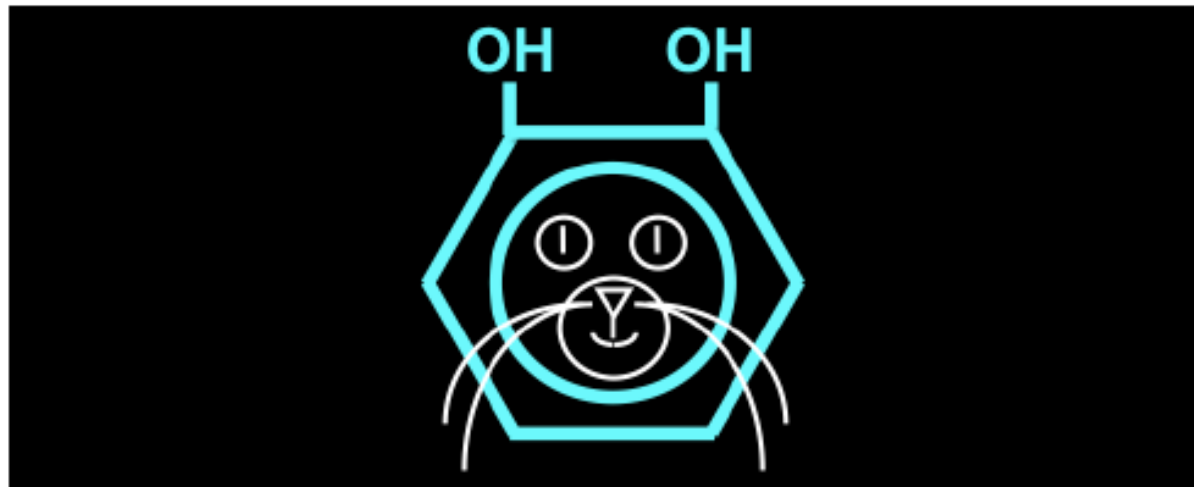
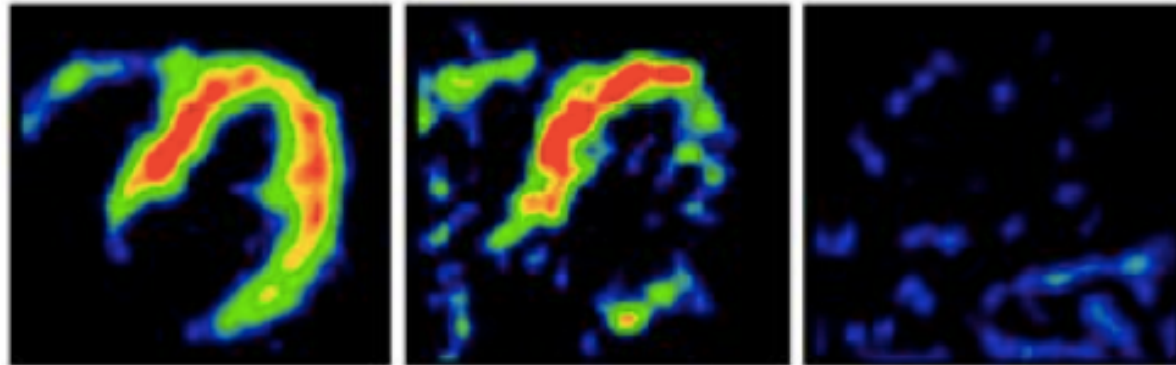
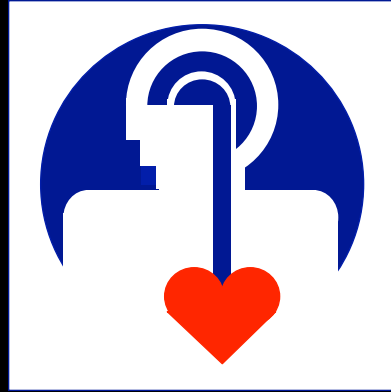


# Principles of Autonomic Medicine



David S. Goldstein, MD PhD



## **Overview of Autonomic Failure**

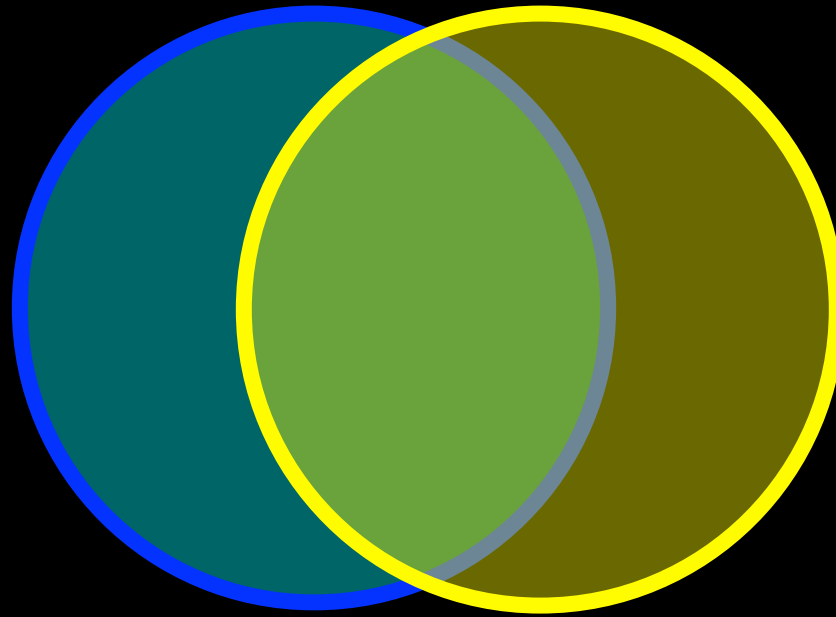
David S. Goldstein, MD, PhD

*Clinical Neurocardiology Section  
National Institute of Neurological Disorders and Stroke  
National Institutes of Health  
Bethesda, MD*





Dysautonomias

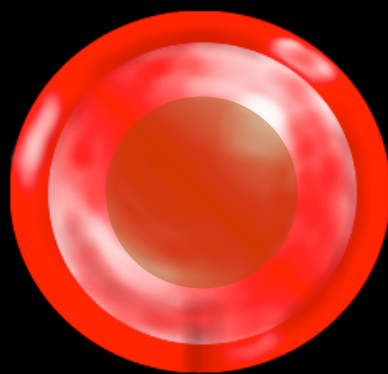


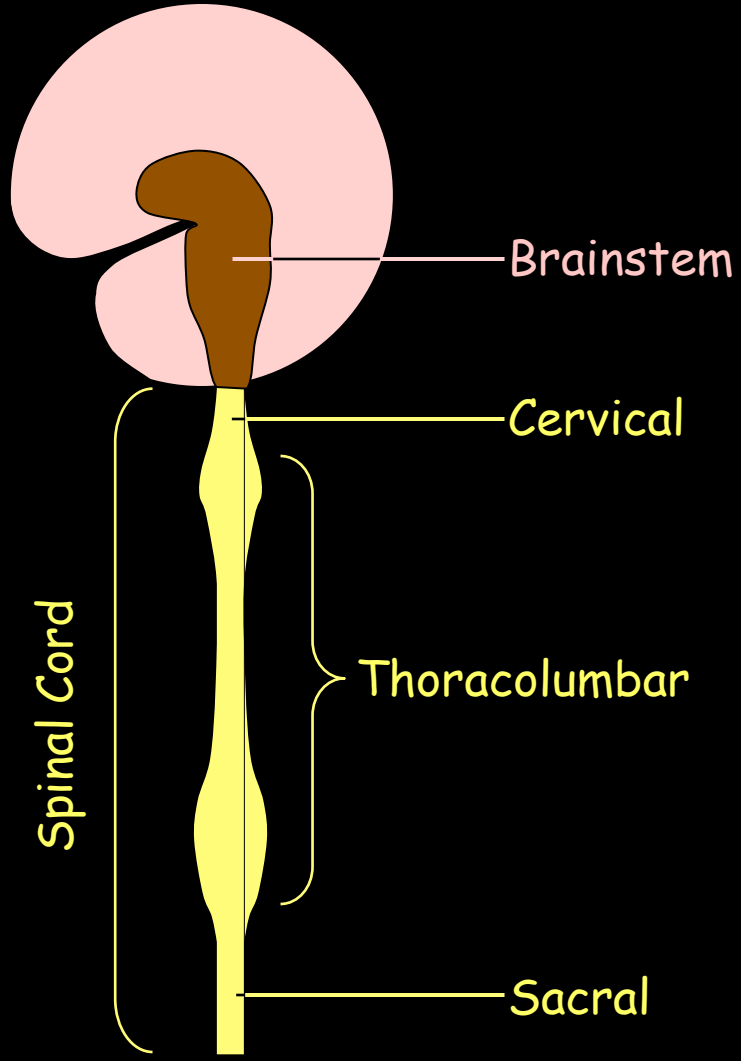
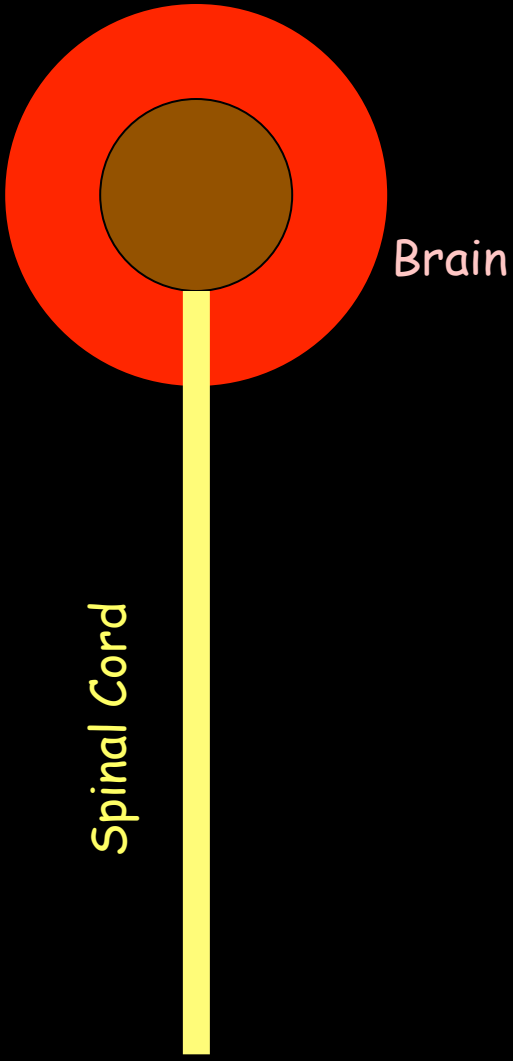
Catecholamines

