



# **THE PUPIL**

## **Observation and Grading**

# **Alpha Omega Pupil**

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**College of Syntonic Optometry  
101 Course  
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# The Pupil And Syntonics

How do you know if a person  
needs Syntonic Treatment?

# The Pupil And Syntonics

Three keys elements in Syntonic Clinical  
evaluation and treatment application.

1. The Pupil - AO
2. The Field - Kinetic
3. The Patient History

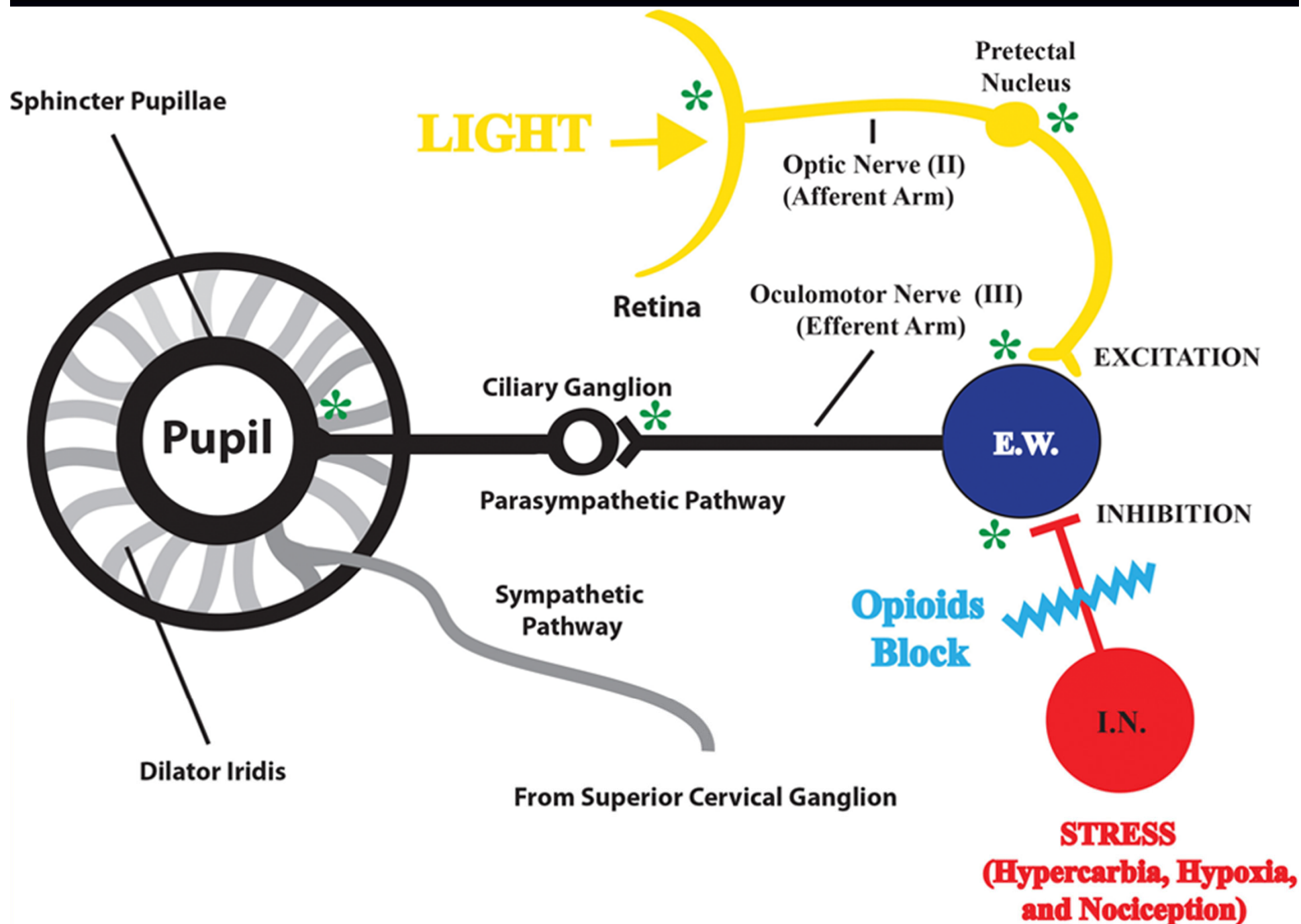
# The Pupil

One of the most sensitive measures of ANS activity.

- ANS/Brainstem function
- “Eyes are the Window to the Soul”  
The Pupils are the Windows.
- Portal of Energy Reception and Projection. Portal through which we interact with our world.
- Non-verbal Communication and strong emotional indicator.
- Reception of “nutrition” - LIGHT







# The Pupil

## Neurological Pathways

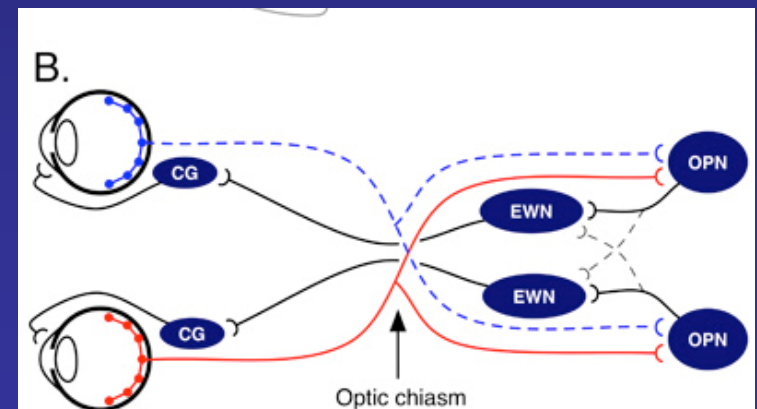
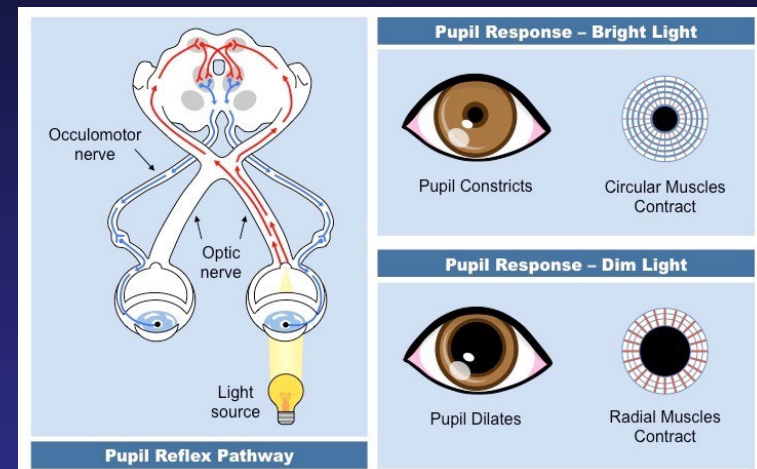
### Parasympathetic - Constriction

- The Pupillary Light Reflex (PLR)
- Influence on Iris Sphincter
- Light-Inhibited Sympathetic Path
- Trigeminal Nerve – sensory stimulation to eye/iris

### Sympathetic – Dilation

- Direct stimulation of Iris Dilator through 3 neuron arc
- Inhibition of EW nucleus

Pulaski AO Pupil



# The Pupil

## Neurological Pathways

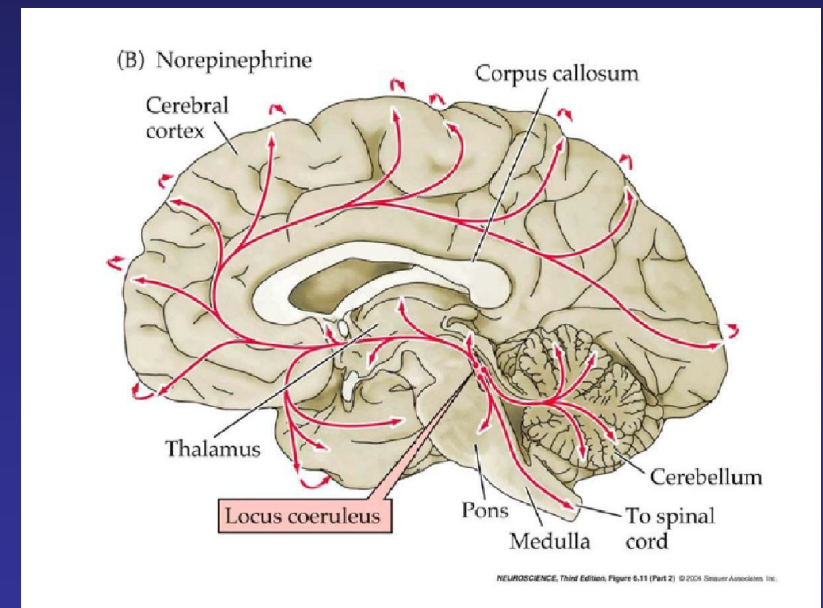
### Pathway of Dilation

- Direct Stimulatory - Iris dilator

- Hypothalamus
- Nucleus Coeruleus
- Superior Colliculus
- Frontal Eye Fields

- Inhibitory – EW nucleus

- Nucleus Coeruleus
- Superior Colliculus
- Supernuclear Inhibition from the Reticular Activating Formation in brainstem



# The Pupil In Syntonics

In Syntonics we are interested in the pupil as an indication of the well being of our patient particularly in regards to the state of the ANS. The two major reactions observed are:

- Alpha Omega Pupil
- Pupillary Light Reflex



# The Pupil

## Reactions

### Alpha Omega Pupil



- An Alpha Omega Pupil is the abnormal re-dilation of the pupil during direct, constant light stimulation.
- Unique to the practice of Syntonics
- First suggested as a term by Dr. Paul Johnson in 1934.
- The abnormality is brought to normalcy with phototherapy treatment
- There is an inverse relation between the size of the functional visual field and the degree of the AO Pupil.

# THE NORMAL PUPIL

Pulaski AO Pupil

# **THE PUPIL**

## **Anatomy, Physiology, and Clinical Applications**

**IRENE E. LOEWENFELD, Ph.D.**

Based on the cooperative work with  
Otto Lowenstein, M.D.



# The Pupil

## The “Normal” Pupil

- Steady state size
- Dynamic, transient response
- Neurons in E-W Nucleus generate steady firing rate even when no external inputs are involved. Balanced by cortical inhibition.
- Slight latent period before contracts
- Maximum contraction is reached in about 2 sec.
- When stimulus removed pupil re-dilates much slower than it contracted – Recovery response
- Under prolonged stimulation there are normal oscillations



# The Pupil

## The "Normal" Pupil

### Pupillogram – 24 y.o. healthy male

•From Loewenfeld, "The Pupil"

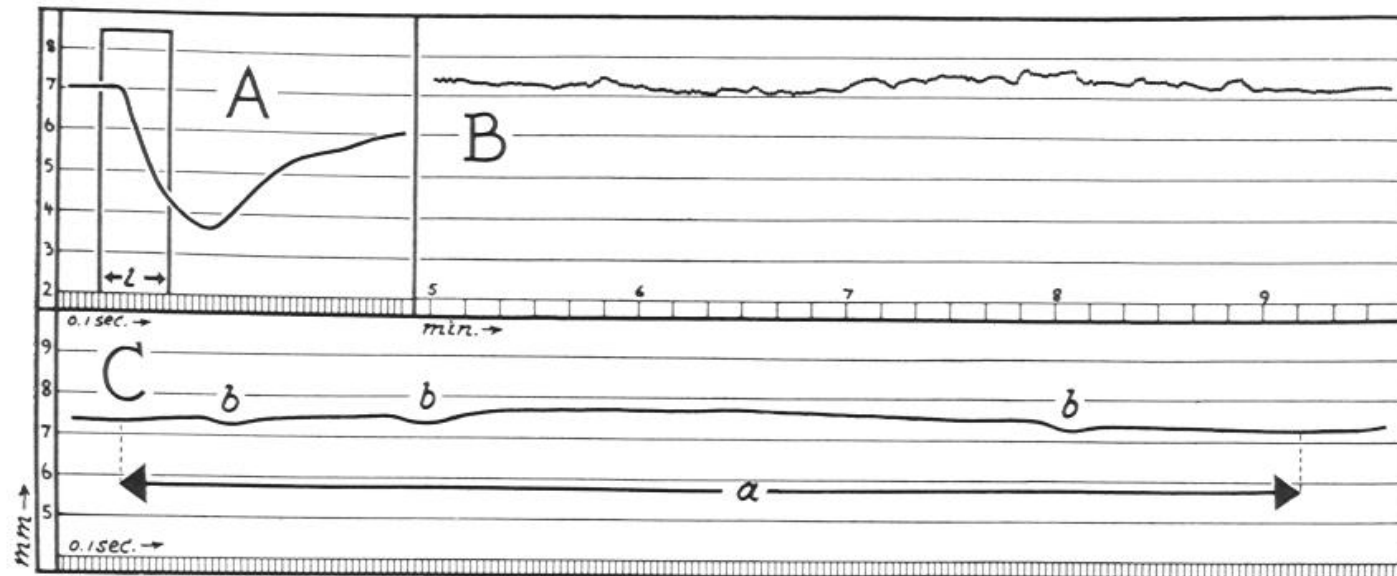


Figure 10-1. Spontaneous pupillary movements in a healthy 24-year-old man. The pupillograms of the right eye are shown. A and C were original records. In B, the time axis of the graph was compressed in the following manner: the pupillary diameter at the beginning of each successive second was taken from the original record, and was plotted as a single measurement (small rectangles); sixty such measurements thus show the pupillary movements

that occurred within each minute. A: Normal light reflex; B: Diameter during the fifth to ninth minute in darkness. The pupil was large and quiet. The subject was not tired, and was able to continue the test for more than 2 hours without remarkable changes in pupillary behavior. C: Slow (a) and fast (b) pupillary oscillations of small extent (see text). (From O. Lowenstein, R. Feinberg, and I.E. Loewenfeld, *Invest. Ophthalm.*, 2 [1963]:138)

# The Pupil

## The “Normal” Pupil

- Pupillary Unrest
- Pupillary Fatigue
- Pupillary Escape

# The Pupil

## The “Normal” Pupil

### Pupillary Unrest

- Defined by Lowenfeld as “normal pupillary oscillations brought on by steady light and absent in darkness.”
- They are continuous, constant rippling and pumping, rapid and irregular movements of the pupil in a lighted environment that cease when the light is turned off.
- Can vary from one individual to another but the pattern is the same for that individual over time. Postulated that it is unique due to our genetic make-up.
- Their cause remains unknown although it is Lowenfeld’s opinion that they originate in the neurons of the midbrain.

