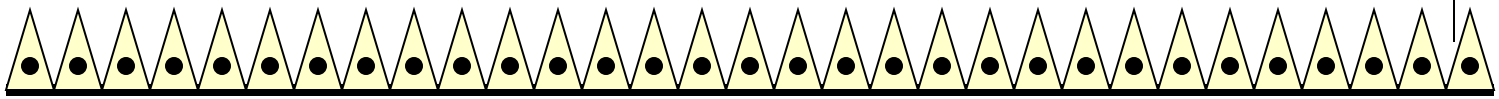

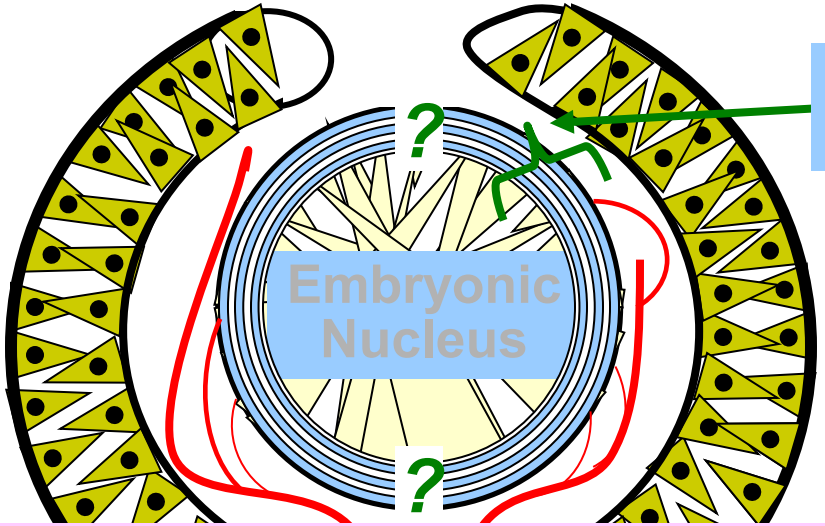

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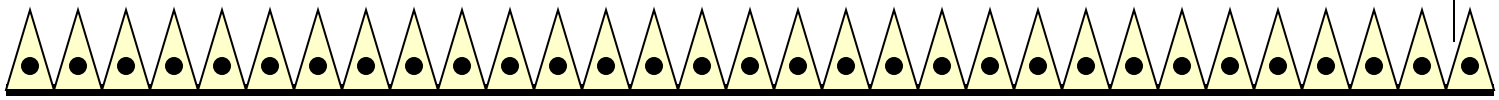
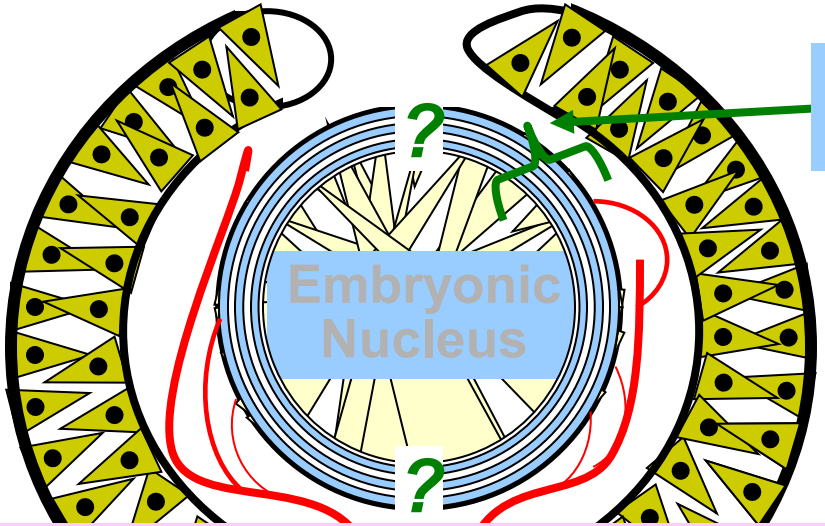
What two structures—easily observable in the adult lens—do these interdigitations form?

