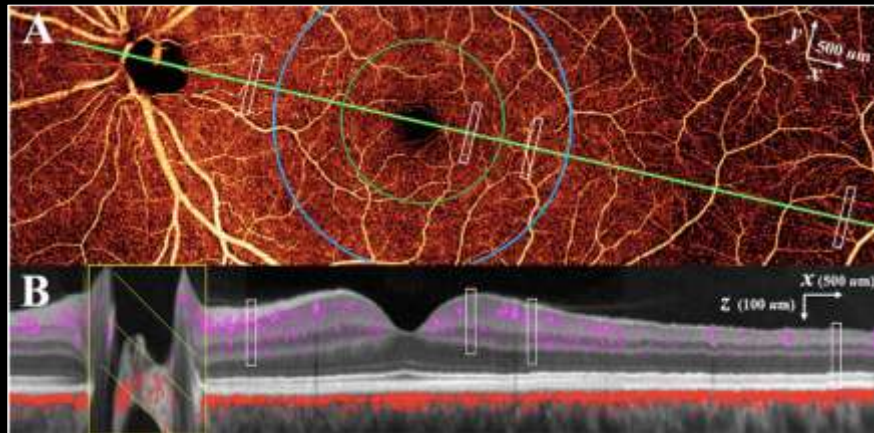




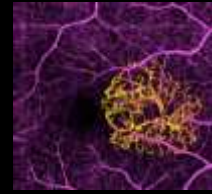
ANGIOOCT: ADVANTAGES & PITFALLS

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CONTENTS

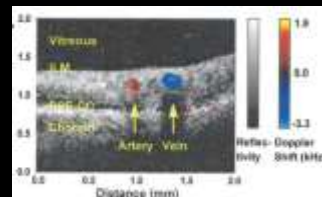


- GENERAL PRINCIPLES
- COMPARISON WITH OTHER IMAGE MODALITIES
- MAIN ARTIFACTS AND LIMITATIONS
- CURRENT CLINICAL APPLICATIONS
- FUTURE DEVELOPMENTS

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OCTA

- First steps : **2006** (18.7 kHz SD-OCT)
- 2012: Jia et al: Split-spectrum amplitude-decorrelation angiography (SSADA)
- What was attempted before?



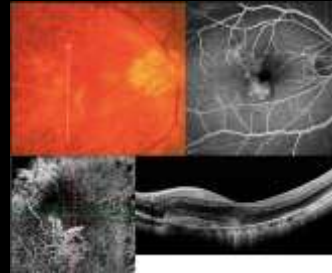
Doppler OCT also uses the movement of red blood cells and works well in large vessels not in microvasculature.

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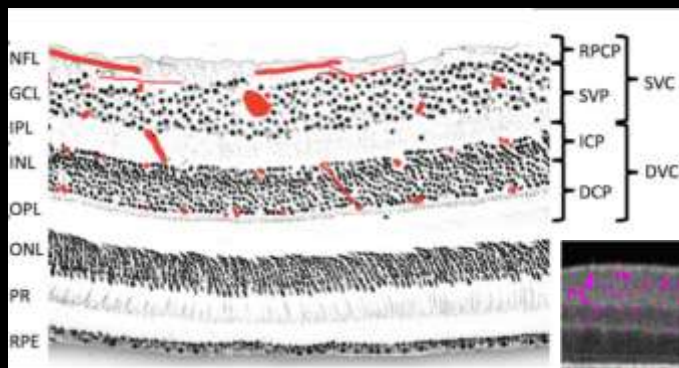
HOW DOES IT WORK?

- OCTA is performed by repetition of B-scans in the same position 2 to 5 times.
- Structural OCT only passes once, so always FASTER.

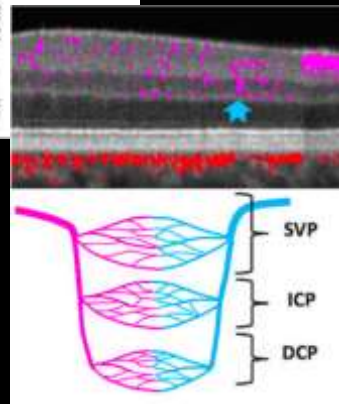
- Each device has its own speed:
therefore the concept of
“movement detected” is relative.



