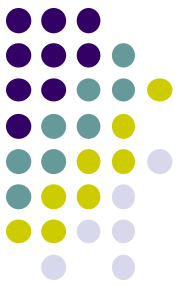


Q

Diabetic Retinopathy: The Basics

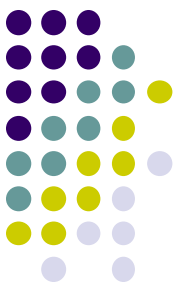
How many American adults are diabetic or pre-diabetic?



A

Diabetic Retinopathy: The Basics

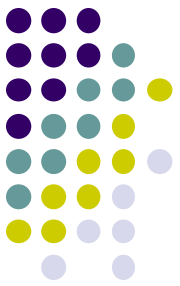
How many American adults are diabetic or pre-diabetic?
Over 100M!



Q

Diabetic Retinopathy: The Basics

3



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Of the ~30M or so adults with full-blown diabetes, what proportion don't even know they have it?

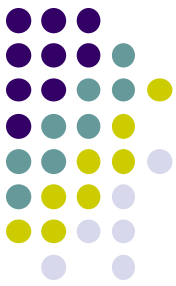


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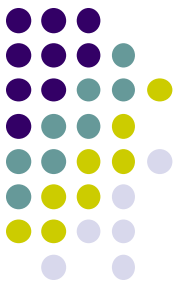
About 25%!



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Does diabetes prevalence vary with age?



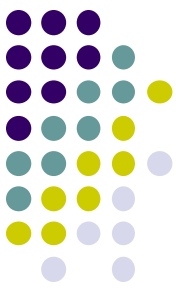
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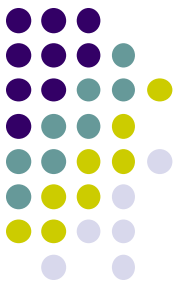


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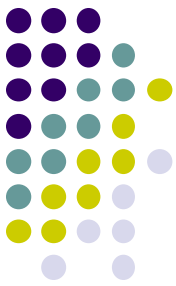


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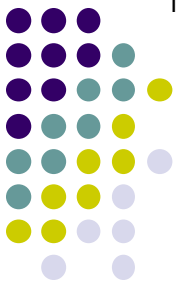
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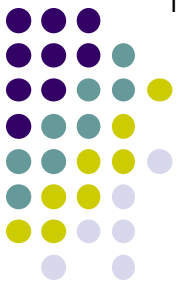
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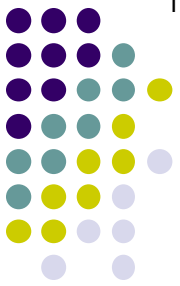
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What proportion of diabetics receive screening eye exams at recommended intervals?
Only about 60%

Q

Diabetic Retinopathy: The Basics

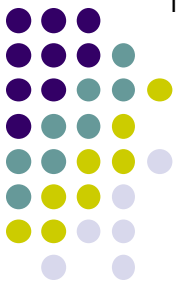
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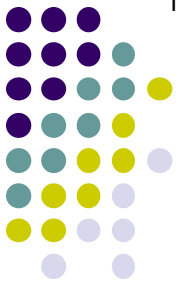


A

Diabetic Retinopathy: The Basics

Worldwide, what proportion of diabetics have retinopathy?
About a third





Worldwide, what proportion of diabetics have retinopathy?

About a third

Of those diabetics with retinopathy, what proportion have vision-threatening retinopathy?

A

Diabetic Retinopathy: The Basics



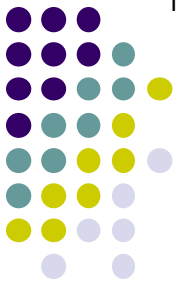
16

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Of those diabetics with retinopathy, what proportion have vision-threatening retinopathy?

Again, about a third



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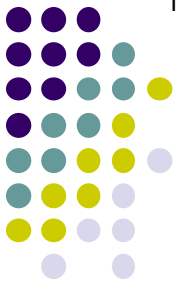
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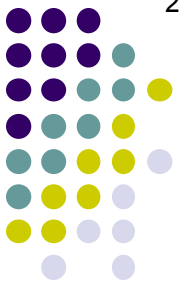
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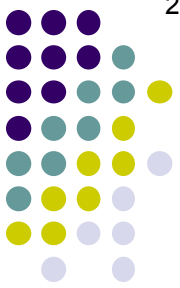
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99%!

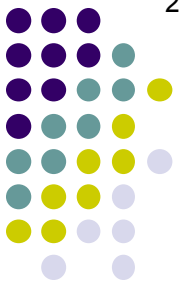


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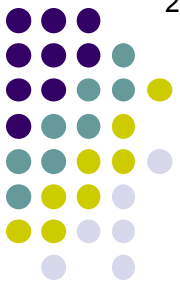


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*Per the Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR), what proportion of **Type 2 diabetics** have proliferative retinopathy (PDR) after 20 years?*
25%

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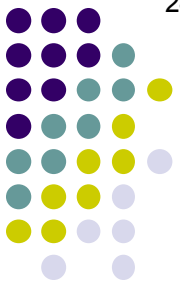
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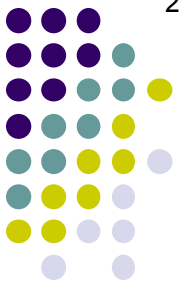
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Diabetic Retinopathy: The Basics

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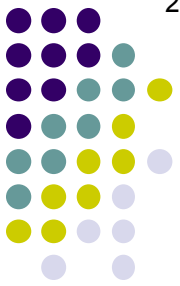
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Per the WESDR, after 20 years? 99%!

(If you're not sure what *proliferative retinopathy* is, no worries—it'll be covered in this slide-set)

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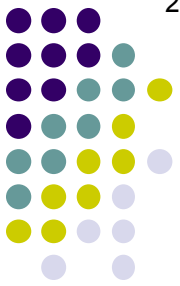
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Diabetes also causes CAD, CVA, nephropathy, and neuropathy. (Thanks Captain Obvious.) However, only one has an onset that is strongly correlated with the onset of retinopathy. Which one?



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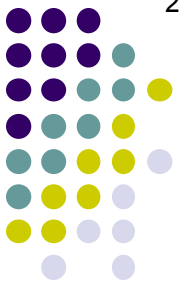
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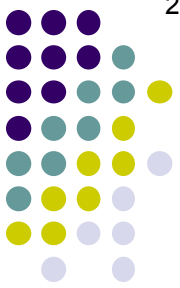
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Nephropathy—when a pt develops one of the two, it's a lock s/he's going to develop the other very soon

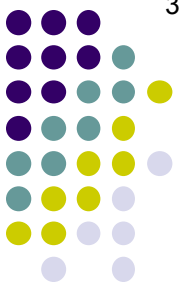


- What are the three histological vascular derangements in DBR?
 - 1)
 - 2)
 - 3)



- What are the three histological vascular derangements in DBR?

- 1) cell type **loss** *BM = Basement membrane*
- 2) abb. **thickening** → ↓ **lumen diameter**
- 3) **Loss of** diff dell type **barrier function**



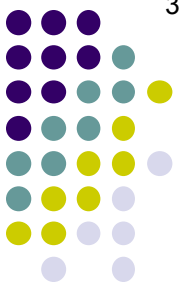
- What are the three histological vascular derangements in DBR?

- 1) Pericyte loss

BM = Basement membrane

- 2) BM thickening → ↓ lumen diameter

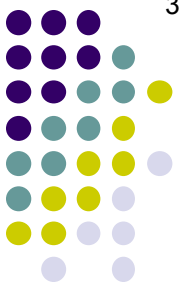
- 3) Loss of endothelial barrier function



- What are the three histological vascular derangements in DBR?

- 1) **Pericyte** loss
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With respect to the structure of retinal arterioles and capillaries, how are pericytes and endothelial cells related to one another?

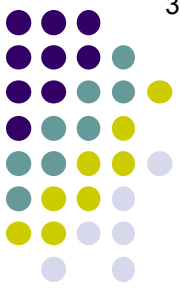


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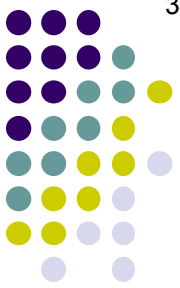


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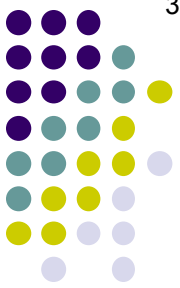


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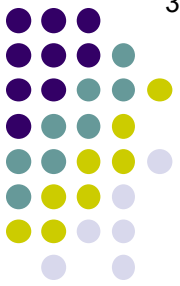


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four words

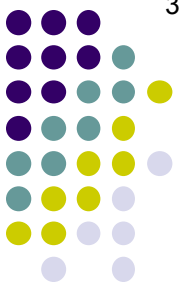


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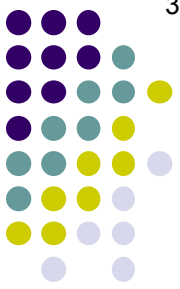


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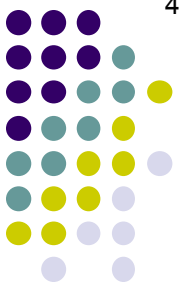
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Do retinal vessels have an intimal lining?

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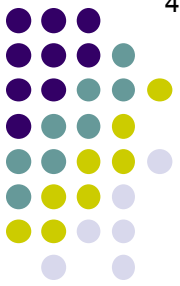
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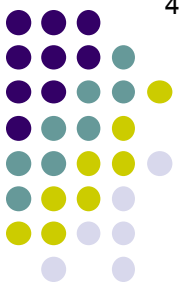
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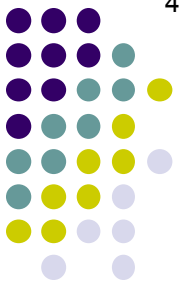
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Q

Diabetic Retinopathy: The Basics

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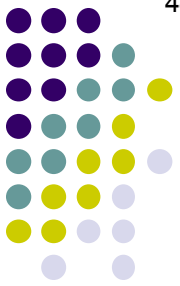
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With what nearby vascular bed do they share the lack of these features?



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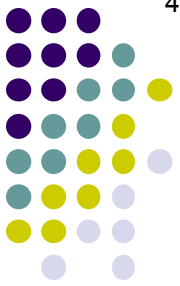
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The cerebral vasculature (which makes sense, because *the retina is in essence an extension of the CNS*)



Q

Diabetic Retinopathy: The Basics

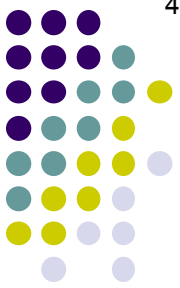
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That this is known as the inner blood-retina barrier implies the existence of what?

How are

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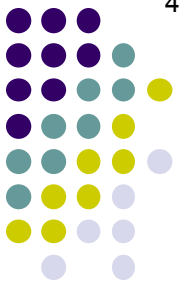
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That this is known as the inner blood-retina barrier implies the existence of what?
An **outer** blood-retina barrier

are

ended by their

BM. They are **nonfenestrated**. Tight junctions between cells form the so-called **inner blood-retina barrier**. The pericytes surround the vessel, and are embedded in the BM of the endothelial cells.



- What are the three histological vascular derangements in DBR?

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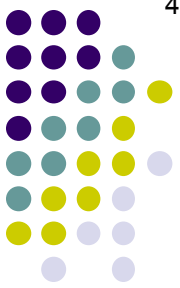
Tight junctions between **three words** cells

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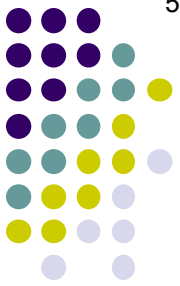
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Tight junctions between retinal pigment epithelium (RPE) cells

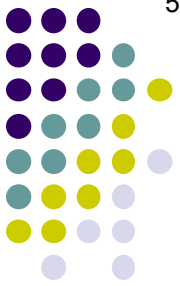
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- 1) Pericyte loss
- 2) BM thickening → ↓ lumen diameter
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Which occurs first?



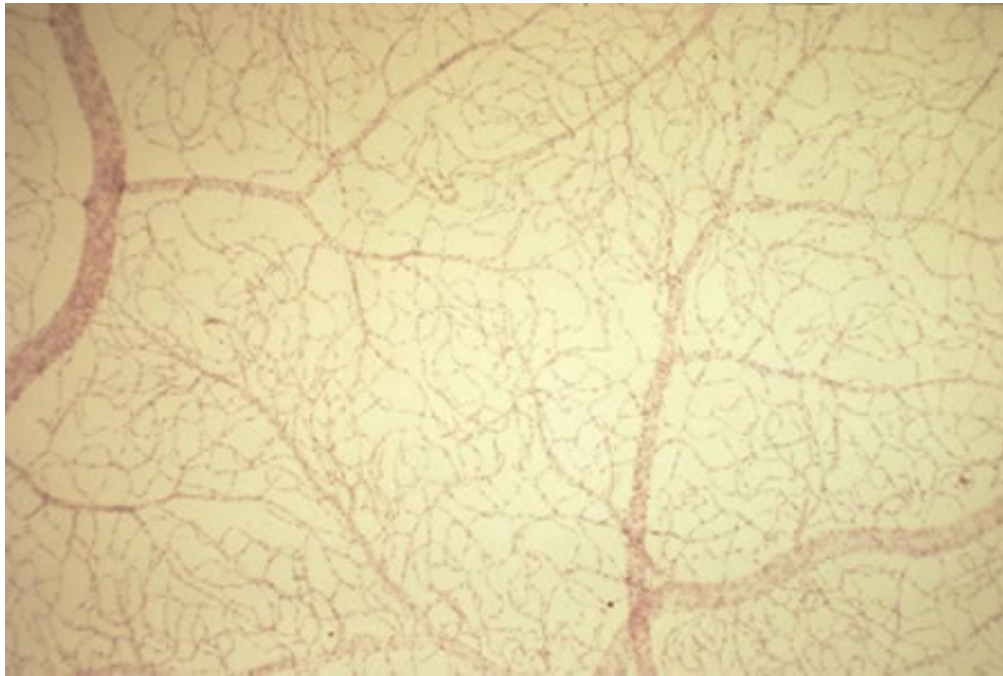
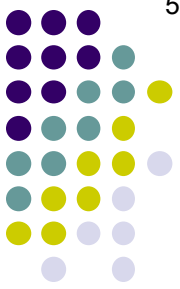
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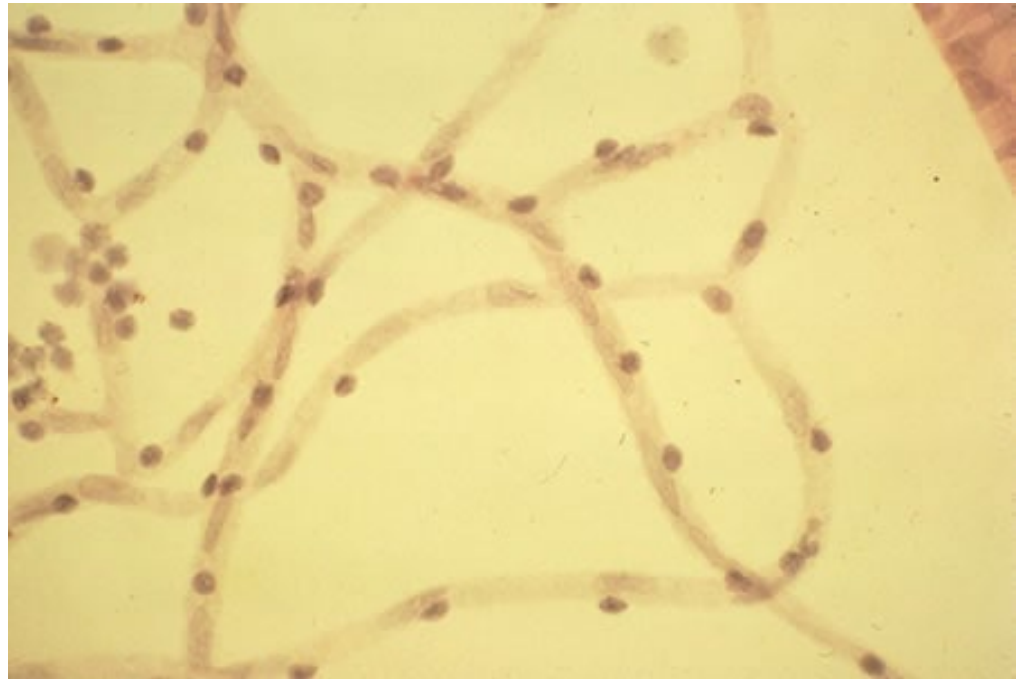
Which occurs first?
Pericyte loss

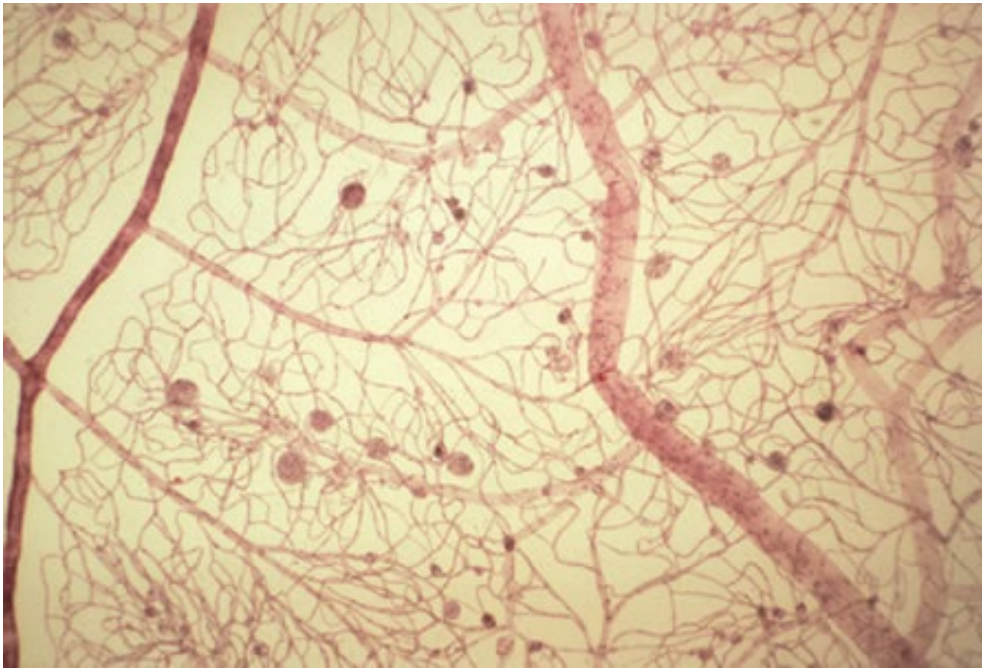
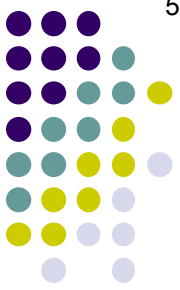


*Trypsin mount of normal retina--
low and high mag*

The dark nuclei belong to pericytes;
the lighter, to endothelial cells.

