What happens when light hits the retina?

1. Transmission
2. Absorption
3. Reflection

Only $10^{-5}$ to $10^{-9}$ of incident light is reflected back.

OCT images are created by:

1. Ocular pigments
2. Interfaces with differing refractive indices

What pigments are found within the eye?

1. Xanthophylls
2. Hemoglobin
3. Melanin

Ocular Pigments: melanin, xanthophylls, hemoglobin
What color is the retina?

Xanthophyll

Melanin

OCT Imaging = Optical Biopsy

Normal Macular Anatomy

Fresnel Equations

\[ R = \frac{R_s + R_p}{2} \]

Pre-operative macular hole

Post-operative

Previous vitrectomy with silicone oil

Aqueous

20 minutes later
OCT tomogram of cervical epithelium

Optical coherence tomography showing prostatic capsule and cancer cells underneath the thin layer.

Resolution – 150 µ
TD-OCT: Resolution – 10 µ
SD-OCT: Resolution – 3 to 6 µ

3.5 or 6 mm
Spectral Domain OCT (SDOCT) Imaging

- Faster image acquisition:
  - $\approx 27,000$ – $40,000$ A-scans/sec: currently available instruments.
  - $250,000$ – $300,000$ A-scans/sec: research instruments.
- Higher density scans over larger areas, image averaging to improve image quality, fewer eye motion artifacts.

SDOCT Imaging of Macula

- Qualitative assessment of retinal anatomy:

SDOCT Imaging of Wet AMD

- Segmentation of retinal layers necessary for quantitative assessments:
  - ILM segmentation
  - RPE segmentation
- Segmentation algorithms result in reliable retinal thickness maps:
  - ILM segmentation
  - RPE segmentation

SDOCT Imaging of Wet AMD: Anti-VEGF Therapy

- VA: 20/100
- Anti-VEGF Therapy: 1 month post-injection

SDOCT Imaging of Wet AMD

- Segmentation algorithms result in reliable RPE elevation (PED) maps (Cirrus, software 6.0):
- Segmentation algorithms result in reliable RPE elevation (drusen) maps (Cirrus, software 6.0):

SDOCT Imaging of Dry AMD

- Segmentation algorithms result in reliable RPE elevation (drusen) maps (Cirrus, software 6.0):

Macular edema

RPED
Why this shadow?

Gas bubble
2 weeks later

OS – 20/40

OD – 20/25

Stage 2

Stage 1

Lamellar hole

Cyst?

Lamellar hole
Epiretinal Membrane

Pre-Op

Post-Op

20/40

20/30
Case
71 yo man with wet AMD OS
- Multiple injections for the last 12 months
- Complains of worsening in VA after treatment

Case
74 y.o. man decreased vision OD (20/200)

Case
73 y.o. woman with neovascular AMD
- VA: 20/20
- Ranibizumab #2
- VA: 20/20

Case
65 y/o woman with a vascularized, hemorrhagic PED
- Color photo
- Early FA
- Late FA
Case 4: Dosing Every 2 Weeks

66 year old woman
10 injections: Bev X6, Ran X4 (~q5wks)

July 2007

20/50

1 year later

20/200

Diagnosis?

IOP = 4

OD OS

OD OS

1 month later

BDR

Pre-op

1 day Post-op

6 months

VA: 20/20

Baseline

Following steroid injection

c/o superior field defect
Acute retinal artery occlusion

Inner retinal thickening
Retinal thinning

Treatment options:
1. External beam irradiation
2. Systemic chemotherapy

Treatment:
1. Observation
2. Laser photocoagulation
65 y.o. s/p scleral buckle for RD
Now with VA of 20/100 for 6 months.

2nd opinion: 68 y.o. with iritis and VA of 20/40 OU