# The “Normal” Pupil

## Pupillary Unrest

Pupillogram of normal 24 y.o. female under sustained light (Loewenfeld, “The Pupil”)

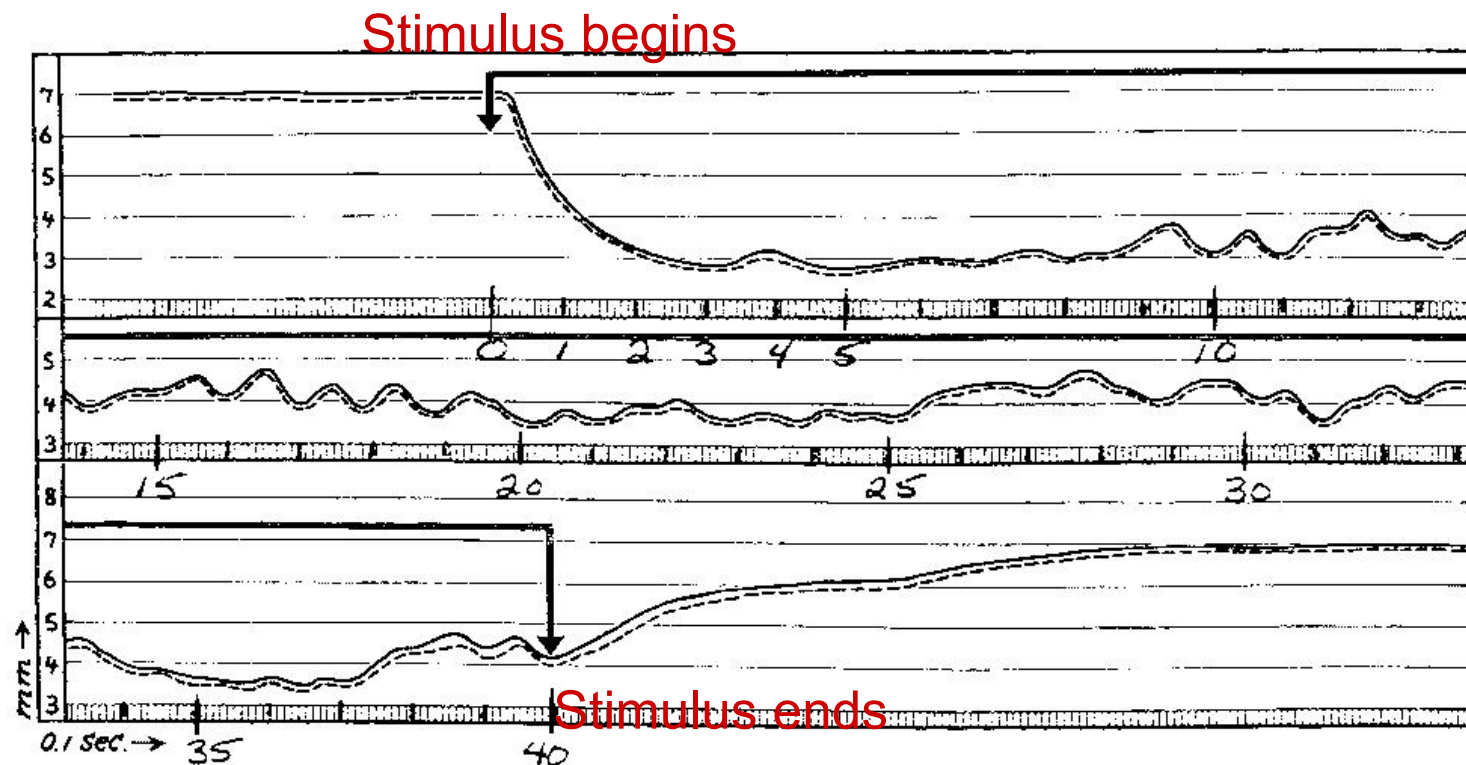


Figure 3-67. Pupillary oscillations during unilateral adaptation to a bright, steady light. Pupillogram of a normal 24-year-old woman. The solid line represents the right, the broken line the left pupil. **First line:** The pupils were large and quiet in darkness. When the right eye was exposed to a steady, bright light, both pupils contracted, then redilated somewhat and began to oscillate. **Second line:** Pupillary oscillations after the right eye had been

light was turned off (arrow), the pupils enlarged and the oscillations disappeared. The movements of the right and left pupils remained equal throughout the experiment, even though the right eye alone was stimulated, while the left eye remained in darkness. (From O. Lowenstein and I.E. Loewenfeld, *Amer. J. Ophthalm.*, 48, II [1959]:536; published with permission of *The American Journal of Ophthalmology*, ©The Ophthalmic Publishing Company)

# The Pupil

## The “Normal” Pupil

### Fatigue Waves

- They originate from fluctuation in central nervous system integration.
- They begin to occur with a decrease in sympathetic discharges and inhibitory influences on the EW nucleus causing increased constriction of the pupil.
- Causes include boredom, sleepiness, illness and ageing.
- They decrease during periods of arousal, when the person is mentally active.
- The reflex becomes well integrated after a good night's rest.
- **Adrenal Fatigue**

# The Pupil

## The “Normal” Pupil

### Fatigue Waves

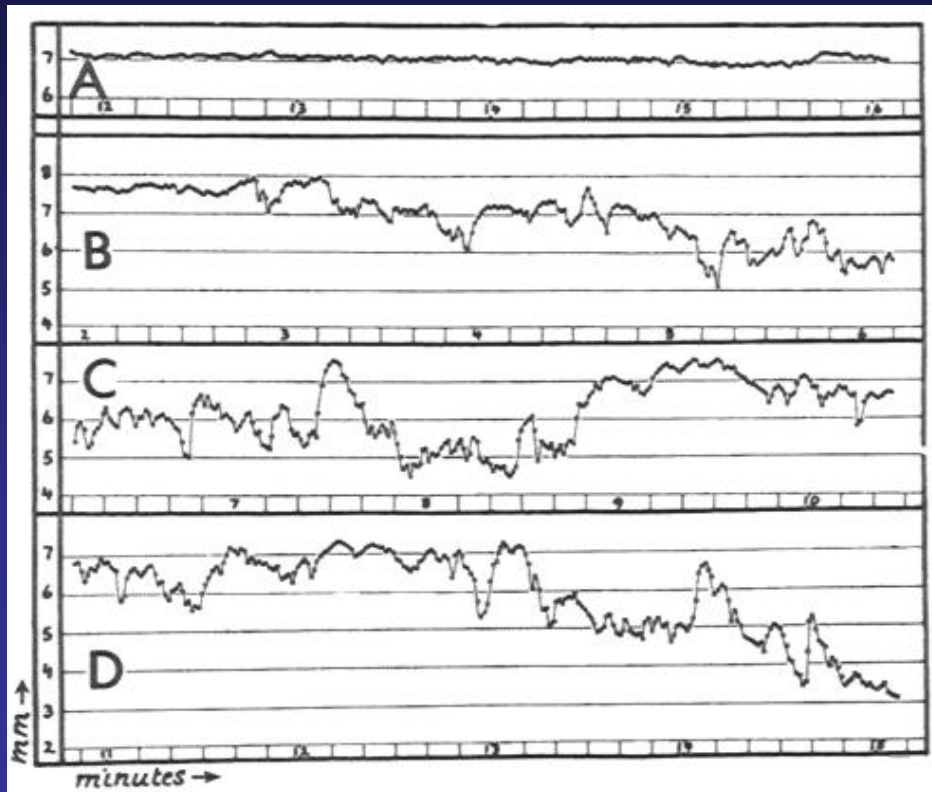


Figure 10-2. Pupillary “fatigue waves.” In each line, the diameter of the subject’s right pupil was plotted as the ordinate by the same method described for Figure 10-1. **A:** Record obtained from a normal, alert 24-year-old man. The pupils showed only little activity after many minutes in darkness. The graph shows the movements between the twelfth and sixteenth minute of the experiment. **B to D:** Pupillary movements of a healthy but very tired 38-year-old man. Less than 3 minutes after the beginning of the test the pupils began to become smaller. During the following minutes extensive, irregular waves of pupillary contraction and dilation appeared as the subject repeatedly drifted toward sleep and roused himself spontaneously (lines **B** and **C**). Finally, the periods of arousal became shorter and shorter and less and less complete. Immediately before he fell asleep, the pupils were very small (end of line **D**). (From O. Lowenstein and I.E. Loewenfeld, *Annls N.Y. Acad. Sci.*, 117 [1964]:142)

•From Loewenfeld, “The Pupil”  
Pulaski AO Pupil



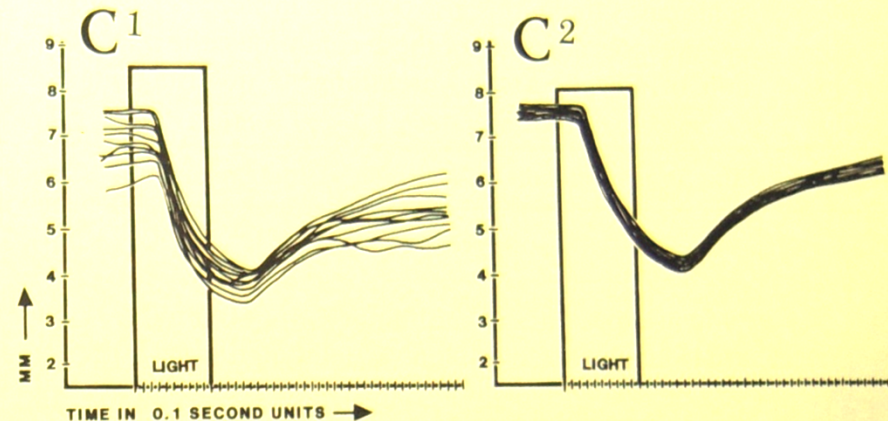
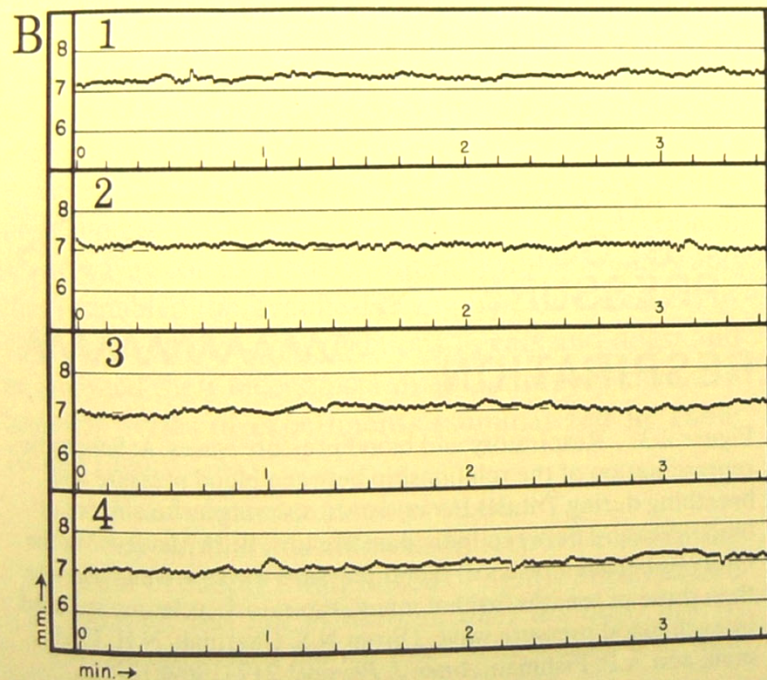
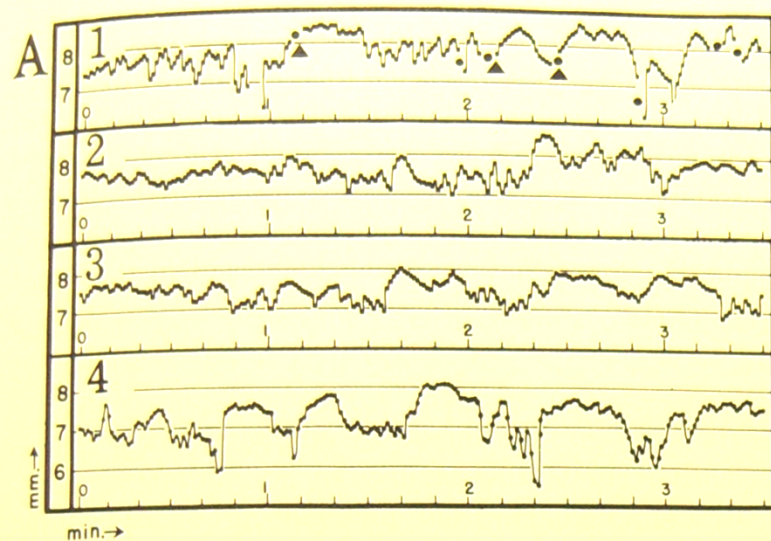


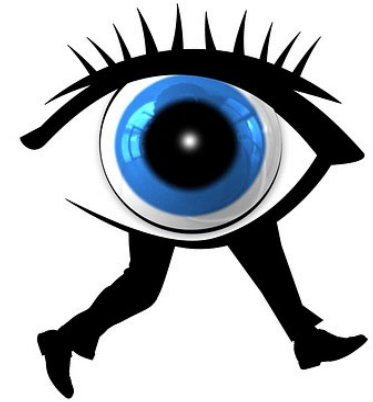
Figure 2-1. Spontaneous pupillary movements in darkness. **A** and **B**: Pupillary behavior of two healthy young men during  $3\frac{1}{2}$  minutes in darkness on four different days, at intervals of 1 week (lines 1 to 4). The records were taken between 5 and 6 P.M. Both subjects were conscientious dental students who had worked hard in the clinic all afternoon. The first subject (**A**) quickly became sleepy as he sat in the dark. The second (**B**) did not. The records show pupillary diameter (in mm) plotted against time (in minutes). They were obtained by contracting the usual time axis of the pupillograms to one-twentieth of its usual length, by measuring the pupillary size at the beginning of each successive second of the original record, and plotting each measurement as a small square on the graph. Subject **A**'s pupils became unsteady already within the first minute of the experiment. In contrast, subject **B**'s pupils never showed more than the slightest variations. The longest test run on **B** was 90 minutes, but even then his pupils did not waver. **C**<sup>1</sup> and **C**<sup>2</sup>: Light reflexes of the students, elicited by ten consecutive 1-second bright light flashes, with 2-minute rest periods interposed (white light,  $5^\circ$  retinal area, centrally fixated, 7.5 log units above the subjects' scotopic visual threshold). The individual reflexes were superimposed. Note the marked variability in reactions for **A** (**C**<sup>1</sup>), and the tight bundle of curves for **B** (**C**<sup>2</sup>).