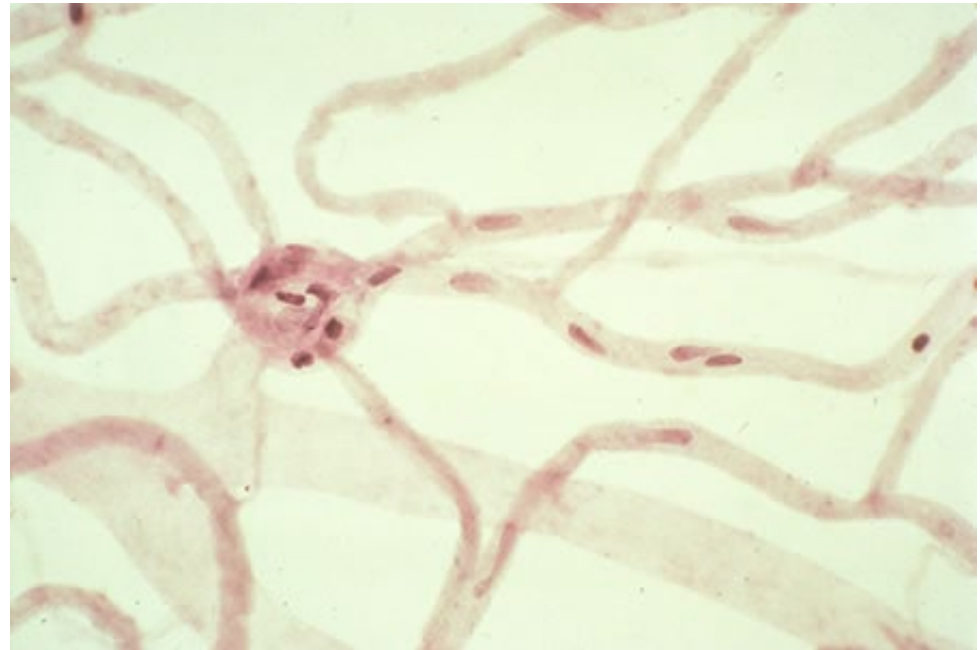
*Note that the ratio between them is
roughly 1:1.*

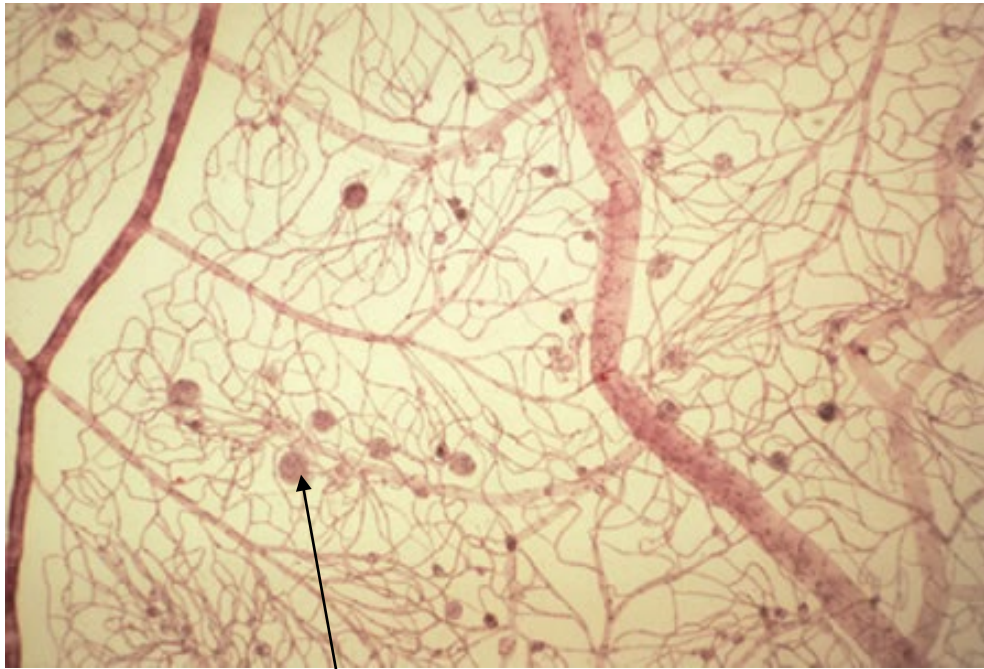
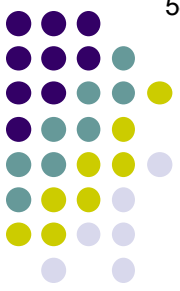




*Trypsin mount of **DBR** retina--
low and high mag*

But in a retina with damage 2ndry to diabetes, the ratio of endothelial cells to pericytes is **many-to-one**.

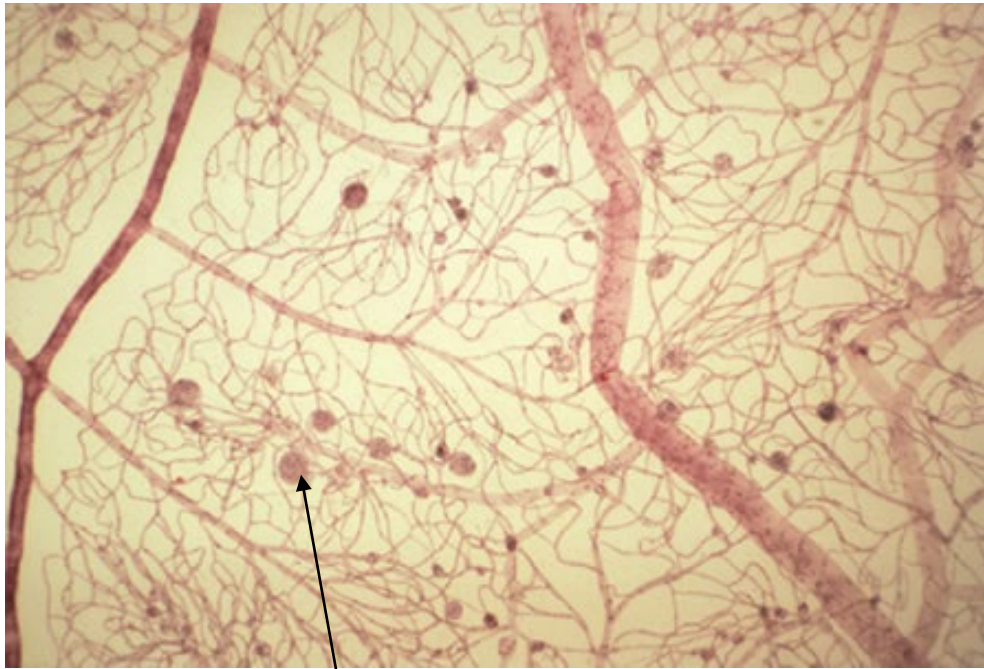
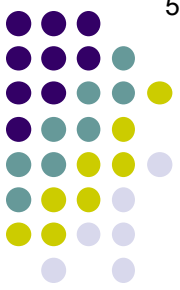




*Trypsin mount of **DBR** retina--
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What are these things?

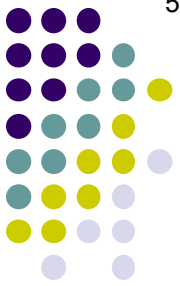




*Trypsin mount of **DBR** retina--
low and high mag*

What are these things?
Microaneurysms



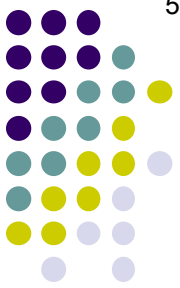


- What are the three histological vascular derangements in DBR?

1) Pericyte loss

2) **BM thickening** → ↓ **lumen diameter**

What pathological state is the endpoint of decreasing lumen diameter?

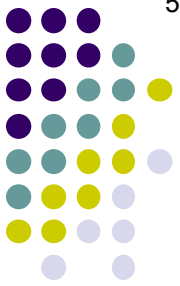


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Occlusion of the retinal vessel



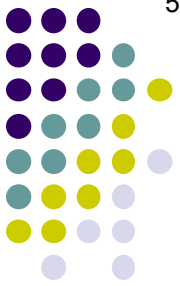
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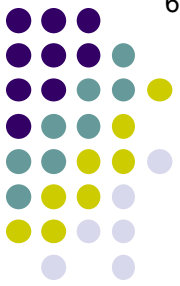
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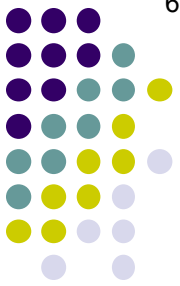
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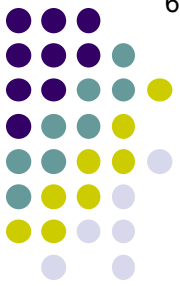
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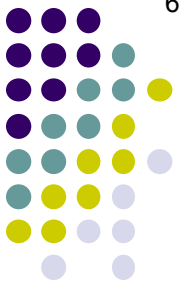
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Hypoxic retinal cells release a signaling molecule that is central to the pathogenesis of DBR. What is that signaling molecule?



- What are the three histological vascular derangements in DBR?

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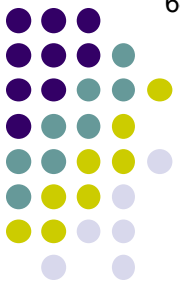
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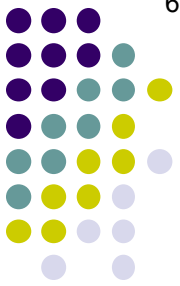
Retinal ischemia leads to what pathological state?
Hypoxia of the affected retinal cells

Hypoxic retinal cells release a signaling molecule that is central to the pathogenesis of DBR. What is that signaling molecule?
VEGF (we will have much more to say about VEGF shortly)



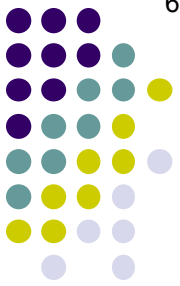
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Loss of endothelial barrier function leads to what pathologic event?



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Loss of endothelial barrier function leads to what pathologic event?
Leaching of serum into the retina



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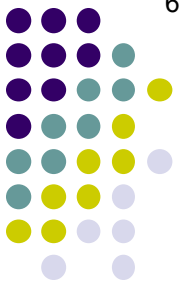
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Loss of endothelial barrier function leads to what pathologic event?
Leaching of serum into the retina

Leaching of serum into the retina leads to what pathological state?
Retinal edema



Q

Diabetic Retinopathy: The Basics

- *Classification of diabetic retinopathy*

- ?

Two broad categories of DBR

- ?



- *Classification of diabetic retinopathy*
 - **Nonproliferative diabetic retinopathy (NPDR)**

Two broad categories of DBR

- **Proliferative diabetic retinopathy (PDR)**



Q

Diabetic Retinopathy: The Basics

- *Classification of diabetic retinopathy*
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Two broad categories of DBR

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What is the histological definition of proliferation in this context?



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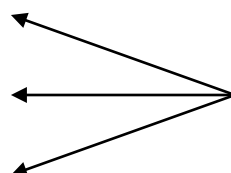
What is the histological definition of proliferation in this context?

Retinal neovascularization that breaks through the internal limiting membrane (ILM)



Q

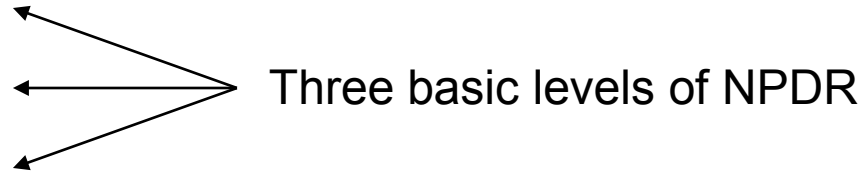
Diabetic Retinopathy: The Basics

- *Classification of diabetic retinopathy*
 - **Nonproliferative diabetic retinopathy (NPDR)**
 - ?
 - ?
 - ?

Three basic levels of NPDR
 - Proliferative diabetic retinopathy (PDR)



- *Classification of diabetic retinopathy*
 - **Nonproliferative diabetic retinopathy (NPDR)**
 - *Mild*
 - *Moderate*
 - *Severe*
- Proliferative diabetic retinopathy (PDR)





- *Classification of diabetic retinopathy*

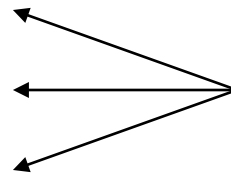
- **Nonproliferative diabetic retinopathy (NPDR)**

- *Mild*

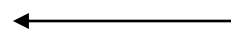
- *Moderate*

- *Severe*

- *?*



Three basic levels of NPDR



One more level (not universally used)

- **Proliferative diabetic retinopathy (PDR)**



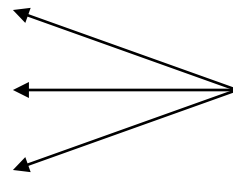
- *Classification of diabetic retinopathy*

- **Nonproliferative diabetic retinopathy (NPDR)**

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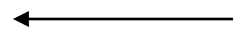
- *Moderate*

- *Severe*



Three basic levels of NPDR

- *Very severe*



One more level (not universally used)

- **Proliferative diabetic retinopathy (PDR)**



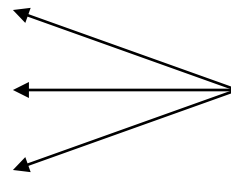
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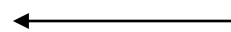
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Three basic levels of NPDR

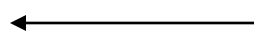
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One more level (not universally used)

- **Proliferative diabetic retinopathy (PDR)**

- *?*



One level of concern



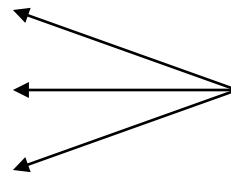
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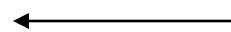
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Three basic levels of NPDR

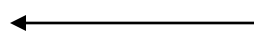
- *Very severe*



One more level (not universally used)

- **Proliferative diabetic retinopathy (PDR)**

- *High-risk PDR*



One level of concern



Q

Diabetic Retinopathy: The Basics

- *Classification of diabetic retinopathy*
 - **Nonproliferative diabetic retinopathy (NPDR)**
 - *Mild*
 - *Moderate*
 - *Severe*
 - *Very severe*
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What landmark clinical trial provided this system of DBR classification?

A

Diabetic Retinopathy: The Basics



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What landmark clinical trial provided this system of DBR classification?

The **Early Treatment of Diabetic Retinopathy Study**.
Note that the ETDRS is one of the studies you are expected to be familiar with **by name**.