Eye embryology made simply ridiculous





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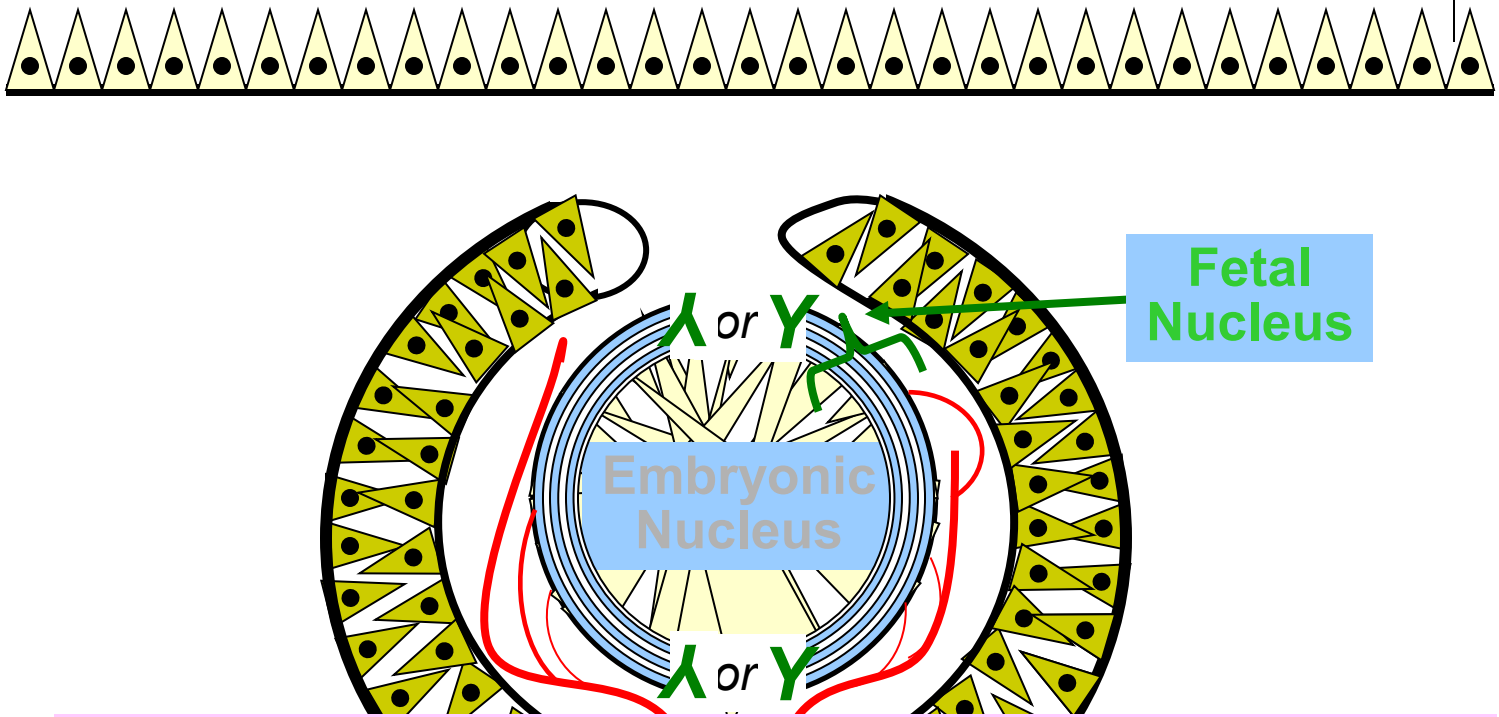
The Y sutures