(Loewenfeld "The Pupil")

# The Pupil

## Reactions

### Pupillary Escape



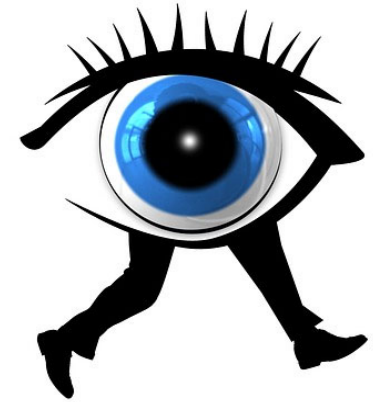
- Re-dilation of the pupil after exposure to a moderate light source.
- Stated that the re-dilation is due to retinal adaptation
- Pupillary “Unrest” follows
- The Alpha Omega pupil might be considered as a form of pupillary escape by non-light therapists



# The Pupil

## Reactions

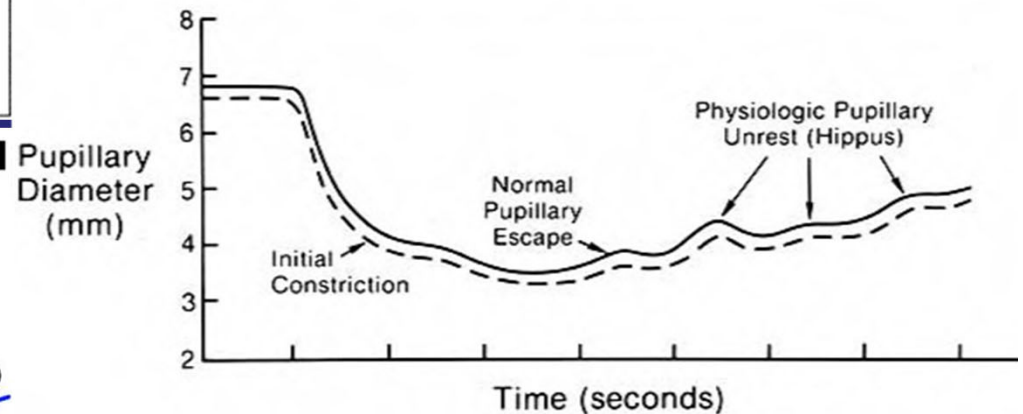
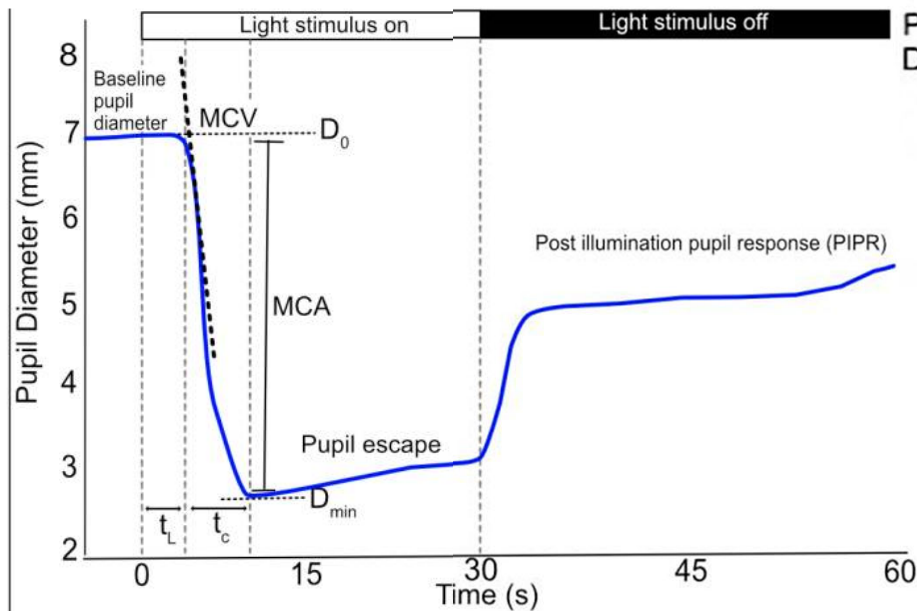
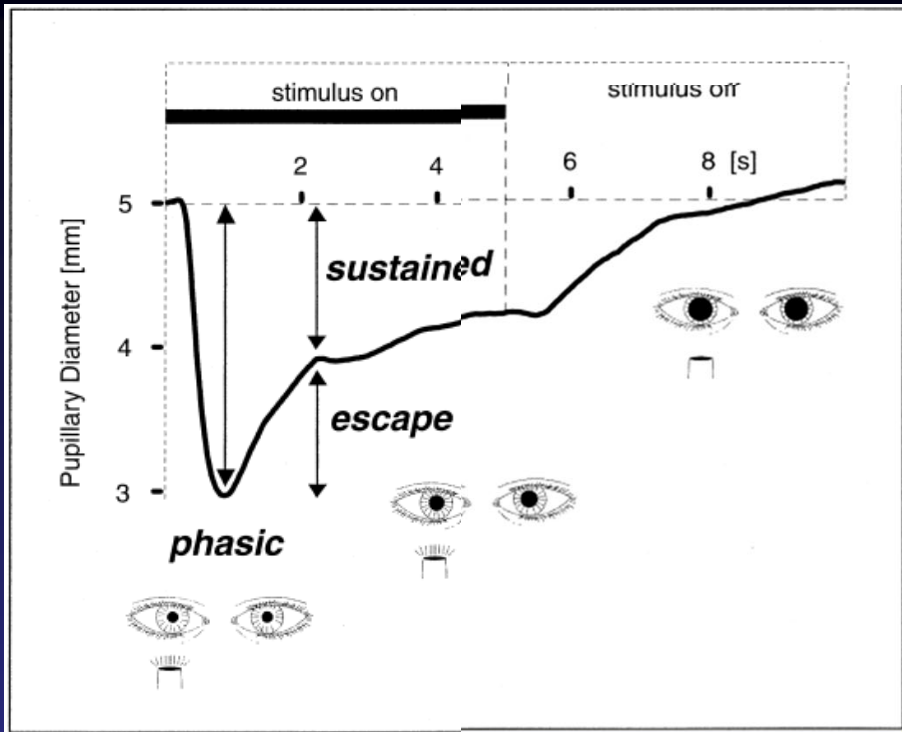
### Pupillary Escape



- Duke-Elder,<sup>1</sup> in 1959 discussing the clinical picture of optic neuritis, mentions "a peculiar pupillary reaction common to all forms of conduction interference, wherein, although both the direct and consensual reactions are present the contraction is not maintained under bright illumination so that the pupil slowly dilates again while the light is still kept upon the eye."
- "**Pupillary escape**" is an abnormal **pupillary** response to a bright light, in which the **pupil** initially constricts to light and then slowly redilates to its original size. **Pupillary escape** can occur on the side of a diseased optic nerve or retina, most often in patients with a central field defect.

# The Pupil Reactions

## Pupillary Escape



# The Pupil Reactions

## Alpha Omega Pupil



- An Alpha Omega Pupil is the abnormal re-dilation of the pupil during direct, constant light stimulation.
- An Alpha Omega Pupil differs from Pupillary Unrest in that its occurrence happens before 8-9 seconds have elapsed. Its amplitude is greater than 1 mm in many cases.
- It's measurement or recording can be effected by the influence of "Fatigue Waves" in a very tired person and effect the variability of response during testing.
- It can be considered a form of pupillary "escape" but without pathology that is reversible with treatment. There are also differences in frequency and amplitude.
- Conclusion – The pupil reaction is extremely complex

# The Pupil

## Sympathetic

### Influences on Pupillary Reflex Dilation

#### The Normal Pupillary Reflex Dilation

Any sensory, emotional, or mental stimulus elicits reflex dilation. Any sound, touch or pain, fear, joy or anger or spontaneous thoughts and intentional efforts all dilate the pupils.

The amplitude of reaction depends on the degree of arousal caused by the stimulus and the subject's physical and mental state at the time of stimulation.

Loewenfeld

# The Pupil

## Influences on Pupillary Reflex Dilation

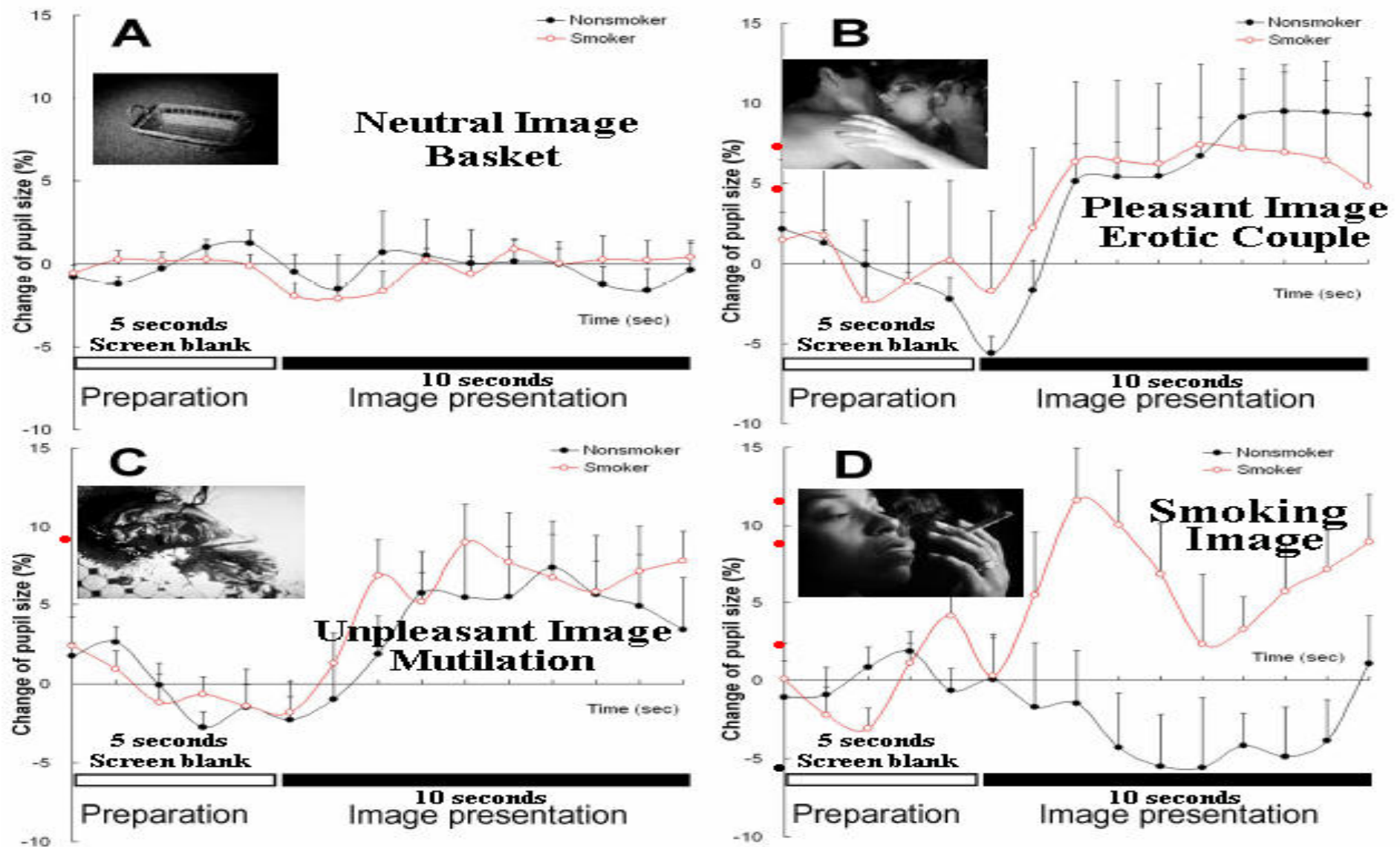
### Increased Dilation

Increased attention  
Orienting Reflex  
Increased mental effort  
Mental arithmetic  
Memory formation  
Pleasant sounds  
Perception of odors  
Sexual arousal  
Dishonesty, Lying  
Enjoy/Dislike what is seen

### Increased Constriction

Mind wandering/Distraction  
Introspection  
Poor task performance  
Disgust  
Images of the sun  
High level scene processing  
Memory retrieval

# Autonomic Changes in Pupil Size Upon Viewing Smoking Cues



Average change in pupil size in response to visual cues as measured by a pupillometer among 12 non-smokers, and 7 smokers who averaged 10.6 cigarettes per day, after 3 hours without smoking. Chae Y. et al, Subjective and Autonomic Responses to Smoking-Related Visual Cues, The Journal of Physiological Sciences, March 25, 2008 - Graphic compiled using study figures by WhyQuit.com

# The Pupil

# REACTIONS

# The Pupil Reactions

- Alpha Omega
- Hippus
- Afferent Pupillary Defect
- Pupillary Light Response (PLR)
- Near Reflex



# The Pupil

## Reactions

### Alpha Omega Pupil



- Why is it not Hippus?
- Why is it not an APD defect?
- How do other reactions relate?
- How does the field relate?

# The Pupil Reactions Alpha Omega Pupil



- An Alpha Omega Pupil is the abnormal re-dilation of the pupil during direct, constant light stimulation.
- It is related to imbalances within the ANS. Hypothalamus and Adrenal activity are important.
- The reaction reveals many aspects of the vitality of the human being.
- Rian Shah, N.D. states that oscillations are due to severe sodium depletion secondary to decreased adrenal function, specifically diminished aldosterone. Also called “rebound” pupil.

# The Pupil

## Testing Standards in Measurement

### Alpha Omega Pupil

Pulaski, 2006

## Observation and Recording of AO Pupil

1. Quickness of initial stimulation – PLR
2. Time to release
3. Amplitude of release
4. Reactions after initial release – fluctuations
5. Change in response with repeated stimulation
6. Sensory reactions – tearing, pain, etc

# The Pupil

## Grading Standardization

### Alpha Omega Pupil

Alpha Omega Grading Standard  
(Pulaski 2010)

Grade	Release Time	Fluctuations	Amplitude
Normal	$\geq 9$ seconds	Trace	Trace
1+ AO	4 – 6 sec	Moderate	Mild
2+ AO	2 – 3 sec	Marked	Mild-Moderate
3+ AO	1 – 2 sec	Mild-Moderate	Moderate
4+ AO	$< 1$ sec	Mild	Large

# The Pupil

## Grading Summary

OD					OS					
0	1	2	3	4		0	1	2	3	4
0	1	2	3	4	PLR Near Reflex	0	1	2	3	4
	Yes	No			Normal Direct		Yes	No		
	Yes	No			Normal Consensual		Yes	No		
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					Time of Release					
					Amplitude of Release					
0	1	2	3	4	Fluctuations	0	1	2	3	4
0	1	2	3	4	AO Pupil	0	1	2	3	4
<div style="border-bottom: 1px solid black; width: 100%; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; width: 100%; height: 15px;"></div>					Change in repeated stimulation	<div style="border-bottom: 1px solid black; width: 100%; height: 15px; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; width: 100%; height: 15px;"></div>				
					Sensory reactions					

## Field / Progress Evaluation

DATE \_\_\_/\_\_\_/\_\_\_ NAME \_\_\_\_\_ Filter AO/MD MU UO/MU  
Copay \_\_\_\_\_ Total Weeks \_\_\_\_\_ Since LastOV \_\_\_\_\_

HX Compliance + - \_\_\_\_\_ Changes in Health/Medication None \_\_\_\_\_

Field Testing Tested by KL JP Reliability 1 2 3 4 \_\_\_\_\_

V A sc cc OD 20 \_\_\_\_\_ Pupils Size SS/Lt PLR  $\alpha\Omega$  APD Near NPC \_\_\_\_\_/\_\_\_\_\_  
OS 20 \_\_\_\_\_ OD \_\_\_\_\_/\_\_\_\_mm 1 2 3 4+ 0 1 2 3 4+ - + + -  
OS \_\_\_\_\_/\_\_\_\_mm 1 2 3 4+ 0 1 2 3 4+ - + + -  
Photophobia None 1 2 3 4+ Other \_\_\_\_\_

Fields White Green Red Blue BS EOM's Pursuits Saccades Hypo/Hypermetric  
OD \_\_\_\_\_% \_\_\_\_\_% \_\_\_\_\_% \_\_\_\_\_% \_\_\_\_\_ SAFE 1 2 3 4+ \_\_\_\_\_% Rt 1 2 3 4+ \_\_\_\_\_  
OS \_\_\_\_\_% \_\_\_\_\_% \_\_\_\_\_% \_\_\_\_\_% \_\_\_\_\_ SAFE 1 2 3 4+ \_\_\_\_\_% Lt 1 2 3 4+ \_\_\_\_\_  
Jerky 1 2 3 4+ Fixation Loss 1 2 3 4+ Sac Int \_\_\_\_\_+

Dynamic OD \_\_\_\_\_ Impression ☐ Visual Field Contraction Plan ☐ Continue Current Filters  
OS \_\_\_\_\_ ☐ Improving W C ☐ Same W C ☐ FUp \_\_\_\_\_ Weeks  
☐ Worse OD OS ☐ Asymmetric

Externals OD OS  
Lid/Lash \_\_\_\_\_  
Conjunctiva \_\_\_\_\_  
☐ Pursuit / Saccadic Dysfunction ☐ Change Tx \_\_\_\_\_  
☐ Pupillary Abnormality \_\_\_\_\_  
☐ Convergence Insufficiency \_\_\_\_\_

