

Laser Safety (because it might happen to you!)



SEAS Safety Committee Meeting
Harvard University
Cambridge, MA, November 9, 2011



Laser Safety (because it just might happen to you!)



@eric_mazur

Harvard University
Cambridge, MA, November 9, 2011



When I work with lasers, I wear safety goggles:

- 1. absolutely always**
- 2. almost always**
- 3. most of the time**
- 4. only when I think it is necessary**
- 5. rarely**
- 6. I stay away from lasers**

How sure are you that the goggles you wear are the right ones?

- 1. completely sure**
- 2. pretty sure**
- 3. not so sure**
- 4. I have never really checked**
- 5. I don't work with lasers**

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problem!

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problem!

1 scare you

2 injury mechanisms

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problem!

① scare you

② injury mechanisms

③ prevention



1 scare you

popping sound

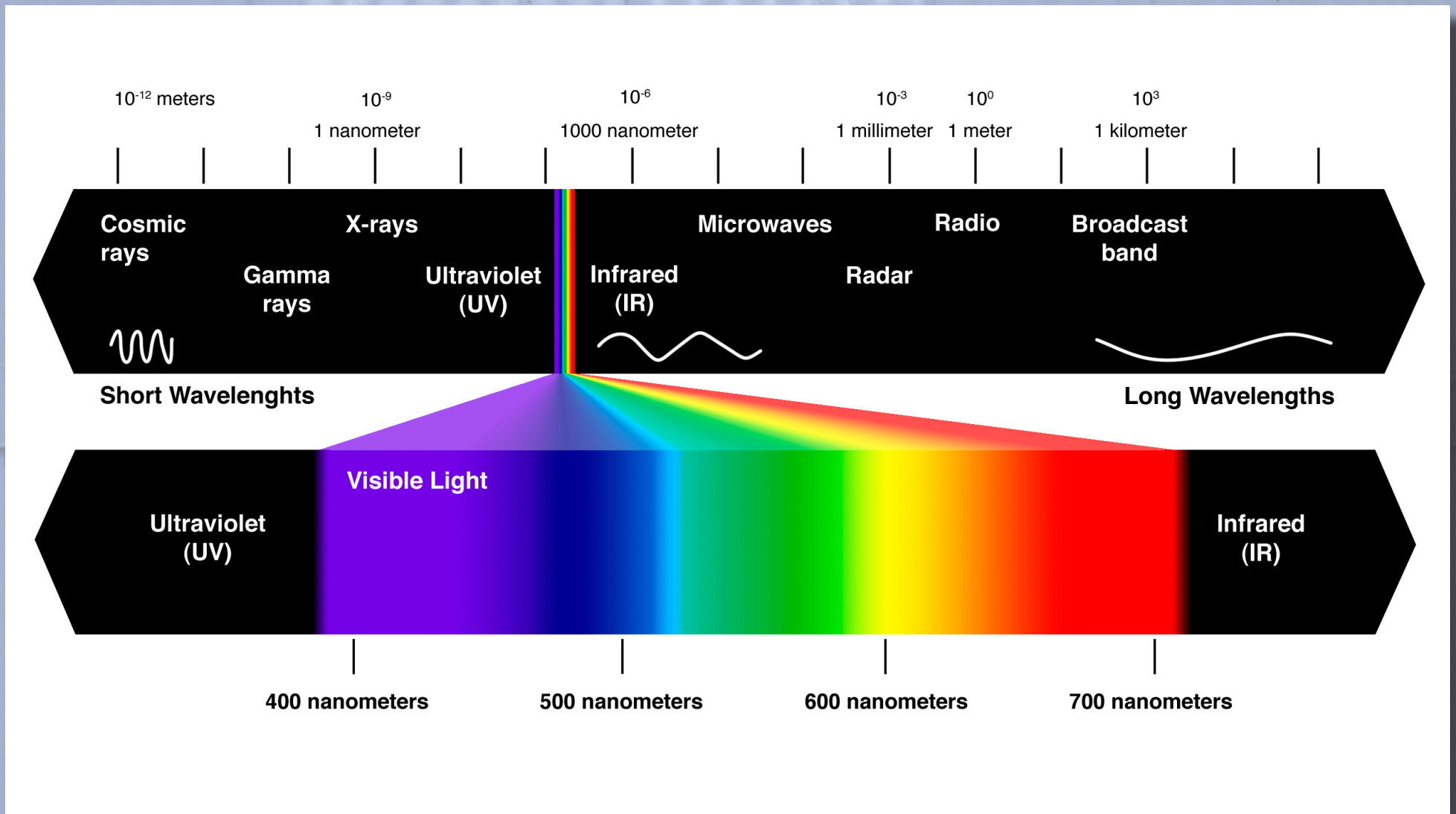
1 scare you

laser-induced explosion

1 scare you

bloodfilled eyeball

1 scare you



Laser radiation categories:

ultraviolet $< 0.35 \mu\text{m}$

'ocular focus' $0.35 - 1.4 \mu\text{m}$

infrared $> 1.4 \mu\text{m}$

visible $0.35 - 0.7 \mu\text{m}$

invisible $0.7 - 1.4 \mu\text{m}$

**dangerous
stuff**

Laser radiation

ultraviolet

'ocular focus' 0.35 – 1.4 μm

visible 0.35 – 0.7 μm

invisible 0.7 – 1.4 μm

infrared > 1.4 μm



1 scare you

green flash

1 scare you

blind spot

1 scare you

blood pooling

1 scare you

**What happens
when laser hits eye?**

LOL



1 scare you

2 injury mechanisms



cw lasers:

**thermal damage
photochemical degeneration
chronic exposure**

pulsed lasers:

“blast” damage



important parameters:

- **wavelength**
- **power density (cw) or energy density (pulsed)**

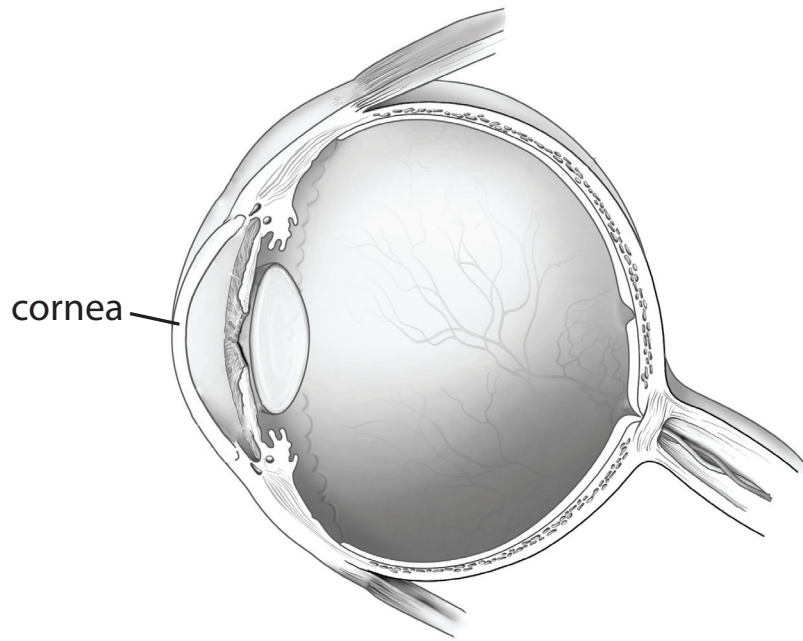
1 scare you

2 injury mechanisms



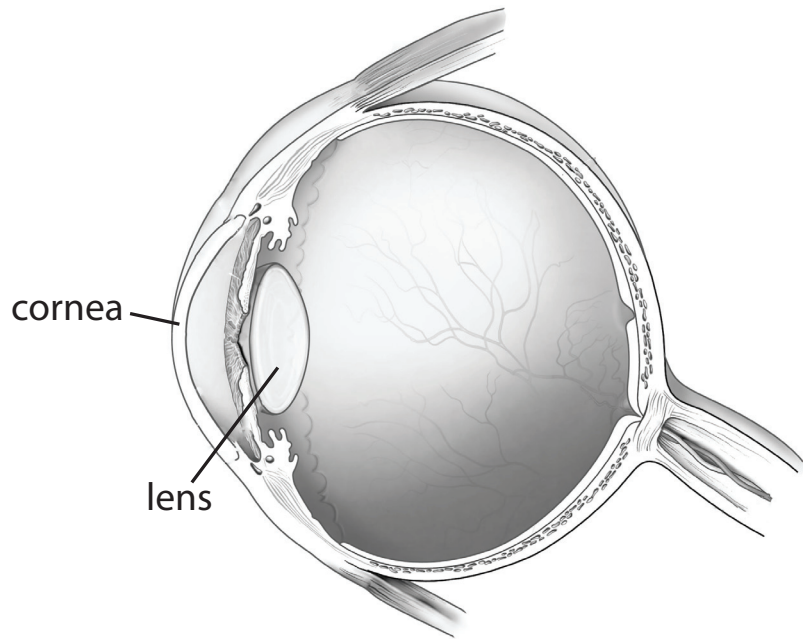
1 scare you

2 injury mechanisms



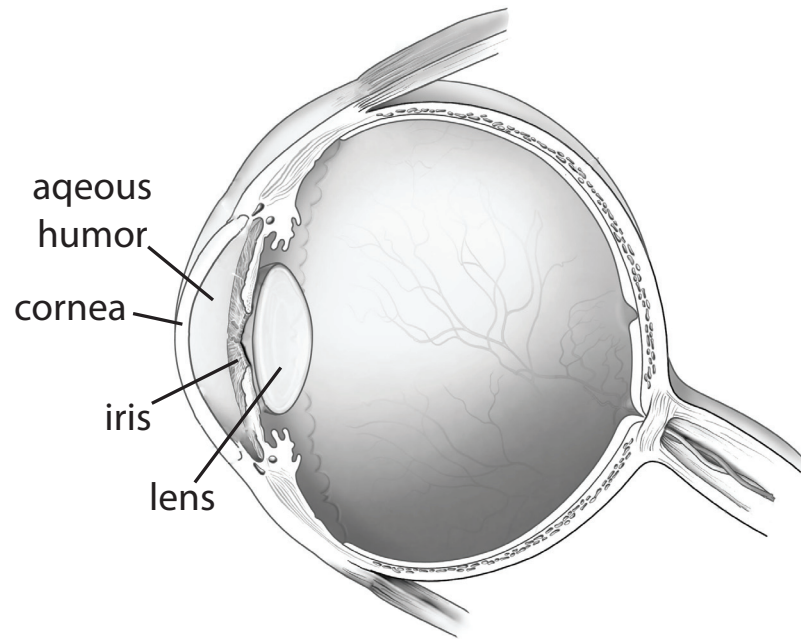
1 scare you

2 injury mechanisms



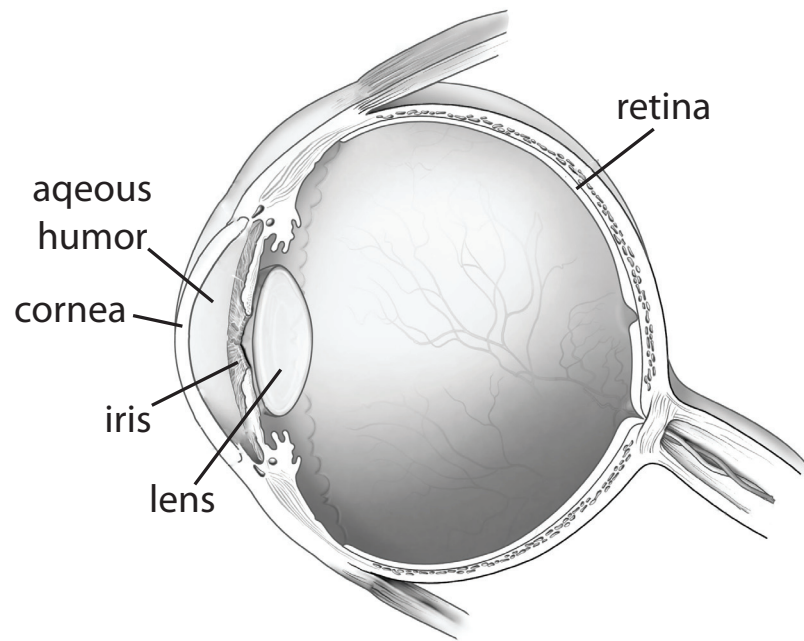
1 scare you

2 injury mechanisms



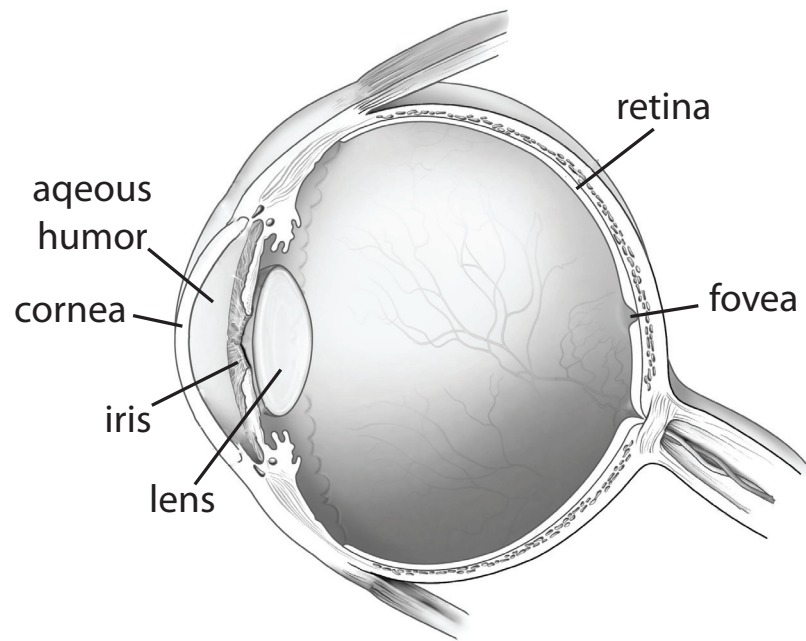
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2 injury mechanisms