Q

Diabetic Retinopathy: The Basics

- *Classification of diabetic retinopathy*
 - **Nonproliferative diabetic retinopathy (NPDR)**
 - *Mild* *How are mild and moderate NPDR defined?*
 - *Moderate*
 - *Severe*
 - *Very severe*
 - **Proliferative diabetic retinopathy (PDR)**
 - *High-risk PDR*



- *Classification of diabetic retinopathy*
 - **Nonproliferative diabetic retinopathy (NPDR)**
 - *Mild*
How are mild and moderate NPDR defined?
With respect to the standard photographs employed in the DRS
 - *Moderate*
 - *Severe*
 - *Very severe*
 - **Proliferative diabetic retinopathy (PDR)**
 - *High-risk PDR*



Q

Diabetic Retinopathy: The Basics

- *Classification of diabetic retinopathy*
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 - **Mild:**

definition
 - *Moderate*
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 - *High-risk PDR*

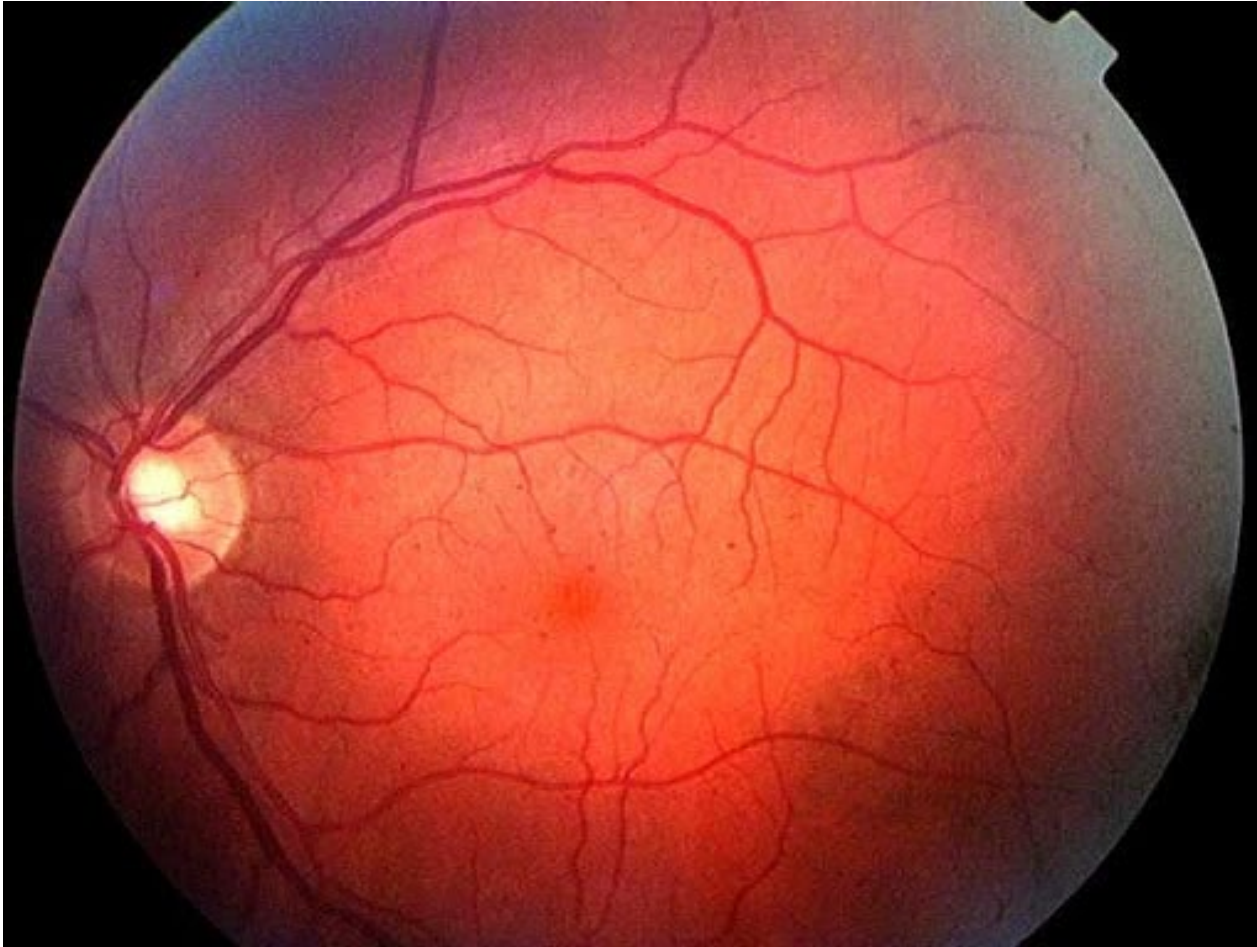


A

Diabetic Retinopathy: The Basics

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 - **Nonproliferative diabetic retinopathy (NPDR)**
 - ***Mild:*** Any DBR < moderate
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 - *Severe*
 - *Very severe*
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Diabetic Retinopathy: The Basics



Mild nonproliferative diabetic retinopathy



Q

Diabetic Retinopathy: The Basics

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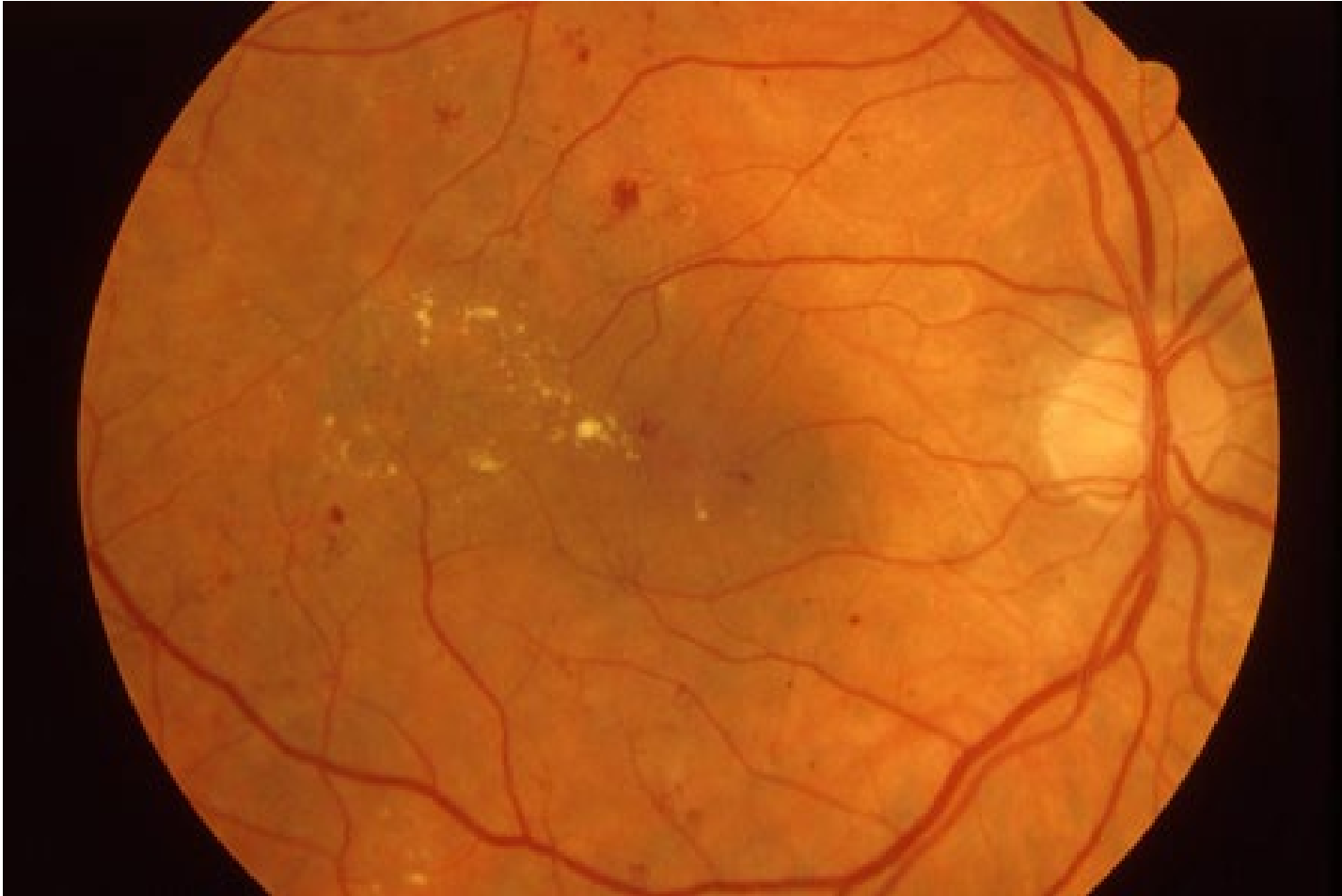


A

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Diabetic Retinopathy: The Basics



Moderate nonproliferative diabetic retinopathy



Q

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chance of high-risk PDR within 1 year
 - *Very severe*
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What is the 4:2:1 rule?



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What is the 4:2:1 rule?

--4 retinal quadrants of...

--2 retinal quadrants of...

--1 retinal quadrant of...



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Diabetic Retinopathy: The Basics



Severe nonproliferative diabetic retinopathy:
Extensive hemorrhages



Q

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Diabetic Retinopathy: The Basics



Severe nonproliferative diabetic retinopathy:
Venous beading



Q

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Diabetic Retinopathy: The Basics

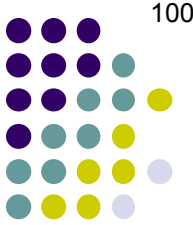
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 - *Moderate: DBR > mild but < severe*
 - **Severe: Presence of any 1 of the **4:2:1 rule****
chance of high-risk PDR within 1 year
 - *Very severe*
 - What is the 4:2:1 rule?
 - 4 retinal quadrants of...**extensive retinal hemorrhages**
 - 2 retinal quadrants of...**venous beading**
 - 1 retinal quadrant of...**IRMA**
 - **Proliferative diabetic retinopathy (PDR)**



Q

Diabetic Retinopathy: The Basics

- *Classification of diabetic retinopathy*
 - Nonproliferative diabetic retinopathy (NPDR)
 - Mild: Any DBR < moderate
 - Moderate: DBR > mild but < severe
 - Severe: Presence of any 1 of the **4:2:1 rule**
 - What does IRMA stand for?
 - ...extensive retinal hemorrhages
 - ...venous beading
 - ...IRMA
 - Proliferative diabetic retinopathy (PDR)



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 - What does IRMA stand for?
Intraretinal microvascular anomalies
 - rule?
 - ts of...extensive retinal hemorrhages
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 - t of...**IRMA**
 - Proliferative diabetic retinopathy (PDR)



Q

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What does **IRMA** stand for?

Intraretinal microvascular anomalies

What does that mean?

rule?

ts of... **extensive retinal hemorrhages**

ts of... **venous beading**

t of... **IRMA**

- **Proliferative diabetic retinopathy (PDR)**



A

Diabetic Retinopathy: The Basics

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What does IRMA stand for?

Intraretinal microvascular anomalies

What does that mean?

Think of it as neovascularization that has **not** broken through the ILM

rule?

ts of...extensive retinal hemorrhages

ts of...venous beading

t of...**IRMA**

- Proliferative diabetic retinopathy (PDR)

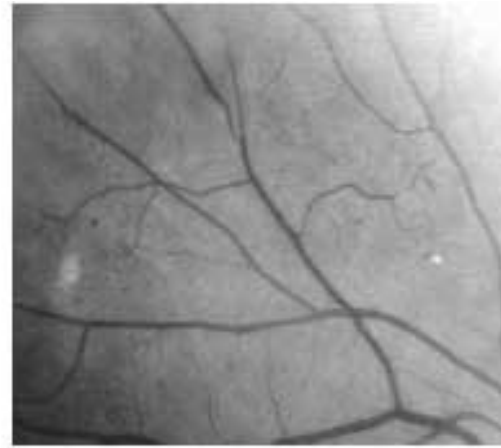
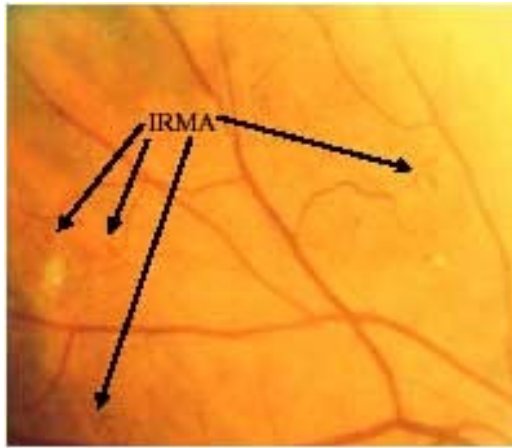
IRMA

What is the histological definition of ^Vproliferation in this context?

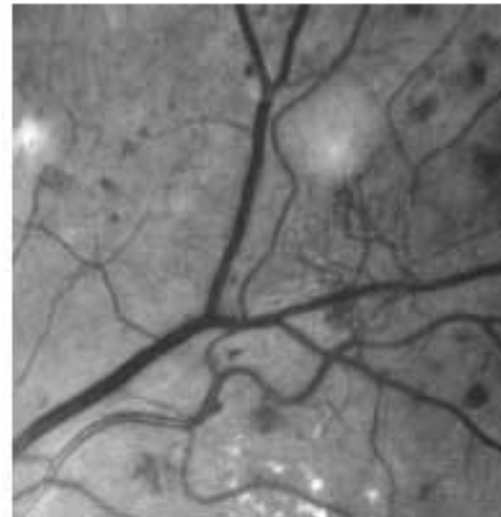
Retinal neovascularization that [^]breaks through the internal limiting membrane (ILM)

hasn't broken

Diabetic Retinopathy: The Basics



4 patches of IRMA (Airlie House Slide 6a). Note that they are more visible in the right-hand red-free image



Severe nonproliferative diabetic retinopathy:
IRMA



Q

Diabetic Retinopathy: The Basics

- *Classification of diabetic retinopathy*
 - **Nonproliferative diabetic retinopathy (NPDR)**
 - *Mild:* Any DBR < moderate
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 - *Very severe:*

definition
 - **Proliferative diabetic retinopathy (PDR)**
 - *High-risk PDR*



A

Diabetic Retinopathy: The Basics

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Q

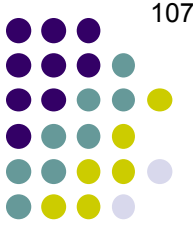
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Next Q

→ Per the DRS, what % of severe NPDR cases will progress to high-risk PDR in 1 year?

- **Proliferative diabetic retinopathy (PDR)**
 - *High-risk PDR*



- *Classification of diabetic retinopathy*
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 - *Mild:* Any DBR < moderate
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15% chance of high-risk PDR within 1 year
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 - **Proliferative diabetic retinopathy (PDR)**
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Q

Diabetic Retinopathy: The Basics

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15% chance of high-risk PDR within 1 year
 - *Very severe: Any 2 of the 4:2:1 rule*

Next Q

What % of very severe NPDR cases will progress to high-risk PDR in 1 year?

- **Proliferative diabetic retinopathy (PDR)**
 - *High-risk PDR*



A

Diabetic Retinopathy: The Basics

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 - **Nonproliferative diabetic retinopathy (NPDR)**
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45% chance of high-risk PDR within 1 year
 - **Proliferative diabetic retinopathy (PDR)**
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Q

Diabetic Retinopathy: The Basics

- *Classification of diabetic retinopathy*
 - **Nonproliferative diabetic retinopathy (NPDR)**

- *Mild: Any DBR < moderate*

How should NPDR be managed?

- /

- S

- V

- **Pre**

- A



- *Classification of diabetic retinopathy*

- **Nonproliferative diabetic retinopathy (NPDR)**

- *Mild: Any DBR < moderate*

How should NPDR be managed?

There is a clear role for controlling three systemic risk factors:

--
--
--

- *Pro*

- *A*



A

Diabetic Retinopathy: The Basics

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- *Mild: Any DBR < moderate*

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- Blood glucose**
- Blood pressure**
- Lipid profile**

- *Pro*

- *A*



Q

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- Blood pressure**
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*What's **less** clear (at the time of this writing) is the role of two modalities that have shown considerable potential:*

--
--

- *Pro*

- *A*



A

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*What's **less** clear (at the time of this writing) is the role of two modalities that have shown considerable potential:*

- Intravitreal anti-VEGF injections**
- Intravitreal steroids**

- *Pro*

- *A*



A

Diabetic Retinopathy: The Basics

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There is a clear role for controlling three systemic risk factors:

- Blood glucose**
- Blood pressure**
- Lipid profile**

*What's **less** clear (at the time of this writing) is the role of two modalities that have shown considerable potential:*

- Intravitreal anti-VEGF injections**
- Intravitreal steroids**

There is good clinical-trial data demonstrating that these interventions can lessen the severity of NPDR--substantially so in some cases. What is uncertain at this time is *whether the cost/benefit ratio of these interventions is favorable enough to warrant mandating their use.* (Trials addressing this issue are ongoing.)