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Do not forget
what we ought to
know already:
ANATOMY

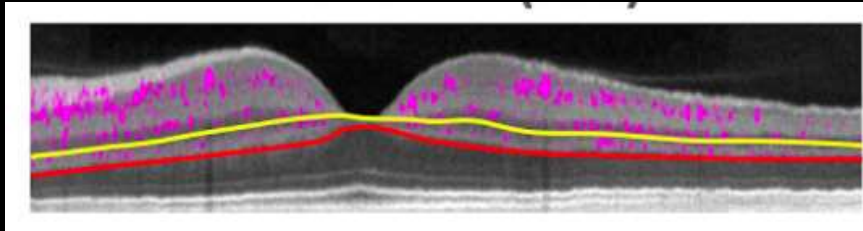


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AUTOMATIC SEGMENTATION



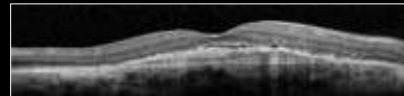
Fixed slabs
 Edit
 Tailored: important
 specially in disease



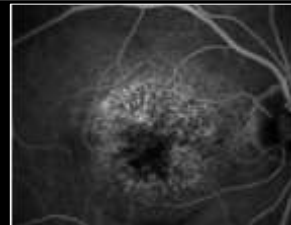
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THE KEY FOR SUCCESS: OTHERS WEAKNESS

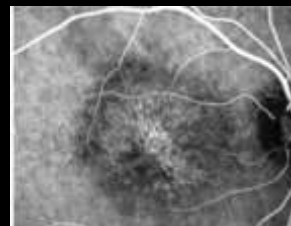
-Structural OCT can not differentiate capillaries from retinal tissue.



-FA sees vascular structures and flow only ABOVE RPE.
 It needs i.v. access, contrast, that can show LEAKING.

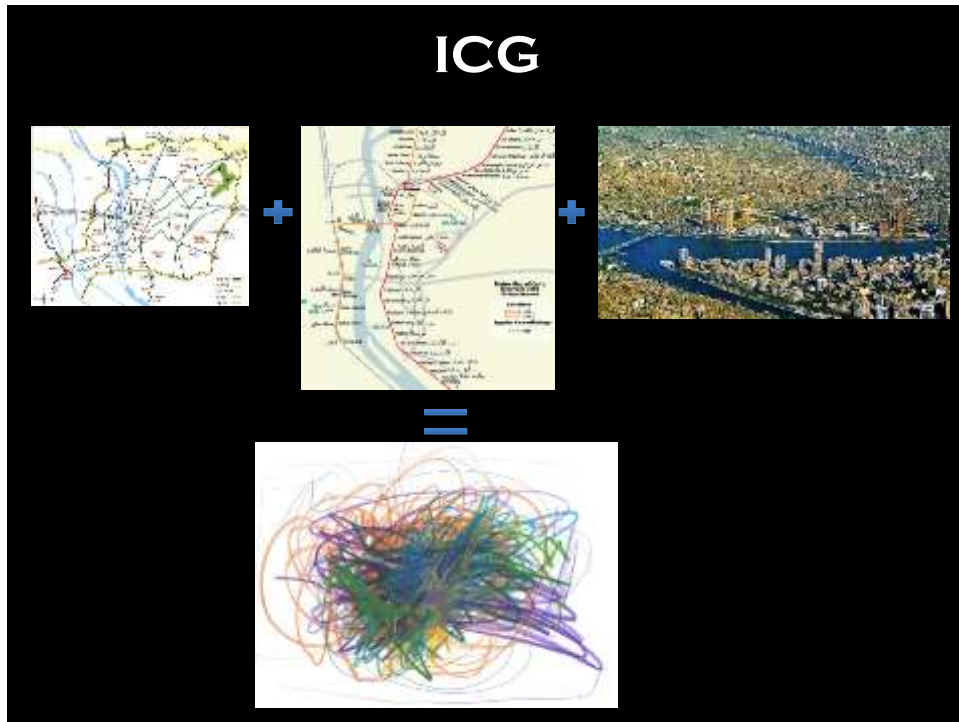


-ICG can see vascular structures ABOVE and UNDER the RPE.
 Wide field images



However...