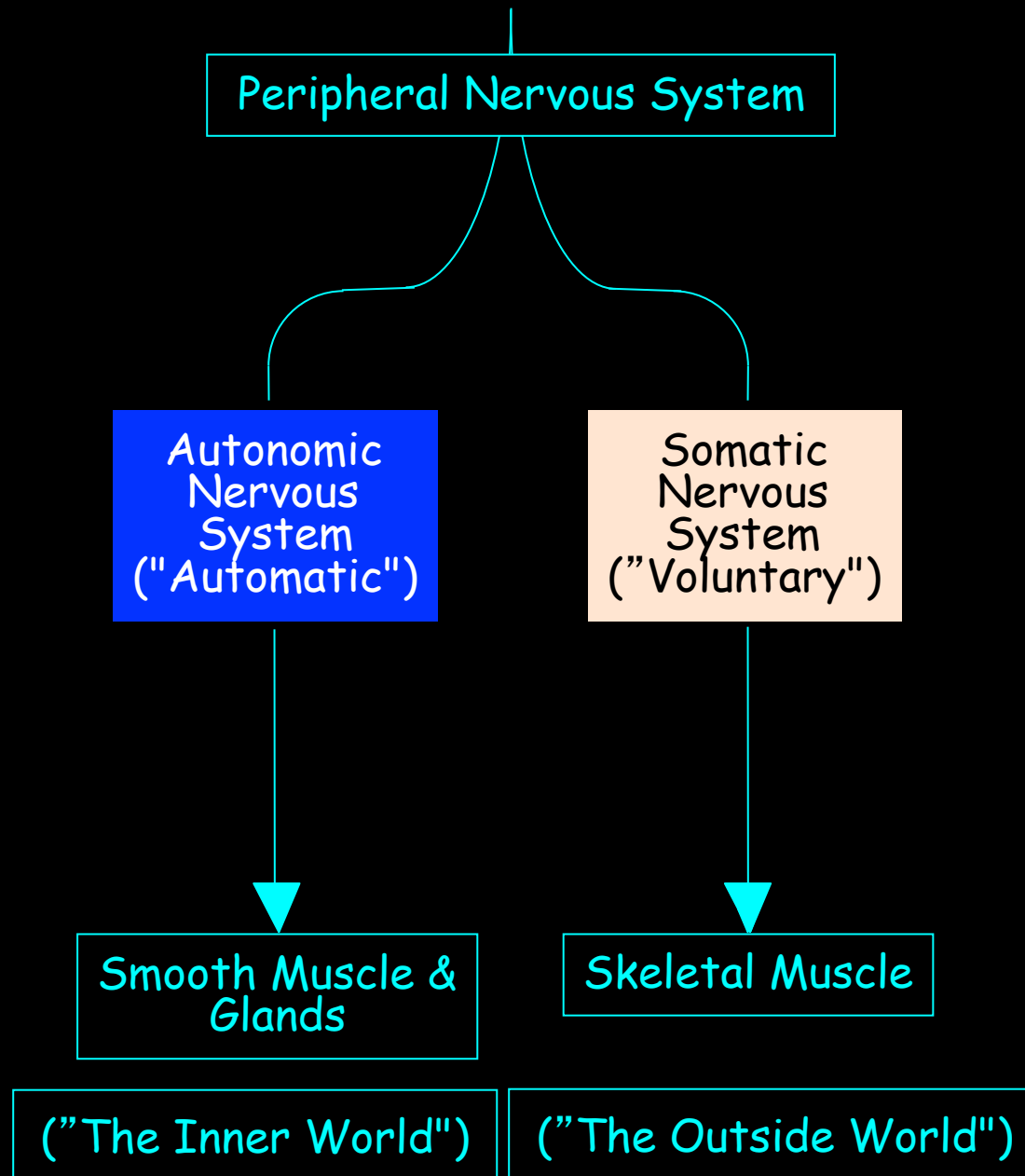
Diss-auto-NO-mias

Cat-a-COAL-a-means



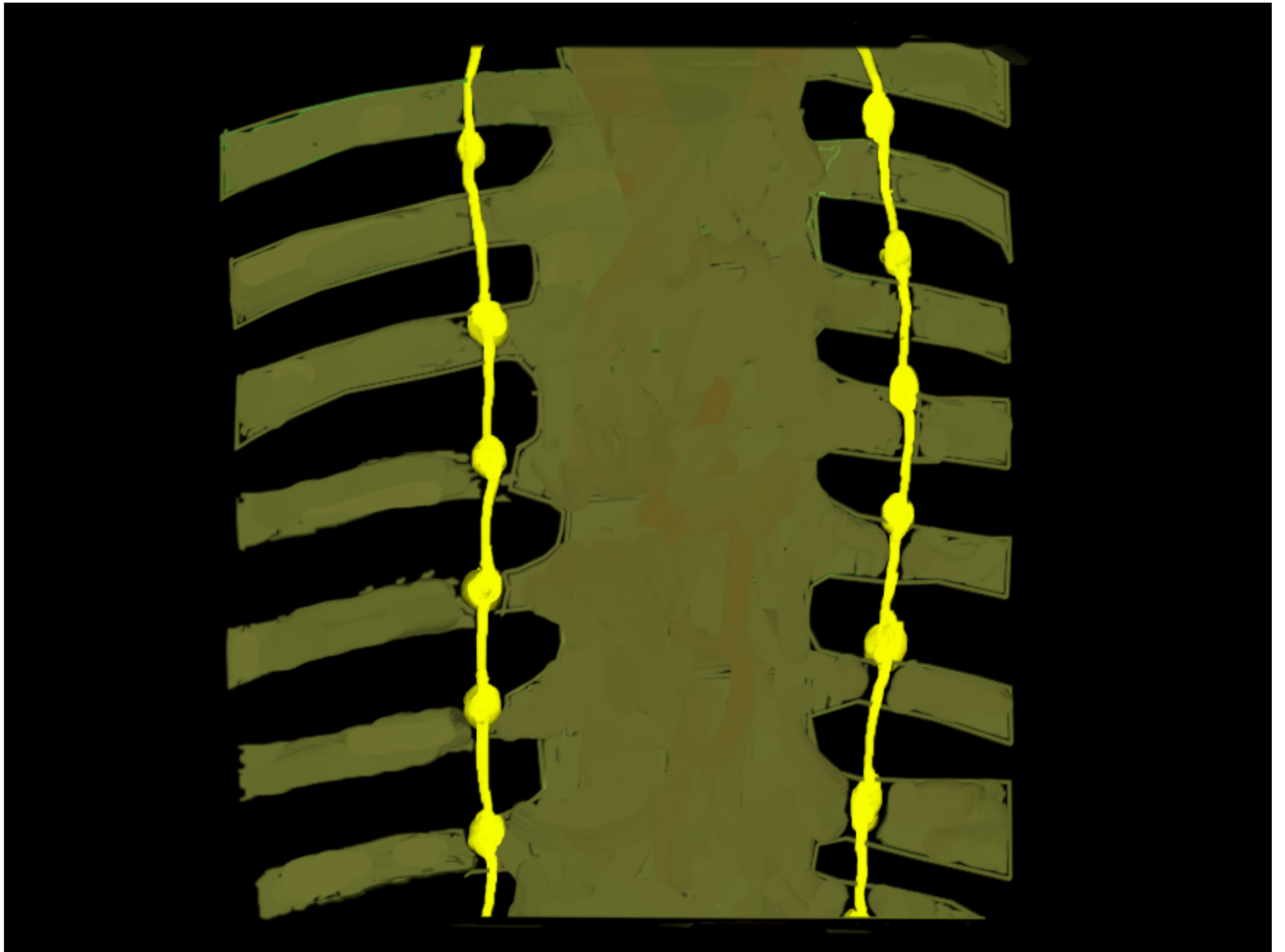


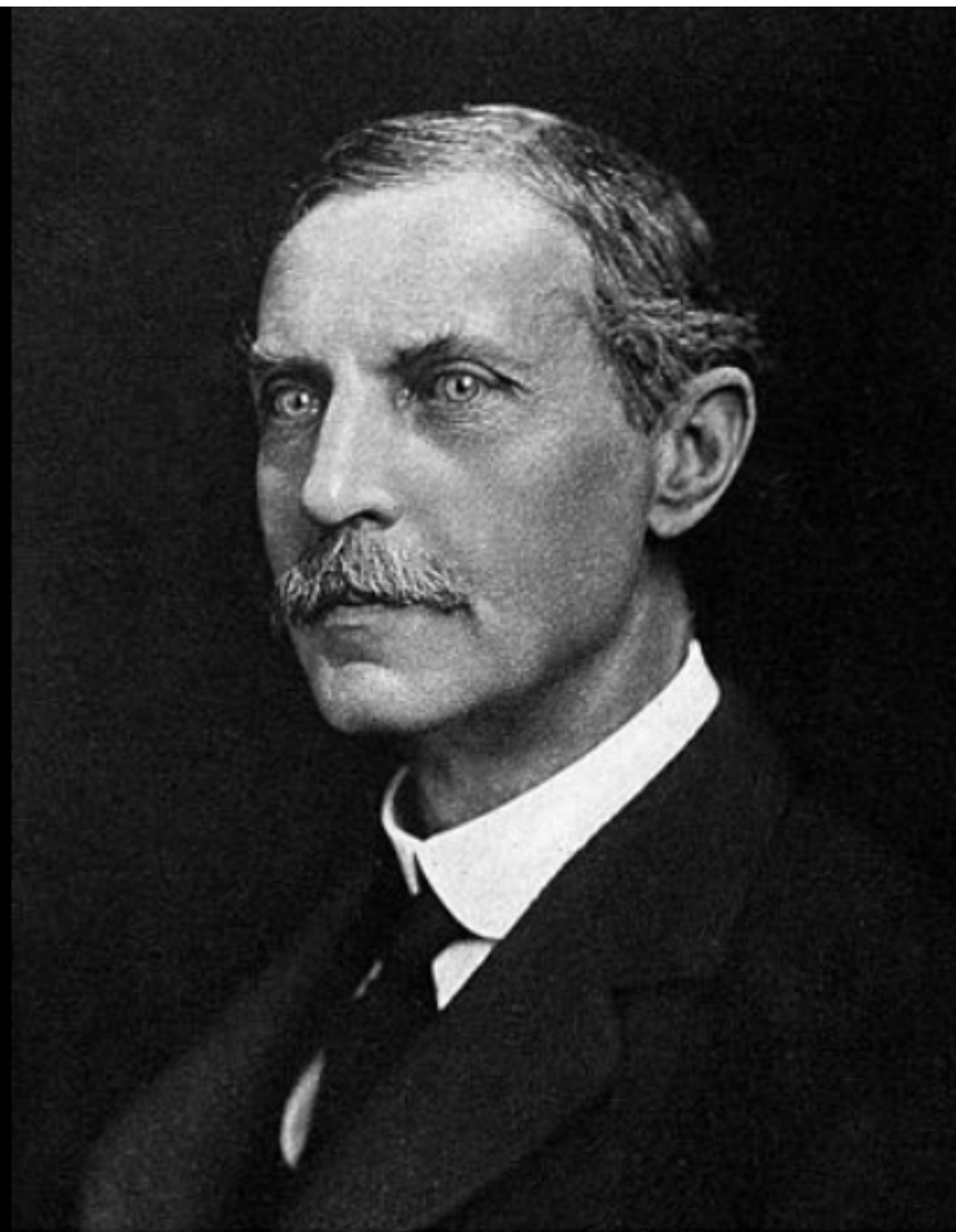












*J. N. Langley*



ANS

Langley

Cannon

Dale

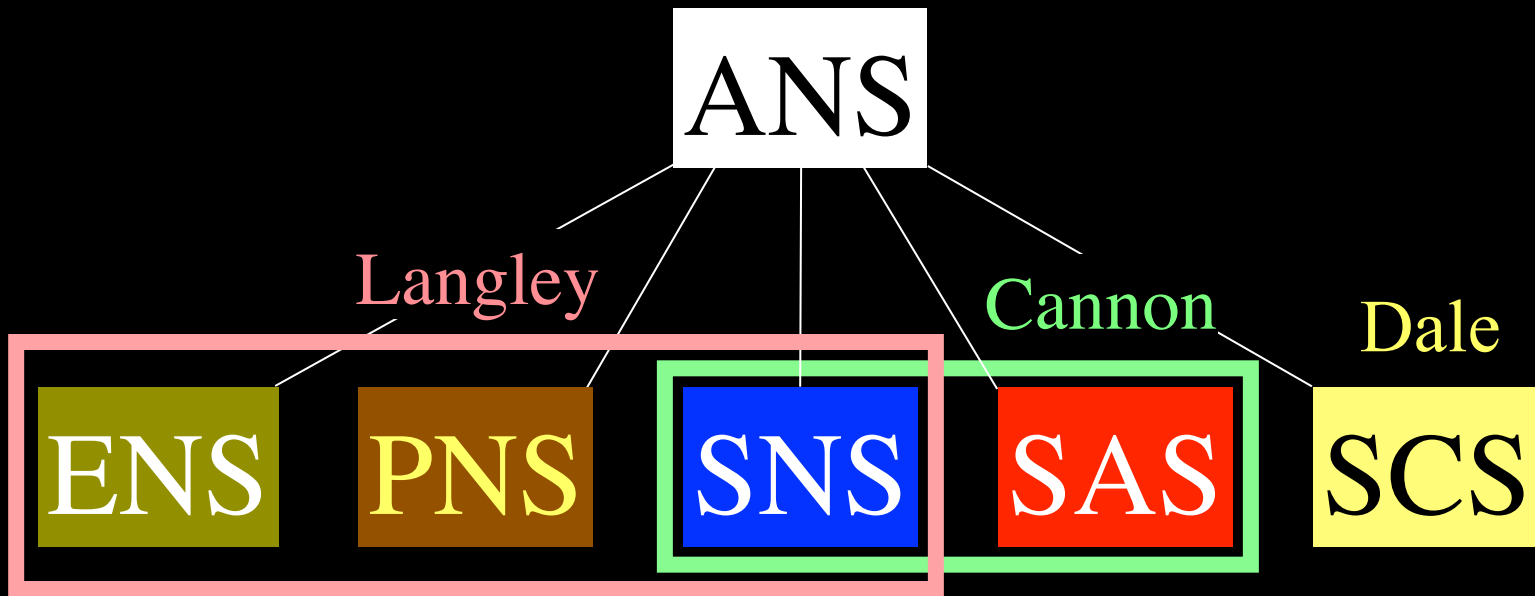
ENS