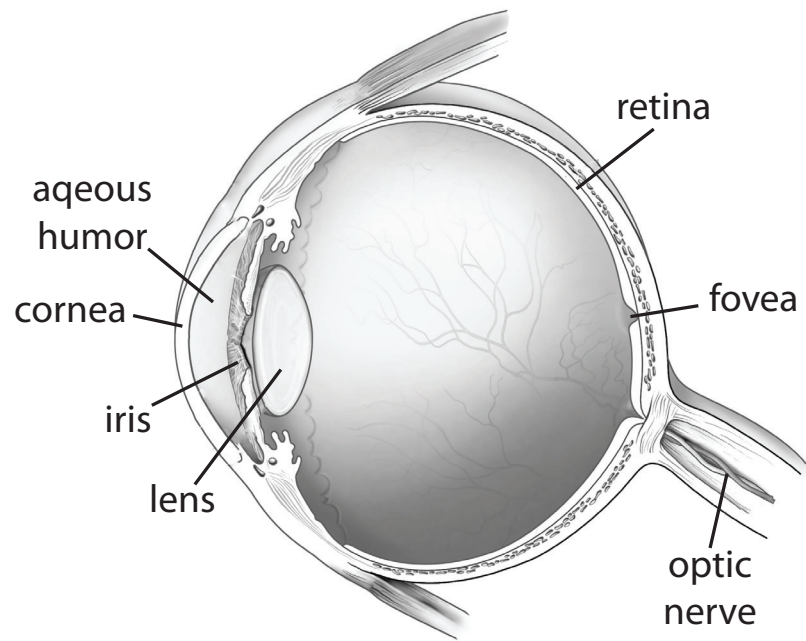
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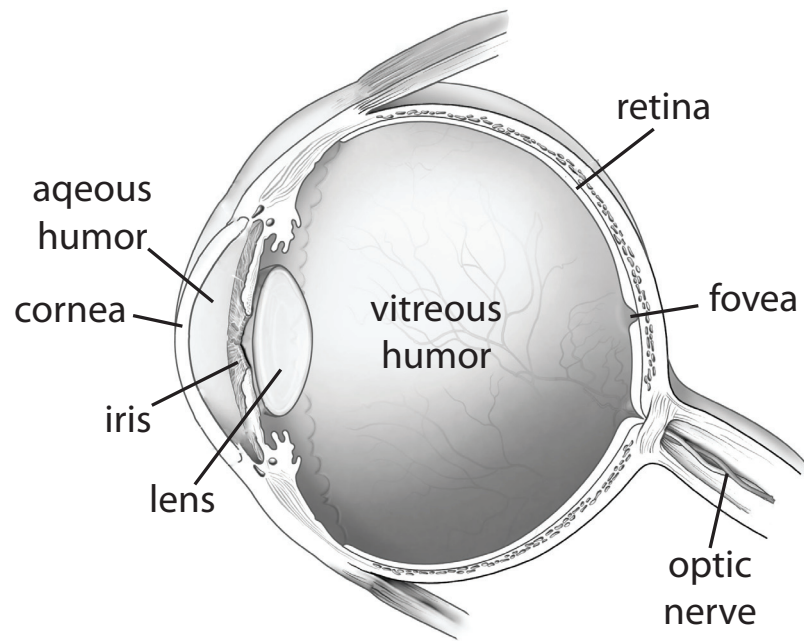
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2 injury mechanisms



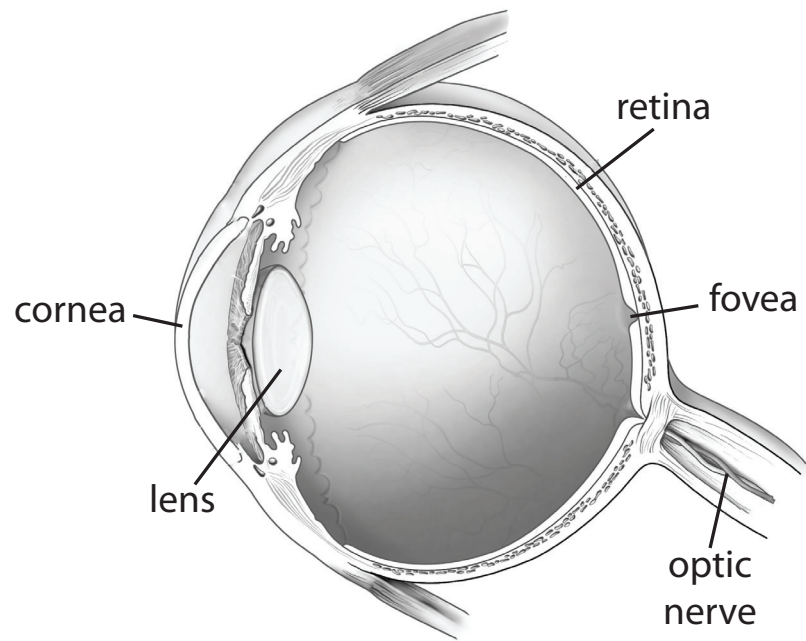
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2 injury mechanisms