Signed \_\_\_\_\_

# The Pupil Reactions

## Hippus

Per Lowenfeld it is a very confusing term

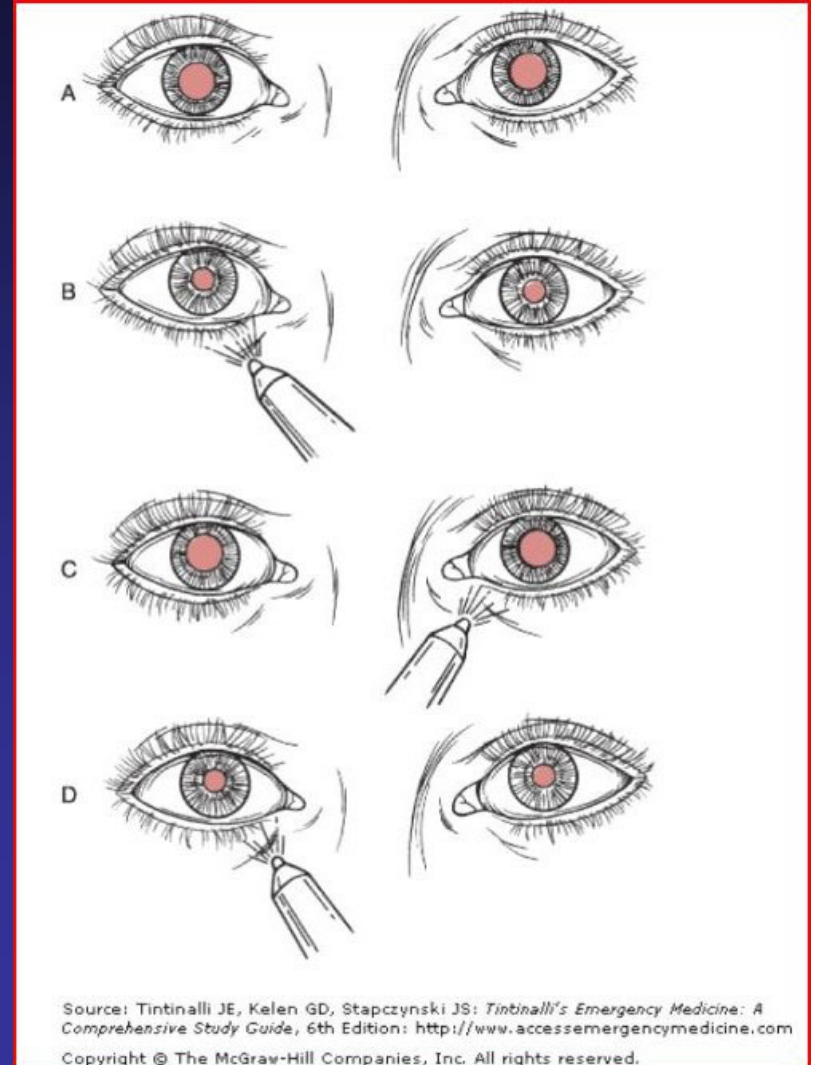
- Nystagmus in ancient times
- Lid fluttering
- 18<sup>th</sup> Century – wave-like pupillary movements
- Nine categories (see addendum – pupillary oscillations)
- Loewenfeld suggests that the name be dropped or defined as “vigorous pupil oscillations of various types”
- Of interest are
  - » Pupillary Unrest
  - » Fatigue Waves
  - » Pupillary Escape Waves

# The Pupil

## Afferent Pupillary Defect

1. Confusion with Alpha Omega
2. RAPD due to Unilateral Optic Nerve Neuropathy. Indication of retinal disease or optic nerve pathology
2. Re-dilation referred to in literature as "Pupillary Escape"
3. Normal consensual with subnormal direct. Decreased PLR. Anisocoria at times
4. Swinging Flashlight Test
5. Characteristic observation is "release" or re-dilation of both pupils when the light is moved from the normal to the affected eye.

Pulaski AO Pupil





# Afferent Pupillary Defect vs. Normal (Loewenfeld "The Pupil")

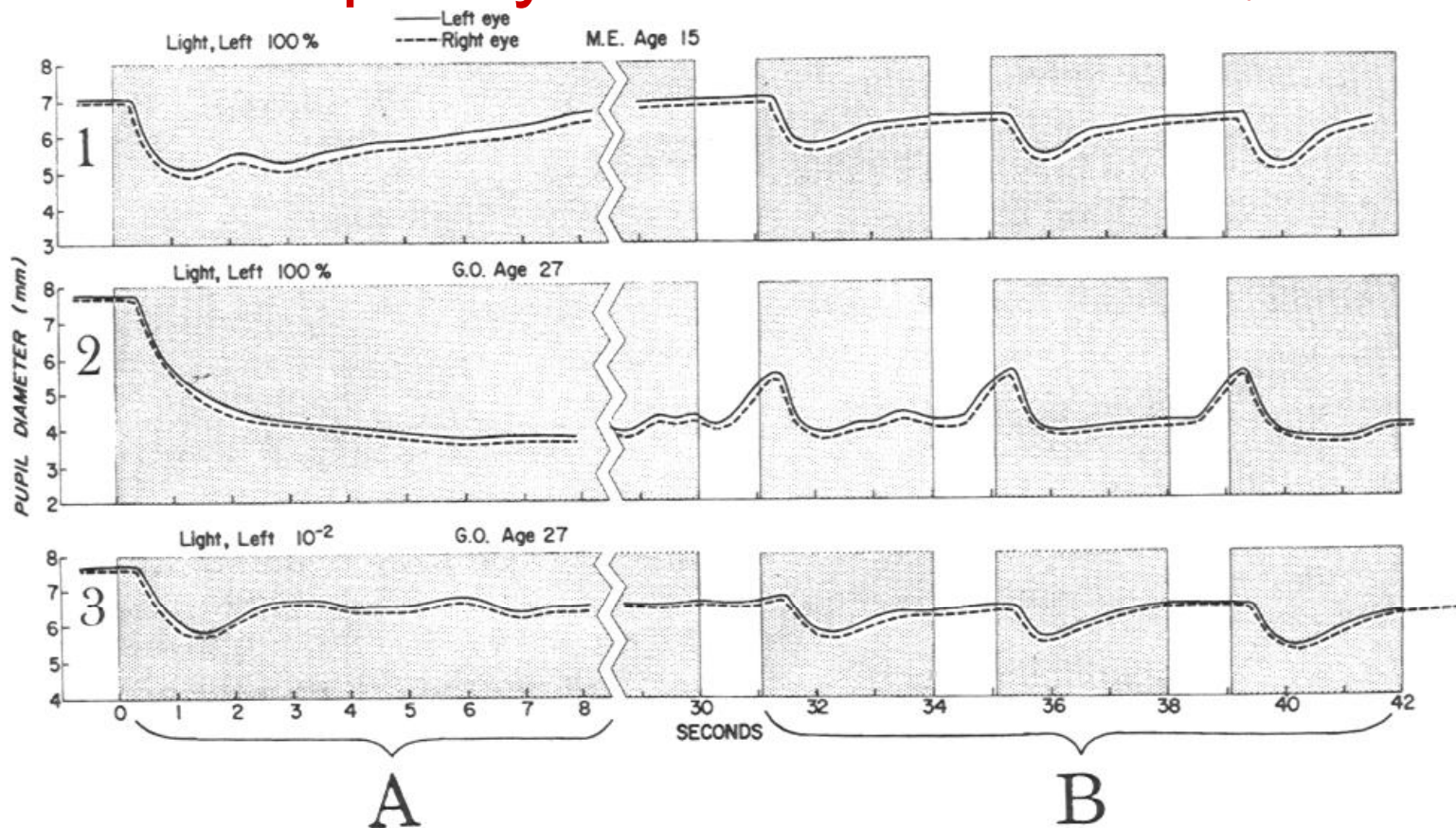


Figure 17-4. Pupillary "escape" in a patient with afferent impairment (line 1), compared with a normal subject (lines 2 and 3). The patient was an obese 15-year-old girl who complained of severe headaches. She was found to have bilateral papilledema and increased intracranial pressure. Extensive diagnostic investigation failed to reveal the cause of her trouble. During the next months the working diagnosis was pseudotumor cerebri. She was treated with steroids and the papilledema receded. About 2 months later her headache recurred and her vision was reduced to light perception. One month later a craniotomy was done for decompression, and the cortex and meninges were found to be studded with nodules of metastatic melanoma. The patient died about 2 months later; and since only the brain was examined, the location of the primary tumor remained unknown. The neuropathologist's report stated that "micro-

the patient's reactions to bright light (A) and to darkness (B). Line 2 shows a normal person's reactions under the same conditions. In line 3 light of reduced intensity was used in the normal person (attenuated by neutral grey filter of 10<sup>-2</sup> density). Note the "escape" of the patient's light reflex, compared to the firm, extensive contraction of the normal subject's pupils. With 2 log units of neutral grey filter interposed between the normal eye and the light the same pupillary "escape" was produced in the normal subject as in the patient with bright light. In the darkness reflexes the normal pupil dilated well to one-second interruptions of the light (white bars); and they recontracted quickly when the light was readmitted. In contrast, both the patient's eye and the normal eye with attenuated light had "low intensity" darkness reflexes: the dark-dilations were missing and the secondary contractions were shallow and short-lasting. (From H.S.

# The Pupil

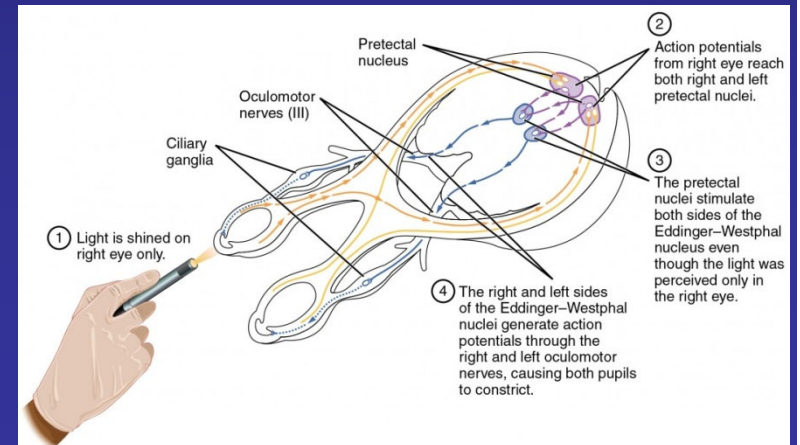
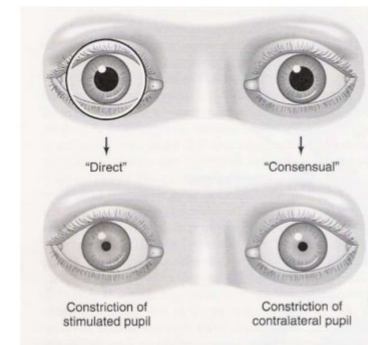
## Reactions

### Pupillary Light Reflex

- 10-20% of RGC axons relate to PLR
- 1% of ipRGC's
- Speed/Strength of contraction
- Coma, TBI, Stroke
- Excited Patient
- Relation to ANS

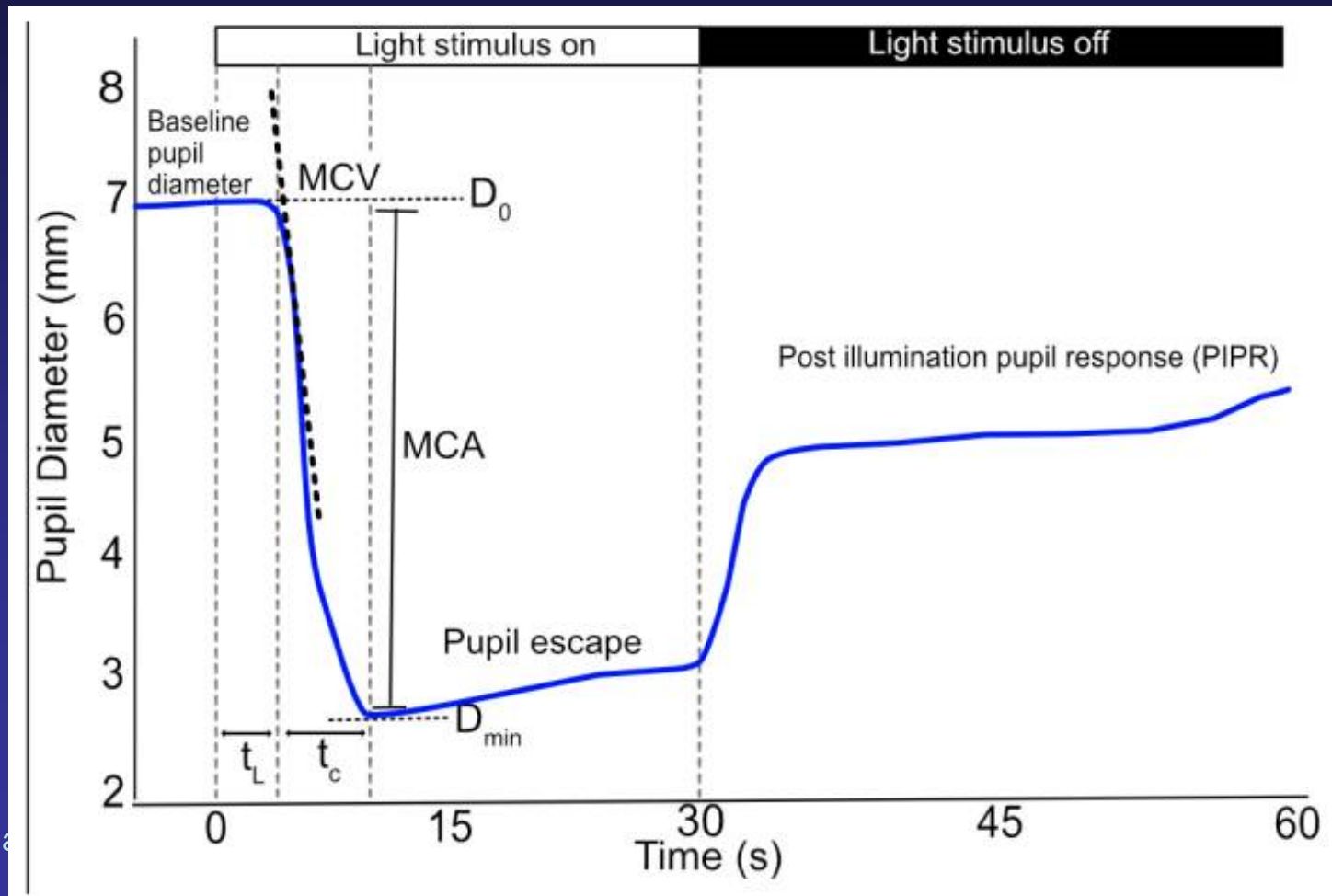
Pulaski AO Pupil

Pupillary Light reflex



# The Pupil Reactions

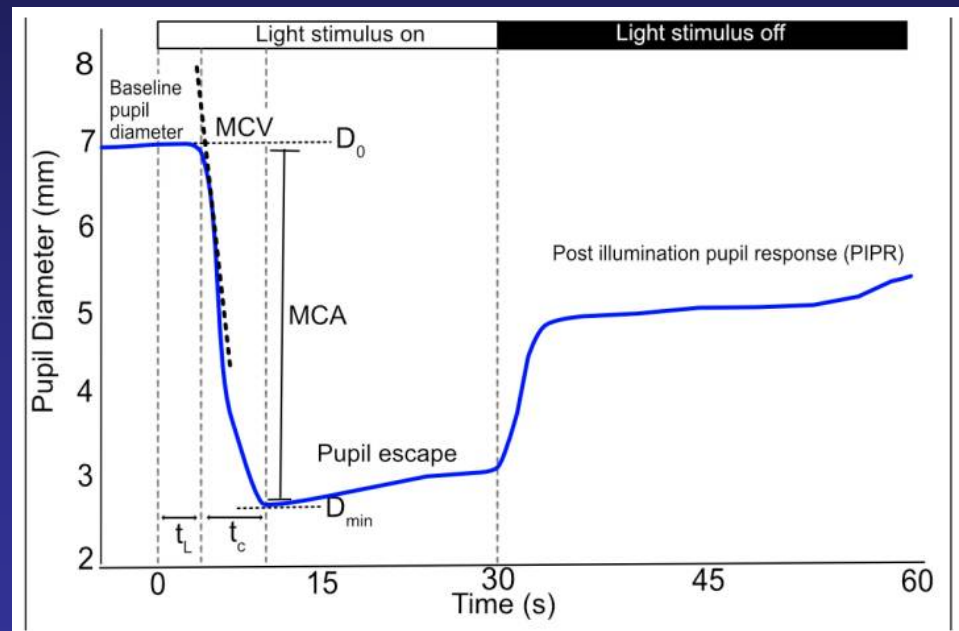
## Pupillary Light Reflex



# The Pupil Reactions

## Pupillary Light Reflex

MCA, MCV predictors for  
Alzheimer's  
Parkinson's  
ABI/TBI  
Autism  
Drugs/Alcohol  
Infection