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STRENGTHS OF OCTA

- Non invasive
- "Sees" the blood flow
- Can see UNDER the RPE
- The images are not blurred by leaking issues
- Can display information in multiple separated layers
- Allows quantification (WE LOVE NUMBERS)

...each of them associates a weakness



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QUESTIONS RAISED

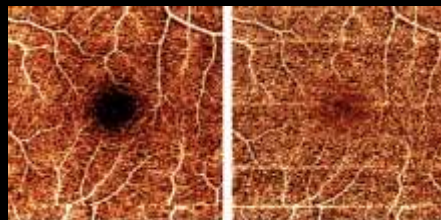
- Motion detection takes time (slower)
- Projection artifacts: shadow from superficial blood flow being projected onto deeper tissue layers.
- Leaking is not blurring the image, BUT leaking is a defining item of pathologic need-to-treat lesions. All the drugs we use target altered permeability. CAUTION

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PROJECTION

Is it so important?

Snodderly estimated that 45% of photons passing towards the perifoveal macula go through a blood vessel



Friend or Foe?

A FRIEND if correctly understood (CVN enhance)

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ALGORITHMS

Phase Variance (CalTech University)

OMAG - Optical Microangiography (University of Washington: Zeiss - Angioplex and Kowa - OCT Bi-μ)

CODAA - Complex OCT-Signal Differential Analysis Angiography (Nidek)

SSADA - Split-Spectrum Amplitude-Decorrelation Angiography (Optovue - Angiovue)

FSADA- ADA - Full-Spectrum Amplitude-Decorrelation Angiography (Canon-HS100)

Spectralis OCTA - Full spectrum probabilistic approach (Heidelberg Engineering)

OCTARA - Full spectrum ratio-based - amplitude ratio analysis (Topcon)

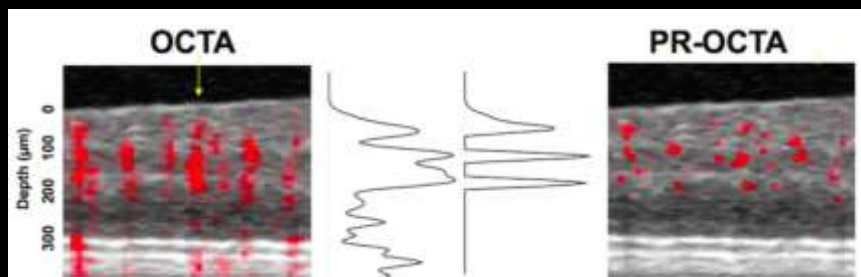
PRD-OCT - Phase-Resolved Doppler OCT (Amsterdam University)

UHS-OCT-A - Ultra High Speed Swept Source OCT Angiography with VISTA (Variable interscan time analysis) (MIT - Fujimoto)

$$\begin{cases} I_i(k) = k, \arg \min \|I(i) - C(k)\|^2 \\ C(k) = \frac{\sum_{i,j \neq k} I(i)}{\sum_{i,j \neq k} 1} \end{cases}$$