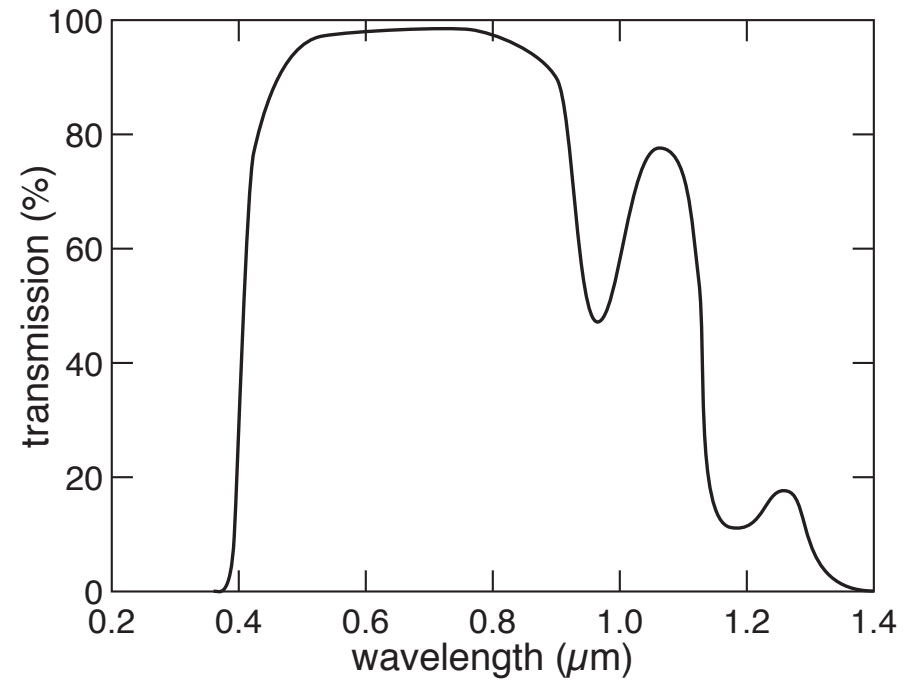
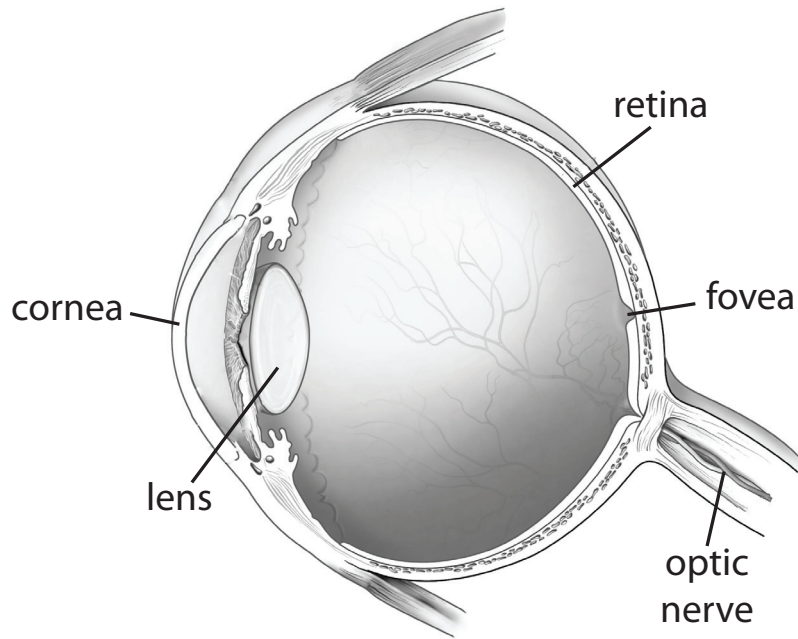
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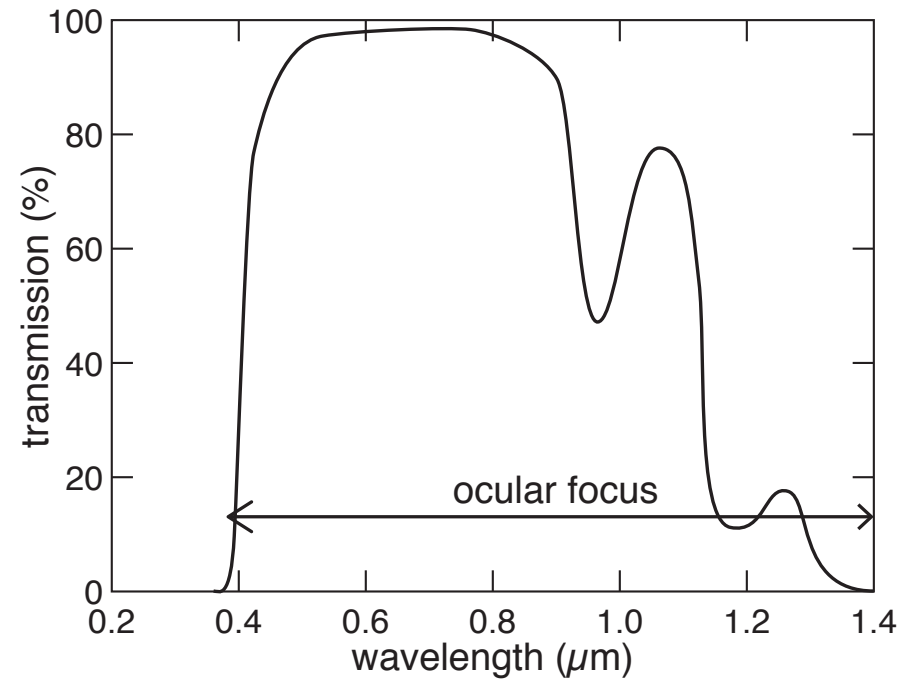
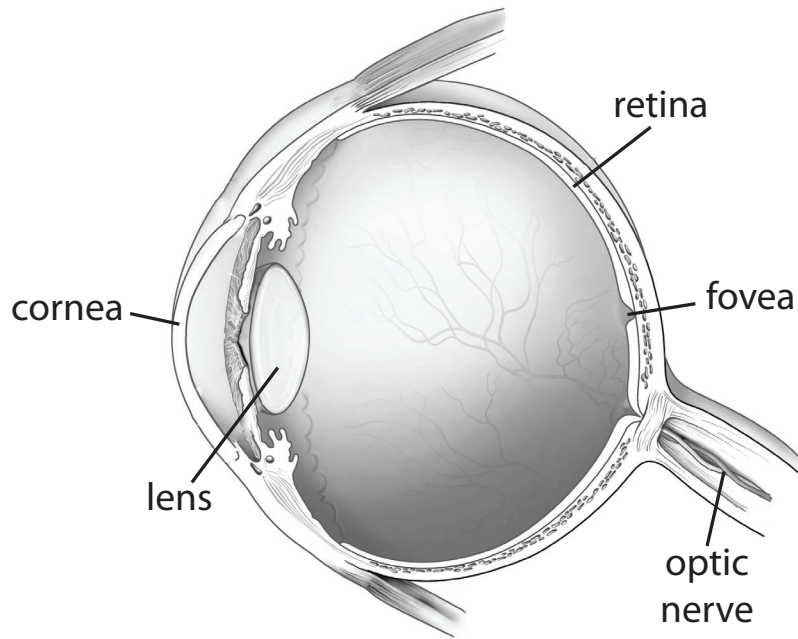
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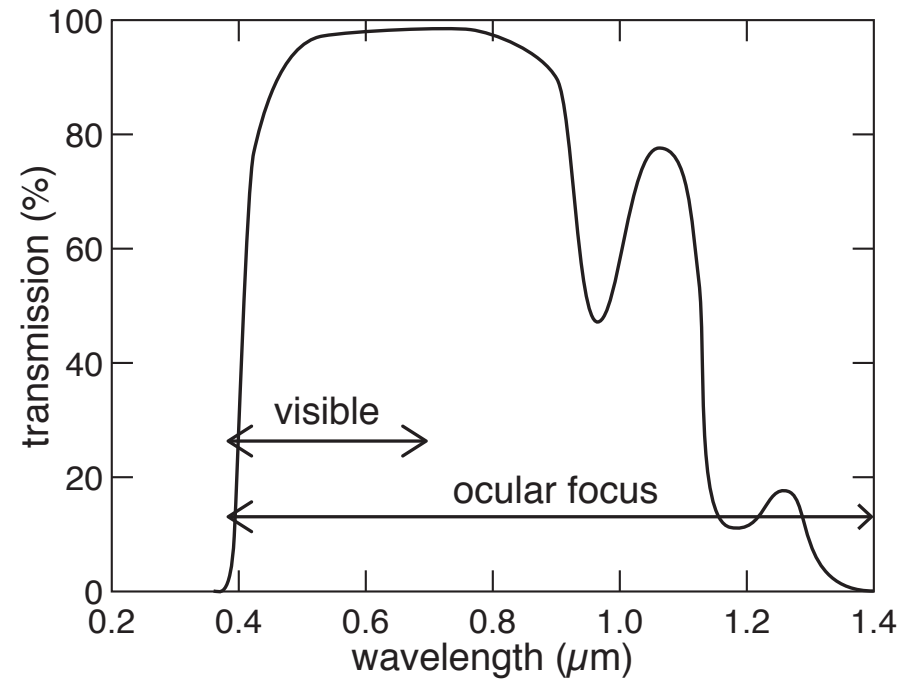
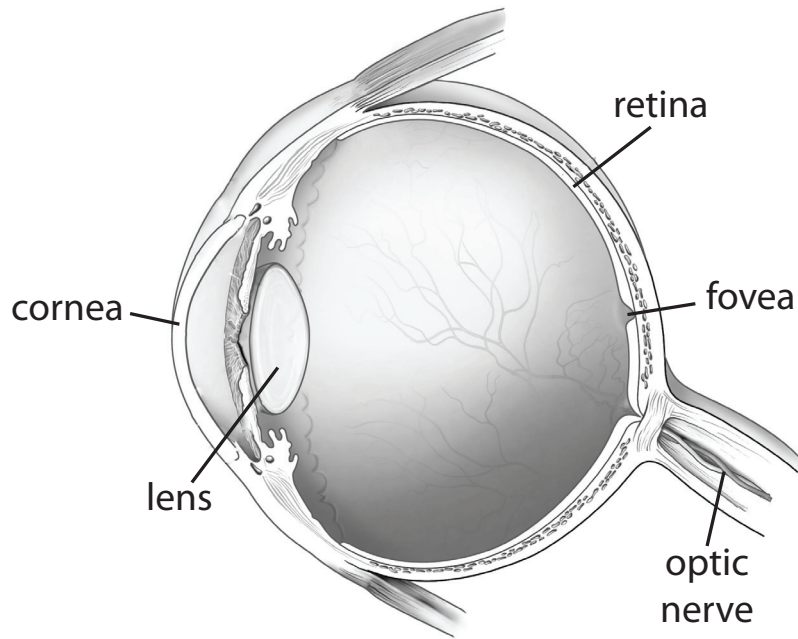
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2 injury mechanisms