Q

Diabetic Retinopathy: The Basics

● *Classification of diabetic retinopathy*

- Nonproliferative diabetic retinopathy (NPDR)

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45% chance of high-risk PDR within 1 year

● Proliferative diabetic retinopathy (PDR)

● *High-risk PDR*

- definition 1 OR
- definition 2 OR
- definition 3

Q/A

Diabetic Retinopathy: The Basics



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● Proliferative diabetic retinopathy (PDR)

● *High-risk PDR*

NVD =
Neovascularization
of the disc

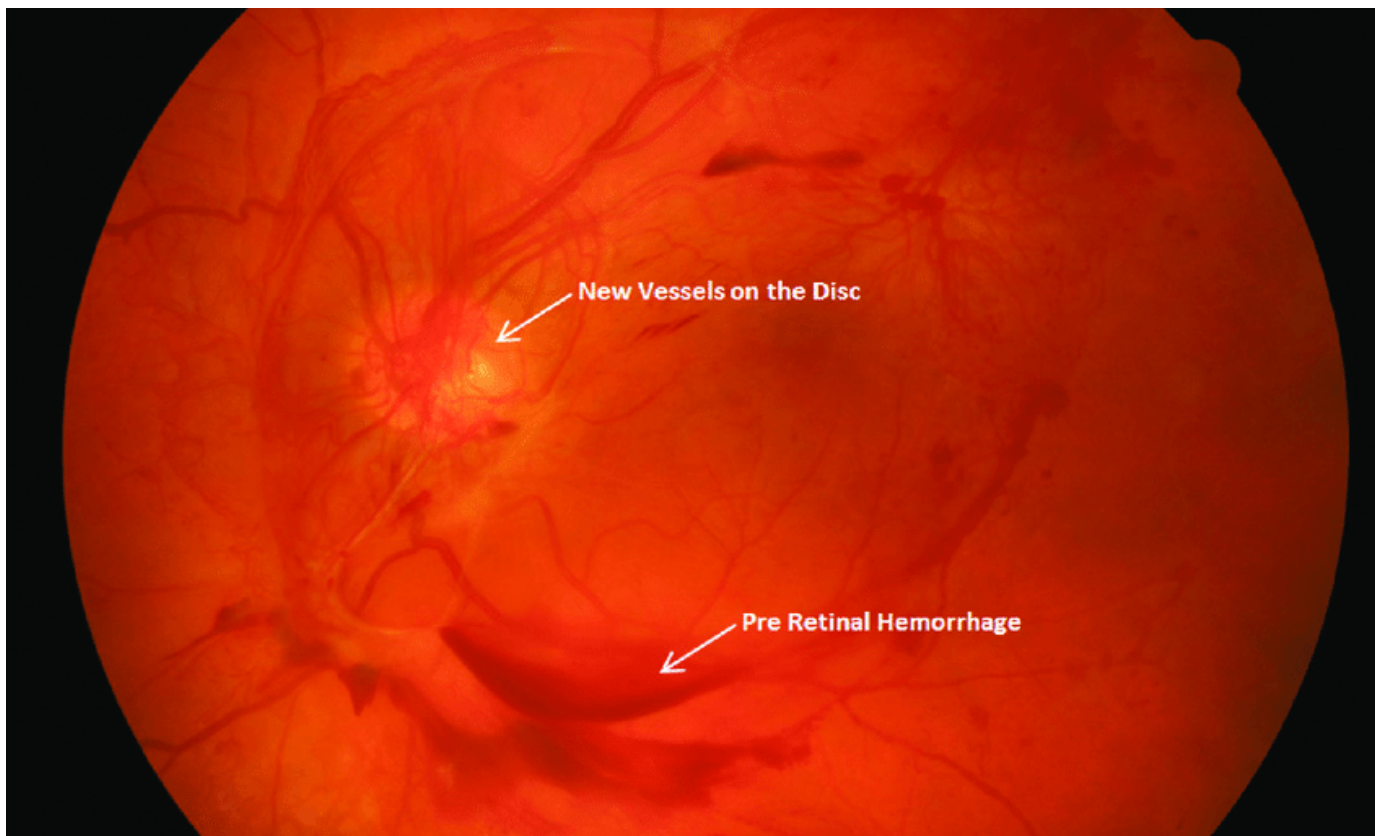
- Any NVD associated with vitreous heme (VH), **OR**

definition 2

OR

definition 3

Diabetic Retinopathy: The Basics



High-risk proliferative diabetic retinopathy:
NVD + vitreous hemorrhage

Q/A

Diabetic Retinopathy: The Basics



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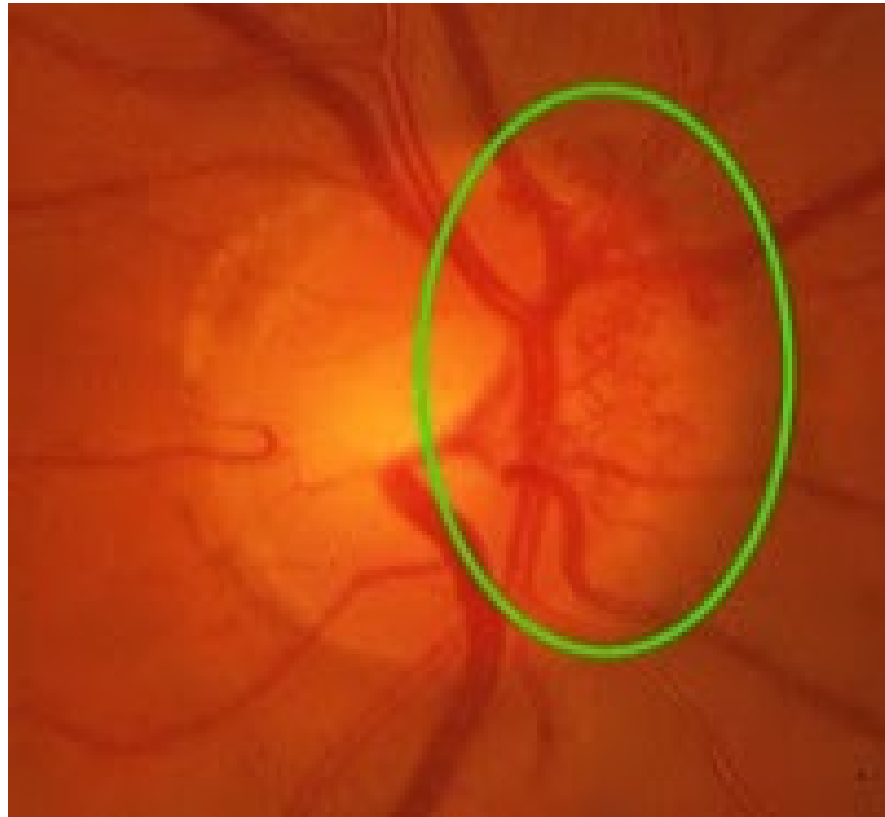
● *High-risk PDR*

- Any NVD associated with vitreous heme (VH), **OR**
- Large (at least $\frac{1}{4}$ DD) area of NVD with or without VH, **OR**

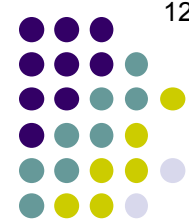
DD = Disc diameter

definition 3

Diabetic Retinopathy: The Basics



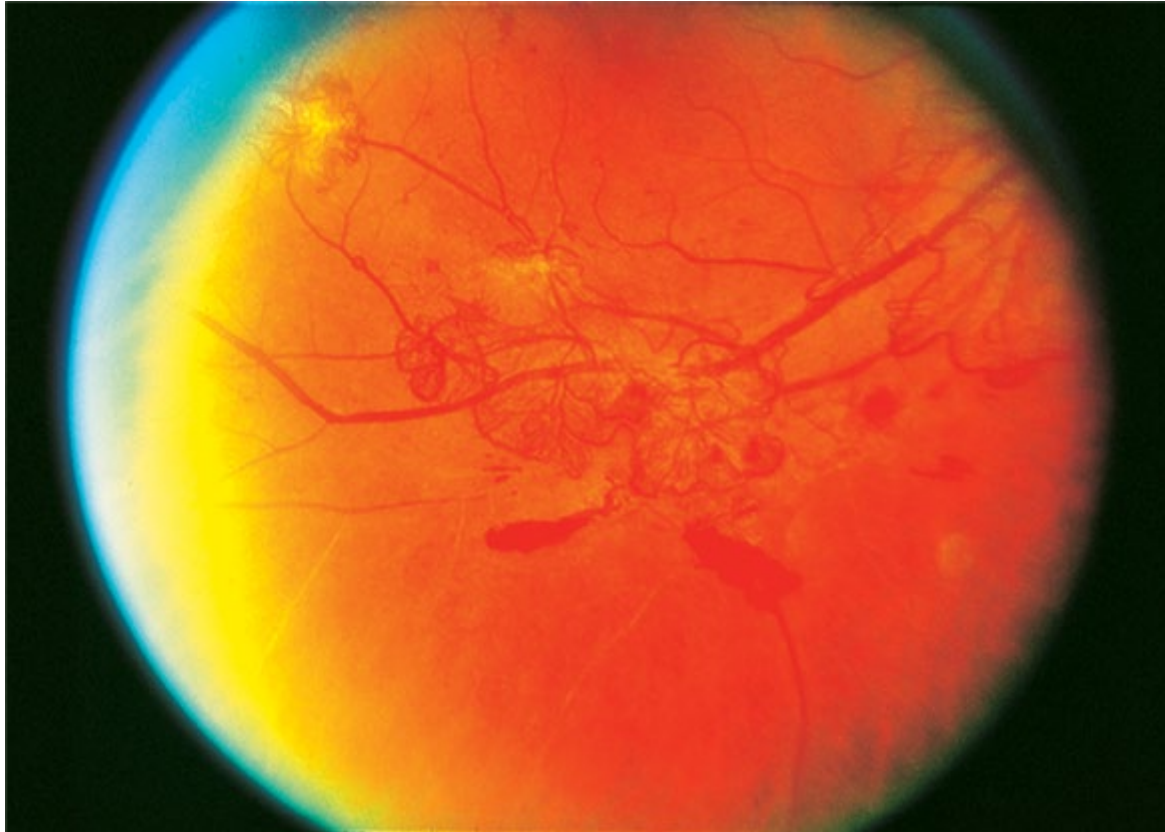
High-risk proliferative diabetic retinopathy:
Extensive NVD



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 - Any NVD associated with vitreous heme (VH), **OR**
 - Large (at least $\frac{1}{4}$ DD) area of NVD with or without VH, **OR**
 - Large (at least $\frac{1}{2}$ DD) area of NVE with VH

NVE = Neovascularization elsewhere (ie, anywhere but the disc)

Diabetic Retinopathy: The Basics



High-risk proliferative diabetic retinopathy:
Large area NVE + associated vitreous heme



Q

Diabetic Retinopathy: The Basics

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DD

How big is a DD in microns?

DD



A

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DD

How big is a DD in microns?

DD

1500 (1.5 mm)



Q

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Circling back for a minute... We said that PDR consists of retinal neovascularization. What sequence of events leads to retinal neovascularization?

hy **PDR**

What is the histological definition of proliferation in this context?

Retinal neovascularization that breaks through the internal limiting membrane (ILM)

- Large (at least ½ DD) area of NVE with VH

A

Diabetic Retinopathy: The Basics



● *Classification of diabetic retinopathy*

● *What pathological state is the endpoint of decreasing lumen diameter?*
Occlusion of the retinal vessel

(No question—proceed when ready)

● *Vessel occlusion leads to what pathological event?*
Ischemia of the retinal area serviced by the vessel

● *Retinal ischemia leads to what pathological state?*
Hypoxia of the affected retinal cells

● *Hypoxic retinal cells release a signaling molecule that is central to the pathogenesis of DBR. What is that signaling molecule?*
VEGF (we will have much more to say about VEGF shortly)

● *Circling back for a minute... We said that PDR consists of retinal neovascularization. What sequence of events leads to retinal neovascularization?*

The answer can be found in this set of questions/answers from earlier in the slide-set:

PDR

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Diabetic Retinopathy: The Basics

● *Classification of diabetic retinopathy*

What pathological state is the endpoint of decreasing lumen diameter?
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To summarize: Occlusive vasculopathy secondary to diabetic derangements produces retinal ischemia.

What is the signaling molecule?

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To summarize: Occlusive vasculopathy secondary to diabetic derangements produces retinal ischemia. In a desperate attempt to recruit a blood supply, hypoxic retinal cells release **VEGF**, which diffuses throughout the vitreous cavity promoting neovascularization.

Angiogenesis or DRR. What is that signaling molecule?

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Diabetic Retinopathy: The Basics

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What pathological state is the endpoint of decreasing lumen diameter?
Occlusion of the retinal vessel

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Vessel occlusion leads to what pathological event?

To summarize: Occlusive vasculopathy secondary to diabetic derangements produces retinal ischemia. In a desperate attempt to recruit a blood supply, hypoxic retinal cells release **VEGF**, which diffuses throughout the vitreous cavity promoting neovascularization. Unfortunately, the resulting new fibrovascular tissue is highly abnormal—it is prone to bleeding and contraction, leading to vitreous hemorrhages and/or tractional retinal detachment.

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Obviously, VEGF plays a central role in the pathogenesis of DBR. Let's take a closer look at it.

VEGF (we will have much more to say about VEGF shortly)

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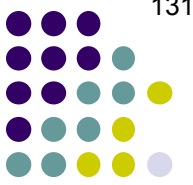
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Q

Diabetic Retinopathy: The Basics



131

What does **VEGF** stand for?

VEGF-A₁₆₅

What does **VEGF** stand for?
Vascular endothelial growth factor

VEGF-A₁₆₅

What does **VEGF** stand for?
Vascular endothelial growth factor

Broadly speaking, what is it?

VEGF-A₁₆₅

*What does **VEGF** stand for?*

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Broadly speaking, what is it?

An extracellular signaling protein
involved in vascular development

VEGF-A₁₆₅

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Does VEGF do anything besides grow new blood vessels?

VEGF-A₁₆₅

What does **VEGF** stand for?
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Broadly speaking, what is it?
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Does VEGF do anything besides grow new blood vessels?
Yes, it also is a potent vasodilator (it was known originally
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How potent?

VEGF-A₁₆₅

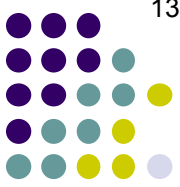
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How potent?
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VEGF-A₁₆₅



Diabetic Retinopathy: The Basics

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How potent?

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VEGF-A₁₆₅

This property accounts for VEGF's role in
the development of diabetic macular edema,
and explains why anti-VEGF meds can treat
this condition!

(Diabetic macular edema is addressed in slide-set R32)

*What does **VEGF** stand for?*

Vascular endothelial growth factor

Broadly speaking, what is it?

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How does VEGF work?

VEGF-A₁₆₅

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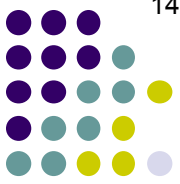
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How does VEGF work?

Extracellular VEGF binds to VEGF
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VEGF-A₁₆₅



*What does the **A** signify?*

*What does **VEGF** stand for?*

Vascular endothelial growth factor

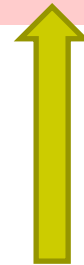
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*What does the **A** signify?*

VEGF is not a single entity—a number of similar-but-different proteins comprise the ‘VEGF family.’ These are differentiated as VEGF-A through VEGF-F. (One family member, *placental growth factor* [PlGF], is the exception to the naming rule.)

When the term *VEGF* is used in the ophthalmology literature without a sub-family designation, it is understood to mean VEGF-A.

VEGF-A₁₆₅



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VEGF-A₁₆₅



*What does **165** signify?*

*What does **VEGF** stand for?*

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VEGF-A₁₆₅



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*What does **165** signify?*

VEGF-A is not a single entity either. At least 4 isoforms exist; these differ in the number of peptides they contain, and that number is used as a subscript to identify specific isoforms.

Why focus on isoform 165?

*What does **VEGF** stand for?*

Vascular endothelial growth factor

Broadly speaking, what is it?

An extracellular signaling protein involved in vascular development

How does VEGF work?

Extracellular VEGF binds to VEGF receptors (VEGFR), which are transmembrane receptor tyrosine kinase (RTK) structures.

VEGF-A₁₆₅



*What does the **A** signify?*

VEGF is not a single entity—a number of similar-but-different proteins comprise the ‘VEGF family.’ These are differentiated as VEGF-A through VEGF-F. (One family member, *placental growth factor* [PlGF], is the exception to the naming rule.)

When the term *VEGF* is used in the ophthalmology literature without a sub-family designation, it is understood to mean VEGF-A.

*What does **165** signify?*

VEGF-A is not a single entity either. At least 4 isoforms exist; these differ in the number of peptides they contain, and that number is used as a subscript to identify specific isoforms.

Why focus on isoform 165?

It seems to be the most important with respect to pathologic angiogenesis in the human eye.



Q

Diabetic Retinopathy: The Basics

• *Classification of diabetic retinopathy*

• Nonproliferative diabetic retinopathy (NPDR)

- *Mild: Any DBR < moderate*

What landmark clinical trial provided this system of PDR classification?

- S

rule

- V

• **Proliferative diabetic retinopathy (PDR)**

- *High-risk PDR*

- Any NVD associated with vitreous heme (VH), **OR**
- Large (at least $\frac{1}{4}$ DD) area of NVD with or without VH, **OR**
- Large (at least $\frac{1}{2}$ DD) area of NVE with VH



A

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What question did the DRS address?
 'Is PRP effective?'
 What does PRP stand for in this context?
Panretinal photocoagulation

● Proliferative diabetic retinopathy (PDR)

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And the answer was...?

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And the answer was...?

We'll get to that in a few slides

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What landmark clinical trial provided this system of PDR classification?

- S The **Diabetic Retinopathy Study (DRS)**

What question did the DRS seek to answer?

- V 'Is **PRP** effective?

Let's drill down on PRP for a minute...

And the answer was...?