Eye embryology made simply ridiculous



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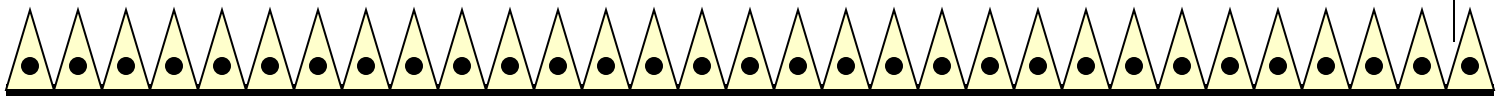
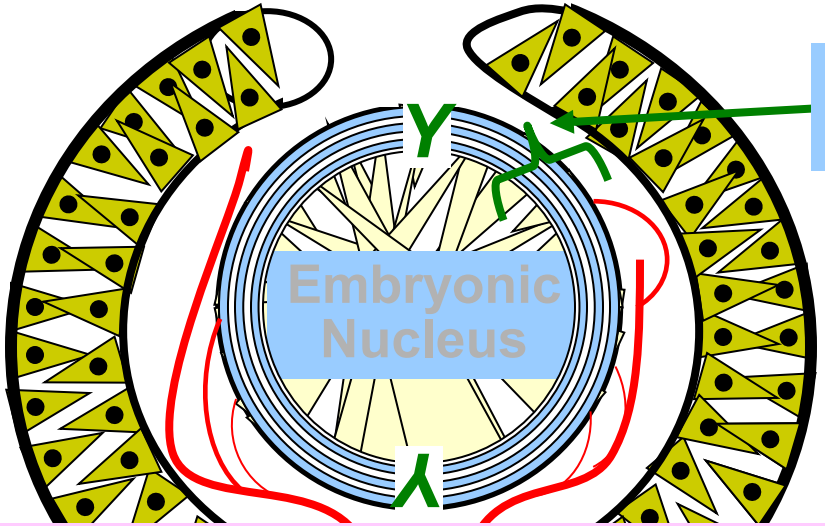
What are the orientations of the two Y sutures?

Eye embryology made simply ridiculous





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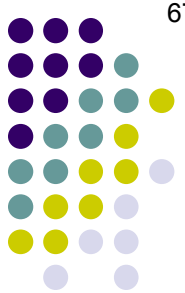
What two structures—easily observable in the adult lens—do these interdigitations form?
The Y sutures

What are the orientations of the two Y sutures?
The anterior Y suture is right-side up; the posterior Y suture is ǝpısdn uʍop

Eye embryology made simply ridiculous

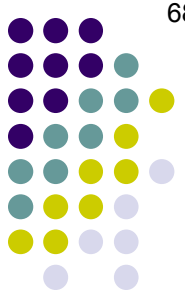


In addition to surface- and neuroectoderm, there are two **embryologic cell/tissue types** we must concern ourselves with:

one word

three words

Eye embryology made simply ridiculous

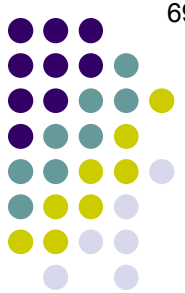


In addition to surface- and neuroectoderm, there are two **embryologic cell/tissue types** we must concern ourselves with:

Mesoderm

Neural crest cells

Eye embryology made simply ridiculous

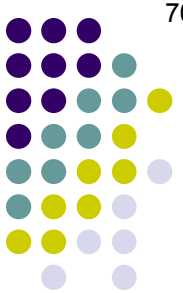


In addition to surface- and neuroectoderm, there are two **embryologic cell/tissue types** we must concern ourselves with:

Mesoderm

What is mesoderm*?*

Eye embryology made simply ridiculous

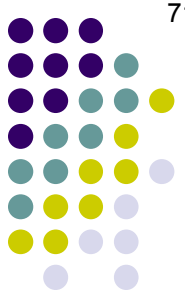


In addition to surface- and neuroectoderm, there are two **embryologic cell/tissue types** we must concern ourselves with:

Mesoderm

What is mesoderm*?*
One of the three primary germ layers of the embryo

Eye embryology made simply ridiculous



In addition to surface- and neuroectoderm, there are two **embryologic cell/tissue types** we must concern ourselves with:

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What is mesoderm*?*
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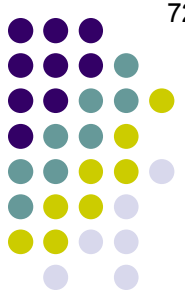
What are the other two primary germ layers?
--
--

Eye embryology made simply ridiculous



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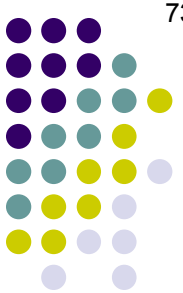
One of the three primary germ layers of the embryo