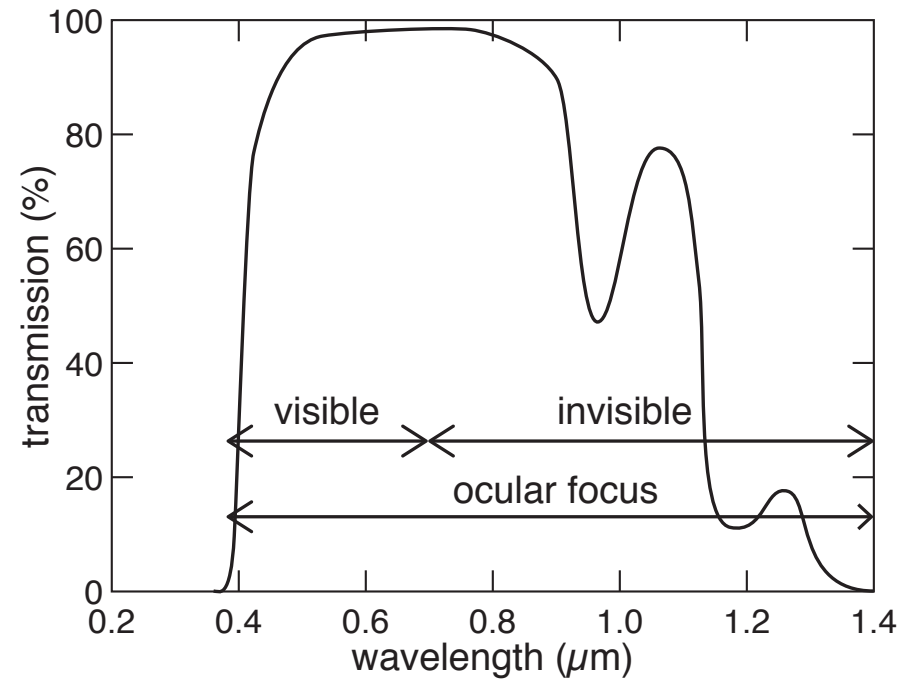
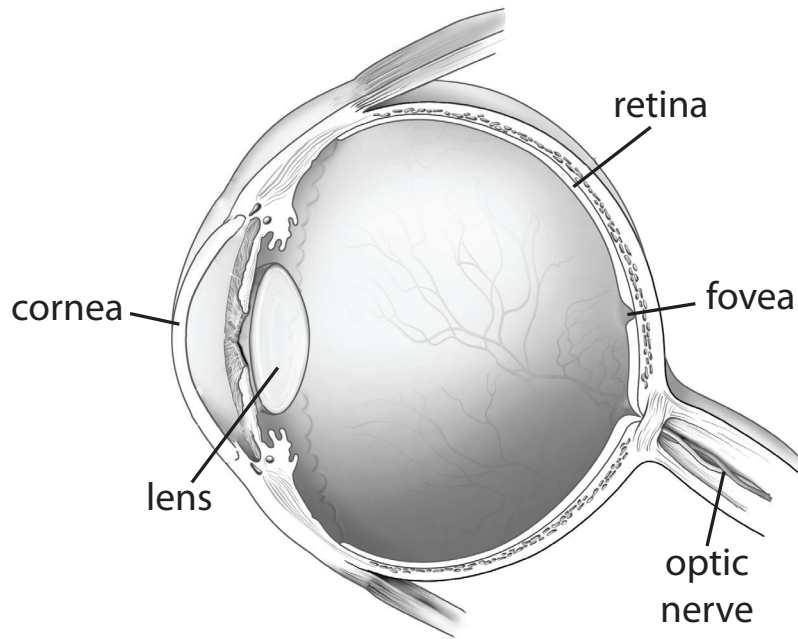
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2 injury mechanisms