We'll get to that in a few slides

● Proliferative diabetic retinopathy (PDR)

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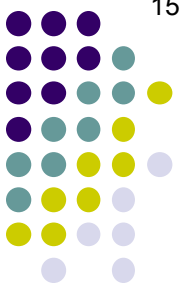
Diabetic Retinopathy: The Basics

First, let's talk about laser-tissue interaction ...



Q

Diabetic Retinopathy: The Basics



What are the five modes of laser-tissue interaction?

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?

?

?

A

Diabetic Retinopathy: The Basics

What are the five modes of laser-tissue interaction?

Photo-
chemical

aka photoactivation

Thermal

Photo-
ablation

Plasma-induced
ablation

Photo-
disruption

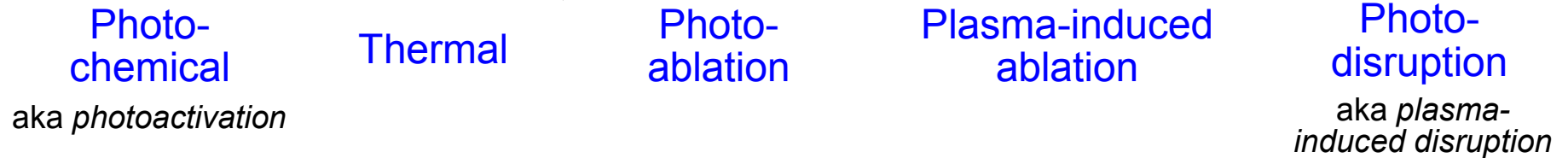
*aka plasma-
induced disruption*



Q

Diabetic Retinopathy: The Basics

The five modes of laser-tissue interaction



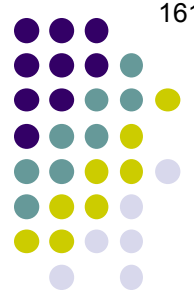
Which mode is PRP an exemplar of?



A

Diabetic Retinopathy: The Basics

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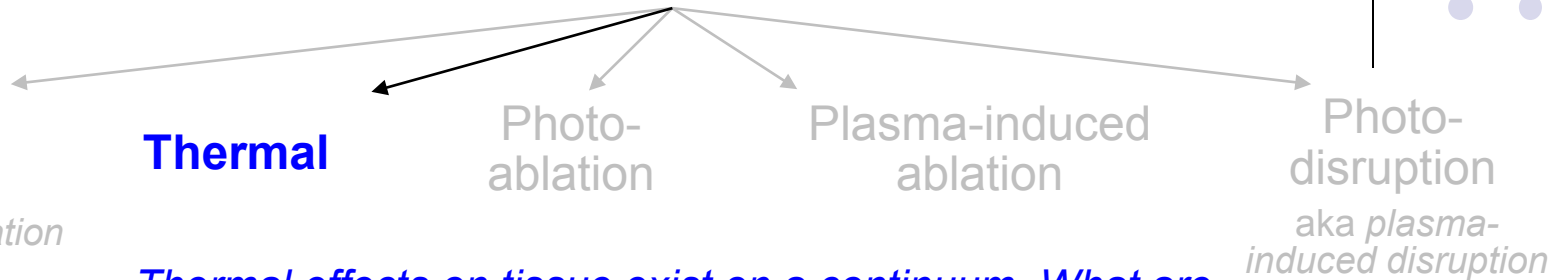
The five modes of laser-tissue interaction



Which mode is PRP an exemplar of?
Thermal



The five modes of laser-tissue interaction

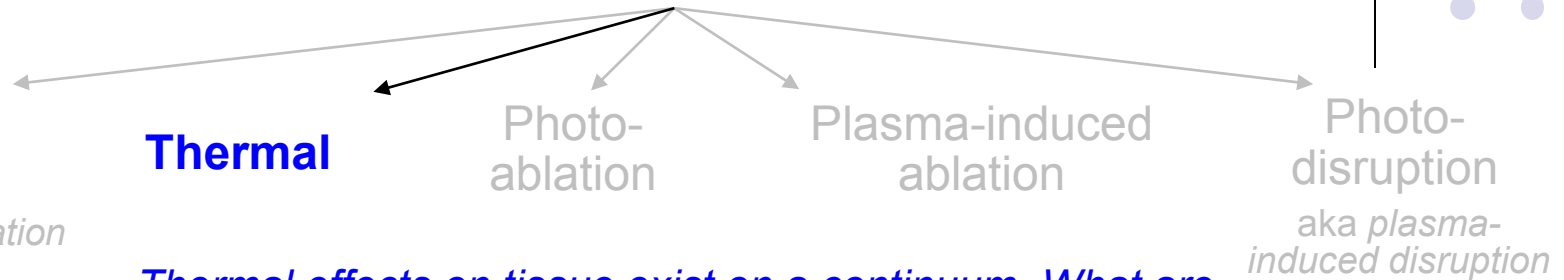


Thermal effects on tissue exist on a continuum. What are the five degrees (see what I did there?) of tissue effects?

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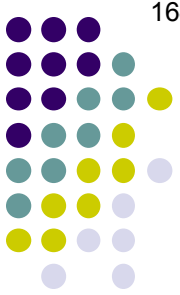


The five modes of laser-tissue interaction

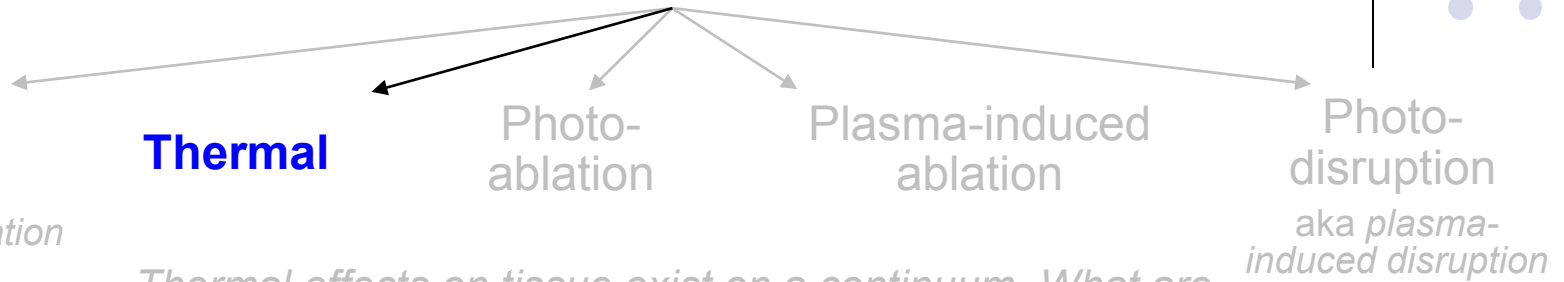


Thermal effects on tissue exist on a continuum. What are the five degrees (see what I did there?) of tissue effects?

- Hyperthermia
- Coagulation
- Vaporization
- Carbonization
- Melting



The five modes of laser-tissue interaction



Thermal effects on tissue exist on a continuum. What are the five degrees (see what I did there?) of tissue effects?

- Hyperthermia?
- Coagulation?
- Vaporization?
- Carbonization?
- Melting?

Which thermal effect is employed most frequently?

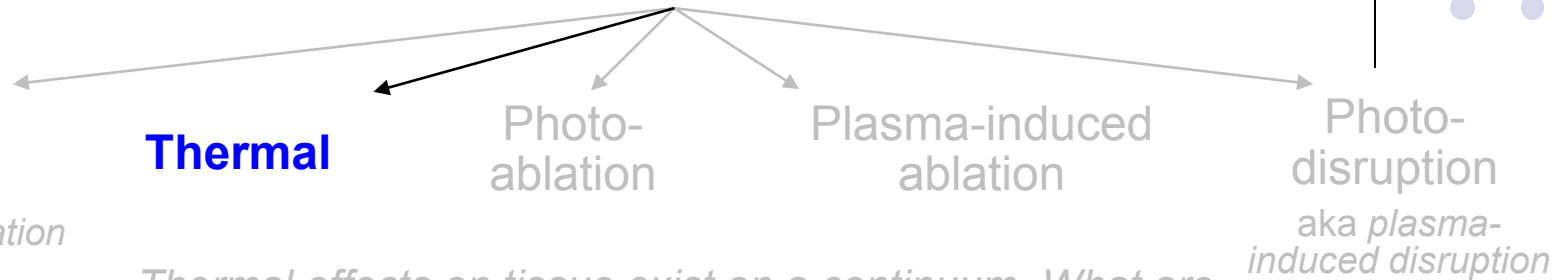
A

Diabetic Retinopathy: The Basics

165



The five modes of laser-tissue interaction



Thermal effects on tissue exist on a continuum. What are the five degrees (see what I did there?) of tissue effects?

--Hyperthermia

--**Coagulation**

--Vaporization

--Carbonization

--Melting

Which thermal effect is employed most frequently?

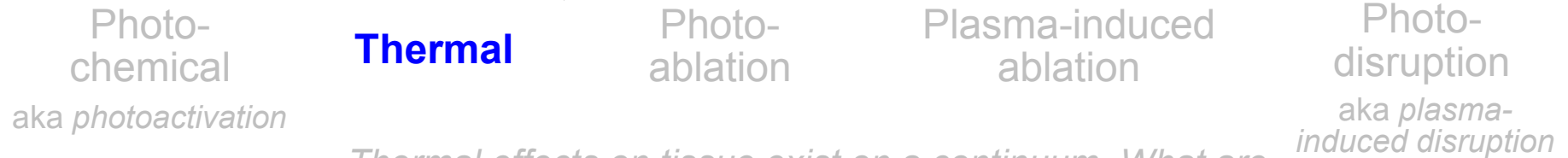
Coagulation

Q

Diabetic Retinopathy: The Basics



The five modes of laser-tissue interaction



Thermal effects on tissue exist on a continuum. What are the five degrees?

--Hyperthermia

--**Coagulation**

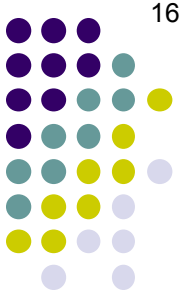
--Vaporization

--Carbonization

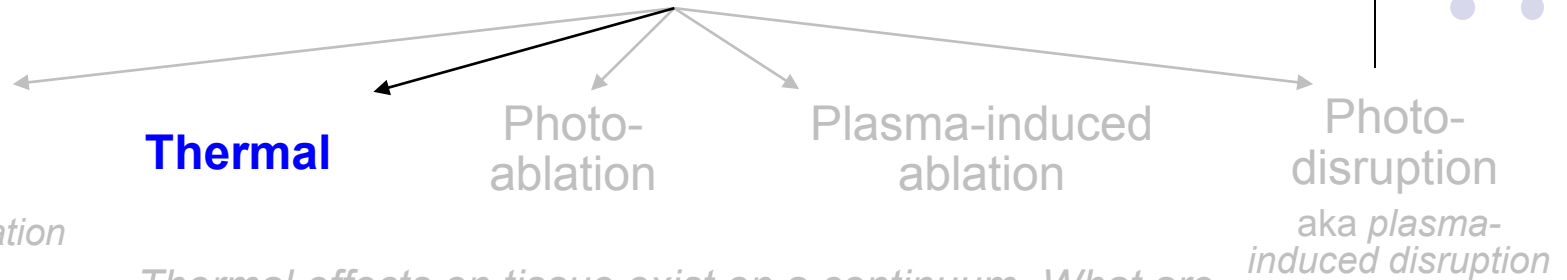
--Melting

*Which thermal
Coagulation*

What does it mean to say that tissue has 'coagulated'?



The five modes of laser-tissue interaction



Thermal effects on tissue exist on a continuum. What are the five degrees?

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*Which thermal
Coagulation*

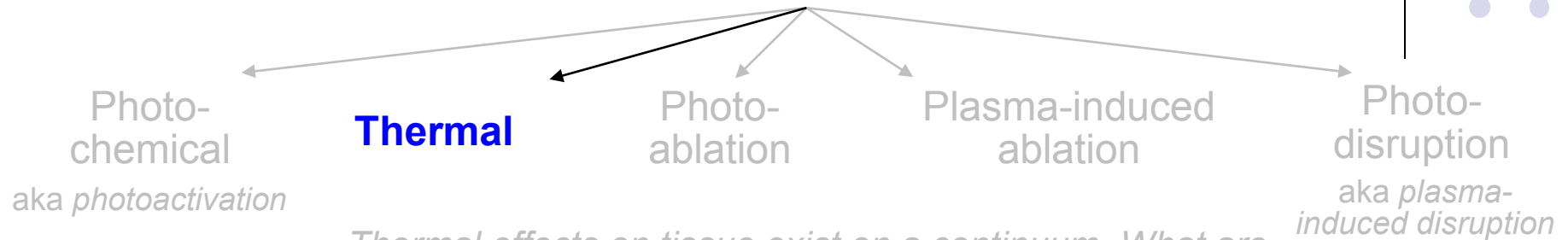
What does it mean to say that tissue has 'coagulated'?
It means the proteins have been denatured

Q

Diabetic Retinopathy: The Basics



The five modes of laser-tissue interaction



Thermal effects on tissue exist on a continuum. What are the five degrees?

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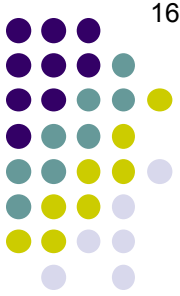
--Melting

*Which thermal
Coagulation*

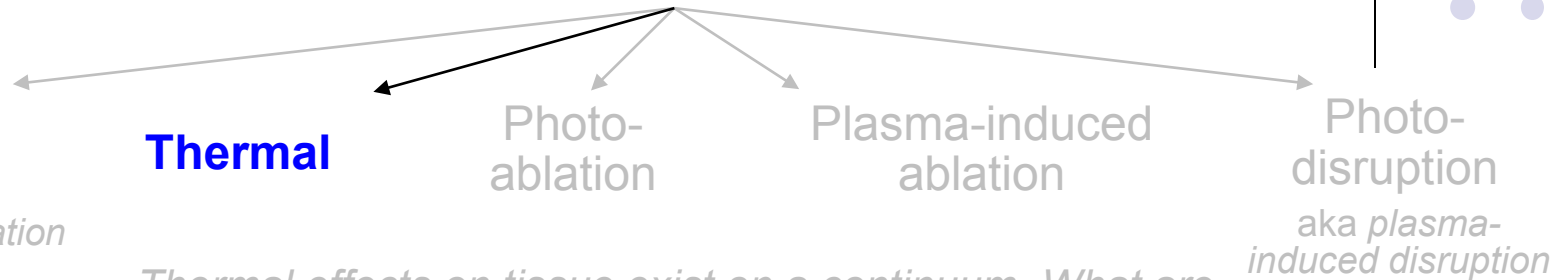
What does it mean to say that tissue has 'coagulated'?

It means the proteins have been denatured

OK, what does it mean to say a protein has been 'denatured'?



The five modes of laser-tissue interaction



Thermal effects on tissue exist on a continuum. What are the five degrees?

--Hyperthermia

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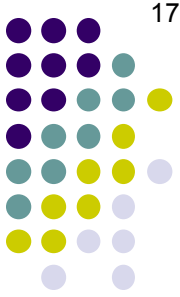
*Which thermal
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What does it mean to say that tissue has 'coagulated'?

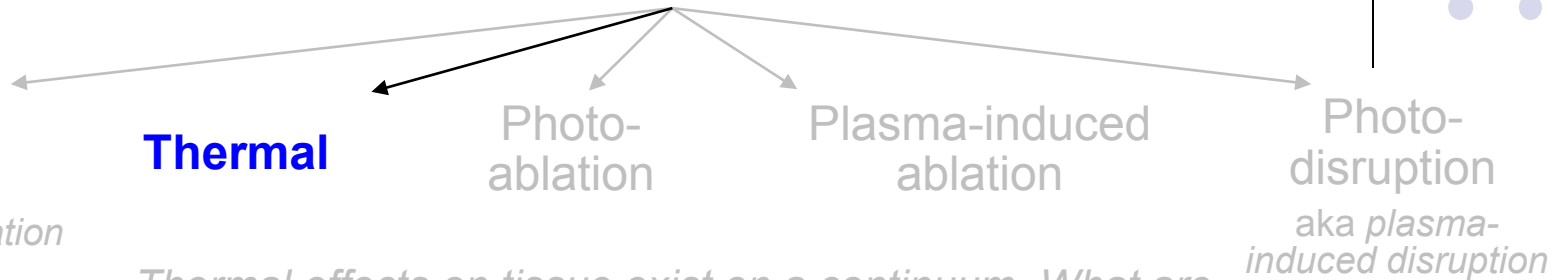
It means the proteins have been denatured

OK, what does it mean to say a protein has been 'denatured'?

It means the protein has been forced out of its native conformation by some sort of applied stress (in this case, heat). Because a protein's function is inextricably tied to its shape, denatured proteins do not behave as they do in their native form.



The five modes of laser-tissue interaction



Thermal effects on tissue exist on a continuum. What are the five degrees?

--Hyperthermia

Coagulation

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*Which thermal
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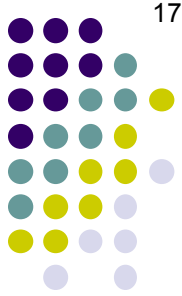
It means the protein has been forced out of its native conformation by some sort of applied stress (in this case, heat). Because a protein's function is inextricably tied to its shape, denatured proteins do not behave as they do in their native form.