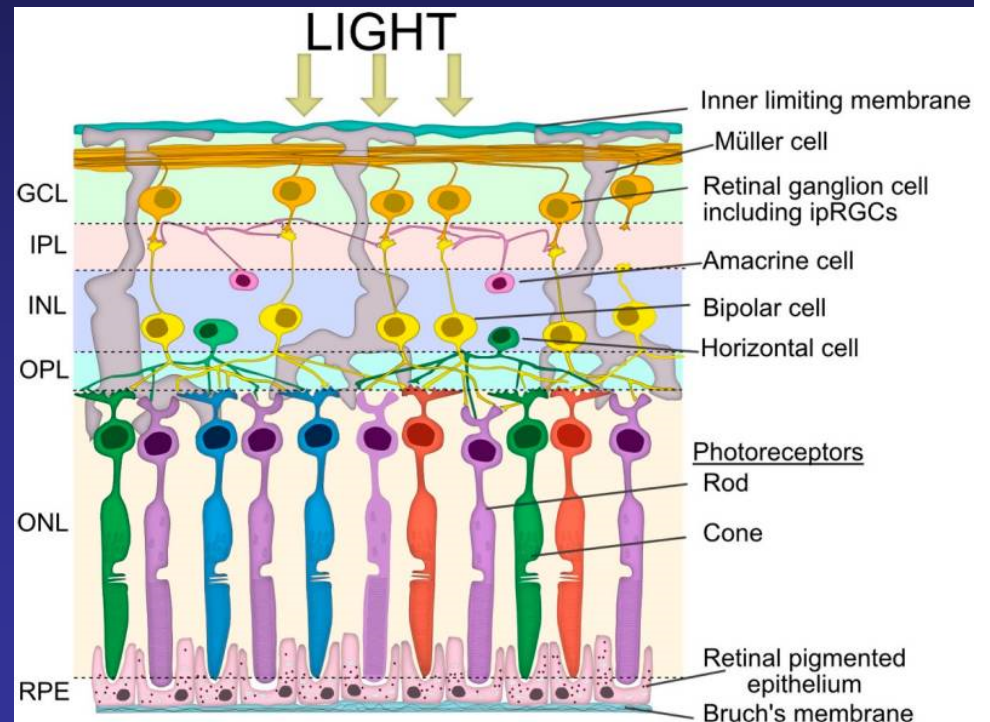




# The Pupil Reactions

## Pupillary Light Reflex

- ipRGC's very important in recovery phase (PIPR)
- Pupil both inhibited and activated by different wavelength sensitive cones
- Important in sustained constriction



# The Pupil Reactions

## Near Reflex

1. Observed reaction of Pupil when the patient looks from a distance to near object.
2. Record strength of constriction from 0 – 4+ for each eye.
3. Is a different pathway and can react even if no PLR

# The Pupil

# TESTING

# The Pupil TESTING

Conventional

Automated Pupillometry



# The Pupil

## Testing Standards in Measurement

### Observation and Recording

#### General Observations and Questions (Loewenfeld "The Pupil")

1. Size - too large/small for age, illumination, etc
2. Direct and Consensual responses.
3. Are reactions to light and to near equally extensive
4. Are they equal in size
5. If unequal is difference greater in dim or bright
6. Do both constrict to light
7. Do both redilate as light removed
8. Is reflex to sensory stimuli intact on both sides
9. Are there other motor or sensory defects relating to the pupillary syndrome

# The Pupil

## Testing Constants in Measurement

### Rigid Test Protocol

- Room Illumination
- Patient Fixation
- Light Source
- Distance and Location
- Duration

# The Pupil

## Testing Constants in Measurement

### Room Illumination

- Dimly lit room in dark adapted state

### Patient Fixation

- At distance (non-accommodative to avoid near reflex)
- Non-descript target – no cognition

# The Pupil

## Testing Constants in Measurement

### Light Source

- Small, bright, concise, with ability to adjust the light intensity



Pulaski AO Pupil

# The Pupil

## Testing Constants in Measurement

### Distance and Location

- Approximately 6-8" from eye
- Light source turned on and below or temporal to eye being tested
- Light should be swung directly to a location straight into the line of sight
- Lag of 2-3 seconds between eyes



# The Pupil

## Testing Constants in Measurement

### Duration

Normally up to 2-3 seconds in front of eye. Needs to be at least 1 second to get full constriction.

### Alpha Omega evaluation

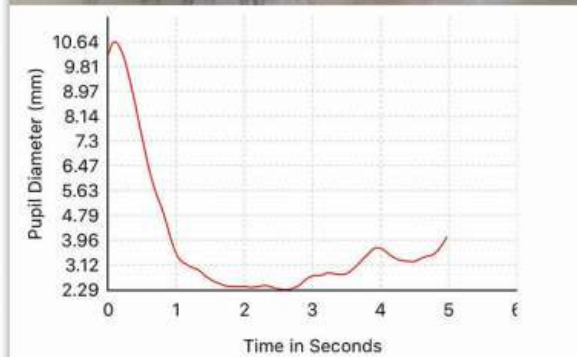
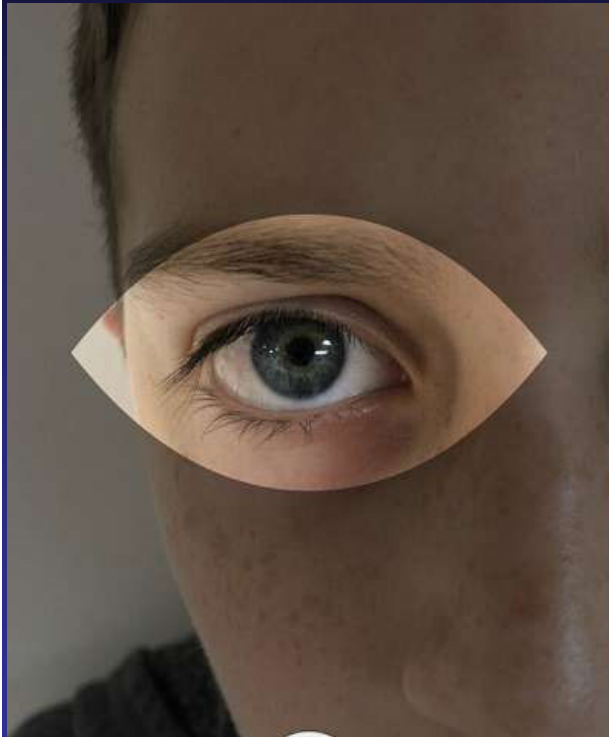
- Observe the pupil under constant light stimulation for at least ten seconds or until first sustained release.
- Test right eye first and then immediately left eye
- Observe time to release, fluctuations and amplitude
- Repeat at least three times observing changes with fatigue



# The Pupil

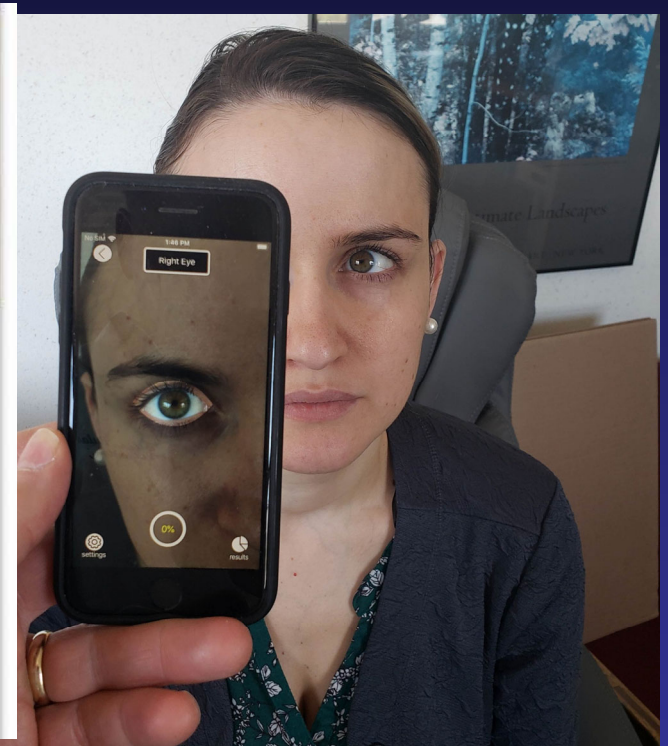
## Testing – Pupillometry

### Bright Lamp



Result Type

Constrict



Pulaski AO Pupil

# The Pupil

## Testing – Pupilometry

### Bright Lamp

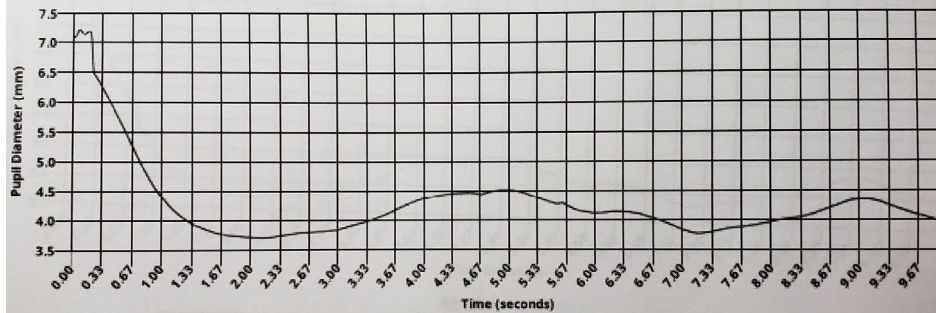
#### Patient Information

Birth Date	05/09/2008
Sex	Female
Eye Location	Left
Concussion Date	N/A
Asymptomatic?	Yes

#### Test Information

Test Date & Time	03/12/2020 05:27:57 PM
Test Administrator	John Pulaski/OD
Test Type	Full Spectrum w/Torch
Torch Level	50%
Flash Status	Off
Video Duration	10.5 sec
Torch Duration	10 sec

#### Pupillogram



#### Results

Metric	Results (red values are $2\sigma$ > mean normative range)	Normative Data
(Beta) Reflex Score	Error: 3	0 - 5
Avg. Constriction Speed	1.762 mm/sec	0.45 - 1.159 mm/sec
Avg. Diameter	4.259 mm	3.169 - 3.816 mm
Avg. Dilation Velocity	N/A	0.888 - 2.699 mm/sec
Constriction Time	2.1 sec	1.178 - 2.217 sec
Latency	0.233 sec	0.138 - 0.279 sec
Max. Constriction Speed	8.4 mm/sec	4.013 - 9.136 mm/sec
Max. Diameter	7.229 mm	3.662 - 5.186 mm
Min. Diameter	3.703 mm	2.861 - 3.317 mm
75% Recover Time	N/A	3.945 - 4.54 sec

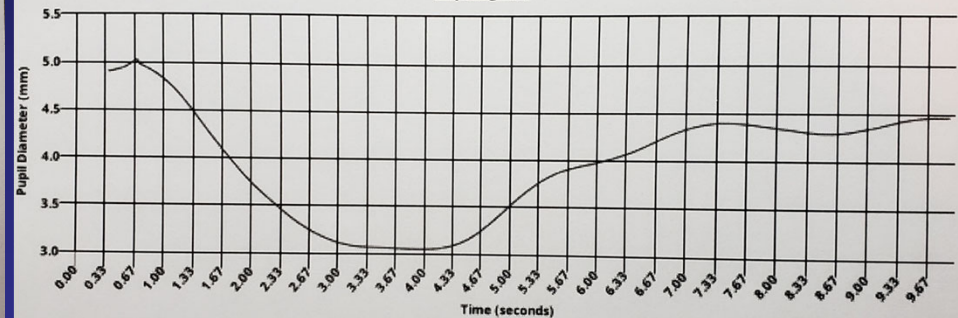
#### Patient Information

Birth Date	03/11/2006
Sex	Male
Eye Location	Left
Concussion Date	N/A
Asymptomatic?	Yes

#### Test Information

Test Date & Time	03/13/2020 09:10:42 AM
Test Administrator	John Pulaski/OD
Test Type	No Light
Torch Level	0%
Flash Status	Off
Video Duration	10.5 sec
Torch Duration	10 sec