What are the other two primary germ layers?
--Ectoderm
--Endoderm

Eye embryology made simply ridiculous



In addition to surface- and neuroectoderm, there are two **embryologic cell/tissue types** we must concern ourselves with:

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What is mesoderm*?*
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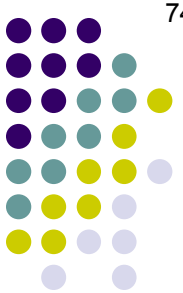
What ocular structures derive from mesoderm? (mnemonic coming…)
--?
--?
--?
--?

The mnemonic is…

Eye embryology made simply ridiculous



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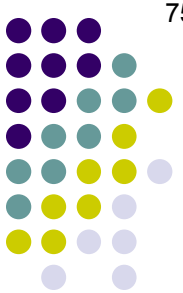
One of the three primary germ layers of the embryo

What ocular structures derive from mesoderm? (mnemonic coming…)
--M
--E
--S
--O

*The mnemonic is…**MESO***

Eye embryology made simply ridiculous



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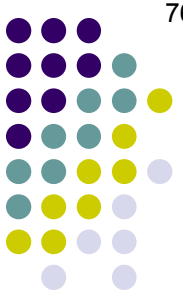
Start here

--M
--E
--S
--O

Eye embryology made simply ridiculous



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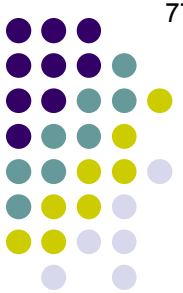
One of the three primary germ layers of the embryo

What ocular structures derive from mesoderm? (mnemonic coming…)
--**M**uscles (EOMs)
--**E**
--S
--O

Next

Eye embryology made simply ridiculous



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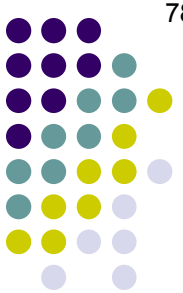
Mesoderm

What is mesoderm*?*
One of the three primary germ layers of the embryo

What ocular structures derive from mesoderm? (mnemonic coming…)
--**M**uscles (EOMs)
--**E**ndothelium of the blood vessels
--**S**
--O

Next

Eye embryology made simply ridiculous



In addition to surface- and neuroectoderm, there are two **embryologic cell/tissue types** we must concern ourselves with:

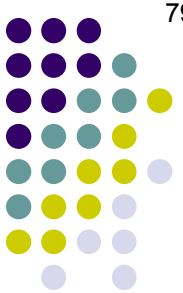
Mesoderm

What is mesoderm*?*
One of the three primary germ layers of the embryo

What ocular structures derive from mesoderm? (mnemonic coming…)
--**M**uscles (EOMs)
--**E**ndothelium of the blood vessels
--**S**chlemm's canal
--**O**

Tricky one

Eye embryology made simply ridiculous



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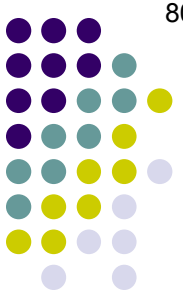
Eye embryology made simply ridiculous



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What is/are neural crest cells*?*

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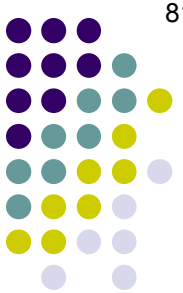

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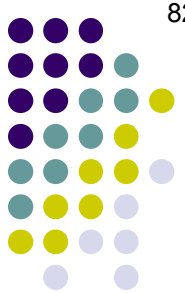
Eye embryology made simply ridiculous



What ocular structures derive from neural crest cells?
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--***?***
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Eye embryology made simply ridiculous

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--*?*
--*?*
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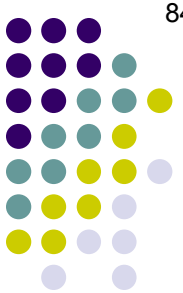

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--*?*
--*?*
--*?*
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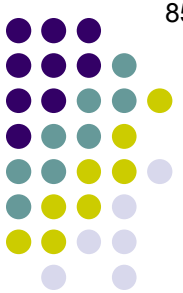