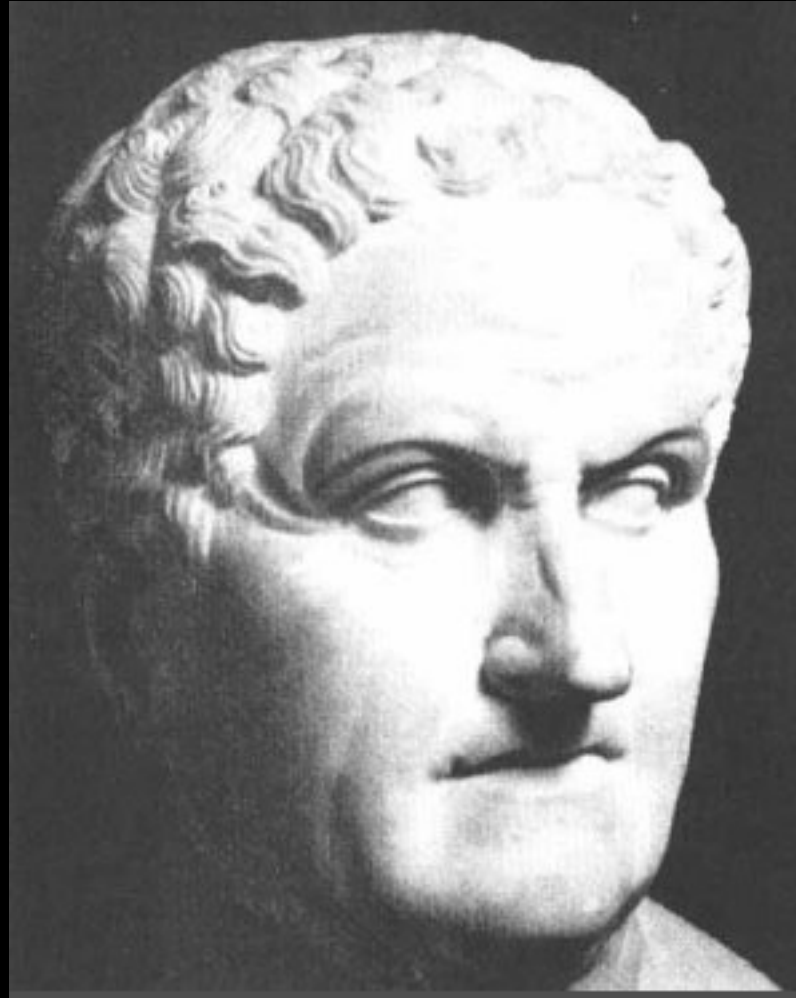
PNS

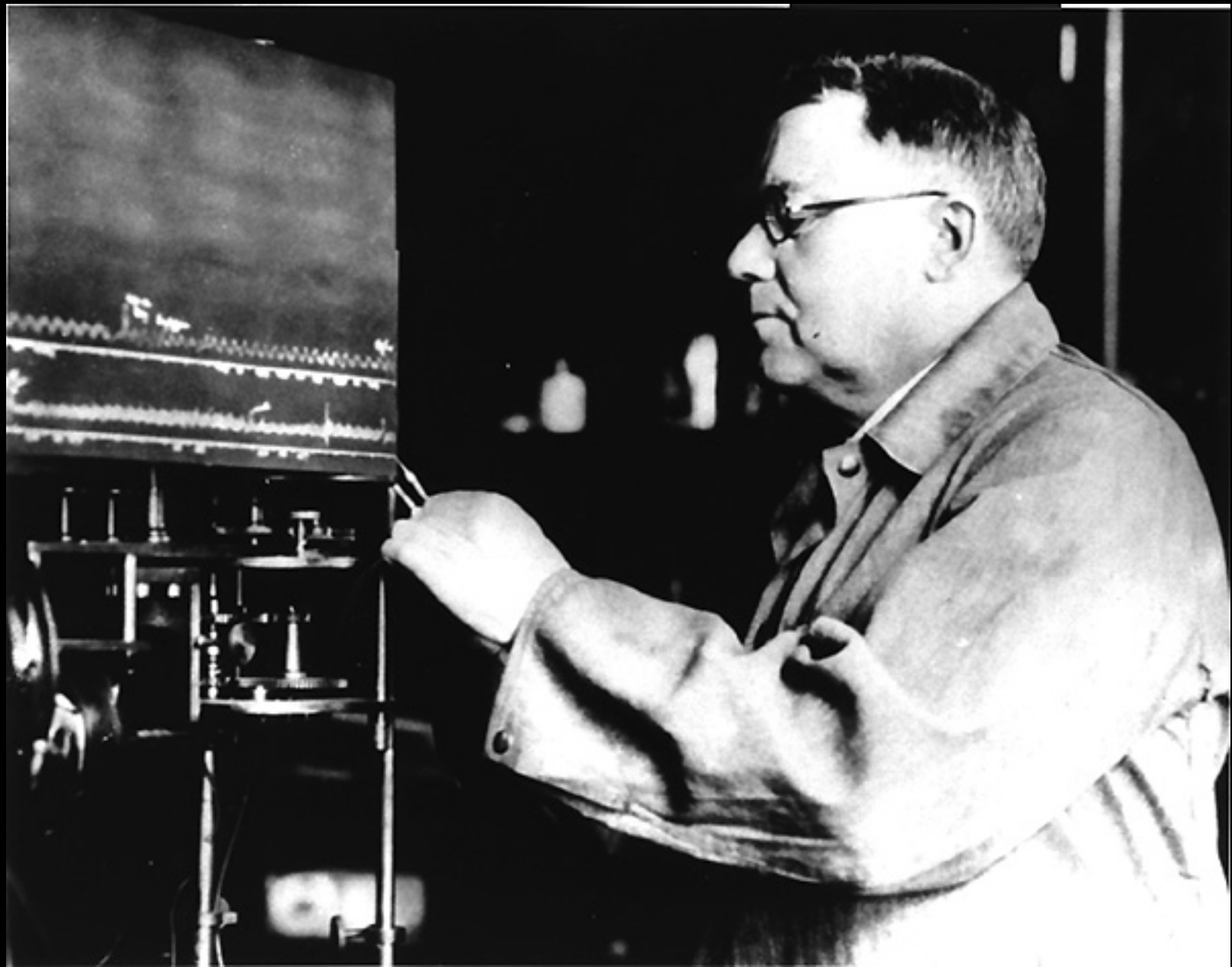
SNS

SAS

SCS









ANS

Langley

Cannon

Dale

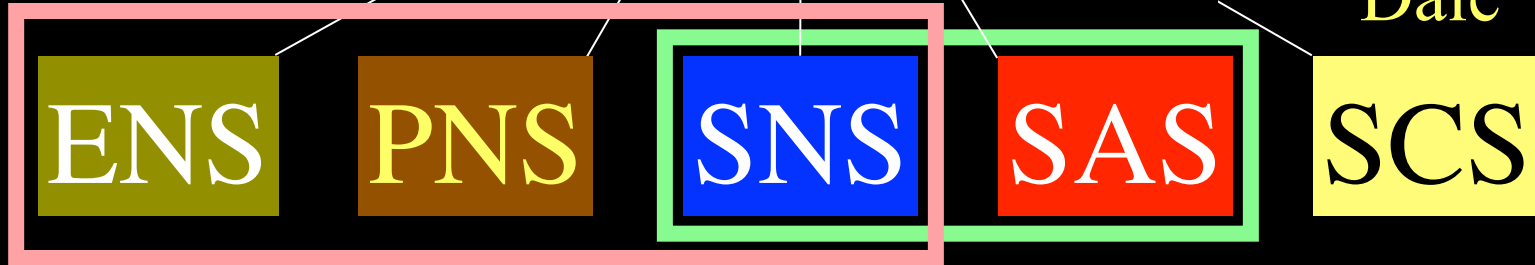
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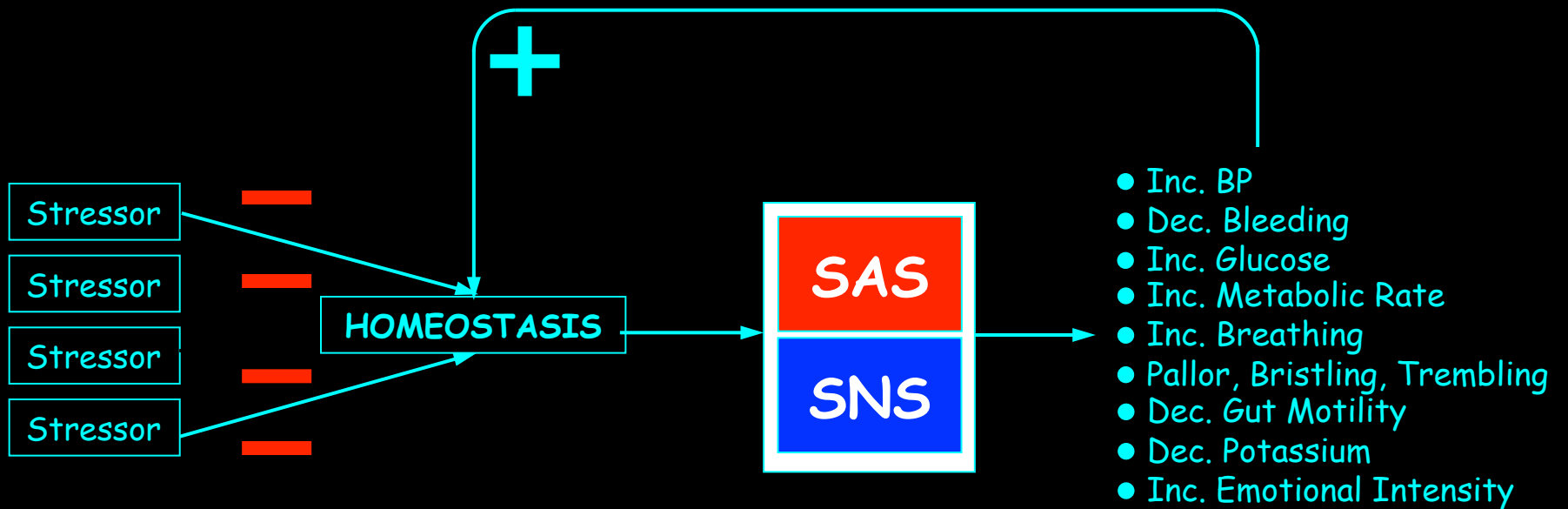
PNS