#### Pupillogram

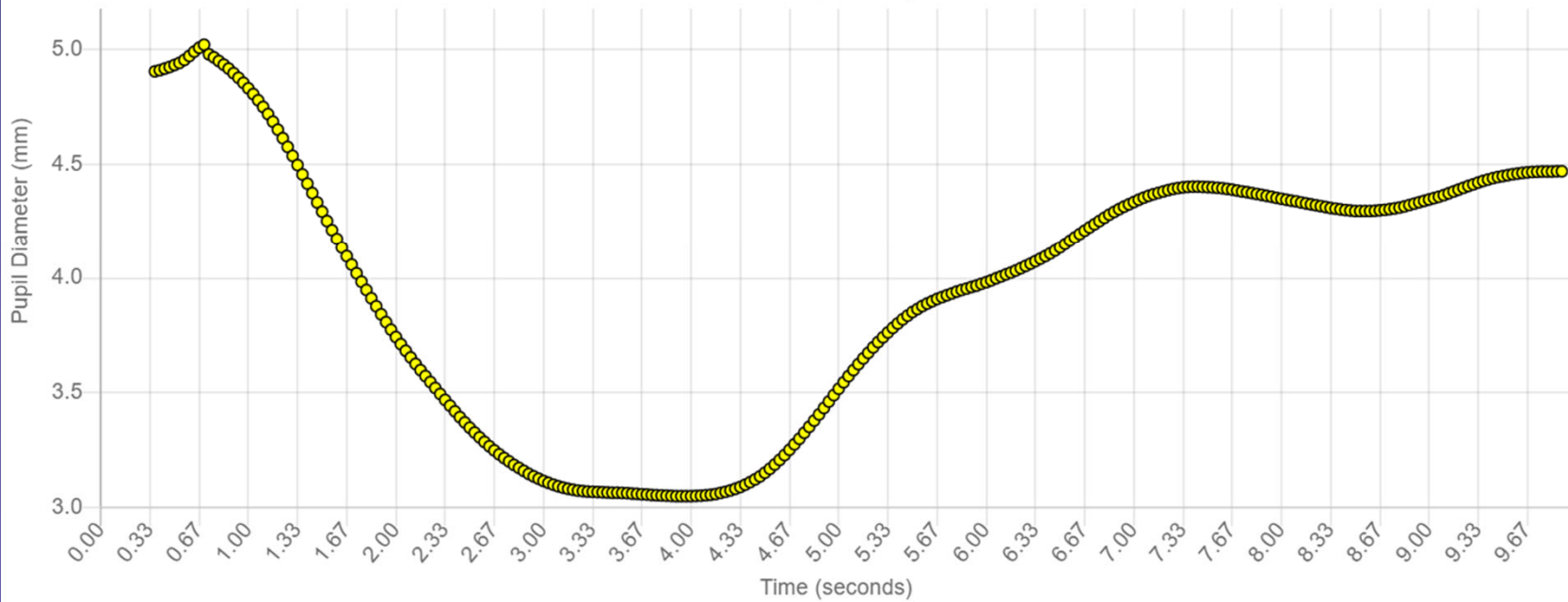
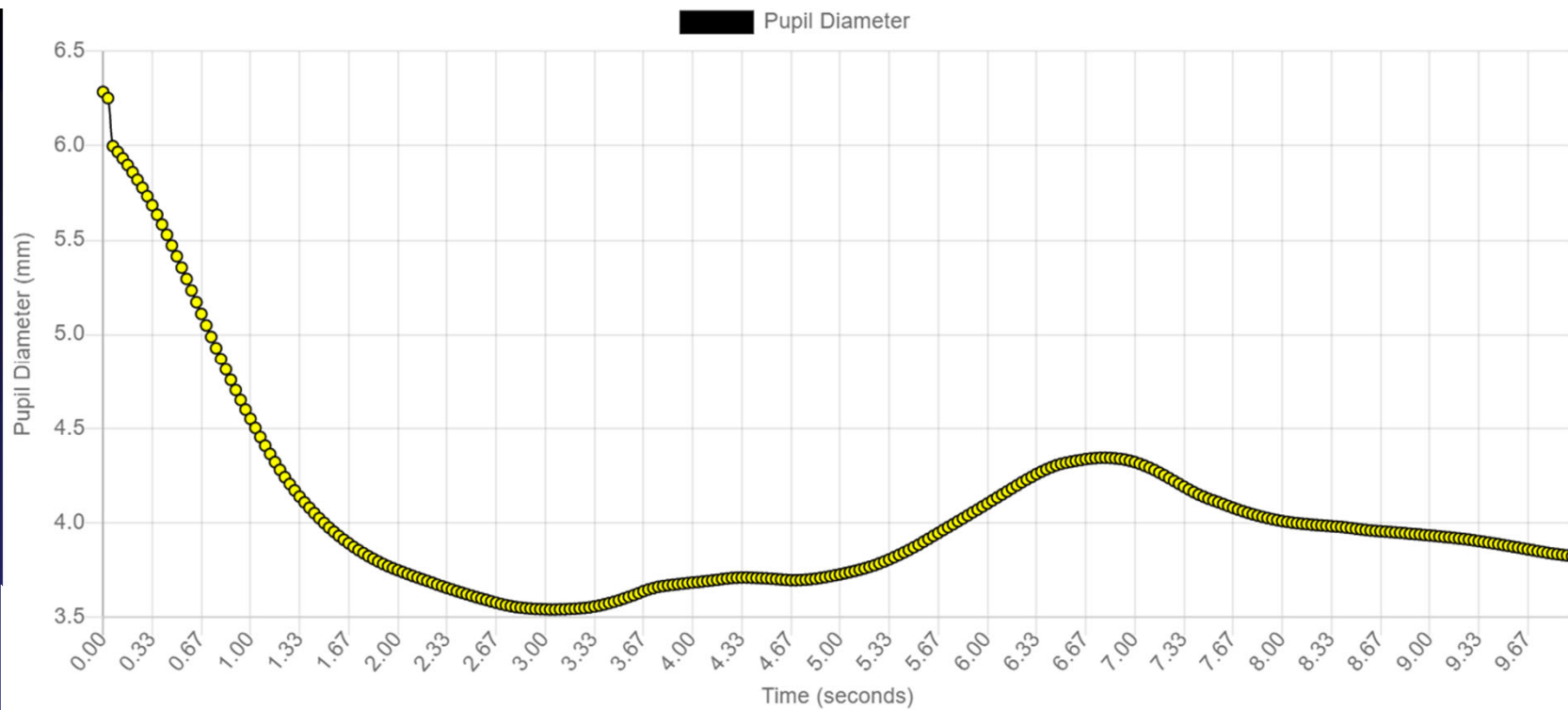


#### Results

Metric	Results (red values are $2\sigma$ > mean normative range)	Normative Data
Avg. Diameter	3.958 mm	3.626 - 5.161 mm
Max. Diameter	5.02 mm	3.825 - 5.545 mm
Min. Diameter	3.05 mm	3.427 - 4.847 mm

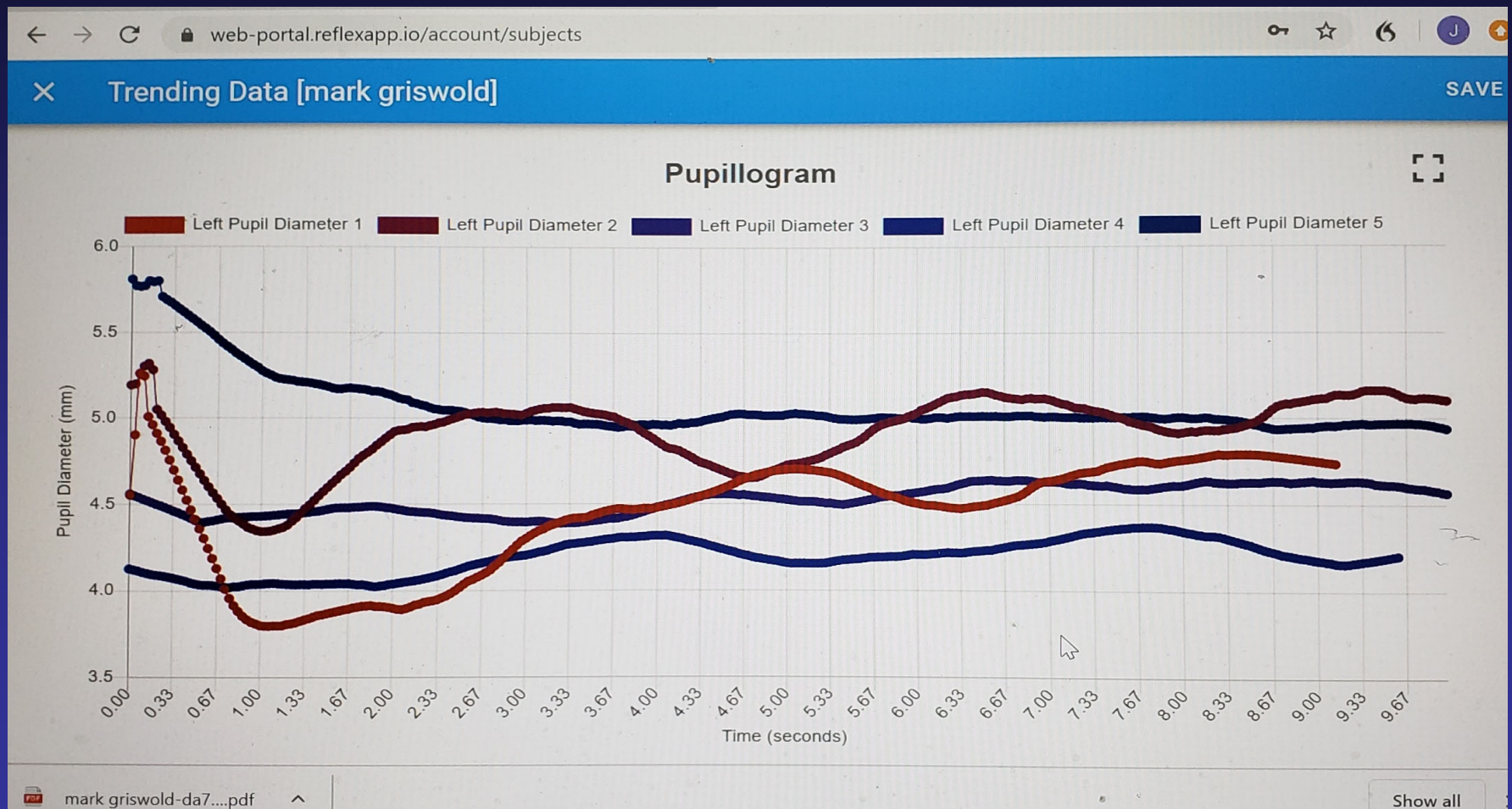
Reflex - PLR Analyzer is designed to help assess and monitor cognitive and neuro-ocular function by providing quantitative data of the Pupillary Light Reflex (PLR). This data can be used by health care professionals to assist in diagnostic decisions and treatment/recovery management. For more details regarding the clinical relevance of PLR, and for more information about Reflex, go to [brightlamp.org](http://brightlamp.org).





# The Pupil

## Testing – Bright Lamp



Pulaski AO Pupil

# The Pupil

## Testing – Bright Lamp

### Pupil Parameter Normal Ranges

• Avg. Constriction Speed	0.45 - 1.159 mm/sec
• Avg. Diameter	3.169 - 3.816 mm
• Avg. Dilation Velocity	0.888 - 2.699 mm/sec
• Constriction Time	1.178 - 2.217 sec
• Latency	0.138 - 0.279 sec
• Max. Constriction Speed	4.013 - 9.136 mm/sec
• Max. Diameter	3.662 - 5.186 mm
• Min. Diameter	2.861 - 3.317 mm
• 75% Recovery Time	3.945 - 4.54 sec



## Questions or Comments?

Matthew Southern

*Marketing Director*

[msouthern@brightlamp.org](mailto:msouthern@brightlamp.org)

Phone: (317) 763-0786



Try Reflex Free For 60-Days:

<https://apps.apple.com/us/app/reflex-plr-analyzer/id1412154869>

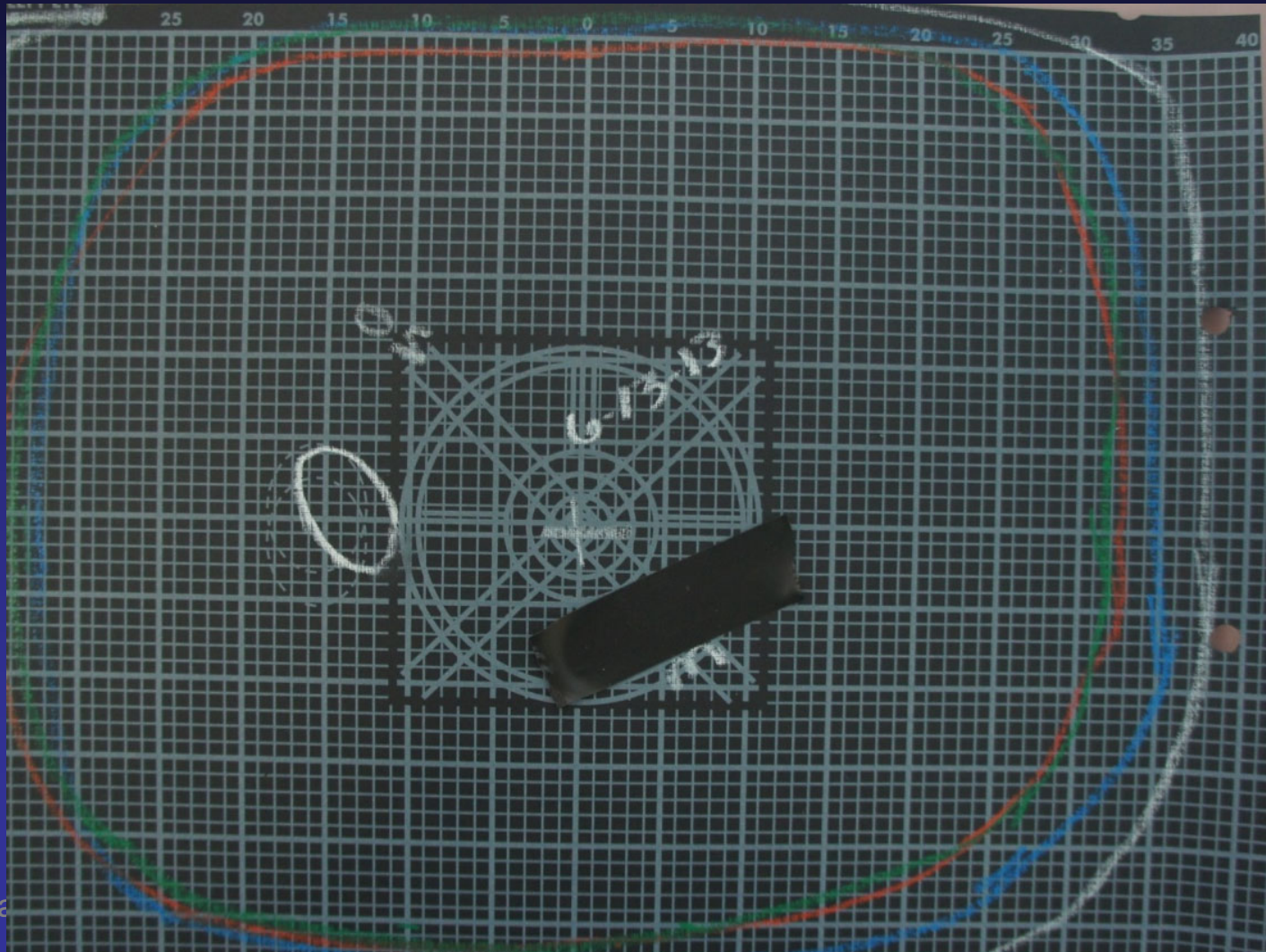
# The Pupil

## REACTIONS OF PUPIL RELATE TO SIZE OF FIELD



# The Kinetic Visual Field

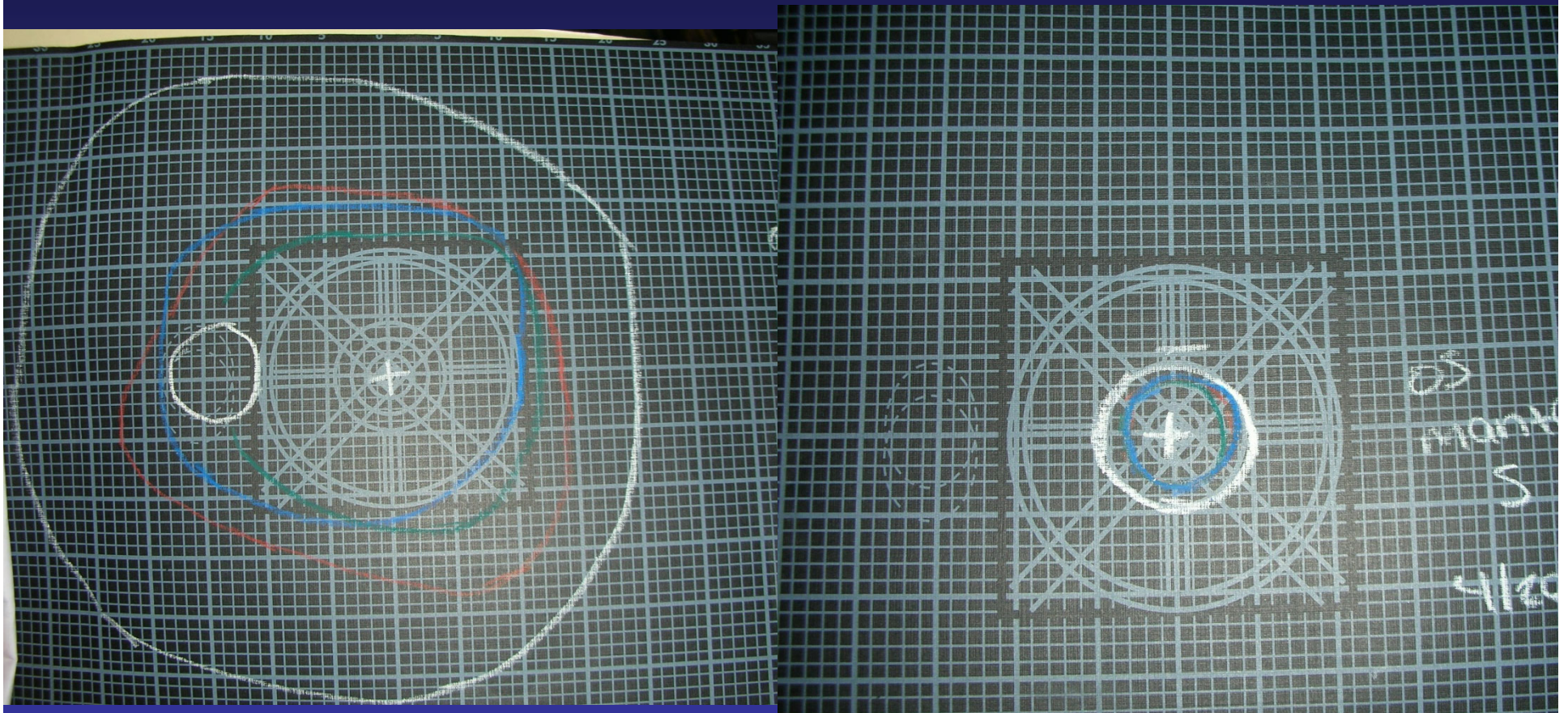
## The Normal Visual Field





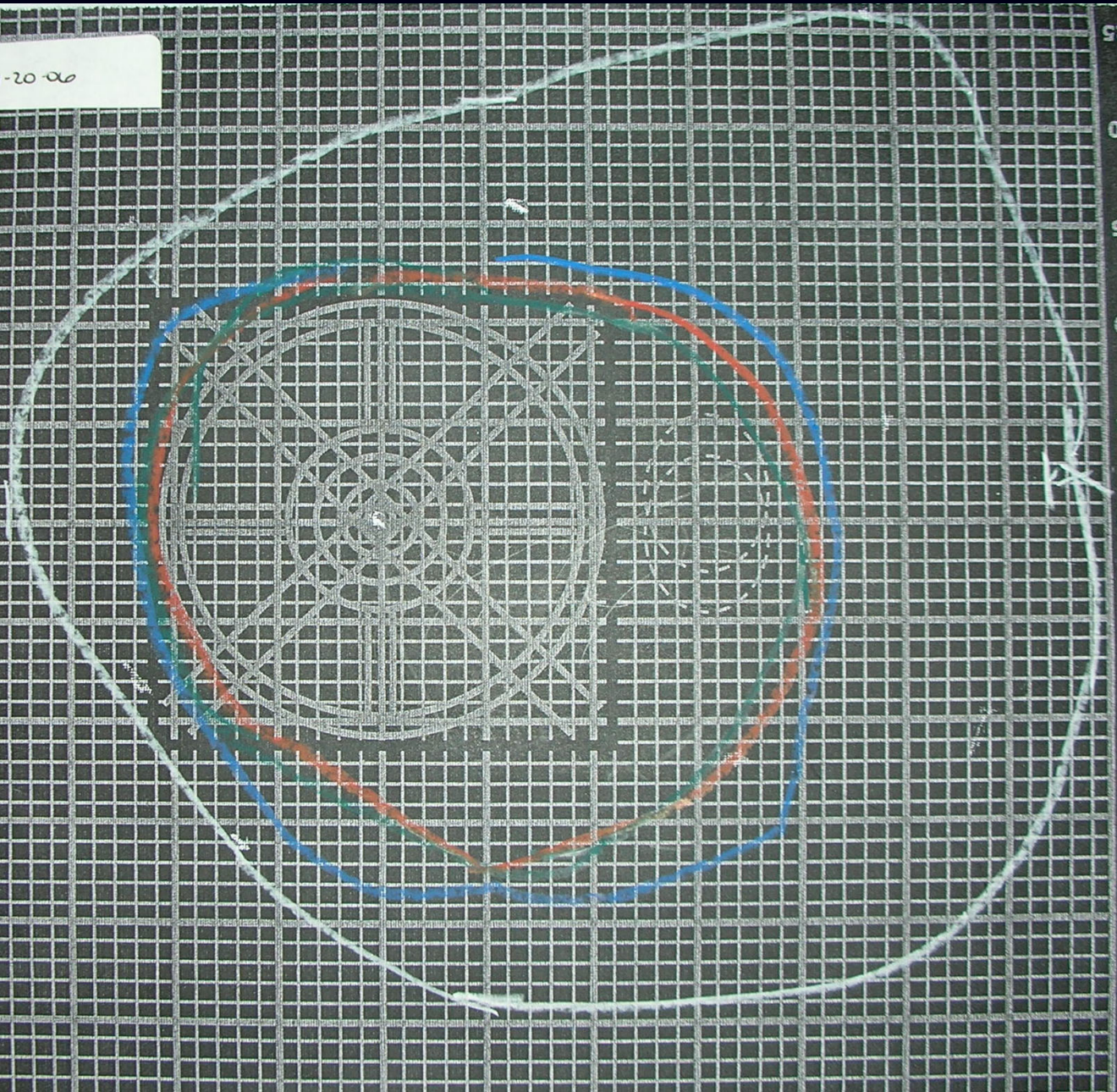
# Kinectic (Functional) Visual Fields

## Abnormal





Nickoli, xhensiq 4-20-06





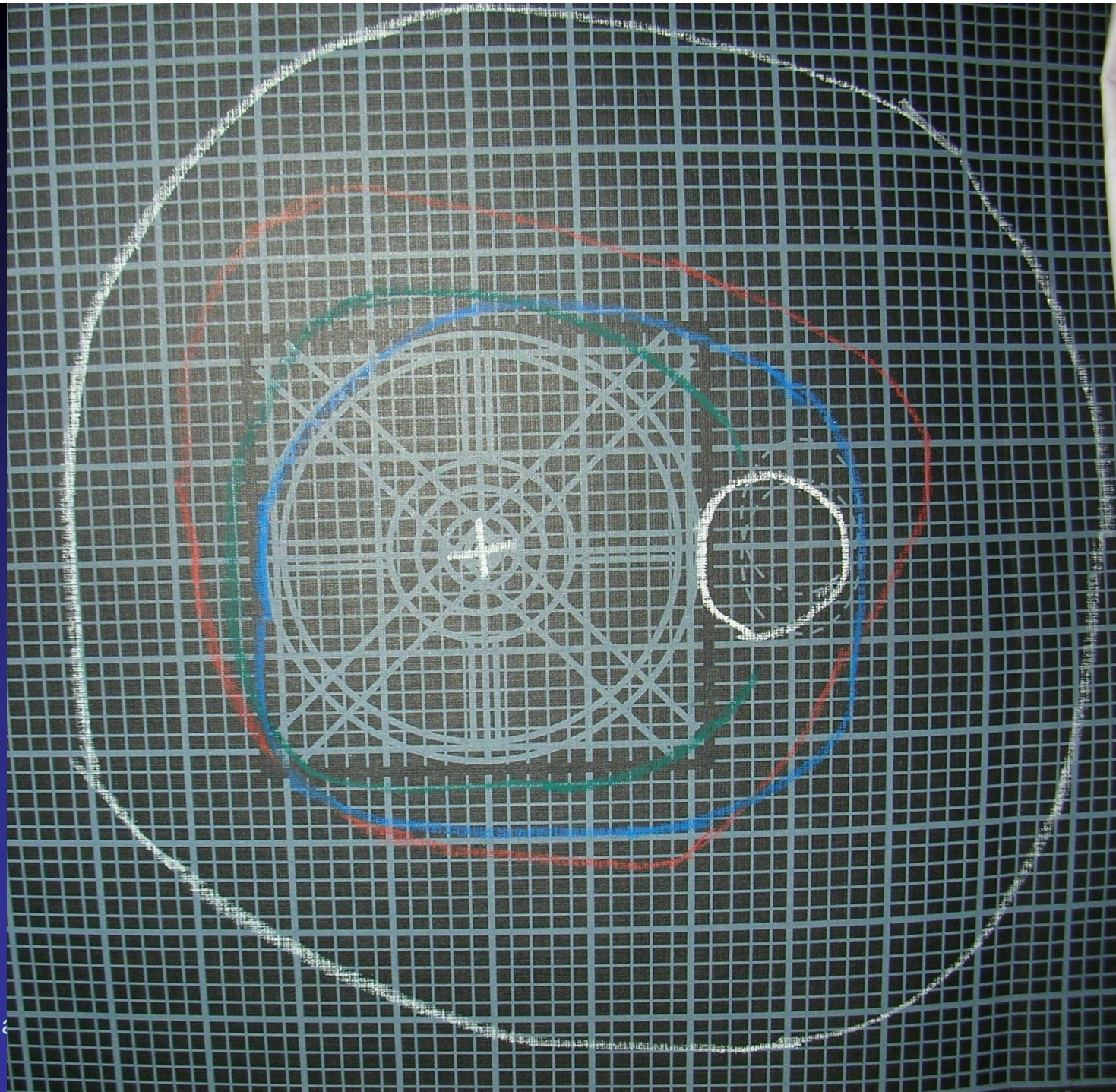
# The Pupil

## Grading Standardization

### Alpha Omega Pupil

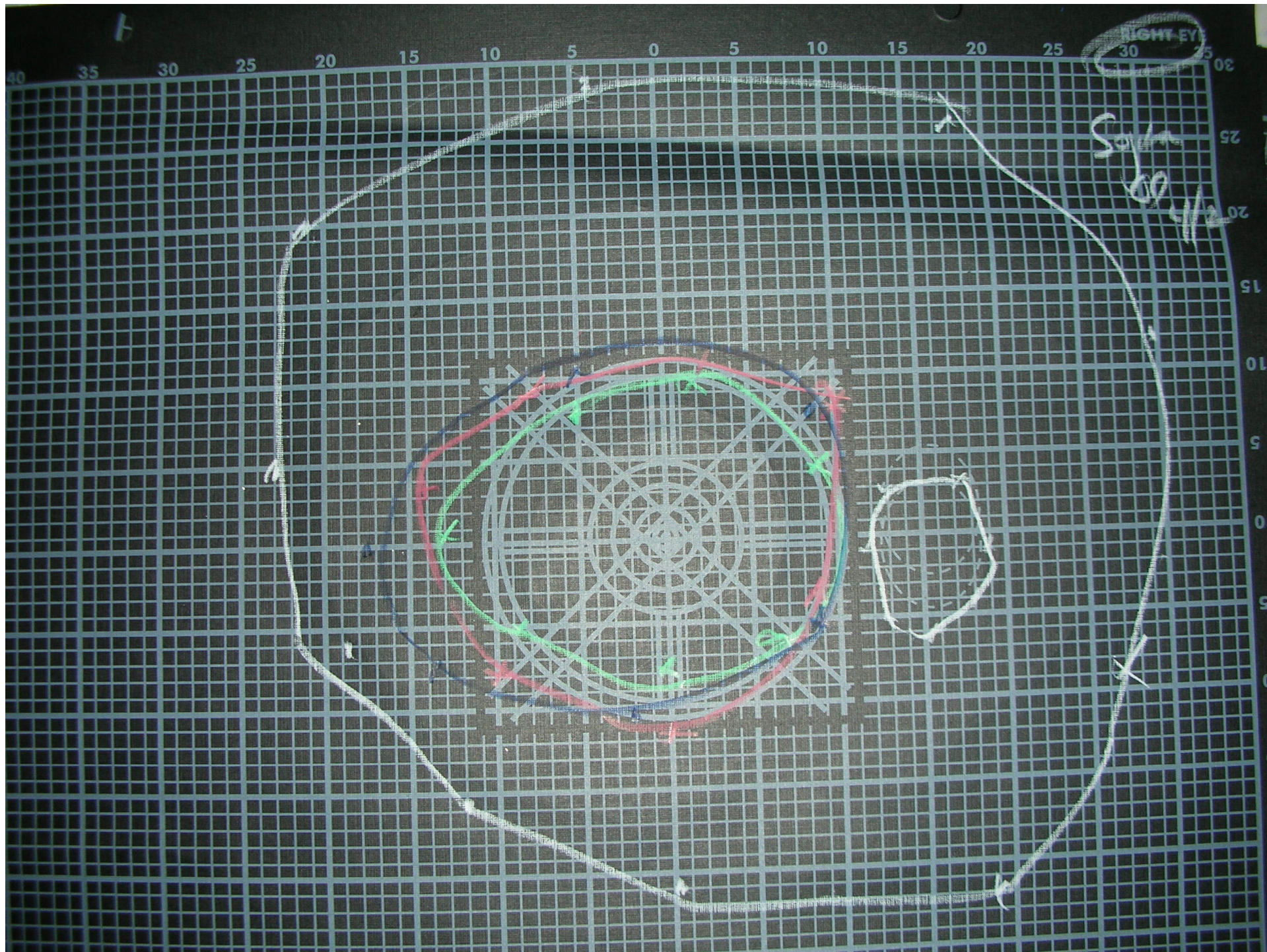
Alpha Omega Grading Standard  
(Pulaski 2010)

Grade	Release Time	Fluctuations	Amplitude
Normal	$\geq 7$ seconds	Trace	Trace
1+ AO	4 – 6 sec	Moderate	Mild
2+ AO	2 – 3 sec	Marked	Mild-Moderate
3+ AO	1 – 2 sec	Mild-Moderate	Moderate
4+ AO	$< 1$ sec	Mild	Large