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-- angle structure (two words)
--*?*
--*?*
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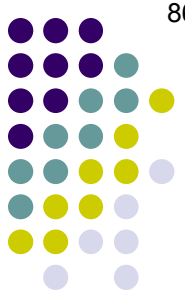

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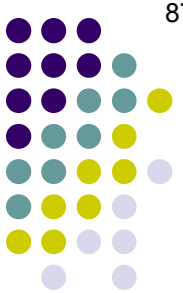

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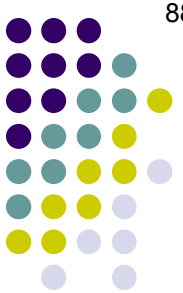

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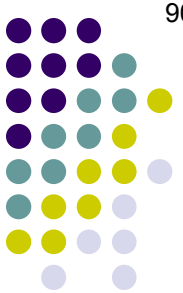

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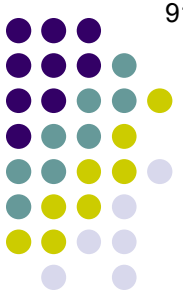

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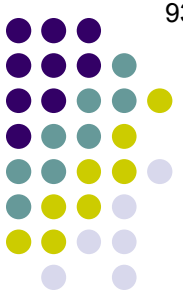

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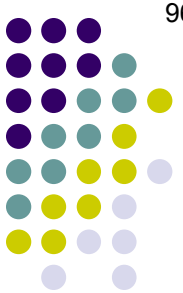

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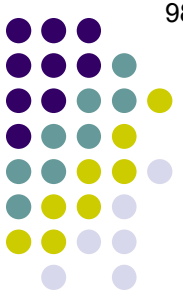

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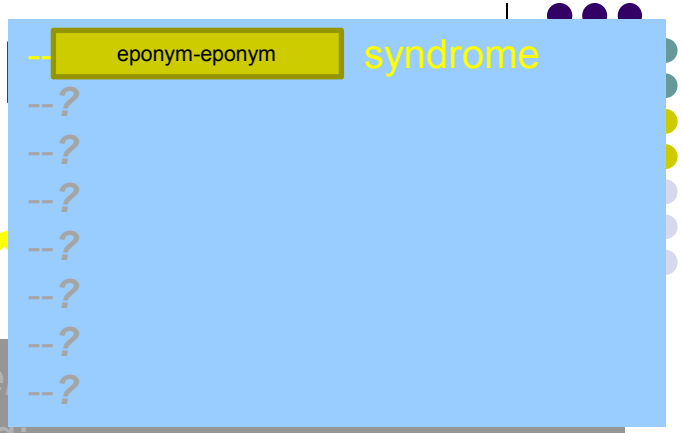

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Eye embryology made sim

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--Peters anomaly
--Posterior keratoconus
--Posterior embryotoxon
--Microcornea and megalocornea
-- (something)cornea and cornea shape
--?
--?

What ocular structures derive from neural crest ce
Just about everything that has yet to be mentioned:
--Corneal stroma and endothelium
--Trabecular meshwork
--Iris stroma
--Choroid
--Most of the sclera (except the small part deriving from mesoderm)

Neural crest cells

What is a neurocristopathy*?*
A congenital/developmental abnormality owing to flawed neural-crest cell migration or differentiation

What are some examples of neurocristopathy?
Some of the important ones include…

Neural crest cell migration concerning the anterior segment occurs in three 'waves.'
Which wave involves which future structure?
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What do CHED *and* CHSD *stand for?*
CHED: [redacted] dystrophy
CHSD: [redacted] dystrophy

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CHED: Congenital hereditary endothelial dystrophy
CHSD: Congenital hereditary stromal dystrophy

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*(Just one, but it's **really** important)*

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Rule of thumb: Guess 'neurocristopathy' for any condition involving anterior-segment dysgenesis—chances are you will be correct!

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The vitreous

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The vitreous. It derives from surface ectoderm, neuroectoderm, mesoderm—pretty much everything BUT neural crest.

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