SNS

SAS

SCS





ANS

Langley

Cannon

Dale

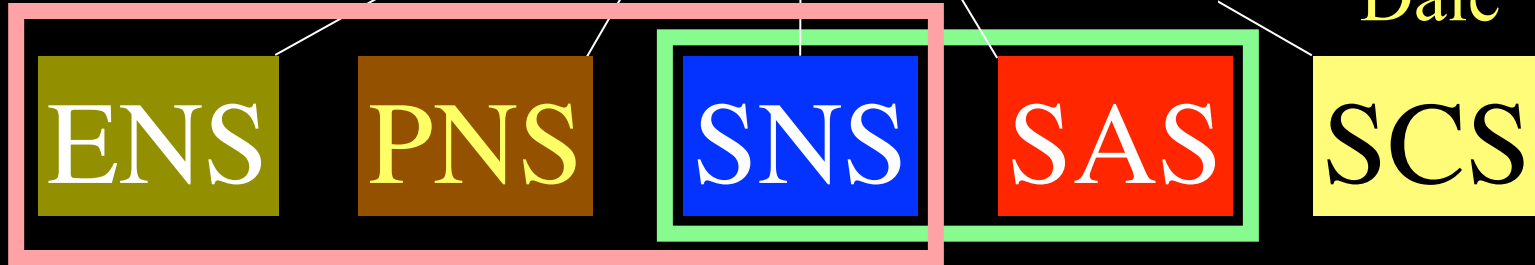
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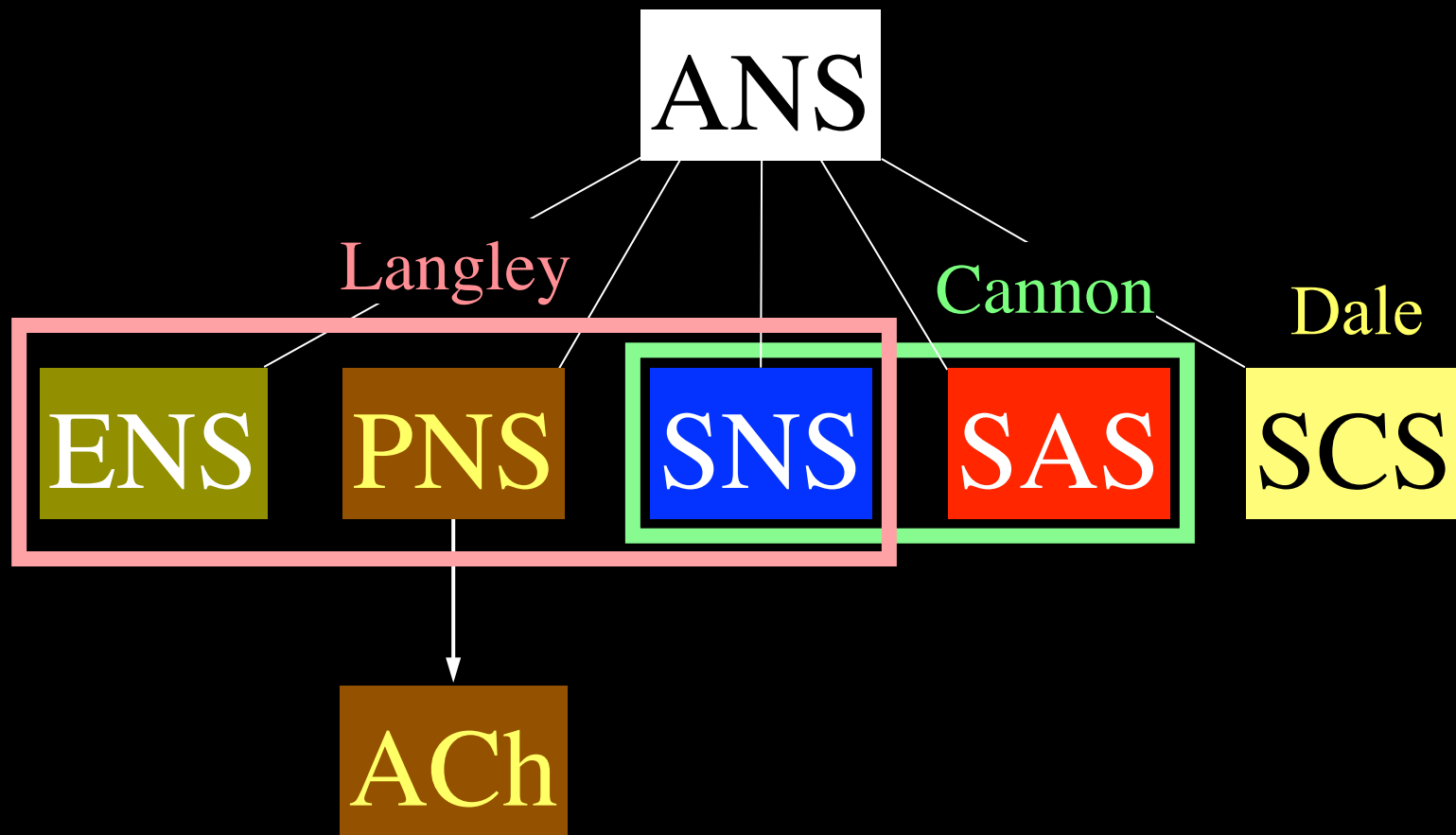
PNS

