Pupillary Pathway & Testing (cont.)

**Learning Objectives:**
1. Identify the structures of the **afferent** pupillary pathway
2. Identify the structures of the **efferent** pupillary pathway
3. Understand how to perform pupillary response tests (e.g., direct, consensual, accommodative and APD testing)

The **Afferent** Pupillary Pathway

- The body has **afferent** neurons (nerves) that carry ‘sensory’ messages to the brain (like images & light!)
- **Afferent** = “A Feeling” (message **to** the brain)
- The AFFERENT pupillary pathway is:
  - Retina
  - Optic Nerve (II CN)
  - Optic Chiasm
  - Optic Tract
     - At this point, the ‘light’ message branches off!
     - Pretectal Nucleus
     - Edinger Westphal Nucleus (part of III CN nucleus)

**NOTE**: The afferent "pupillary pathway" never makes it to the LGB, Optic Radiations, or Visual Cortex!

The **Efferent** Pupillary Pathway

- Once the “brain” receives the afferent (sensory) message & interprets it, it sends out an efferent (motor) message to adjust the pupil’s size

- Remember **AFFERENT** = “Exit the brain” (a motor message to the muscles or glands)

- The Efferent neurons (nerves) carry ‘motor’ messages to the nerves & glands to operate muscles or secrete chemicals to change things within the body
- The **Efferent** pupillary pathway is:
  - Edinger-Westphal (accessory III CN)
  - III Cranial Nerve (two axons; one extends to each eye)
  - Ciliary ganglion (one on each side of head)
  - Iris sphincter muscle (one in each eye)
- The ciliary ganglion axon extends to the iris sphincter muscle & innervates or relaxes it, as needed, to get the pupil at the ‘correct’ size
The **Efferent** Pupillary Pathway (cont.)

Did you notice that the "**EFFERENT**" pathway *does not use any* of the "**AFFERENT**" pathway structures!

- With that in mind, could a totally **BLIND** **EYE** show any pupillary constriction?

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**How to properly assess the pupils (PERRLA & APD)**

- When you test pupils, you are testing the **Afferent** and **Efferent** pathways.

- When you shine a *bright light* into the eyes...
  - An **AFFERENT** message gets carried to the brain (the Edinger Westphal Nucleus – an ‘accessory’ part of the III CN nucleus) for processing.
  - The brain “sees” that the light is very bright and sends an **EFFERENT** message to the iris sphincter muscles (the *constrictor* muscles) to pull the pupils smaller.

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**How to properly assess the pupils (PERRLA & APD) (cont.)**

- **P E R**
  - Pupils **Equal & Round**
    - Pt looks @ 20/400 letter – you look at his/her pupils (NO LIGHT USED YET!) The darker the room, the better 😊

- **R L**
  - Reacts to **Light** (…now you use the light!)
    - Check **DIRECT** reaction
    - Check **CONSENSUAL** reaction
    - (Pt still looking at 20/400 letter!)

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**How to properly assess the pupils (PERRLA & APD) (cont.)**

- **A** = Accomodation! People tend to skip or forget this one. Not a good idea...
  - Start with pt looking at the 20/400 letter
  - Hold a pen or your finger about six inches (6") in front of the patient’s eyes.
  - Have pt look at the near object: **did the pupils **CONSTRIC**T?**
    - If **YES**, that is great. That is what you want to see.
    - If **NO**, that is a problem. Repeat a couple of times to be sure, but if no reaction or if it is a very slow or poor reaction, **LET THE DOCTOR KNOW**
How to properly assess the pupils (PERRLA & APD) (cont.)

- **APD** or **MG** testing (also called the “swinging flashlight test”)
  - Pt looks at the 20/400 letter
  - Shine the light directly into the OD; wait a second, then...
  - Move quickly to the OS
    - Was it the **same size** (constricted?) = **GOOD**!
    - Did it **constrict first**, then grow slightly = **GOOD**
    - Did it **DILATE** as if the light was not there = **BAD**!
  - Now move quickly back to the OD to assess it
Documenting Pupil Testing Results

• This is your patient & everything checks out fine. How would you record it?

Documenting Pupil Testing Results (cont.)

• This is your patient & everything checks out fine. How would you record it?

Documenting Pupil Testing Results (cont.)

• Another way to document pupil testing is by showing pupil sizes in \textit{dim} light, \textit{bright} light, and \textit{rapidity of response} to light, like this example:

<table>
<thead>
<tr>
<th>OD</th>
<th>SCOTOPIC (Dim Light)</th>
<th>7</th>
<th>4+</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>PHOTOPIC (Bright Light)</td>
<td>3</td>
<td>3+</td>
</tr>
<tr>
<td>Size</td>
<td>Reaction Speed: 1 = SLOW &amp; 4 = FAST</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Documenting Pupil Testing Results (cont.)

• Record the way your doctor(s) want it done! You work for them.

• If you see something wrong during your pupil testing, \textit{DO NOT DILATE THE PT!!!}  
  - \textit{Get the doctor} so he/she can assess & make the diagnosis.
  - Once you dilate, that is it. No assessment can be made. That is \textit{NOT} the time to tell the doctor, \textit{“Maybe the right pupil was off a little.”}

Documenting Pupil Testing Results (cont.)

• Pupil testing irregularities can indicate:
  - \textit{Hodgkin’s disease}. \textit{Lung tumor}, trauma to the neck or migraines (\textit{Horner’s Syndrome})
    - \textit{Pleos}, \textit{miosis}, \textit{anhidrosis} (skin dryness); \textit{on one side}
    - Tested \textit{w/cocaine} eye drops; if smaller pupil fails to dilate, \textit{Horner’s is confirmed}
  - \textit{Optic neuritis} or \textit{retrobulbar neuritis} (both signs of \textit{M.S.} (multiple sclerosis)) = + \textit{Afferent Pupillary Defect}
    - Only shows during the “swinging flashlight test”; but usually pupils are unequal & \textit{Visual Acuity (VA)} is poor in one eye
  - \textit{Syphilis} (\textit{Argyll Robertson} pupils)
    - \textit{Miotic}, poor (or no) reaction to light, but \textit{good} accommodative response; \textit{both pupils affected}
  - \textit{Viral infection} (\textit{Adie’s Tonic} Pupil)
    - Unequal pupils, poor light response (slow to constrict & slow to dilate), but decent accommodative response

Pupillary Pathway & Testing

• As you can see, with your \textit{naked eye} & a simple \textit{penlight}, YOU might be able to detect a life threatening disease!

• Do NOT \textit{‘pencil-whip’} your pupil \textit{testing}: your full attention & time are required to get it right!

• If you see \textit{ANYTHING} that doesn’t seem right, \textit{GET THE DOCTOR}.
  - You \textit{DO} have to \textit{‘diagnose’} what the problem is!
  - You \textit{DO} have to be able to tell if there \textit{IS} a problem!