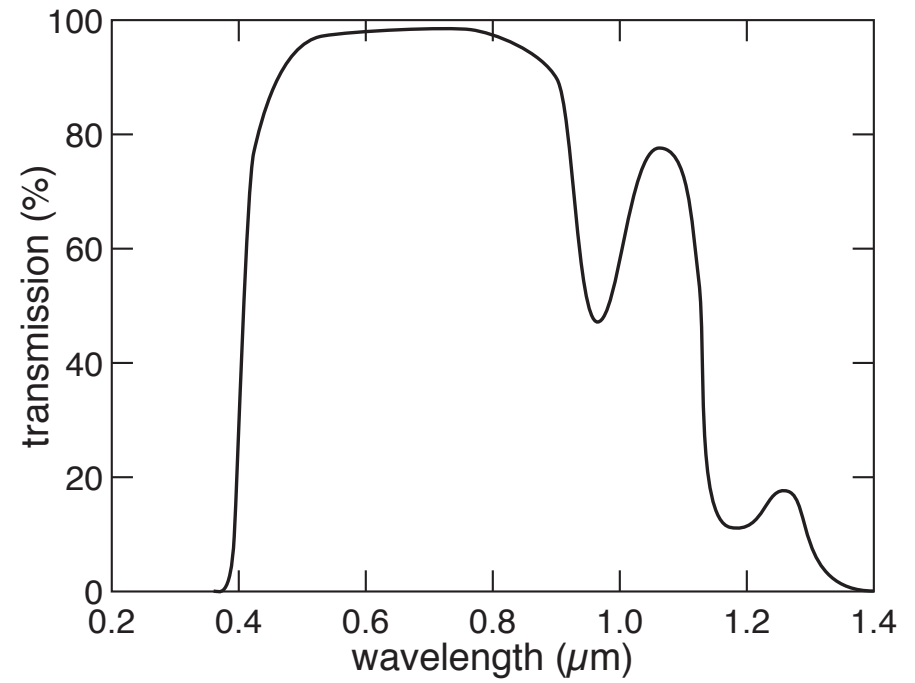
1 scare you

2 injury mechanisms



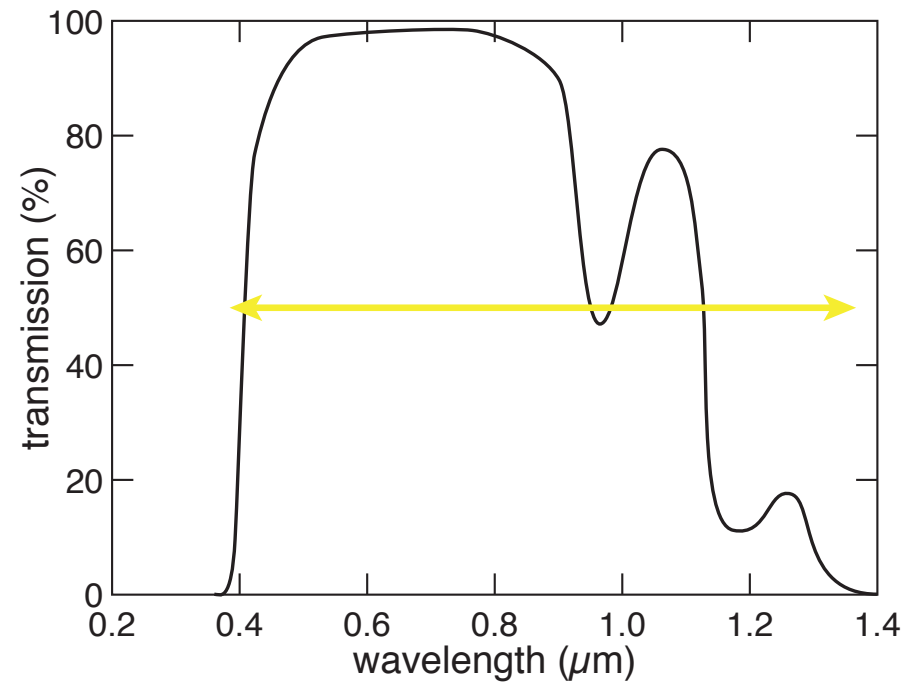
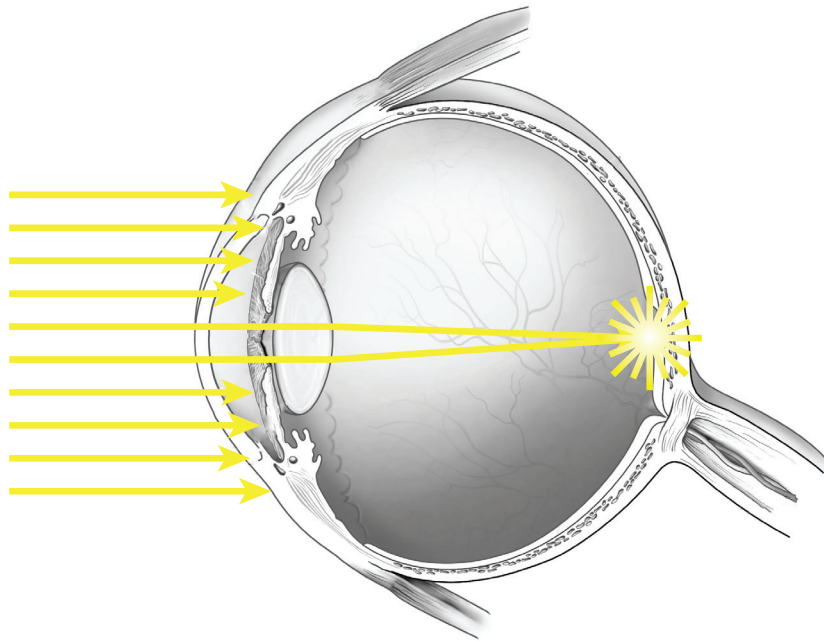
1 scare you

2 injury mechanisms



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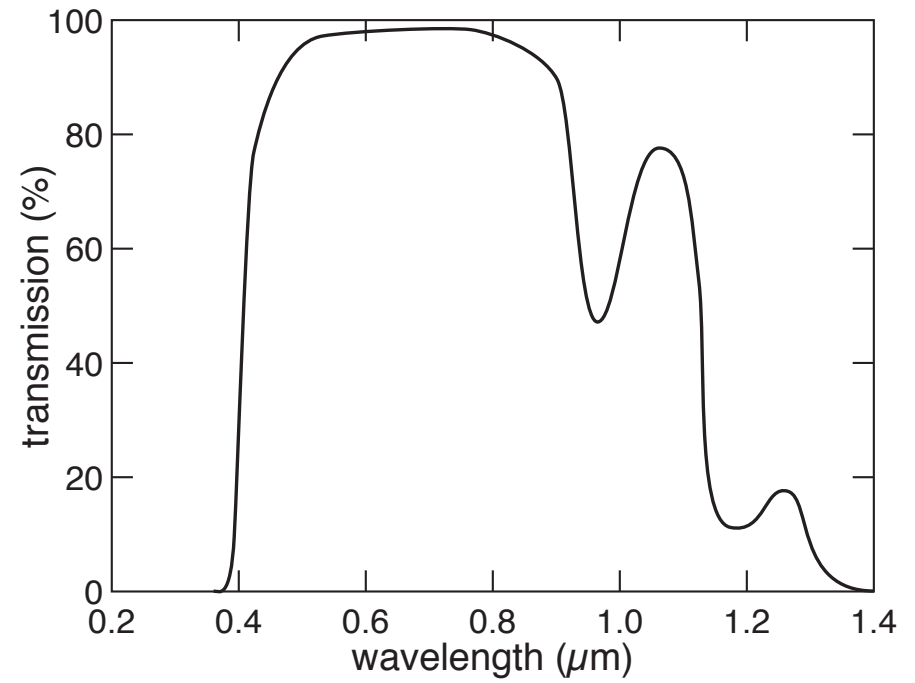
2 injury mechanisms



- retinal lesion
- charring, hemorrhage, gas formation
- disruption of the retina
- physical alteration of the eye structure