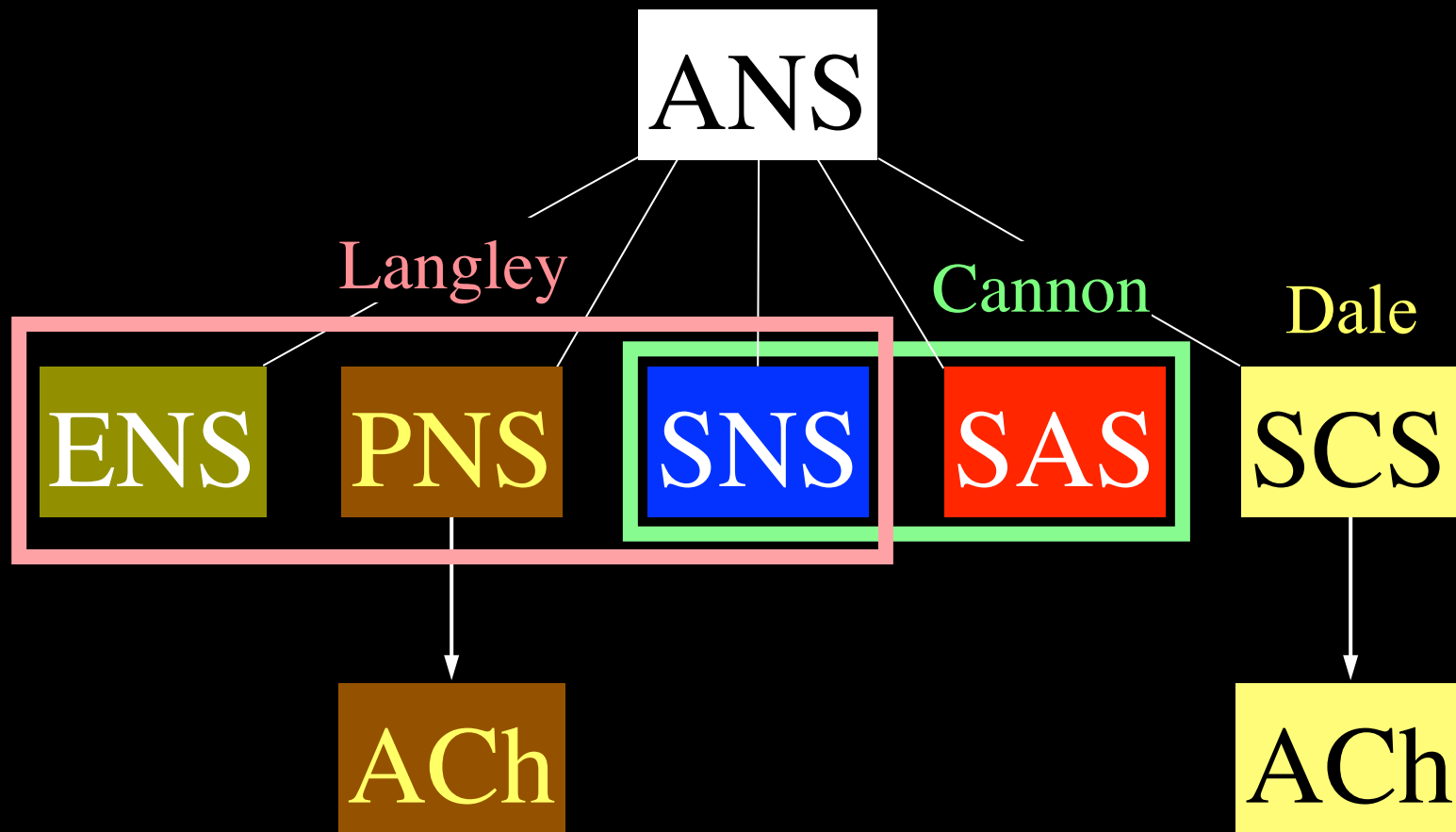
SNS

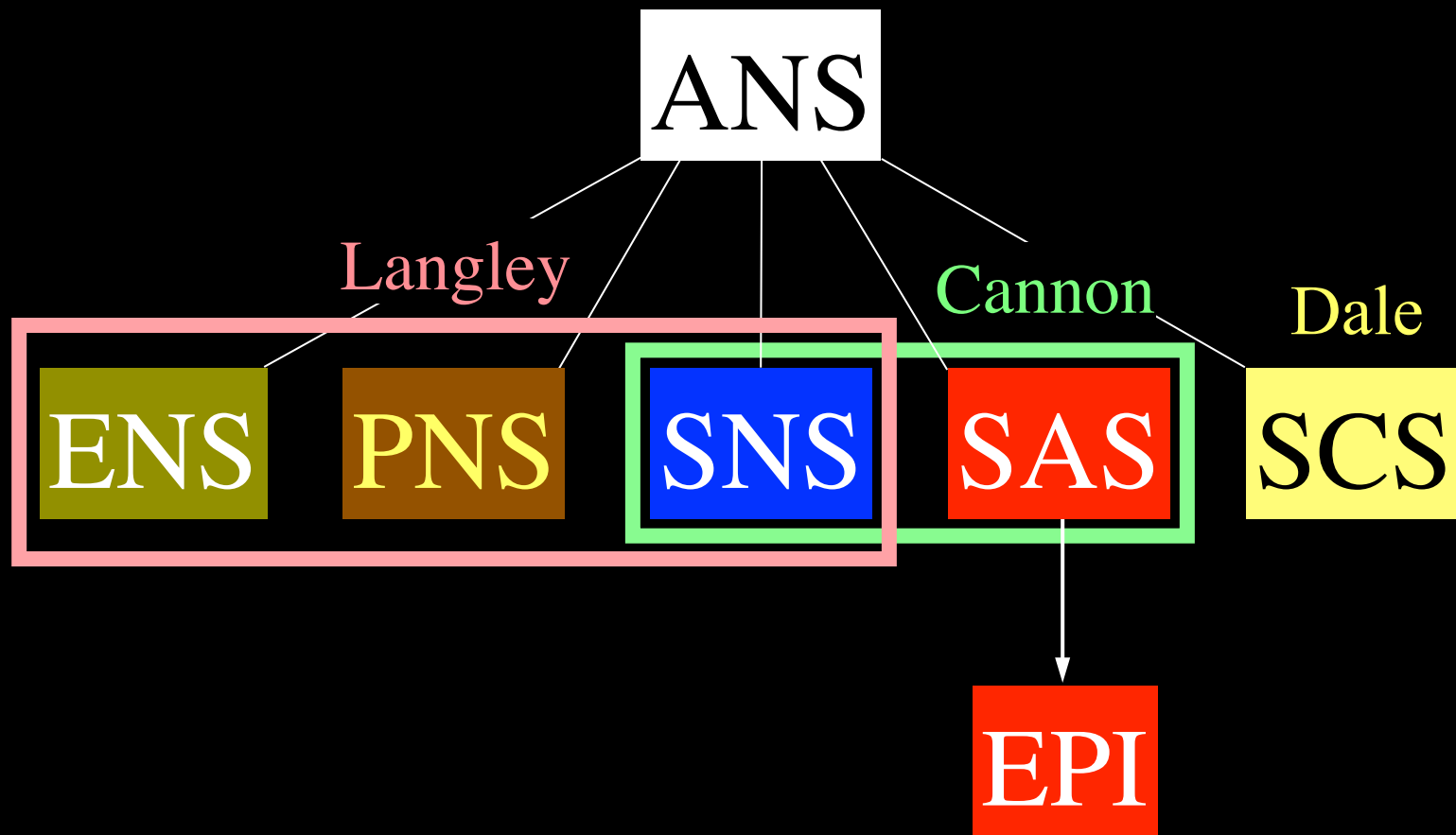
SAS

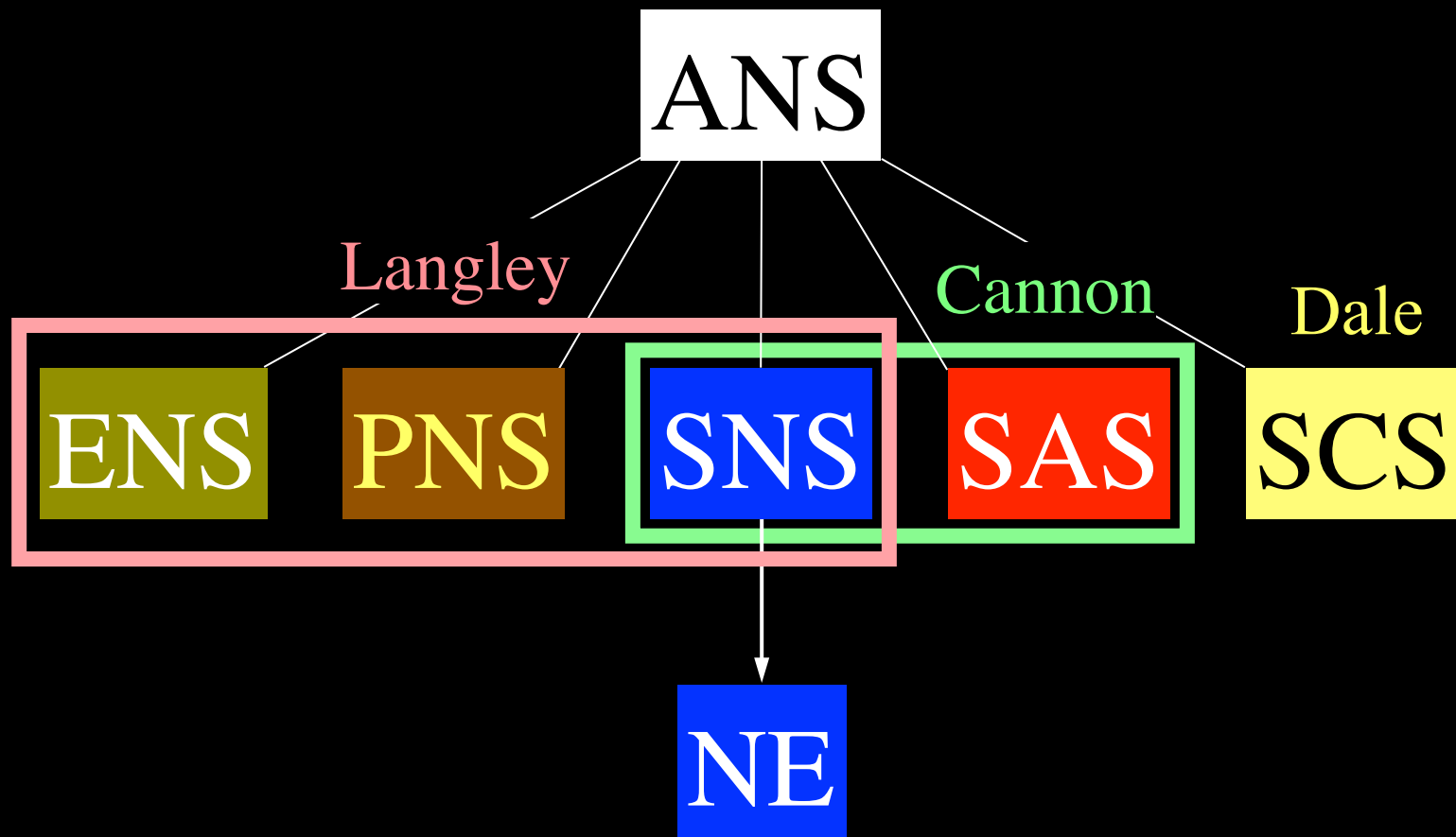
SCS



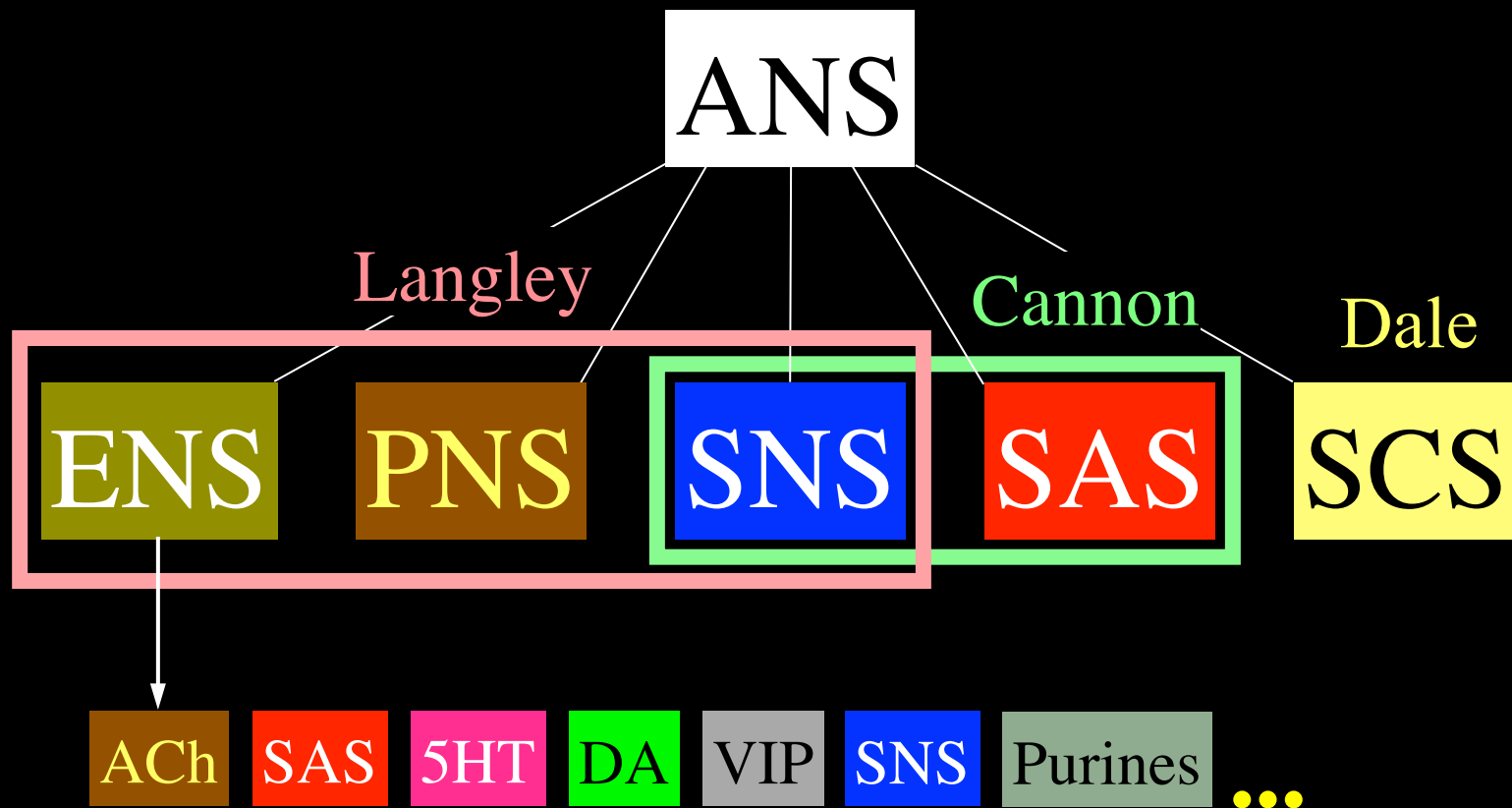




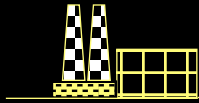




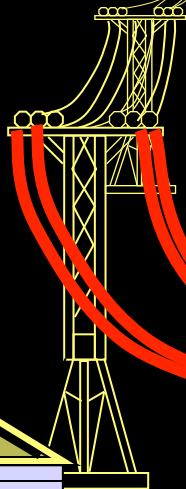