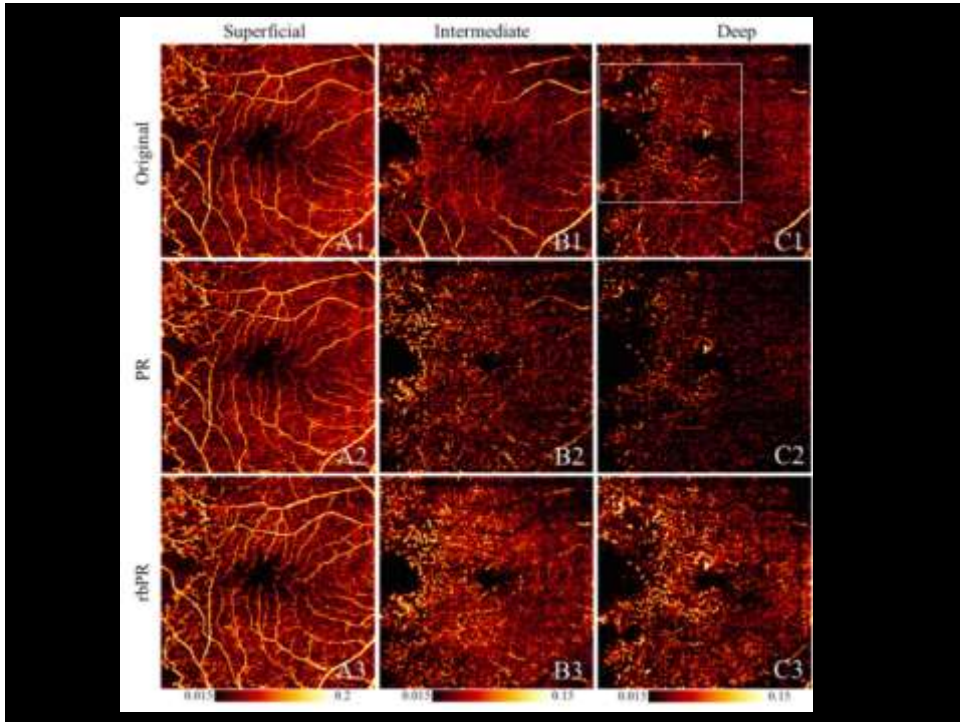
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ALGORITHMS: PROJECTION RESOLVED



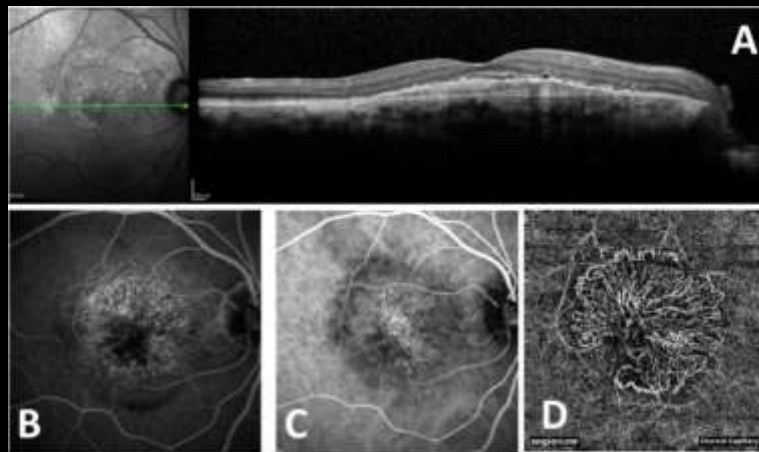
“Normalization” eliminating noise without
Losing the real image

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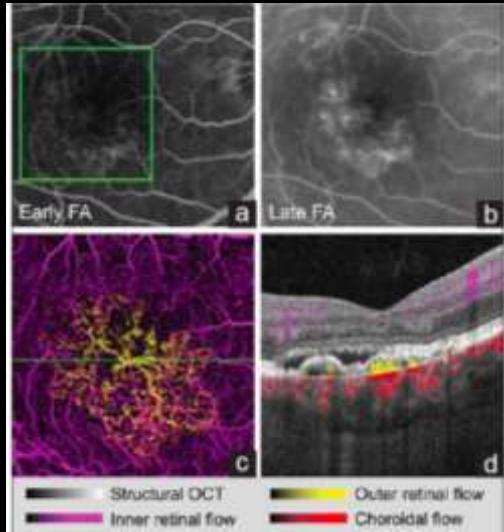
CLINICAL APPLICATIONS

Exudative AMD



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CLINICAL APPLICATIONS



Central Serous Corioretinopathy:

Find CNV!

