



Hippus

Pupillary Athetosis

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What is Hippus?

Rhythmic constriction and dilation of the pupil.

- Can be easily observed when light is shined on eyes
 - Hippus is *however* independent of light
- Often likened to a person dancing or a horse galloping
 - Rhythmic
- Physiological or Pathological:
 - Physiological but can be both
- EXAMPLE: <https://www.youtube.com/watch?v=Yiaj8QoYjlc>



Hippus Mechanism Overview

Constriction pathway

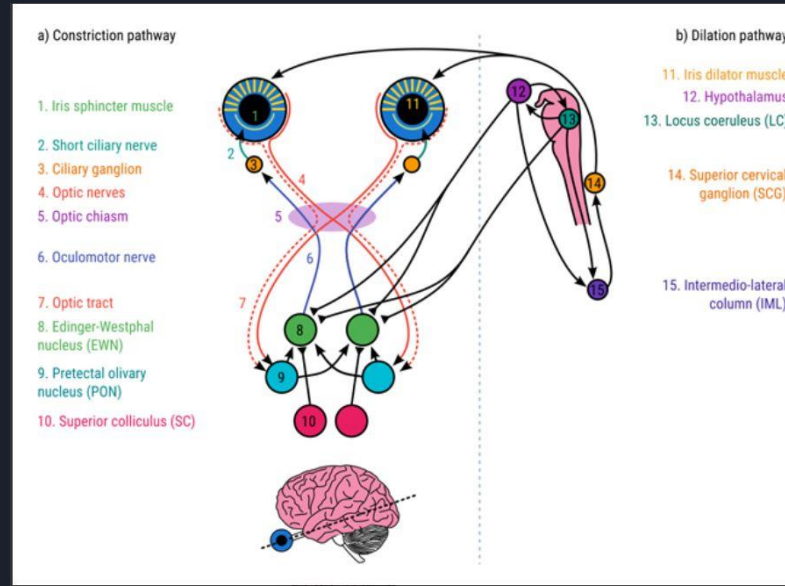
- Subcortical
- Connects retina to the iris sphincter muscle
- Iris sphincter muscle is innervated by the parasympathetic nervous system

Dilation pathway:

- Subcortical
- Connects locus coeruleus and hypothalamus to the iris dilator muscle
- Iris dilator muscle is innervated by the sympathetic nervous system

Constriction Pathway

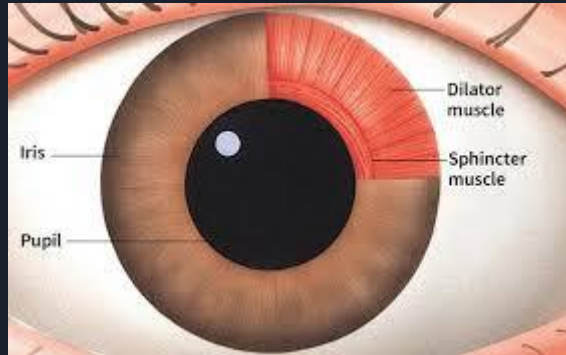
Light → Nerve Impulses from optic nerve → optic chiasm → Pretectal Nucleus → Edinger- Westphal Nucleus → Oculomotor Nerve (III) → Ciliary Ganglion → Iris Sphincter Muscle → Constriction



Dilation Pathway

Locus Coeruleus + Hypothalamus → intermedio-lateral column of spinal cord → Superior Cervical Ganglion → Iris Dilator Muscle

- Less understood than Constriction Pathway
 - Involves brain areas (LC + Hypothalamus) that are active in cognition





Sympathetic vs Parasympathetic Nervous System

The Parasympathetic Nervous System	The Sympathetic Nervous System
Control the body's response while at rest.	Control the body's response during perceived threat.
Spinal cord, medulla	Spinal cord, thoracic and lumbar spinal cord
Rest and digest	Fight-or-flight
Longer pathways, slower system	Very short neurons, faster system
Counterbalance; restores body to state of calm.	Body speeds up, tenses up, becomes more alert. Functions not critical to survival shut down.
Decreases heart rate	Increases contraction, heart rate
Bronchial tubes constrict	Bronchial tubes dilate
Muscles relax	Muscles contract
Constrict	Dilate
Increases stomach movement and secretions	Decreases stomach movement and secretions
Saliva production increases	Saliva production decreases
No involvement	Releases adrenaline
No involvement	Increases; converts glycogen to glucose for muscle energy
Increase in urinary output	Decrease in urinary output



Interaction between Constriction and Dilation Pathway

Exclusivity:

- Locus Coeruleus during aroused state inhibits constriction by inhibiting the Edinger-Westphal Nucleus

Pupil Light Response

- Light first activates the constriction pathway
- Also induces wakefulness in the suprachiasmatic nucleus, which then activates the dilation pathway



Pathologic Hiccup

Retrospective Study of 117 patients with Pathologic Hiccup and 486 patients without Pathologic Hiccup (Control)

- Outcome: Patients with Pathologic Hiccup were found to be more likely to die within 30 days of observation (i.e. Early Mortality)
- Pathologic Hiccup group had high incidence of altered mental state and cirrhosis
- Conclusion: Pathologic Hiccup is an predictor of early mortality

Pathologic Hippius (Continued)

Abnormal manifestation of Hippius

- Rapid oscillations between constriction and dilation
- Slowed oscillations between constriction and dilation
- Amplitude

Typically a symptom of another illness

- Altered mental state
 - Rapid oscillations in some epileptic seizures
- Myasthenia Gravis
 - Slowed oscillations
- Multiple Sclerosis
 - Decreased wakefulness → slowed oscillations
- Cirrhosis
- Aconite Poisoning