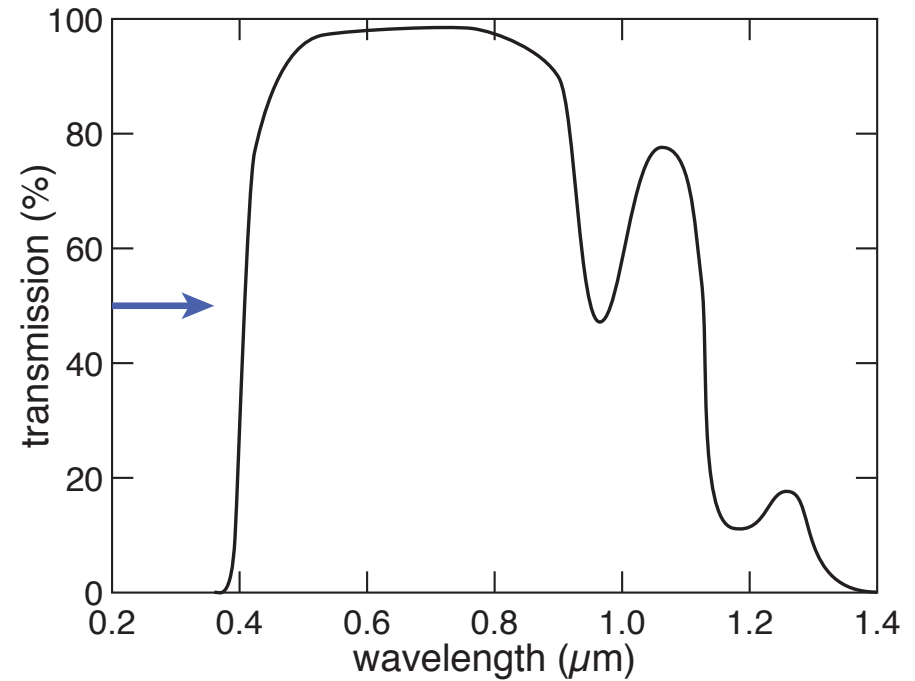
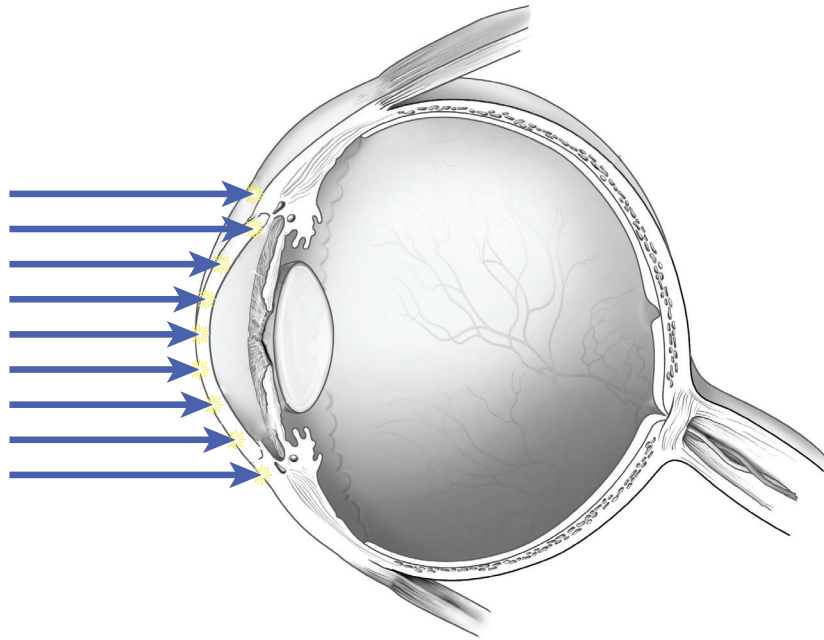
1 scare you

2 injury mechanisms



1 scare you

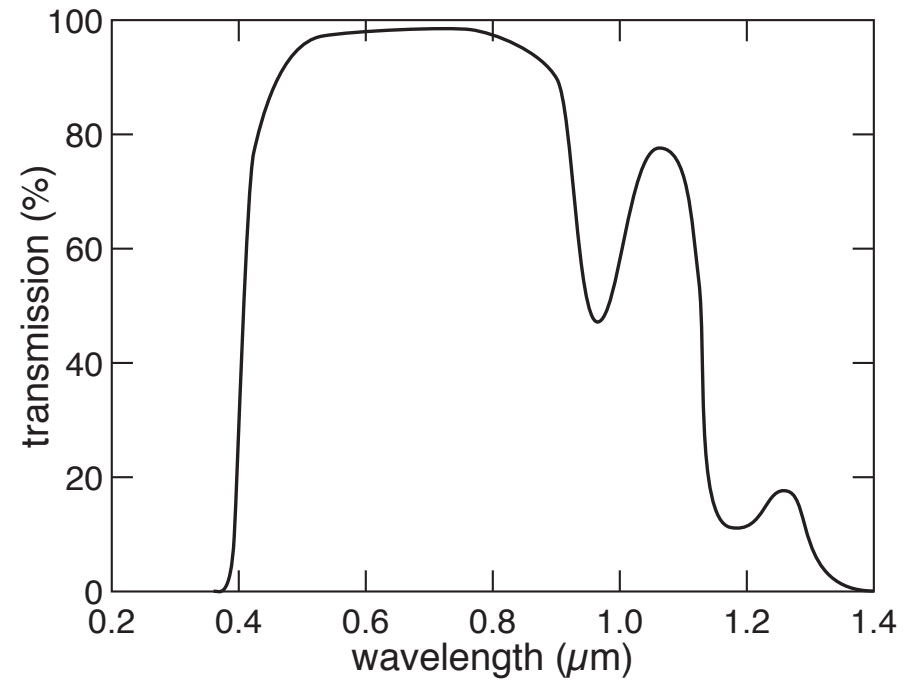
2 injury mechanisms



- tears, redness
- peeling or stripping of surface layer
- corneal damage by photochemical denaturation

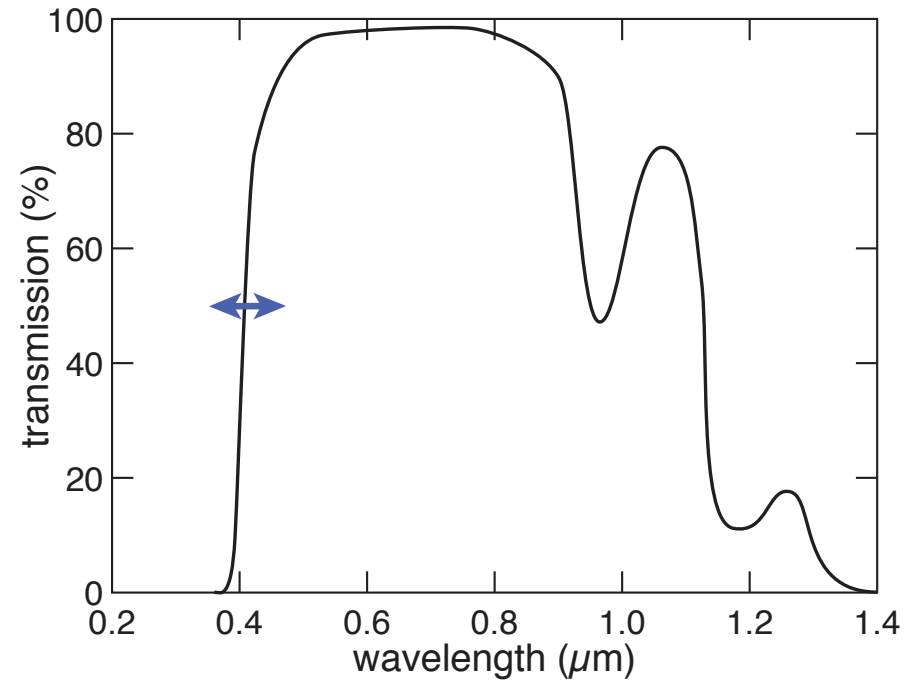
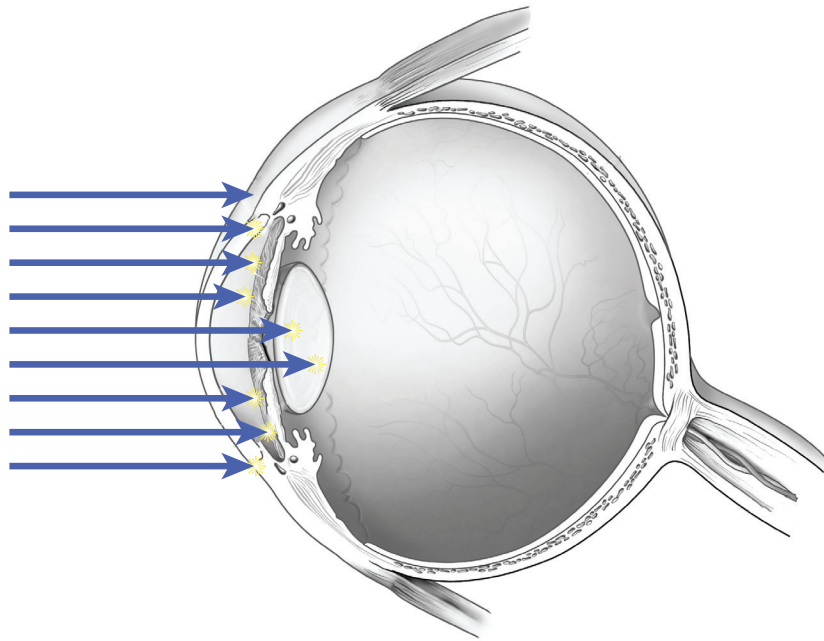
1 scare you