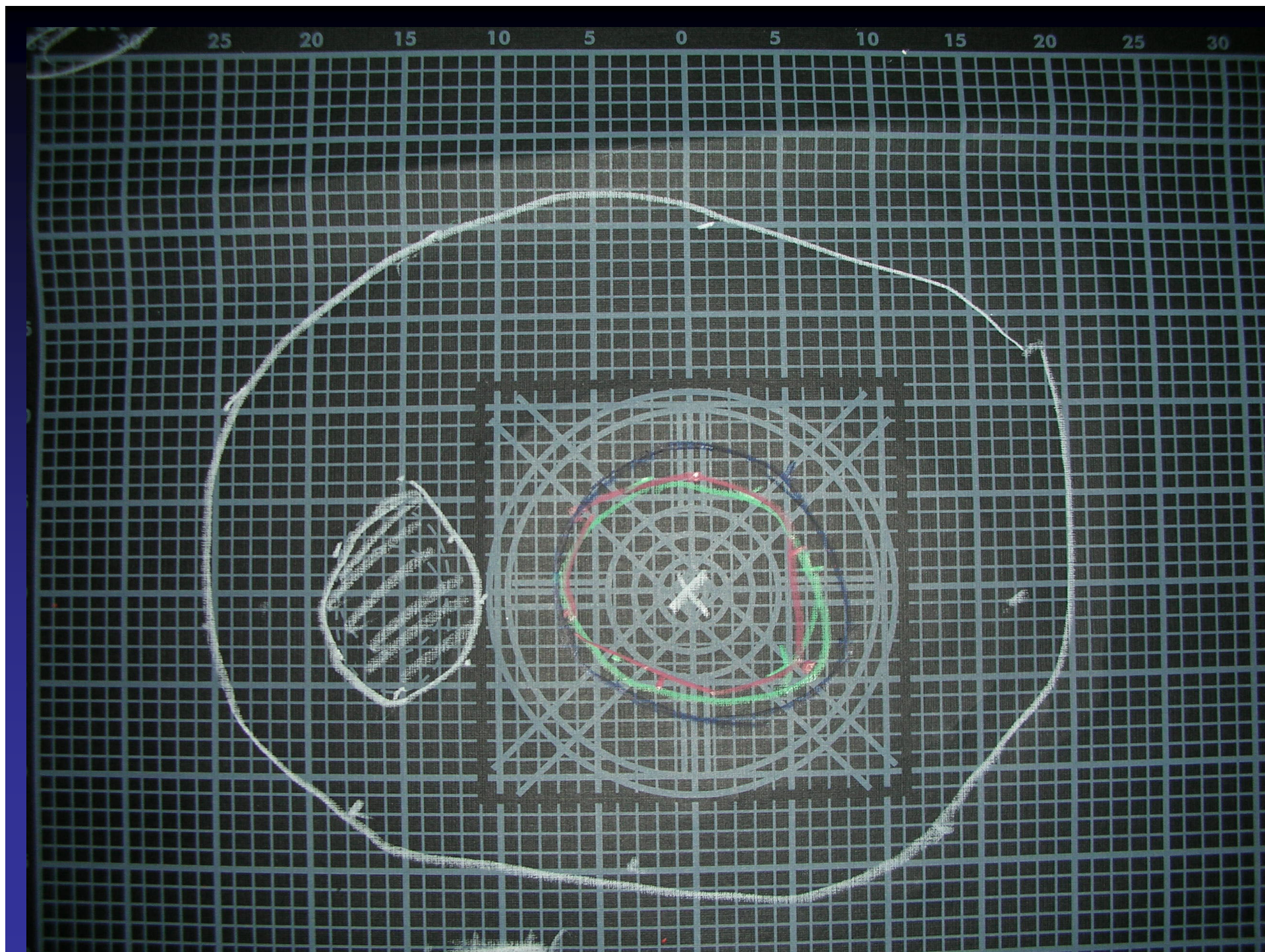


Pula

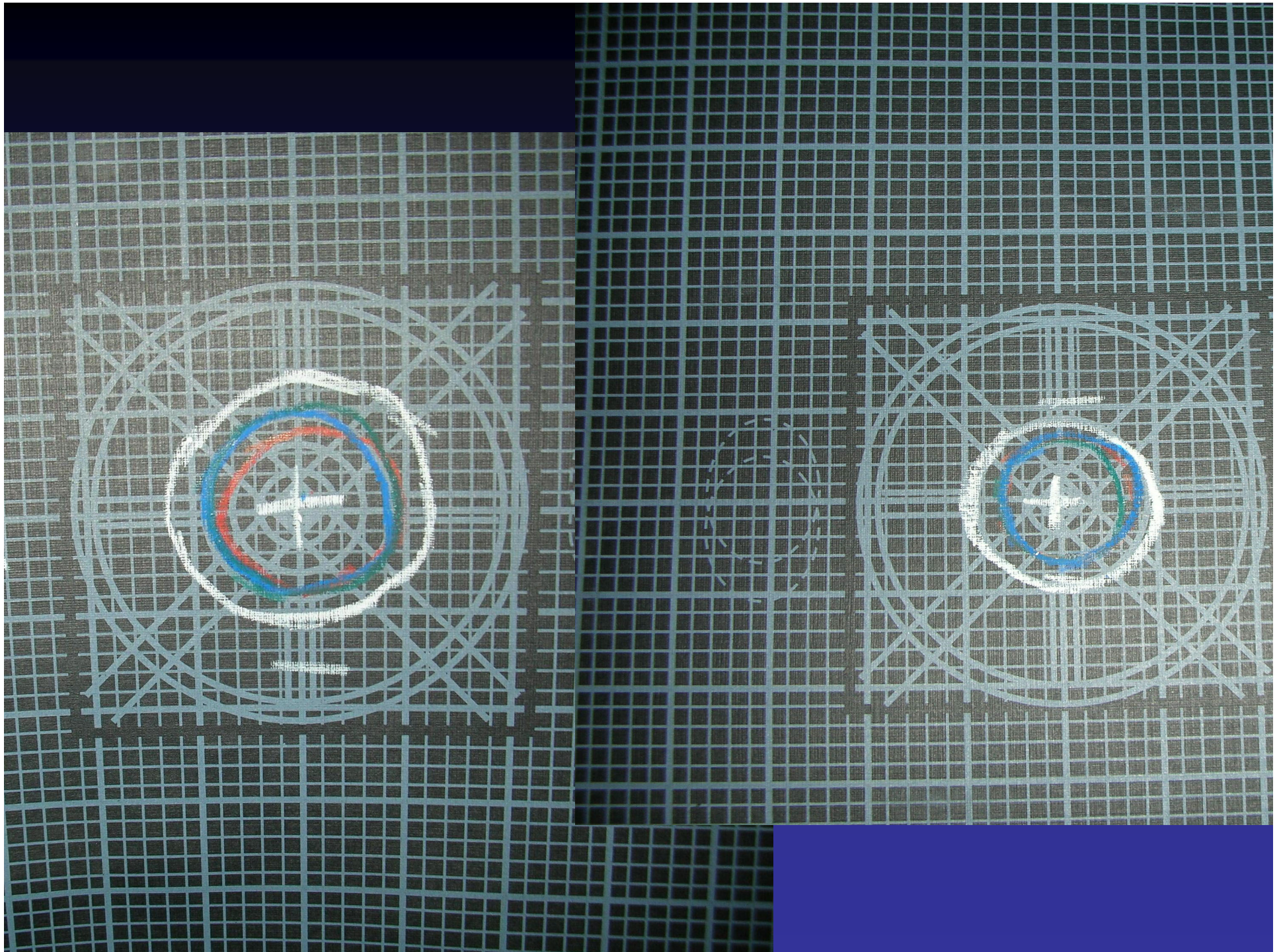




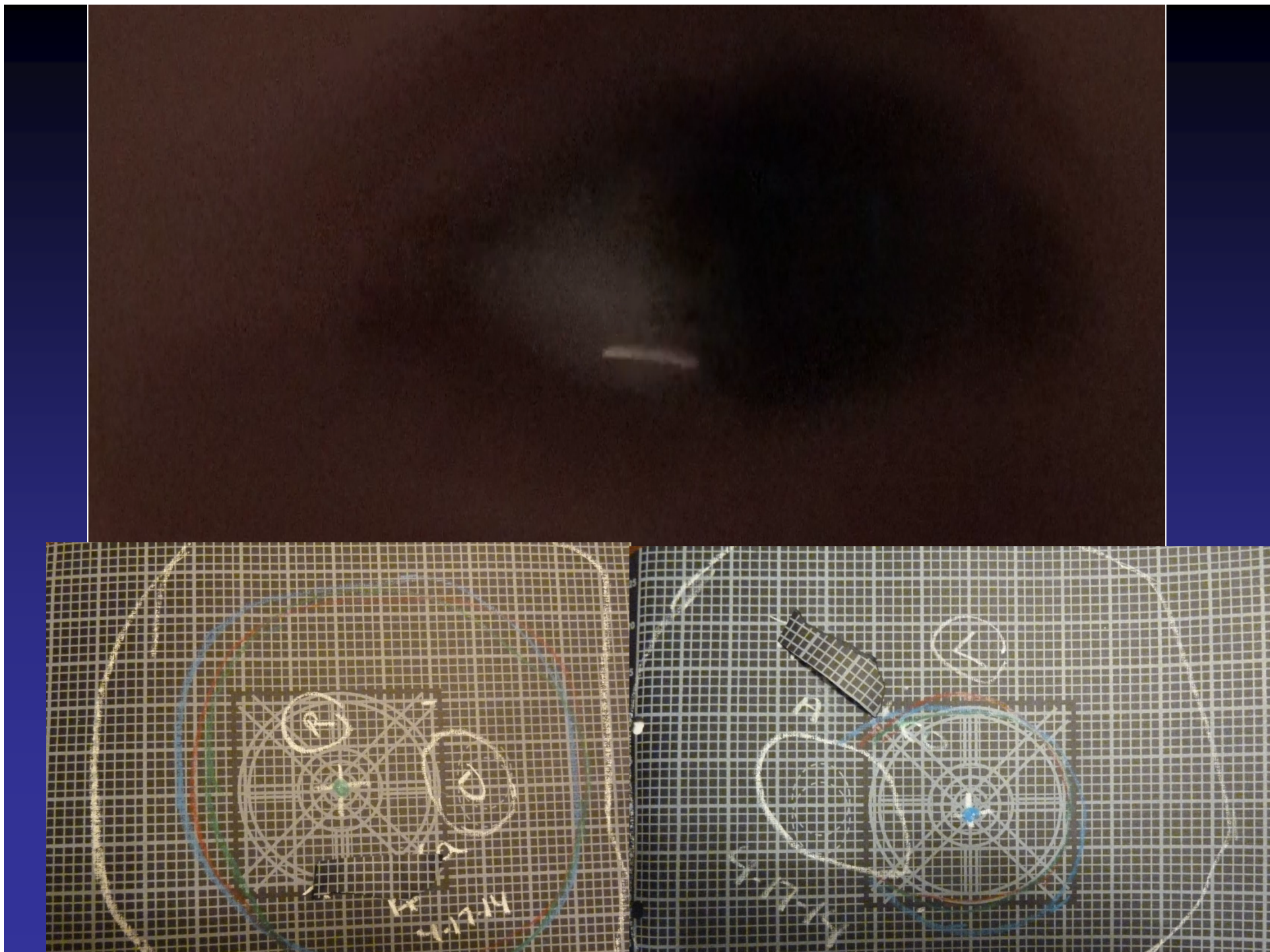












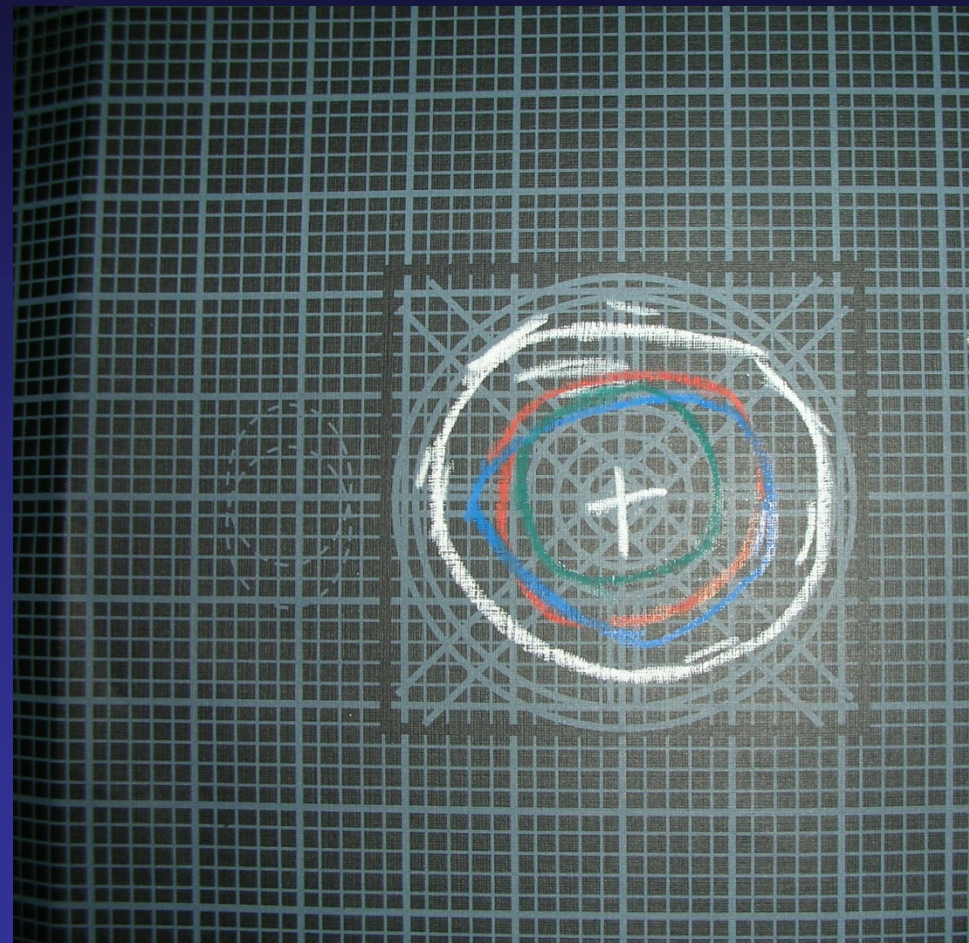
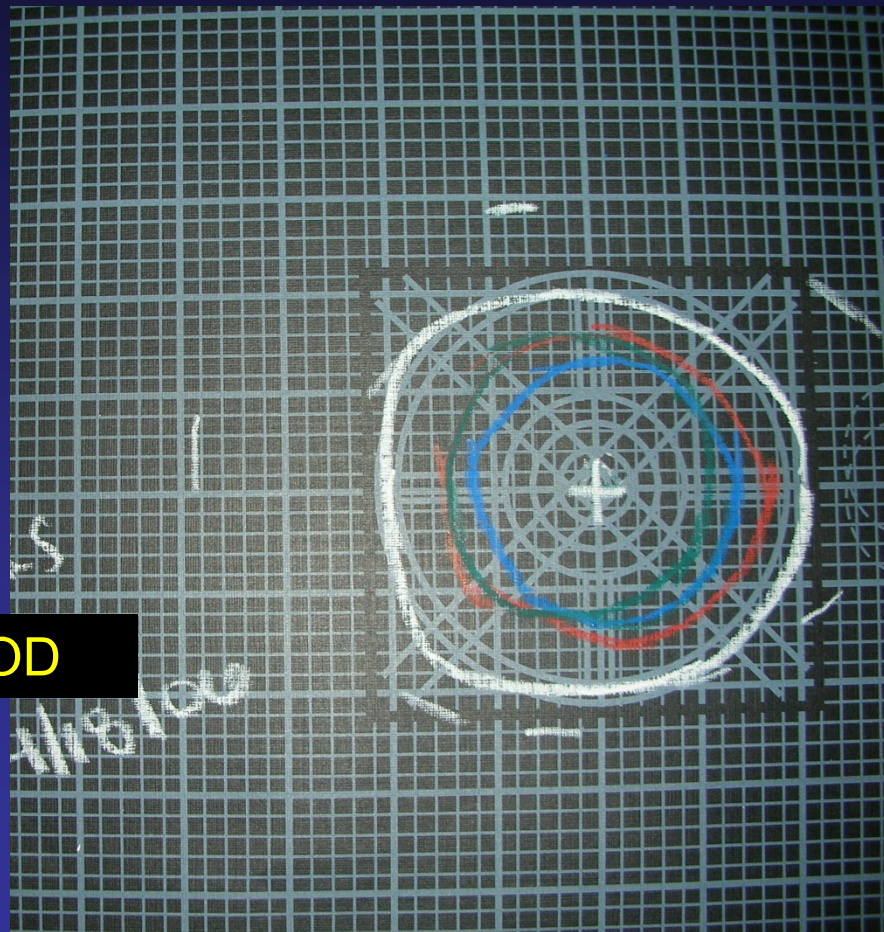




Pulaski AO Pupil



OD



Pulaski AO Pupil

**Thank you!**