Can you give an example of protein denaturation?

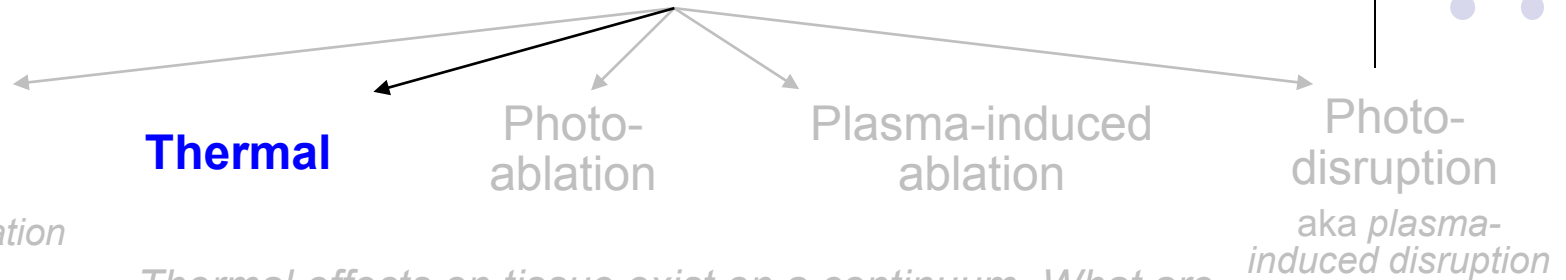
A

Diabetic Retinopathy: The Basics

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The five modes of laser-tissue interaction



Thermal effects on tissue exist on a continuum. What are the five degrees?

- Hyperthermia
- Coagulation**
- Vaporization
- Carbonization
- Melting

Which thermal effect is Coagulation?

What does it mean to say that tissue has 'coagulated'?

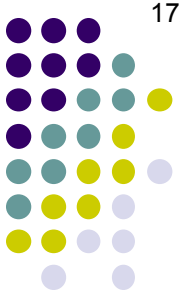
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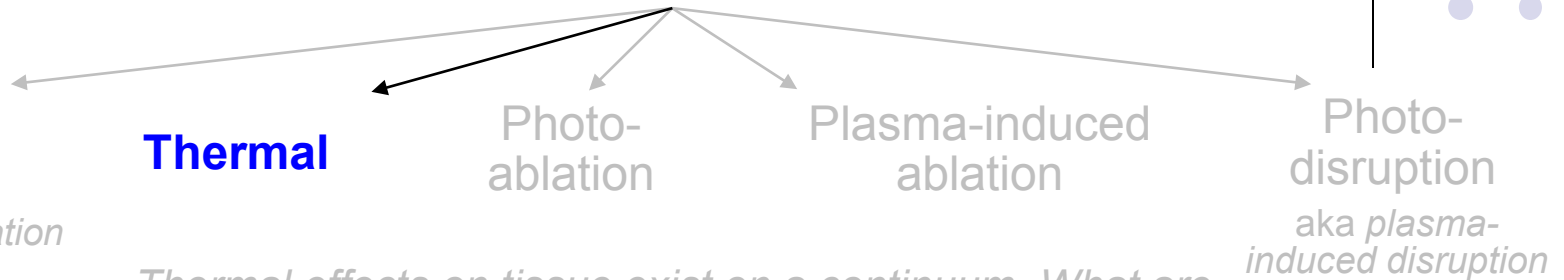
It means the protein has been forced out of its native conformation by some sort of applied stress (in this case, heat). Because a protein's function is inextricably tied to its shape, denatured proteins do not behave as they do in their native form.

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.)



The five modes of laser-tissue interaction



Thermal effects on tissue exist on a continuum. What are the five degrees?

--Hyperthermia

Coagulation

--Vaporization

--Carbonization

--Melting

Which thermal
Coagulation

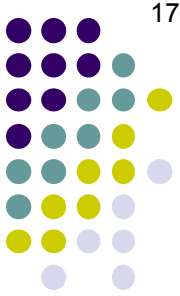
What does it mean to say that tissue has 'coagulated'?
It means the proteins have been denatured

OK, what does it mean to say that tissue has 'denatured'?
It means the proteins have lost their native conformation (shape, function).
Because a protein's function is inextricably tied to its shape, denatured proteins do not behave as they do in their native form.

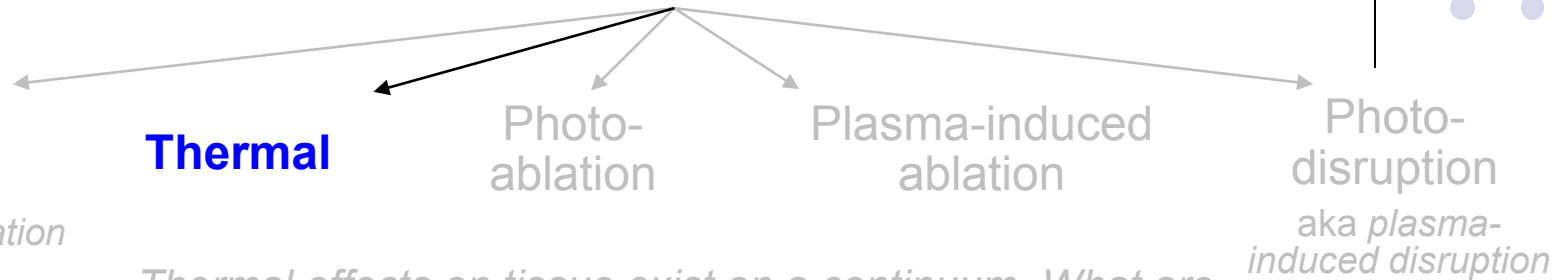
At what temperature does retinal tissue start to coagulate?

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.)



The five modes of laser-tissue interaction



Thermal effects on tissue exist on a continuum. What are the five degrees?

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Which thermal effect is Coagulation?

What does it mean to say that tissue has 'coagulated'?

It means the proteins have been denatured

OK, what does it mean to say that tissue has 'coagulated'?

It means the proteins have been denatured

conformational change (e.g., heat).

Because a protein's function is inextricably tied to its shape, denatured proteins do not behave as they do in their native form.

At what temperature does retinal tissue start to coagulate?

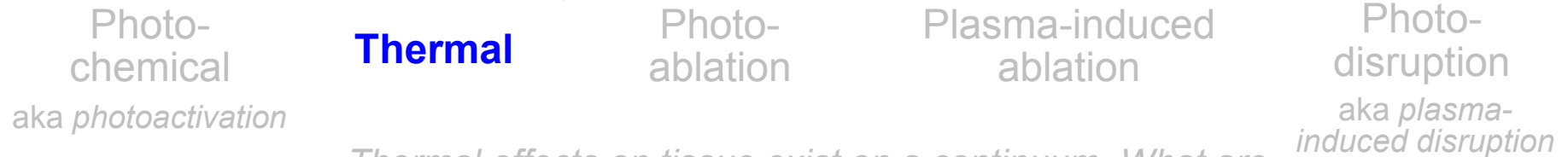
65°C

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.)

Diabetic Retinopathy: The Basics

The five modes of laser-tissue interaction



Thermal effects on tissue exist on a continuum. What are the five degrees?

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Which thermal effect is Coagulation?

What does it mean to say that tissue has 'coagulated'?
It means the proteins have been denatured

OK, what does it mean to say that tissue has 'denatured'?

It means the protein's conformation (shape) has been altered (by heat, for example). Because a protein's function is inextricably tied to its shape, denatured proteins do not behave as they do in their native form.

At what temperature does retinal tissue start to coagulate?
65°C

Can you give an example of protein denaturation?

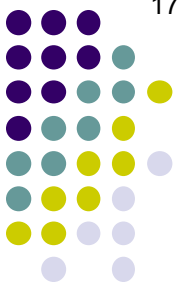
Consider egg albumin. In its native state, it's a clear liquid. But if sufficient heat is applied, it becomes a white solid. (And if sufficient salsa is applied to the white solid, it becomes delish.)

For more info on lasers, see slide-set FELT26

Q

Diabetic Retinopathy: The Basics

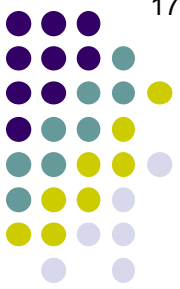
- Which laser is used to perform PRP?

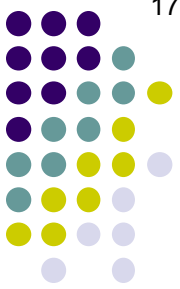


A

Diabetic Retinopathy: The Basics

- Which laser is used to perform PRP?
Argon **green** or **blue-green**





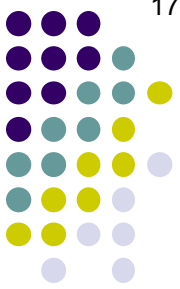
Q

Diabetic Retinopathy: The Basics

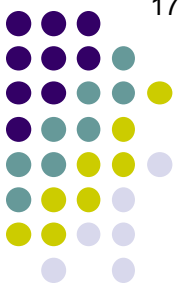
- Which laser is used to perform PRP?
Argon **green** or **blue-green**
- How many shots constitute a full compliment of PRP?

A

Diabetic Retinopathy: The Basics



- Which laser is used to perform PRP?
Argon **green** or **blue-green**
- How many shots constitute a full compliment of PRP? **About 1200-1400**



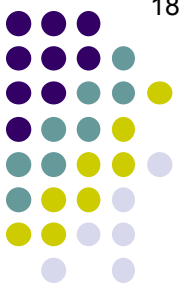
Q

Diabetic Retinopathy: The Basics

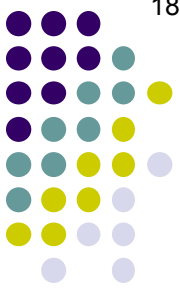
- Which laser is used to perform PRP?
Argon **green** or **blue-green**
- How many shots constitute a full compliment of PRP? **About 1200-1400**
- What spot size should be used?

A

Diabetic Retinopathy: The Basics



- Which laser is used to perform PRP?
Argon **green** or **blue-green**
- How many shots constitute a full compliment of PRP? **About 1200-1400**
- What spot size should be used? **500 μm**



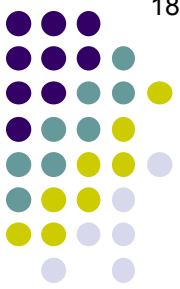
Q

Diabetic Retinopathy: The Basics

- Which laser is used to perform PRP?
Argon **green** or **blue-green**
- How many shots constitute a full compliment of PRP? **About 1200-1400**
- What spot size should be used? **500 μm**
- How much power?

Q/A

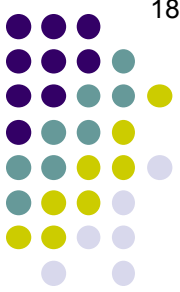
Diabetic Retinopathy: The Basics



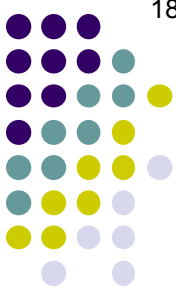
- Which laser is used to perform PRP? Argon green or blue-green
- How many shots constitute a full compliment of PRP? About 1200-1400
- What spot size should be used? 500 μm
- How much power? Enough to produce a color or light color-colored burn

A

Diabetic Retinopathy: The Basics



- Which laser is used to perform PRP? Argon **green** or **blue-green**
- How many shots constitute a full compliment of PRP? **About 1200-1400**
- What spot size should be used? **500 μ m**
- How much power? **Enough to produce a **gray** or **light cream**-colored burn**



Q

Diabetic Retinopathy: The Basics

- Which laser is used to perform PRP?
Argon **green** or **blue-green**
- How many shots constitute a full compliment of PRP? **About 1200-1400**
- What spot size should be used? **500 μ m**
- How much power? **Enough to produce a **gray** or **light cream**-colored burn**
- How much distance between burns?

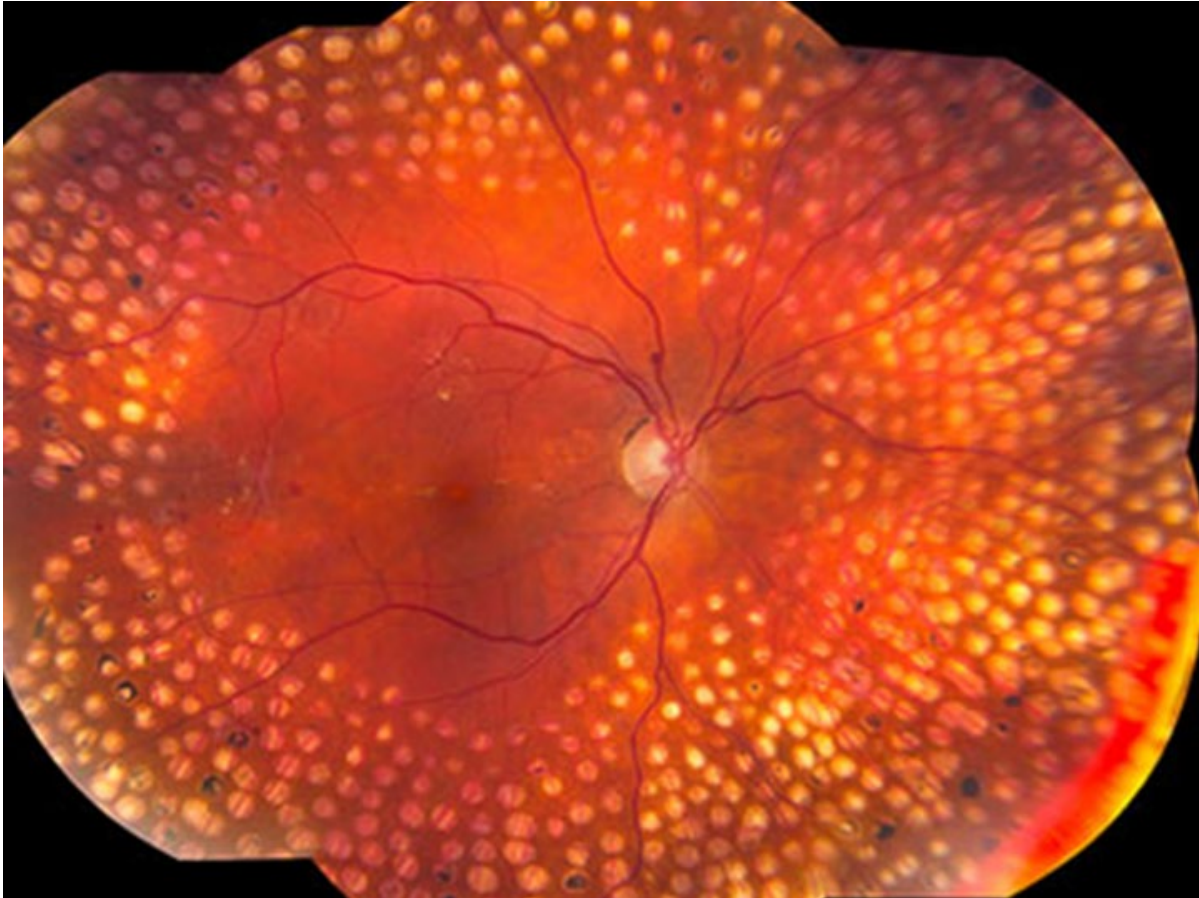


A

Diabetic Retinopathy: The Basics

- Which laser is used to perform PRP? Argon **green** or **blue-green**
- How many shots constitute a full compliment of PRP? **About 1200-1400**
- What spot size should be used? **500 μ m**
- How much power? **Enough to produce a **gray** or **light cream**-colored burn**
- How much distance between burns? **About half a burn's width**

Diabetic Retinopathy: The Basics



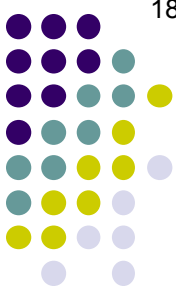
PRP



Q

Diabetic Retinopathy: The Basics

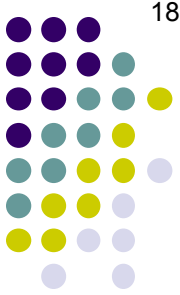
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- How many shots constitute a full compliment of PRP? **About 1200-1400**
- What spot size should be used? **500 μ m**
- How much power? **Enough to produce a **gray** or **light cream**-colored burn**
- How much distance between burns? **About half a burn's width**
- Should it be done in one, or multiple sessions?