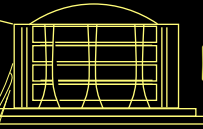




Generator Plant

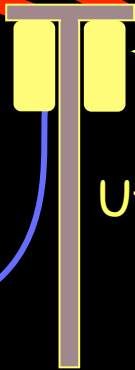
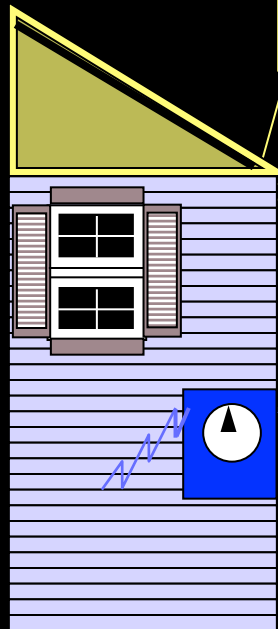


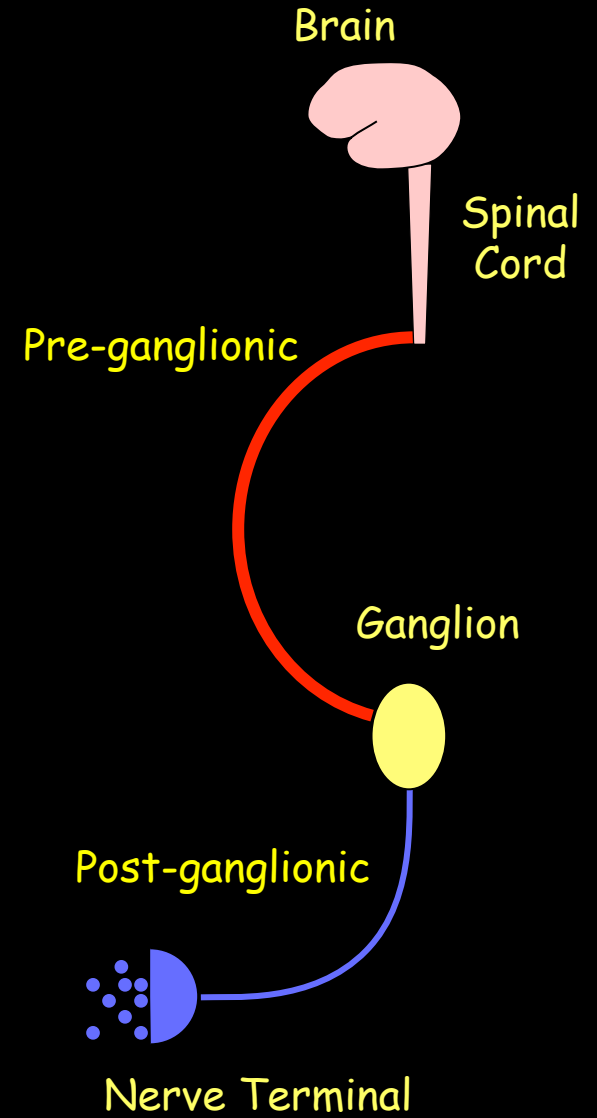
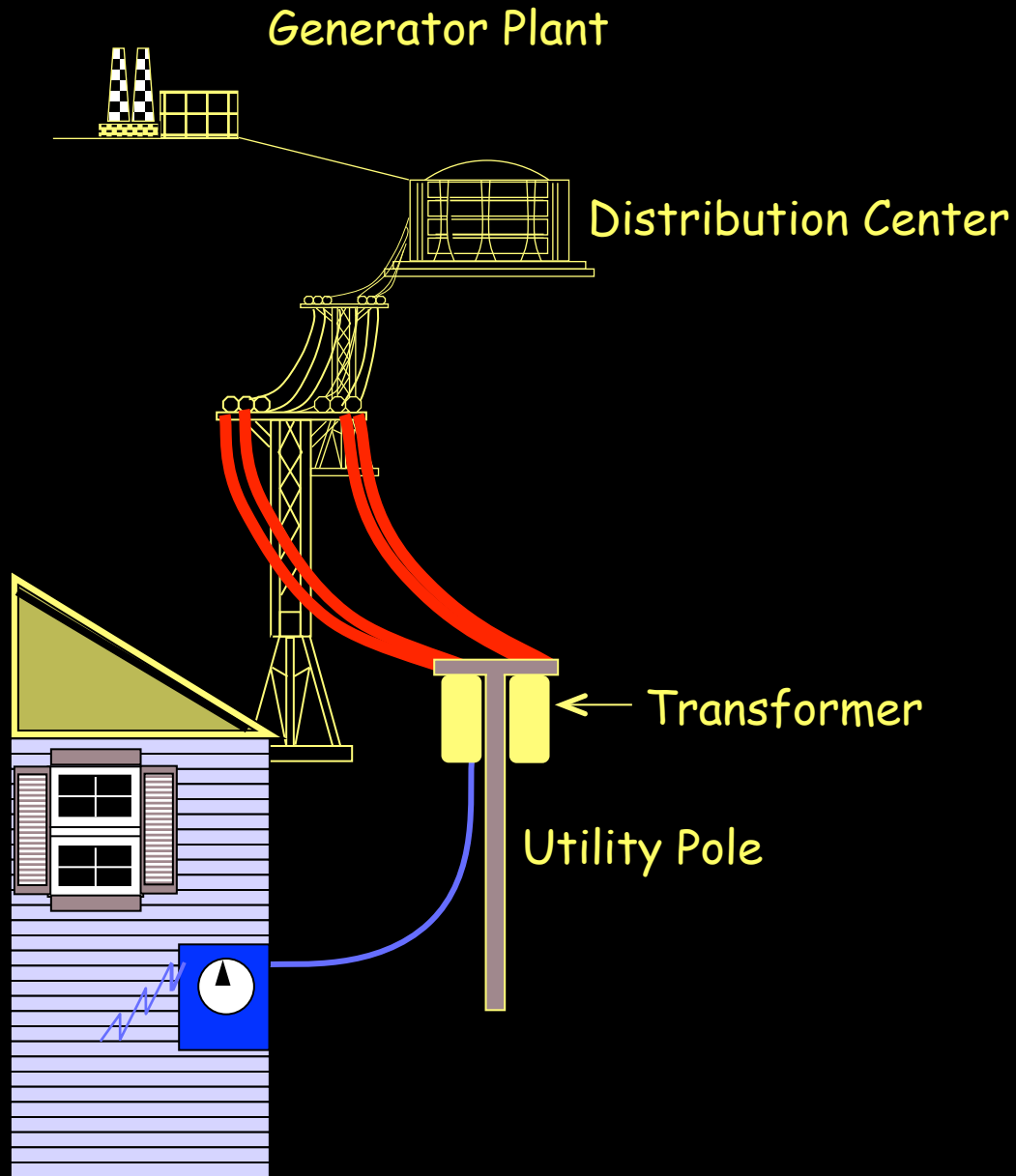
Distribution Center