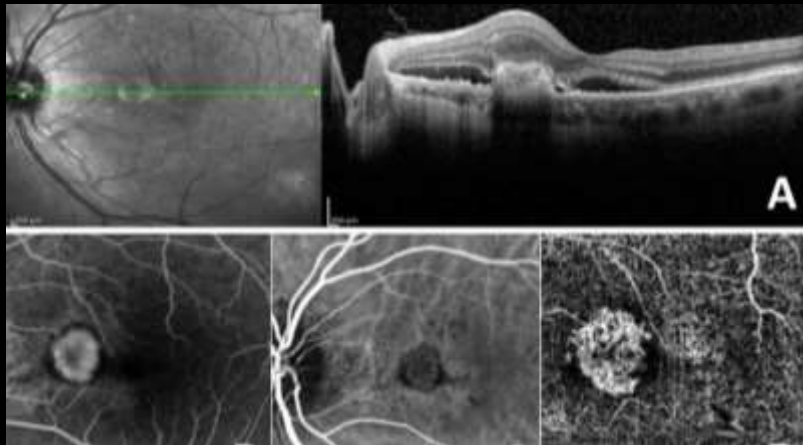
Absence of leakage helpful

Hagag, 2017

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CLINICAL APPLICATIONS

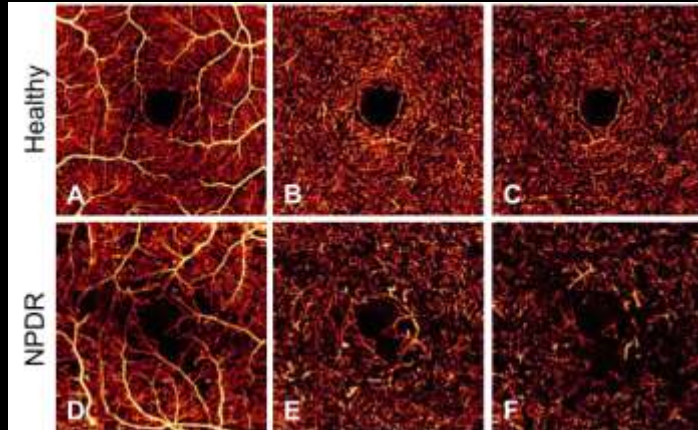
CNV in posterior uveitis: PIC, MFC...



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CLINICAL APPLICATIONS

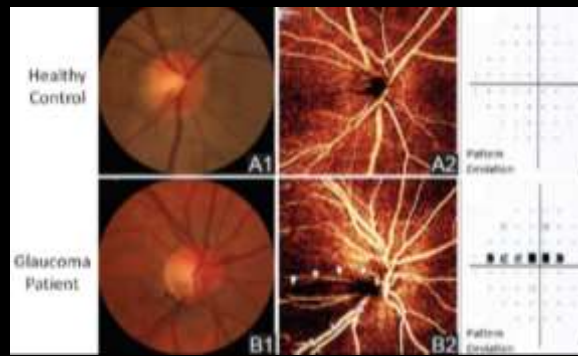
Diabetic retinopathy: enlargement of avascular foveal zone first, capillary drop out



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GLAUCOMA

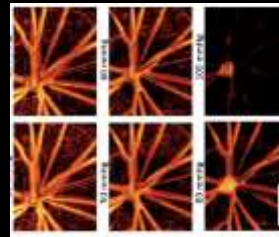
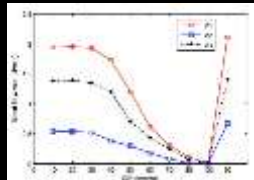
In glaucomatous patients, Jia reported a decreased of 25% in flow index of optic nerve head, with 100% sensitivity and especificity and strong correlation with visual field pattern SD



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FUTURE DEVELOPMENT

- Quantification of the flow: earliest changes
In diabetic patients.
- Prototypes
- Ultra wide field: high speed needed
(Rigth now, widest take 30 seconds)



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