A

Diabetic Retinopathy: The Basics

- Which laser is used to perform PRP? Argon **green** or **blue-green**
- How many shots constitute a full compliment of PRP? **About 1200-1400**
- What spot size should be used? **500 μ m**
- How much power? **Enough to produce a** **gray** **or** **light** **cream**-colored burn
- How much distance between burns? **About half a burn's width**
- Should it be done in one, or multiple sessions? **It doesn't matter**



Q

Diabetic Retinopathy: The Basics

- What are known complications of PRP?
 - Reduced [] vision
 - Reduced [] vision
 - Reduced [two words]
 - Loss of [# to #] lines BCVA
- Effects on vision*

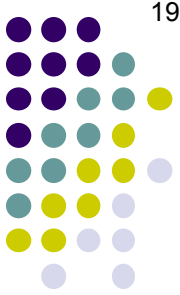


A

Diabetic Retinopathy: The Basics

- What are known complications of PRP?
 - Reduced peripheral vision
 - Reduced color vision
 - Reduced contrast sensitivity
 - Loss of 1-2 lines BCVA

Effects on vision



Q

Diabetic Retinopathy: The Basics

- What are known complications of PRP?
 - Reduced peripheral vision
 - Reduced color vision
 - Reduced contrast sensitivity
 - Loss of 1-2 lines BCVA
 - Decreased

parasympathetic function
 - Decreased

two words



A

Diabetic Retinopathy: The Basics

- What are known complications of PRP?
 - Reduced peripheral vision
 - Reduced color vision
 - Reduced contrast sensitivity
 - Loss of 1-2 lines BCVA
 - Decreased accommodation
 - Decreased corneal sensitivity

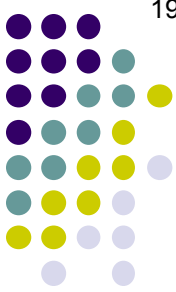


Q

Diabetic Retinopathy: The Basics

- What are known complications of PRP?
 - Reduced peripheral vision
 - Reduced color vision
 - Reduced contrast sensitivity
 - Loss of 1-2 lines BCVA
 - Decreased accommodation
 - Decreased corneal sensitivity

What do accommodation and corneal sensitivity have in common?



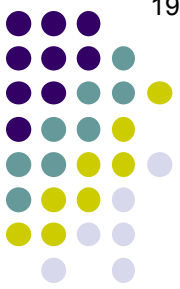
Q/A

Diabetic Retinopathy: The Basics

- What are known complications of PRP?
 - Reduced peripheral vision
 - Reduced color vision
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 - Loss of 1-2 lines BCVA
 - Decreased accommodation
 - Decreased corneal sensitivity

What do accommodation and corneal sensitivity have in common?

Both are mediated by the nerves

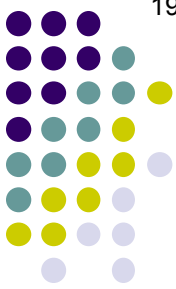


A

Diabetic Retinopathy: The Basics

- What are known complications of PRP?
 - Reduced peripheral vision
 - Reduced color vision
 - Reduced contrast sensitivity
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 - Decreased corneal sensitivity

What do accommodation and corneal sensitivity have in common?
Both are mediated by the long ciliary nerves



Q

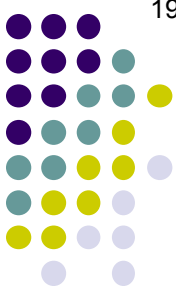
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 - Decreased accommodation
 - Decreased corneal sensitivity

What do accommodation and corneal sensitivity have in common?

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OK, but what do the long ciliary nerves have to do with PRP?



Q/A

Diabetic Retinopathy: The Basics

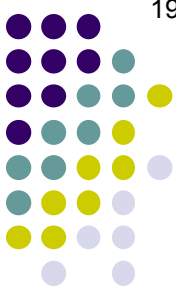
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OK, but what do the long ciliary nerves have to do with PRP?

The long ciliary nerves run pretty deep (ie, just under the choroid) in the
meridian.



A

Diabetic Retinopathy: The Basics

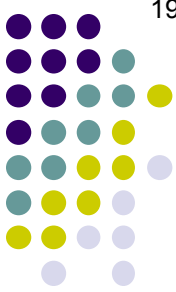
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A

Diabetic Retinopathy: The Basics

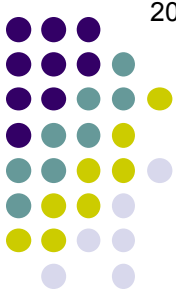
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OK, but what do the long ciliary nerves have to do with PRP?

The long ciliary nerves run pretty deep (ie, just under the choroid) in the horizontal meridian. Because of their location, they are vulnerable to damage during PRP.



Q

Diabetic Retinopathy: The Basics

- What are known complications of PRP?
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 - Reduced color vision
 - Reduced contrast sensitivity
 - Loss of 1-2 lines BCVA
 - Decreased accommodation
 - Decreased corneal sensitivity

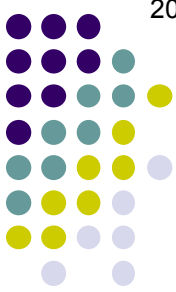
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The long ciliary nerves run pretty deep (ie, just under the choroid) in the horizontal meridian. Because of their location, they are vulnerable to damage during PRP.

How can one minimize the risk to the long ciliary nerves?



A

Diabetic Retinopathy: The Basics

- What are known complications of PRP?
 - Reduced peripheral vision
 - Reduced color vision
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 - Loss of 1-2 lines BCVA
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 - Decreased corneal sensitivity

What do accommodation and corneal sensitivity have in common?

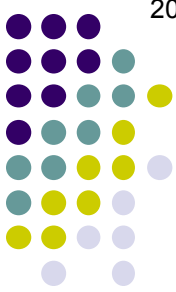
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How can one minimize the risk to the long ciliary nerves?

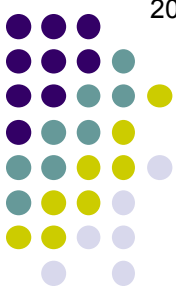
By avoiding the horizontal meridian during PRP



Q

Diabetic Retinopathy: The Basics

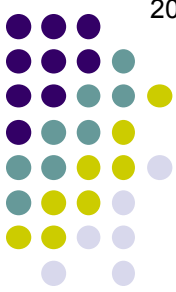
- What are known complications of PRP?
 - Reduced peripheral vision
 - Reduced color vision
 - Reduced contrast sensitivity
 - Loss of 1-2 lines BCVA
 - Decreased accommodation
 - Decreased corneal sensitivity
 - Macular
 - Inadvertent burn



A

Diabetic Retinopathy: The Basics

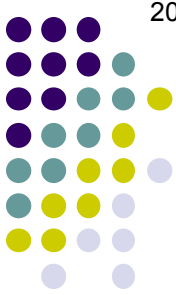
- What are known complications of PRP?
 - Reduced peripheral vision
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 - Reduced contrast sensitivity
 - Loss of 1-2 lines BCVA
 - Decreased accommodation
 - Decreased corneal sensitivity
 - Macular edema
 - Inadvertent foveal burn



Q

Diabetic Retinopathy: The Basics

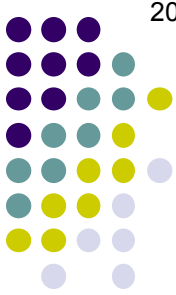
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 - Decreased accommodation
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 - Macular edema
 - Inadvertent foveal burn
 - Choroidal



A

Diabetic Retinopathy: The Basics

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 - Decreased corneal sensitivity
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 - Inadvertent foveal burn
 - Choroidal detachment



Q

Diabetic Retinopathy: The Basics

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 - Decreased accommodation
 - Decreased corneal sensitivity
 - Macular edema
 - Inadvertent foveal burn
 - Choroidal detachment
 - Iatrogenic break in Bruch's →



A

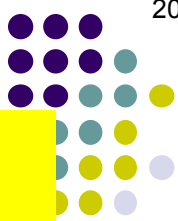
Diabetic Retinopathy: The Basics

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 - Decreased corneal sensitivity
 - Macular edema
 - Inadvertent foveal burn
 - Choroidal detachment
 - Iatrogenic break in Bruch's → CNVM

(CNVM = Choroidal neovascular membrane)

Q

Diabetic Retinopathy: The Basics



What does the term high-risk PDR mean? High risk of what?

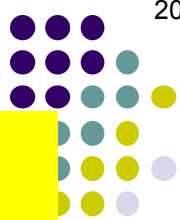
● Proliferative diabetic retinopathy (PDR)

★ *High-risk PDR* ★

- Any NVD associated with vitreous heme (VH), *OR*
- Large (at least $\frac{1}{4}$ DD) area of NVD with or without VH, *OR*
- Large (at least $\frac{1}{2}$ DD) area of NVE with VH

A

Diabetic Retinopathy: The Basics



What does the term high-risk PDR mean? High risk of what?

In the DRS, patients with this level of neovascularization were found to be at high risk of severe vision loss (SVL)

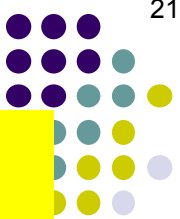
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Q

Diabetic Retinopathy: The Basics



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What was the definition of SVL in the DRS?

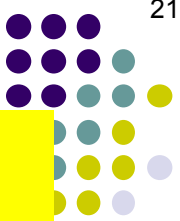
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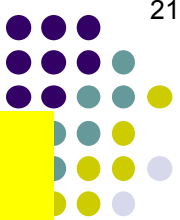
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Why was this level of vision chosen as the benchmark?

• Proliferative diabetic retinopathy (PDR)



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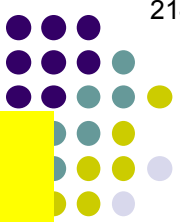
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Q

Diabetic Retinopathy: The Basics



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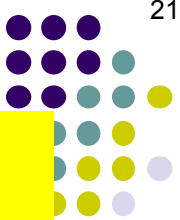
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A

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High-risk PDR is the formal justification for performing PRP (I say 'formal' because many clinicians will offer PRP at lesser levels of DBR if they feel it is warranted)

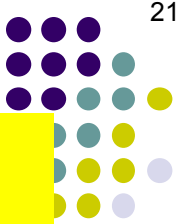
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Q

Diabetic Retinopathy: The Basics



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Q/A

Diabetic Retinopathy: The Basics



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Indeed it is—it reduces the risk by % at 5 years post-treatment

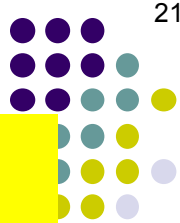
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A

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To answer an earlier question: Per the DRS, is PRP effective at preventing SVL?

Indeed it is—it reduces the risk by 50% at 5 years post-treatment

● Proliferative diabetic retinopathy (PDR)



- Any NVD associated with vitreous heme (VH), OR
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Q

Diabetic Retinopathy: The Basics

There is another 'informal' justification for PRP that has yet to be mentioned—what is it?

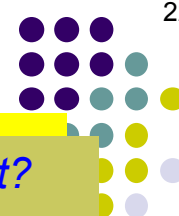
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● Proliferative diabetic retinopathy (PDR)

★ High-risk PDR ★

- Any NVD associated with vitreous heme (VH), OR
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- Large (at least $\frac{1}{2}$ DD) area of NVE with VH



There is another 'informal' justification for PRP that has yet to be mentioned—what is it?
 The presence of extensive [redacted] four words, or any

[redacted] four different words

? is the informal justification for performing PRP (I say 'formal' because many clinicians will offer PRP at lesser levels of DBR if they feel it is warranted)

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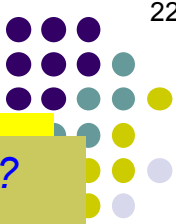
★ High-risk PDR ★



- Any NVD associated with vitreous heme (VH), OR
- Large (at least ¼ DD) area of NVD with or without VH, OR
- Large (at least ½ DD) area of NVE with VH

A

Diabetic Retinopathy: The Basics



There is another 'informal' justification for PRP that has yet to be mentioned—what is it? The presence of extensive **neovascularization of the iris (NVI)**, or any **neovascularization of the angle (NVA)**

NVI/NVA is the informal justification for performing PRP (I say 'formal' because many clinicians will offer PRP at lesser levels of DBR if they feel it is warranted)

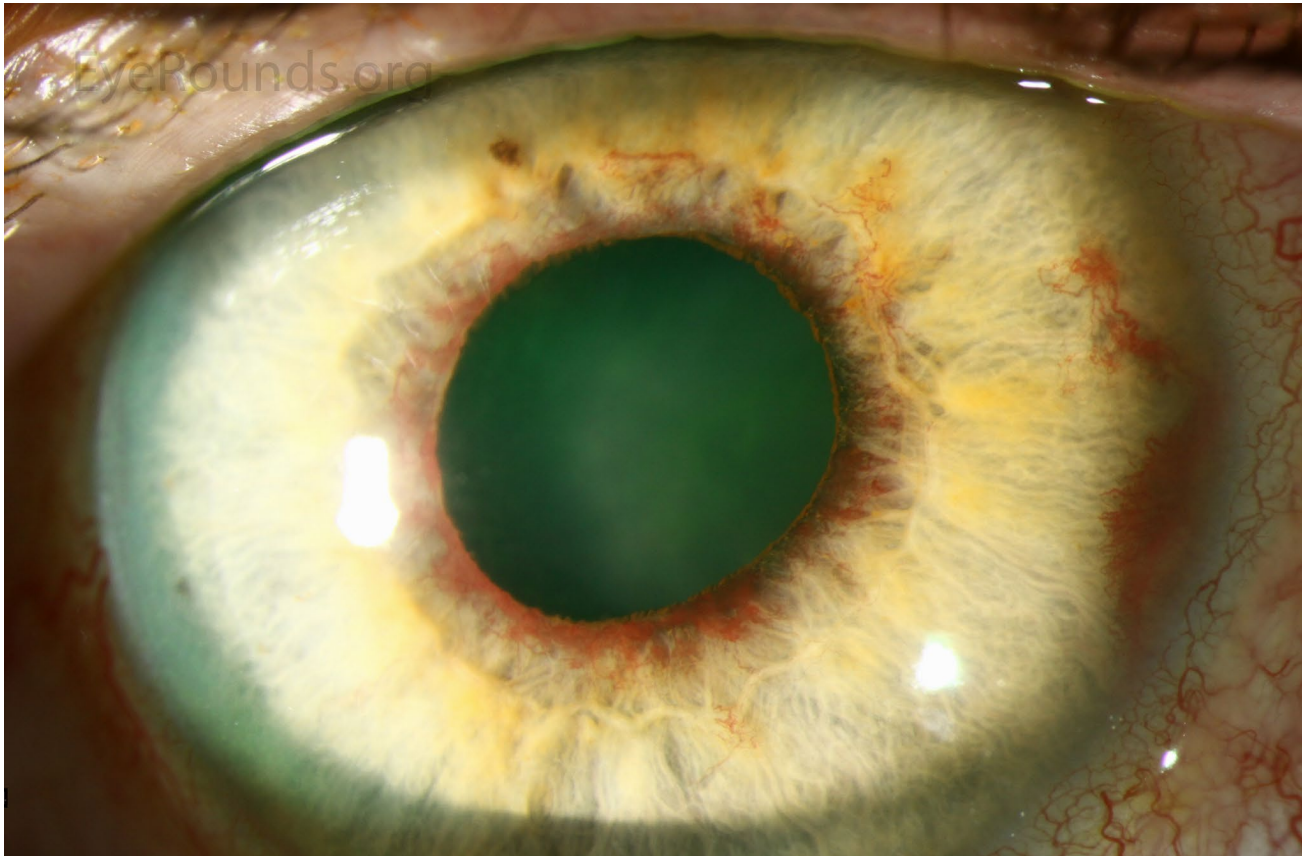
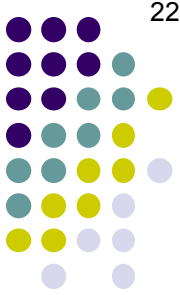
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Diabetic Retinopathy: The Basics



Extensive NVI

Q

Diabetic Retinopathy: The Basics

There is another 'informal' justification for PRP that has yet to be mentioned—what is it? The presence of extensive **neovascularization of the iris (NVI)** , or any **neovascularization of the angle (NVA)**

What is the concern vis a vis extensive NVI, or NVA?

NVI/NVA is the informal justification for performing PRP (I say 'formal' because many clinicians will offer PRP at lesser levels of DBR if they feel it is warranted)

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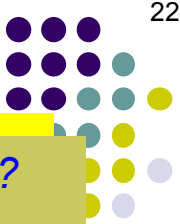
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- Large (at least $\frac{1}{2}$ DD) area of NVE with VH

Q/A

Diabetic Retinopathy: The Basics



There is another 'informal' justification for PRP that has yet to be mentioned—what is it? The presence of extensive **neovascularization of the iris (NVI)** , or any **neovascularization of the angle (NVA)**

What is the concern vis a vis extensive NVI, or NVA?

Their presence is very worrisome for the development of two words , a potentially blinding condition

NVI/NVA is the informal justification for performing PRP (I say 'formal' because many clinicians will offer PRP at lesser levels of DBR if they feel it is warranted)

To answer an earlier question: Per the DRS, is PRP effective at preventing SVL? Indeed it is—it reduces the risk by 50% at 5 years post-treatment

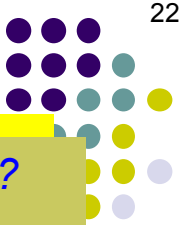
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- Large (at least ¼ DD) area of NVD with or without VH, OR
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A

Diabetic Retinopathy: The Basics



There is another 'informal' justification for PRP that has yet to be mentioned—what is it? The presence of extensive **neovascularization of the iris (NVI)** , or any **neovascularization of the angle (NVA)**

What is the concern vis a vis extensive NVI, or NVA?