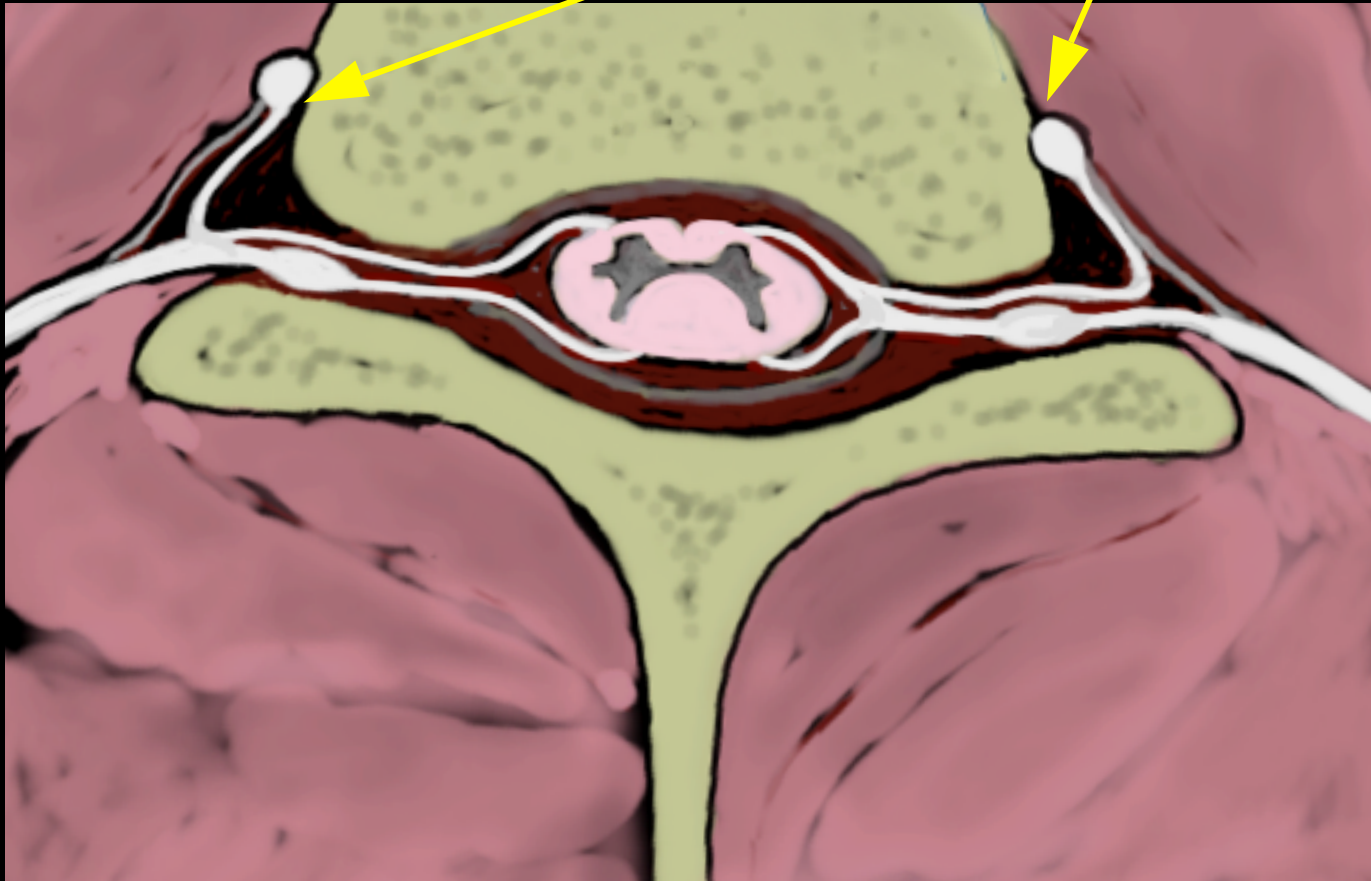
Transformer

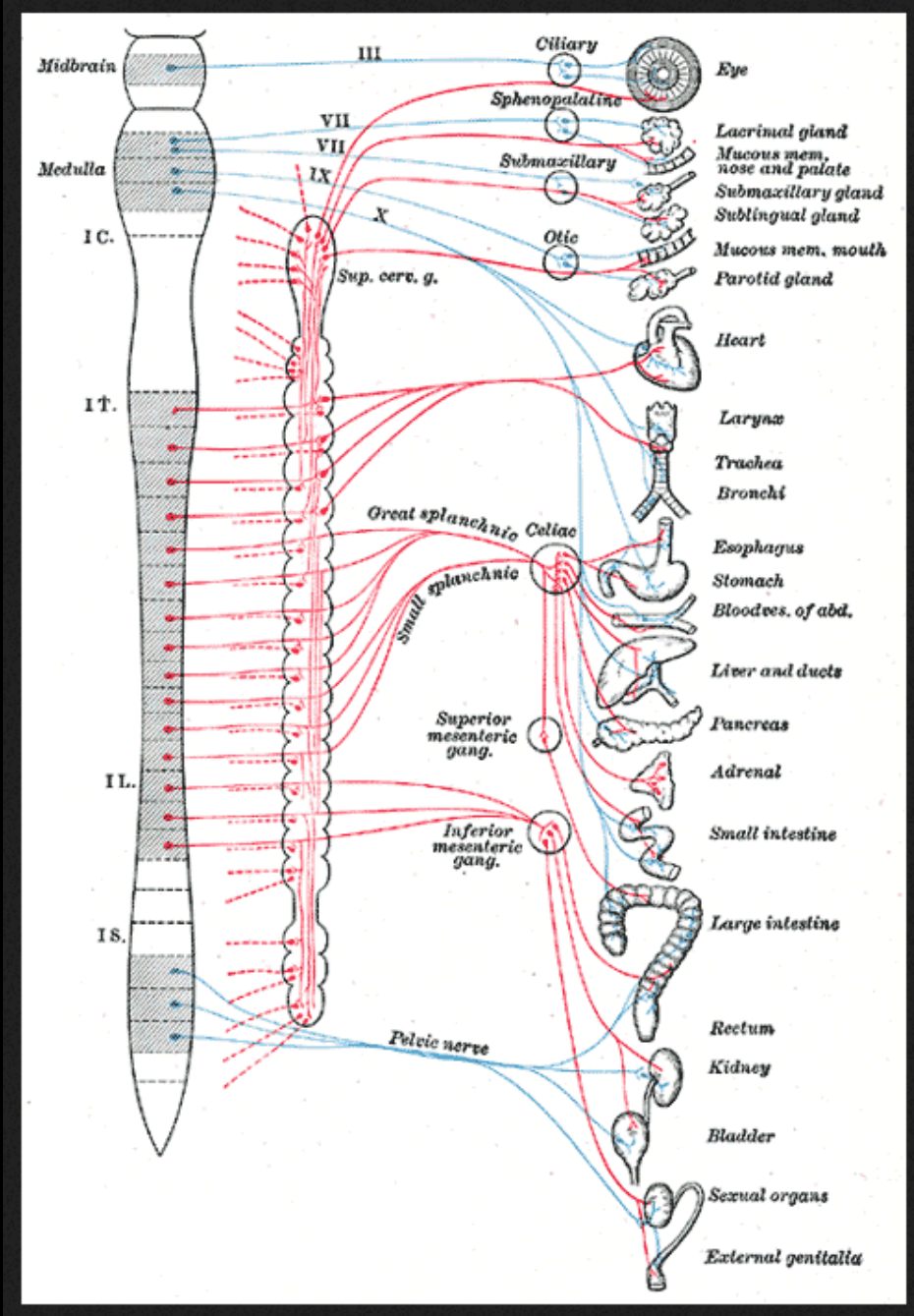
Utility Pole

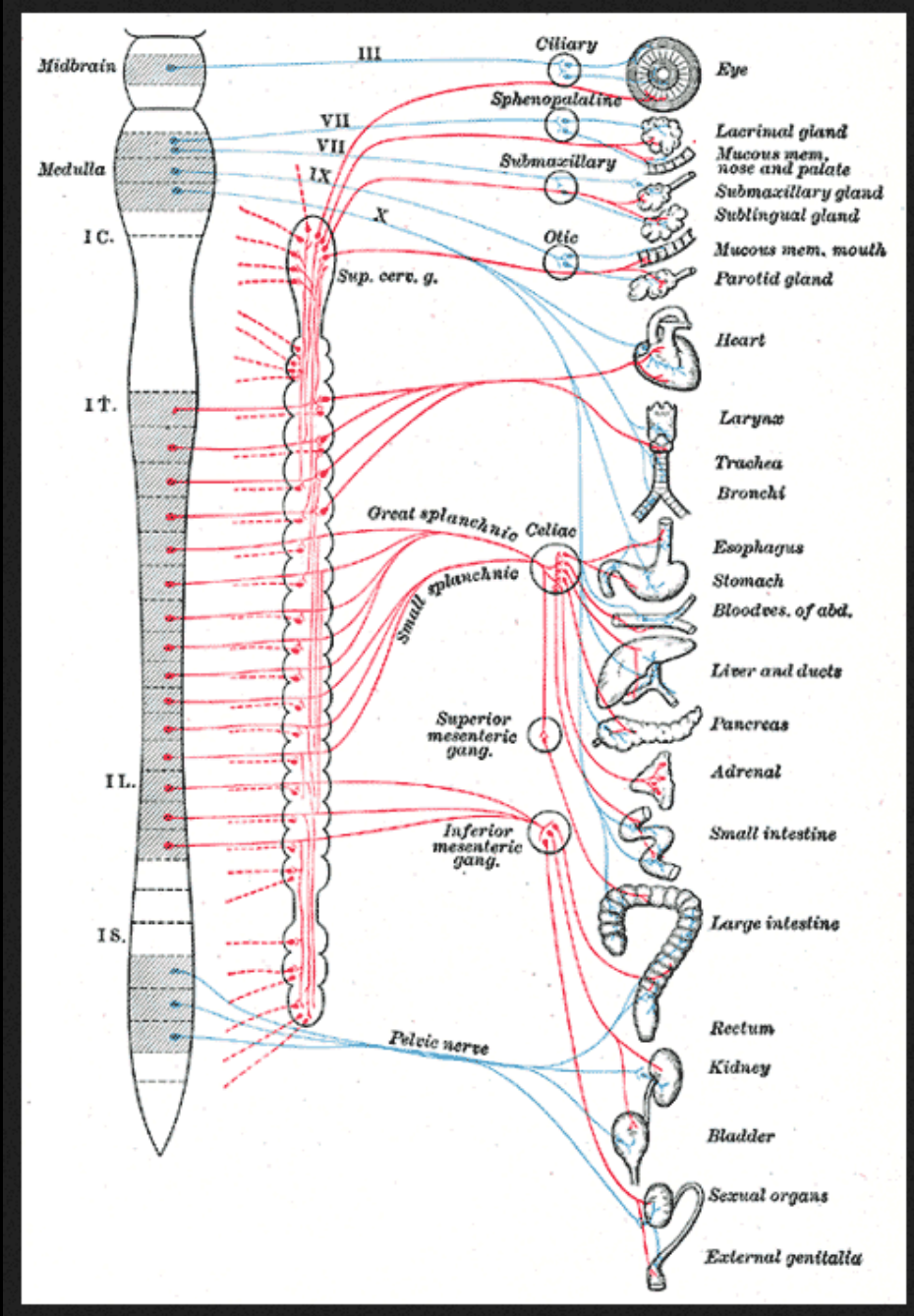




Sympathetic Ganglion

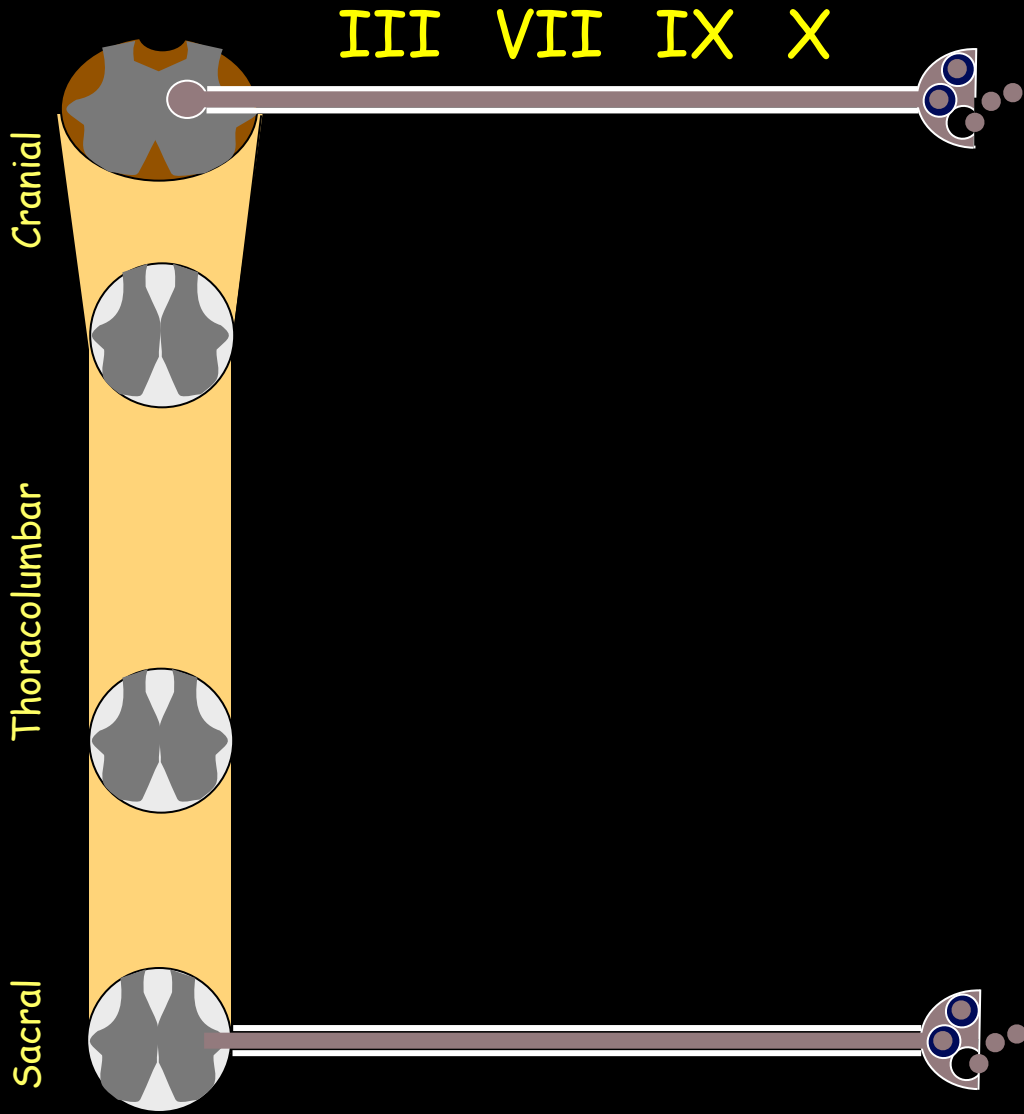




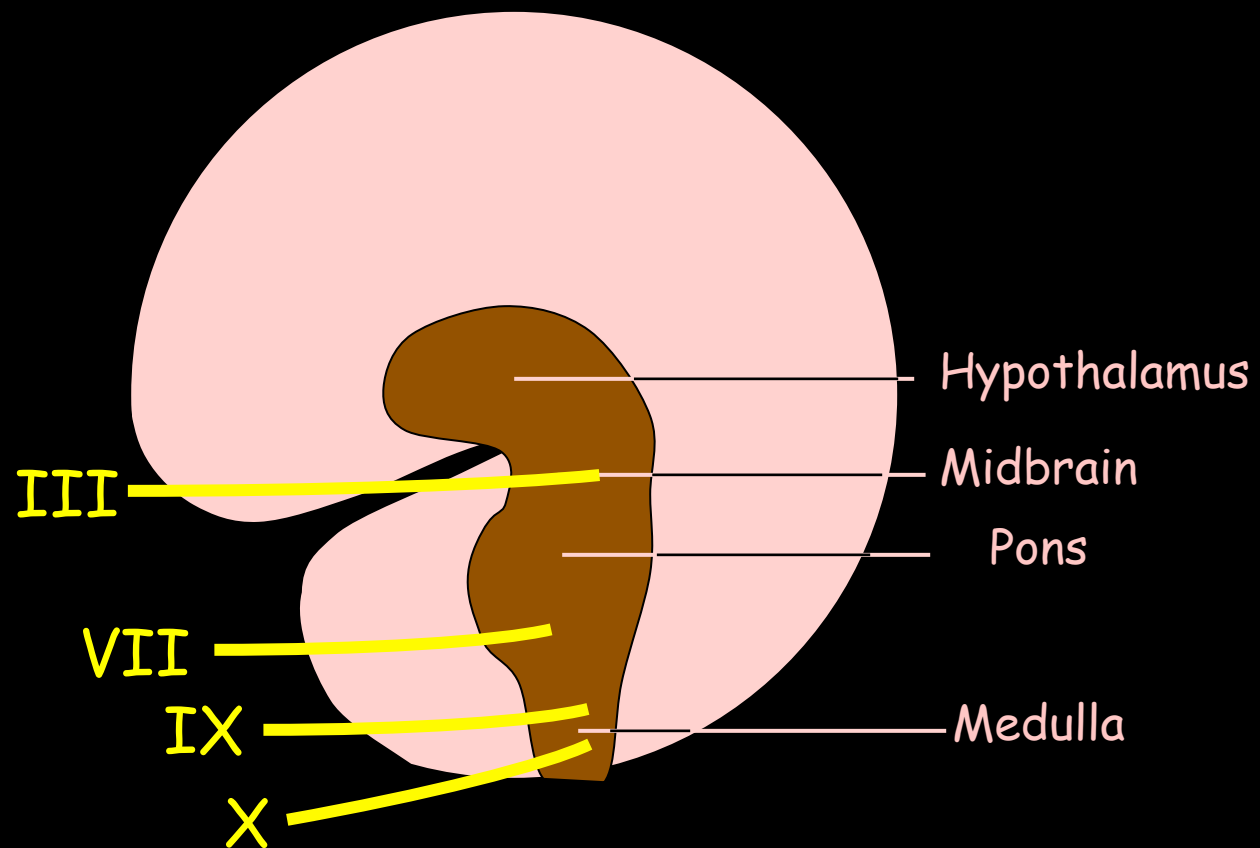


Uh oh.