2 injury mechanisms



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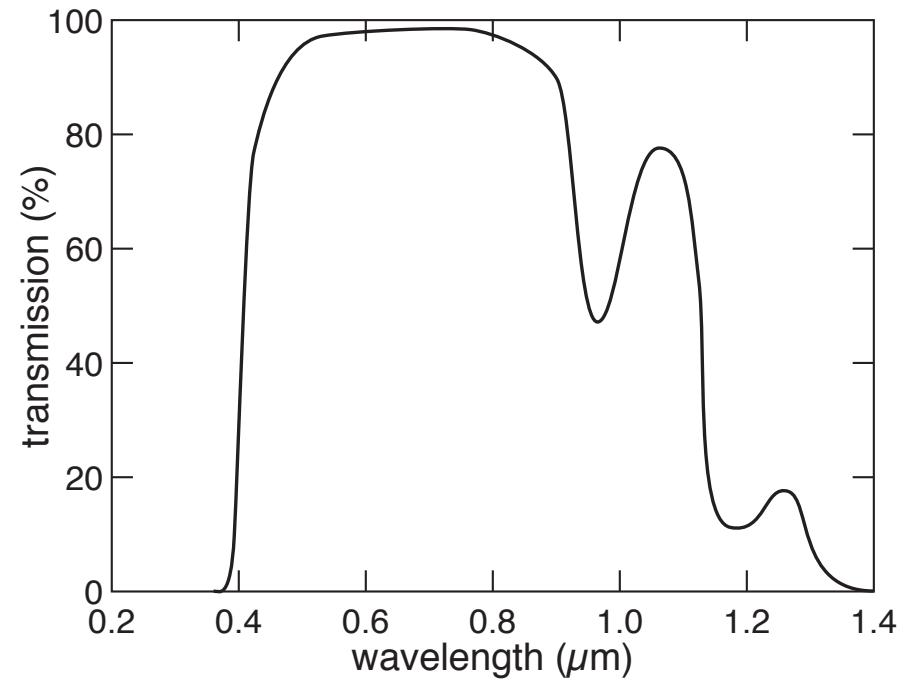
2 injury mechanisms



- lenticular opacity
- corneal opacity

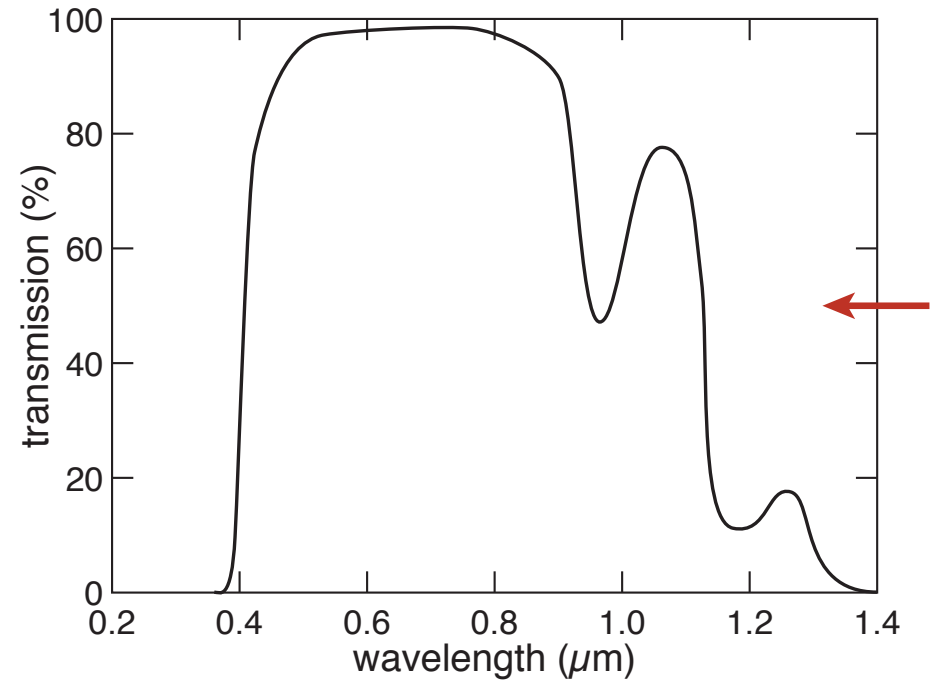
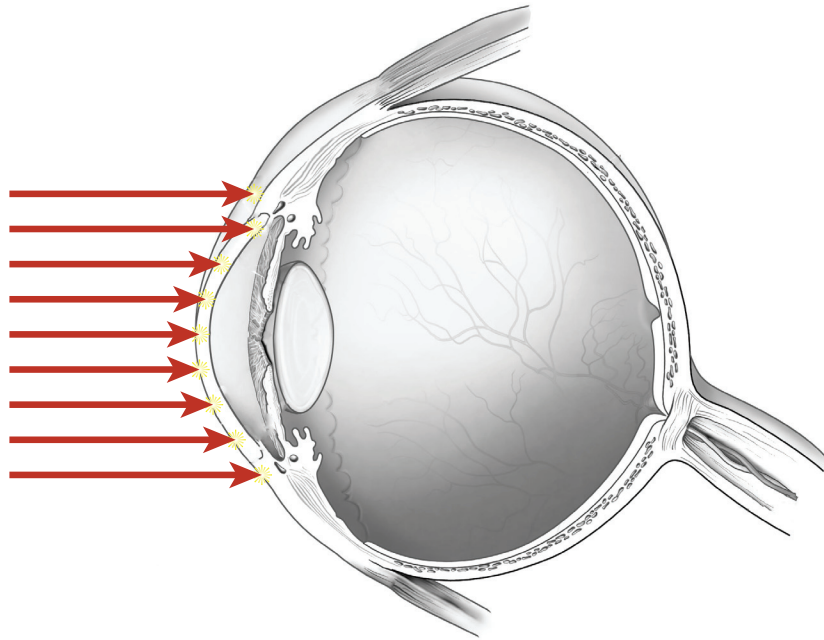
1 scare you

2 injury mechanisms



1 scare you

2 injury mechanisms



- corneal lesion
- loss of transparency (cataract)
- serious damage

1 scare you

2 injury mechanisms



1 scare you

2 injury mechanisms

A large, stylized, red 'WALSH!' stamp is centered on a background of a smiling face. The stamp is composed of thick, blocky letters with a slightly distressed or hand-painted appearance. The background is a light gray, textured surface with a faint, large-scale outline of a smiling face, similar to the 'Smiley Face' logo. The overall aesthetic is bold and graphic.

1 scare you

2 injury mechanisms



1 scare you

2 injury mechanisms

3 prevention



1 scare you

2 injury mechanisms

3 prevention



1 scare you

2 injury mechanisms

3 prevention

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1 scare you

2 injury mechanisms

3 prevention