Their presence is very worrisome for the development of neovascular glaucoma (NVG) , a potentially blinding condition

NVI/NVA is the informal justification for performing PRP (I say 'formal' because many clinicians will offer PRP at lesser levels of DBR if they feel it is warranted)

To answer an earlier question: Per the DRS, is PRP effective at preventing SVL?
Indeed it is—it reduces the risk by 50% at 5 years post-treatment

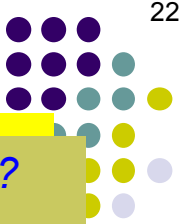
● Proliferative diabetic retinopathy (PDR)



- Any NVD associated with vitreous heme (VH), OR
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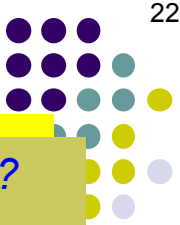
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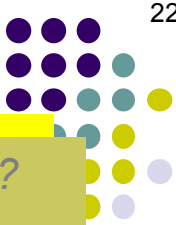
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My diabetic pt has a small area of NVI at the pupillary margin—should I PRP him?

When the NVI is extensive, it can lead to a condition called neovascular glaucoma (NVG), a potentially blinding condition.

In very general terms, what type of glaucoma is NVG, ie, what causes the IOP elevation? It is a type of angle-closure glaucoma.

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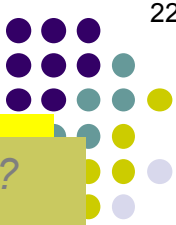
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My diabetic pt has a small area of NVI at the pupillary margin—should I PRP him? Not necessarily. So-called 'tufts' of NVI are a common occurrence in diabetics, and do not of themselves warrant PRP.

When the NVI is extensive, it can lead to neovascular glaucoma (NVG), a potentially blinding condition.

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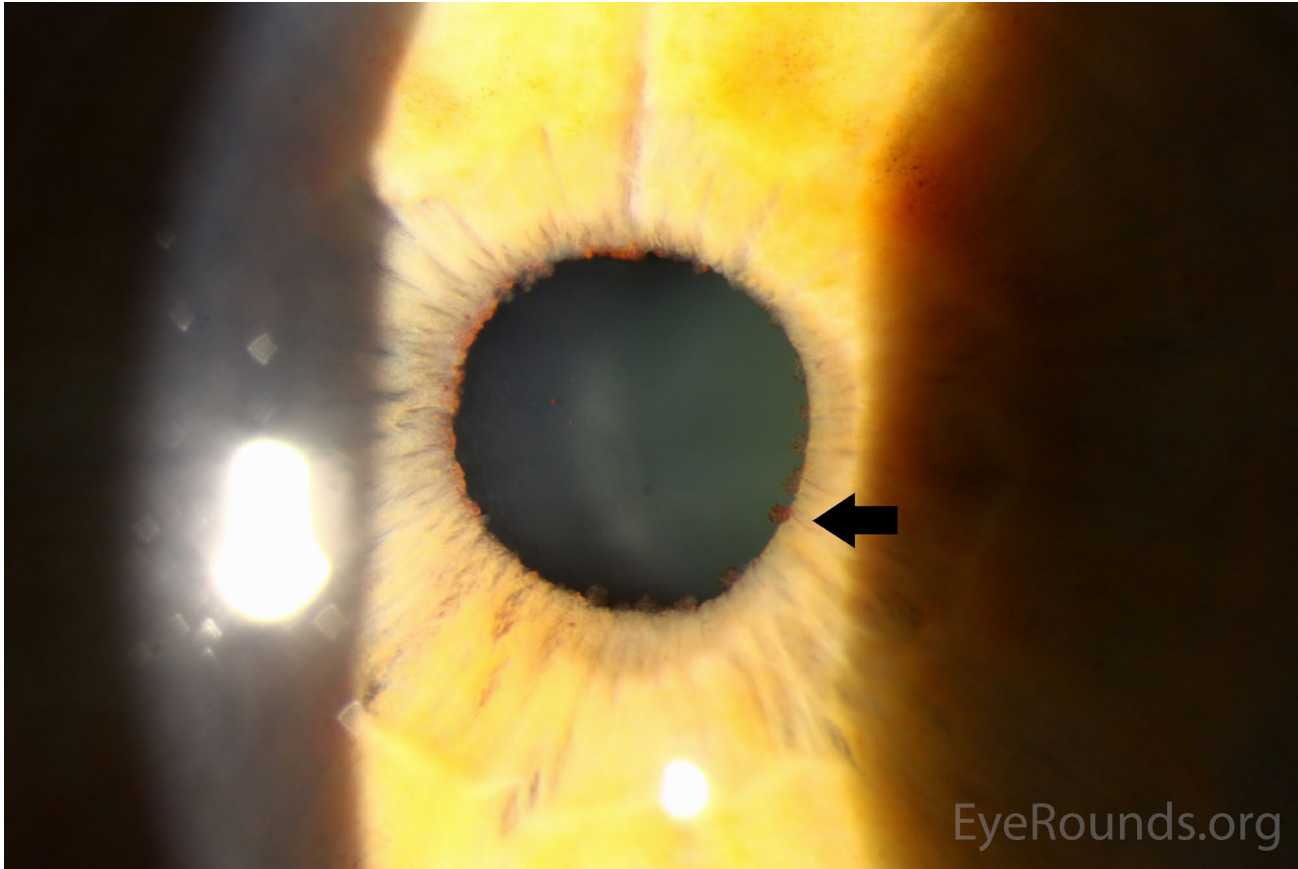
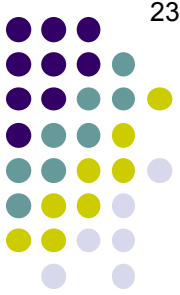
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Diabetic Retinopathy: The Basics



Pupillary vascular tufts

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Diabetic Retinopathy: The Basics

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My diabetic pt has a small area of NVI at the pupillary margin—should I PRP him? Not necessarily. So-called 'tufts' of NVI are a common occurrence in diabetics, and do not of themselves warrant PRP. That said, they **do warrant a careful evaluation of the retina** (consider wide-field FA to assess for extensive nonperfusion and/or subtle NVE), as well as close follow up (including frequent undilated gonioscopy to check for NVA).

In very general terms, what type of glaucoma is NVG, ie, what causes the IOP elevation? It is a type of angle-closure glaucoma

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I'm confused—if extensive NVI or NVA is concerning for the development of angle-closure glaucoma, shouldn't I be performing laser peripheral iridotomy (LPI) rather than PRP?

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LPI?

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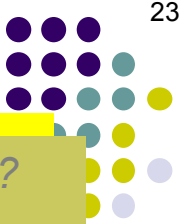
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No. LPI is effective only if/when the mechanism of angle closure is **two words**. In NVA, the mechanism of angle closure is occlusion via **three words**.

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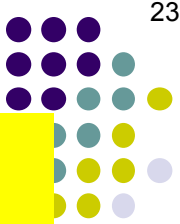
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What does the term high-risk PDR mean? High risk of what?

In the DRS, patients with this level of neovascularization were found to be at high risk of severe vision loss (SVL)

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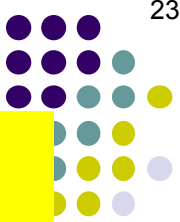
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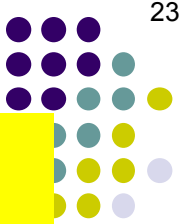
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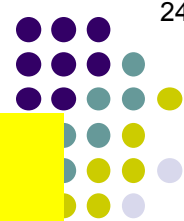
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As stated several times now: DBR renders portions of the retina hypoxic, and hypoxic cells release VEGF, initiating a cascade of deleterious events.

OTOH, dead cells do **not** release VEGF. So by euthanizing the hypoxic retina, the intraocular VEGF burden is reduced, neovascularization is halted, and SVL is avoided.

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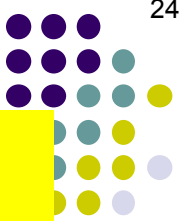
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PRP has two other salutary effects on oxygen tension in the retina—what are they?

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the intraocular VEGF level is reduced, neovascularization is halted, and overuse of laser is avoided.

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--By decreasing the number of living retinal cells competing for oxygen, the remaining ones receive a greater portion of the oxygen delivered to the retina

--The PRP scars facilitate the diffusion of oxygen from the choroidal circulation into the retinal space

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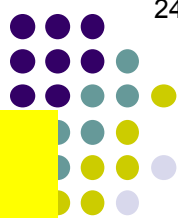


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Diabetic Retinopathy: The Basics



What does the term high-risk PDR mean? High risk of what?

In the DRS, patients with this level of neovascularization were found to be at high

An important aside: The ETDRS looked at whether PRP reduced the risk of SVL in pts with mild, moderate and/or severe NPDR. It found a modest reduction in the risk among pts with severe NPDR, but not for those with mild or moderate dz. Thus, PRP is justified in severe NPDR, but not in mild or moderate dz.

PRP

--By

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● Proliferative diabetic retinopathy (PDR)



● *High-risk PDR*



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Diabetic Retinopathy: The Basics

- *Classification of diabetic retinopathy*
 - Nonproliferative diabetic retinopathy (NPDR)
 - **Mild?** Any DBR < moderate
 - **Moderate?** DBR > mild but < severe
 - **Severe?** Presence of any 1 of the 4:2:1 rule

The **ETDRS** looked at whether PRP for mild, moderate and/or severe NPDR reduced the risk of SVL. What did it find in this regard?

Per the ^{ET}_^DRS, is ^{early}_^PRP effective at preventing SVL?

- Proliferative diabetic retinopathy (PDR)
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Q/A

Diabetic Retinopathy: The Basics

● *Classification of diabetic retinopathy*

● Nonproliferative diabetic retinopathy (NPDR)

- **Mild? Nope** *NPDR < moderate*
- **Moderate? Nope** *NPDR mild but < severe*
- **Severe? Yes!** *Presence of any 1 of the 4:2:1 rule*

The **ETDRS** looked at whether PRP for mild, moderate and/or severe NPDR reduced the risk of SVL. What did it find in this regard?

It found that PRP resulted in a how much? reduction of SVL in severe NPDR (especially in pts with Type # DM), but not in mild or moderate dz

Per the ^{ET}DRS, is ^{early}PRP effective at preventing SVL?

It is for severe NPDR (but not mild or moderate)

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- **Moderate? Nope** *NPDR mild but < severe*
- **Severe? Yes!** *Presence of any 1 of the 4:2:1 rule*

The **ETDRS** looked at whether PRP for mild, moderate and/or severe NPDR reduced the risk of SVL. What did it find in this regard?

It found that PRP resulted in a modest reduction of SVL in severe NPDR (especially in pts with Type 2 DM), but not in mild or moderate dz

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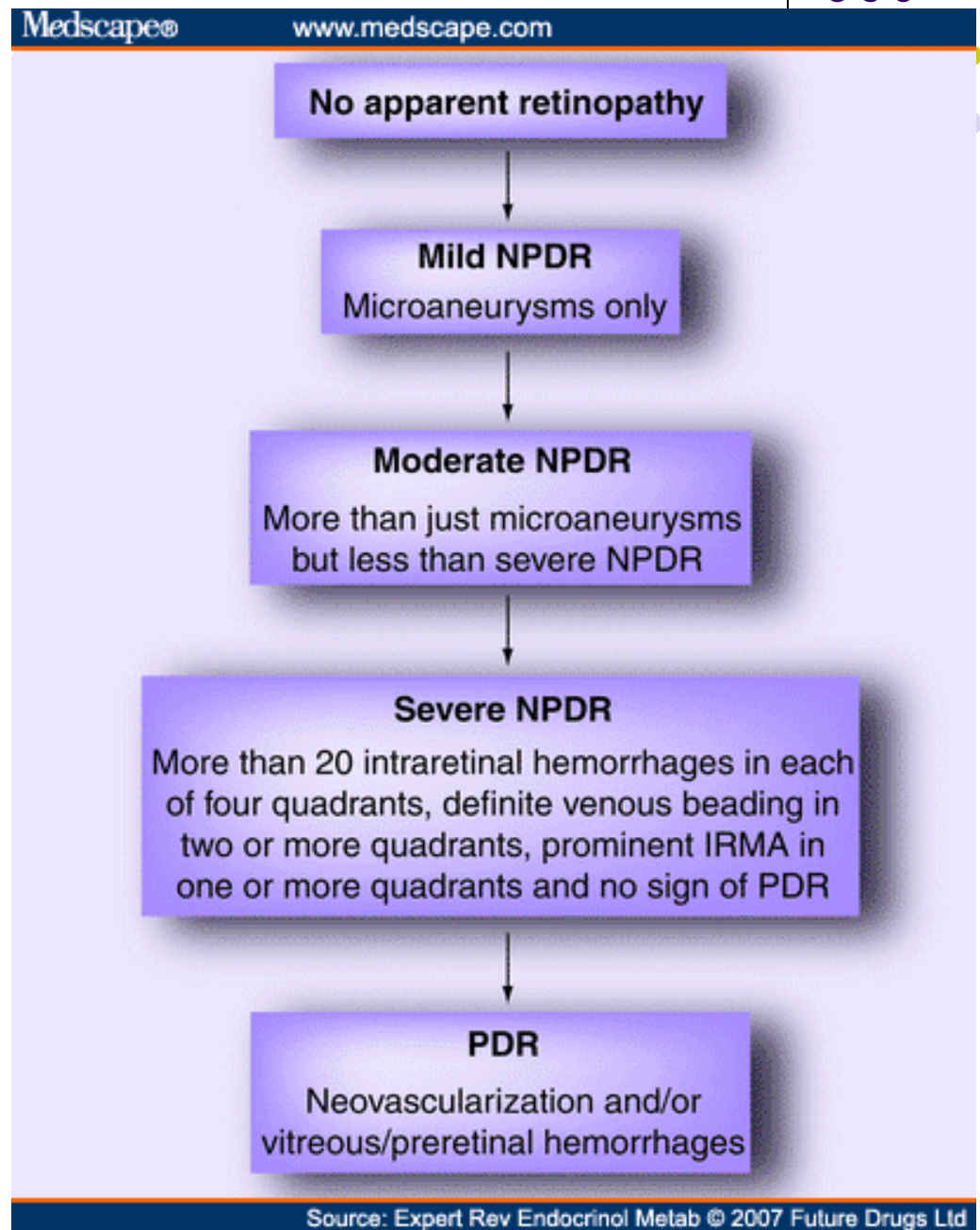
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Take note: DBR is a **progressive** condition, one that passes through a well-defined series of stages on its way to blinding a pt. If DBR is identified at an early stage, the pt has a chance to enact lifestyle modifications that will lead to its resolution. If it is recognized at a later (but pre-SVL) stage, treatment can be performed that may prevent it from blinding the pt. *This is why we screen DM pts on the reg.*





Q

Diabetic Retinopathy: The Basics

● *Classification of diabetic retinopathy*

● Nonproliferative diabetic retinopathy (NPDR)

● *Mild:* Any DBR < moderate

● *Moderate:* DBR > mild but < severe

● *Severe:* **And finally:** With respect to DBR, what does DME stand for?

● *Very severe:*

● Proliferative diabetic retinopathy (PDR)

● *High-risk PDR*

- Any NVD associated with vitreous heme (VH), *OR*
- Large (at least $\frac{1}{4}$ DD) area of NVD with or without VH, *OR*
- Large (at least $\frac{1}{2}$ DD) area of NVE with VH



A

Diabetic Retinopathy: The Basics

● *Classification of diabetic retinopathy*

● Nonproliferative diabetic retinopathy (NPDR)

● *Mild:* Any DBR < moderate

● *Moderate:* DBR > mild but < severe

● *Severe* **And finally:** With respect to DBR, what does DME stand for?

Diabetic macular edema

● *Very severe*

● Proliferative diabetic retinopathy (PDR)

● *High-risk PDR*

▪ Any NVD associated with vitreous heme (VH), *OR*

▪ Large (at least ¼ DD) area of NVD with or without VH, *OR*

▪ Large (at least ½ DD) area of NVE with VH



Q

Diabetic Retinopathy: The Basics

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Diabetic macular edema

● *Very severe:* Where does DME fit into this classification scheme?

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A

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Diabetic macular edema

● *Very severe:* Where does DME fit into this classification scheme?
DME can occur at **any** level of NPDR or PDR

● Proliferative diabetic retinopathy (PDR)

● *High-risk PDR*

- Any NVD associated with vitreous heme (VH), **OR**
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Diabetic Retinopathy: The Basics

- *Classification of diabetic retinopathy*
 - Nonproliferative diabetic retinopathy (NPDR)
 - Mild: Any DBR < moderate
 - Moderate: DBR > mild but < severe
 - Severe: And finally: With respect to DBR, what does DME stand for?

DME is addressed in detail in its own slide-set

Where does DME fit into this classification scheme?

DME can occur at any level of NPDR or PDR

- Proliferative diabetic retinopathy (PDR)
 - High-risk PDR
 - Any NVD associated with vitreous heme (VH), OR
 - Large (at least $\frac{1}{4}$ DD) area of NVD with or without VH, OR
 - Large (at least $\frac{1}{2}$ DD) area of NVE with VH