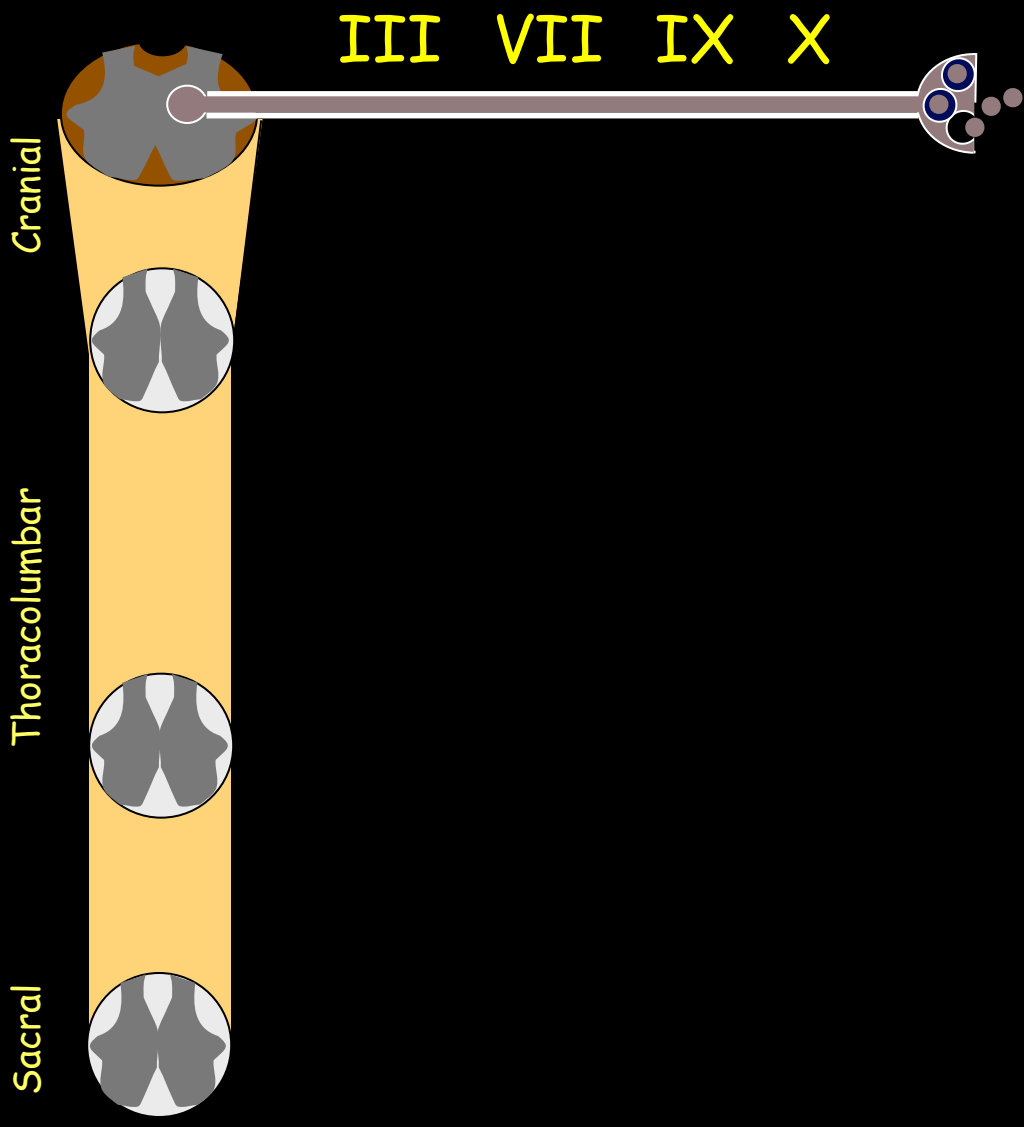
# Spinal Cord



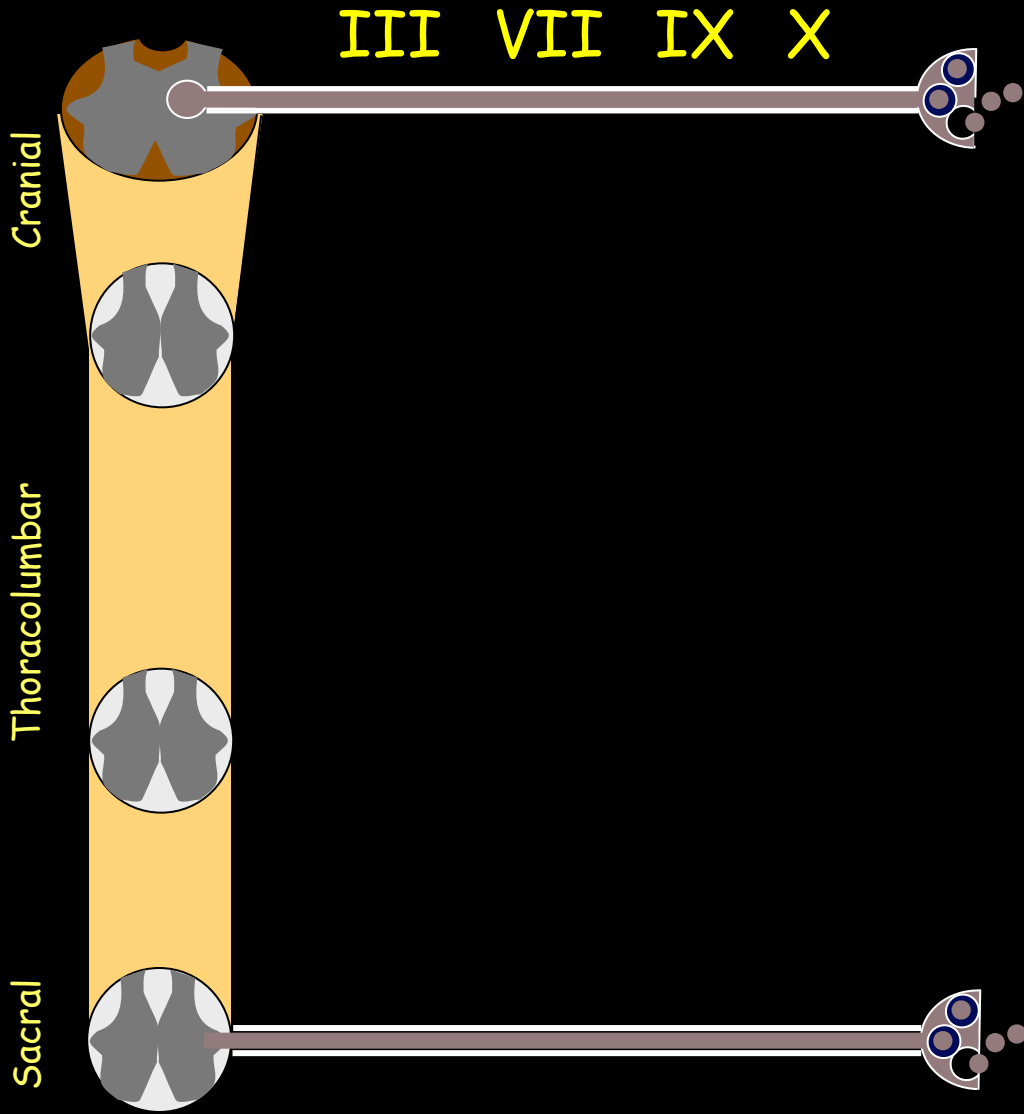


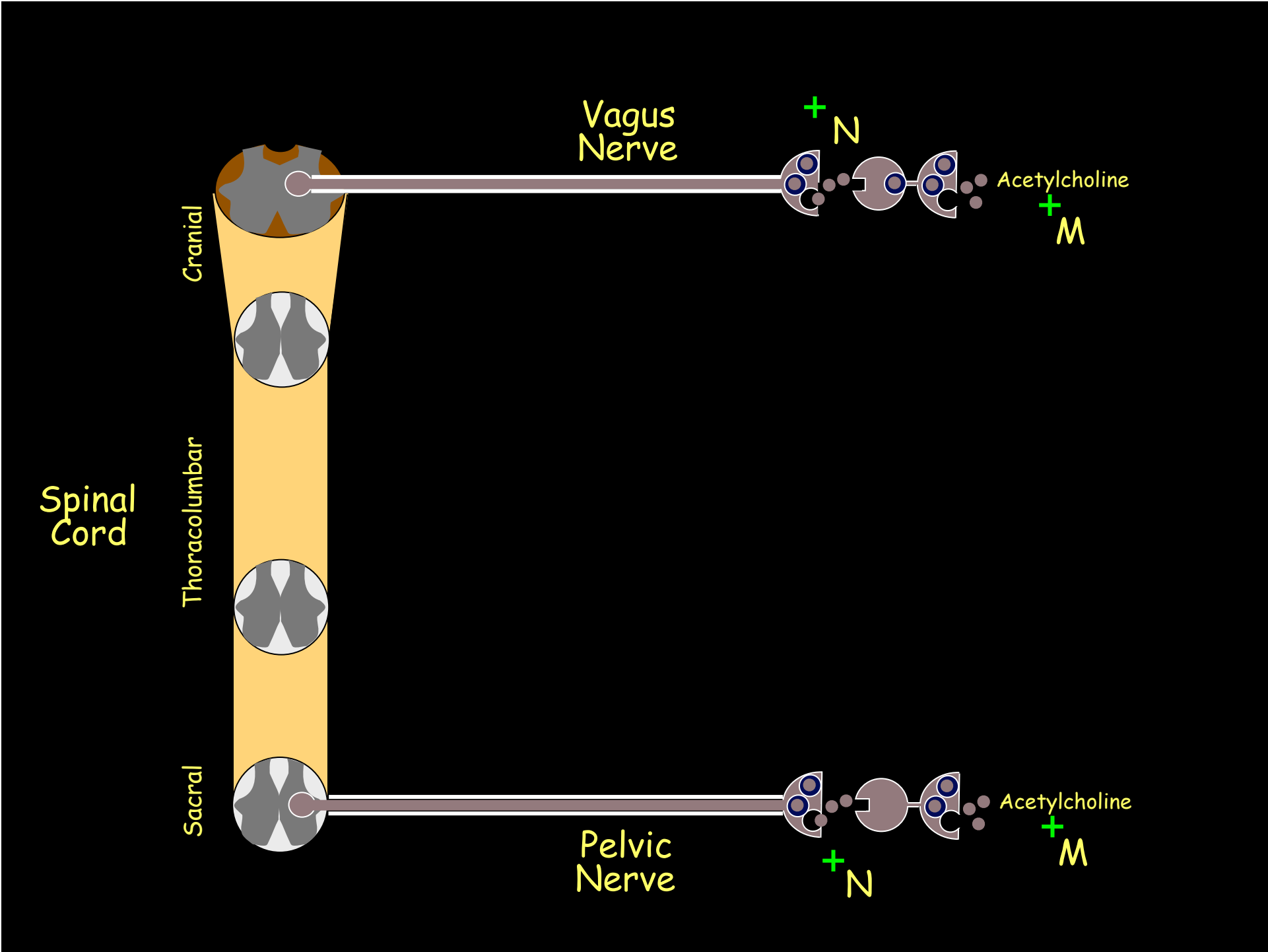


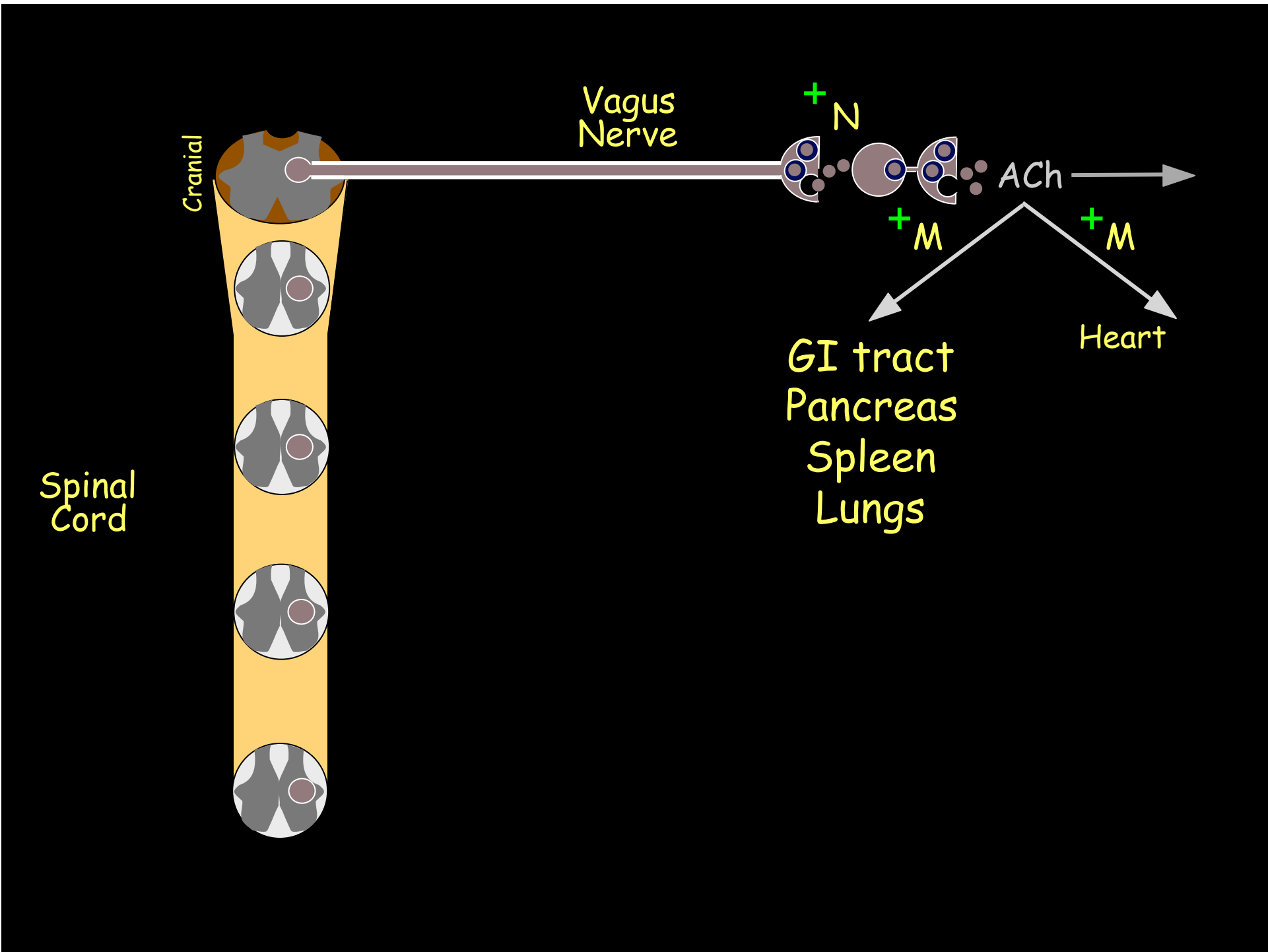
# Spinal Cord



# Spinal Cord

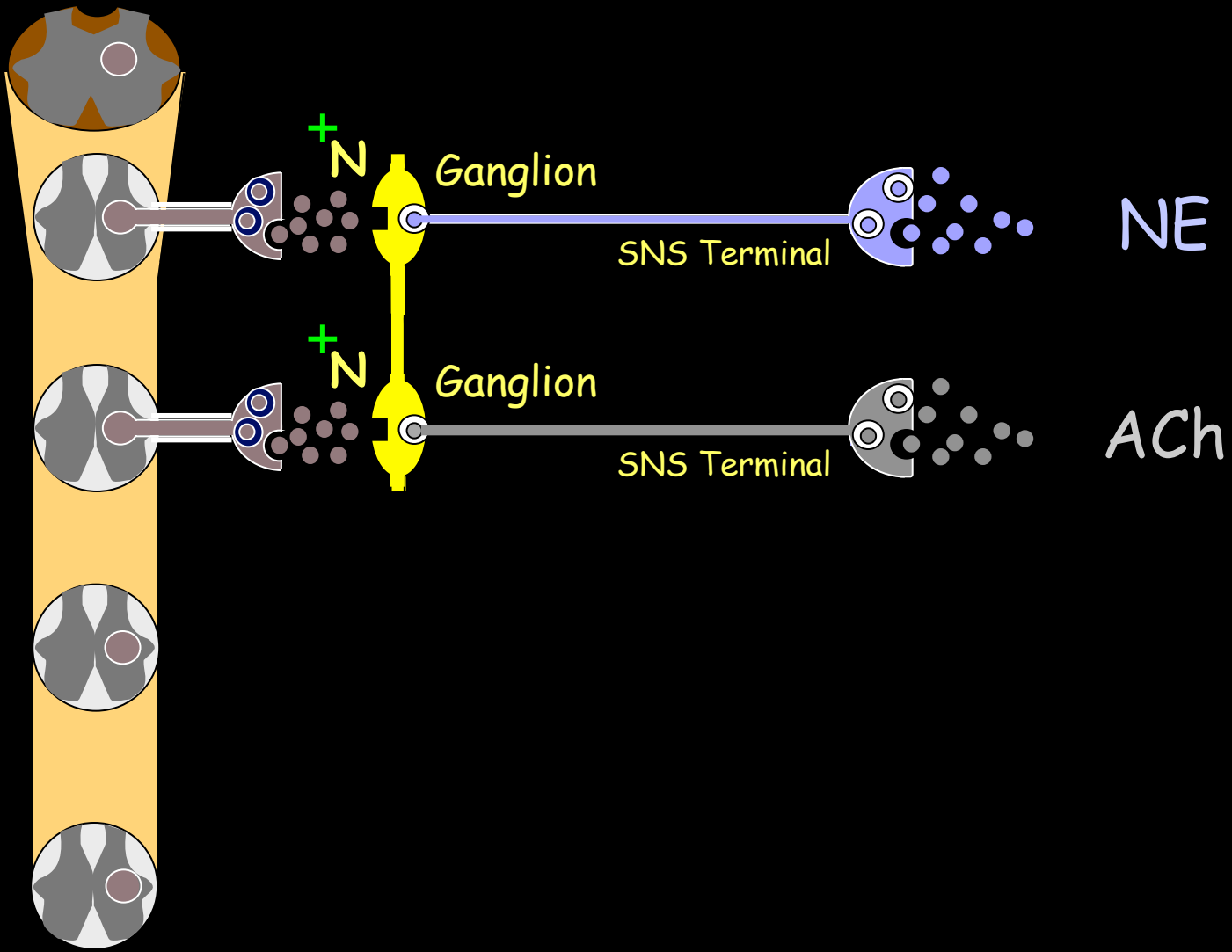




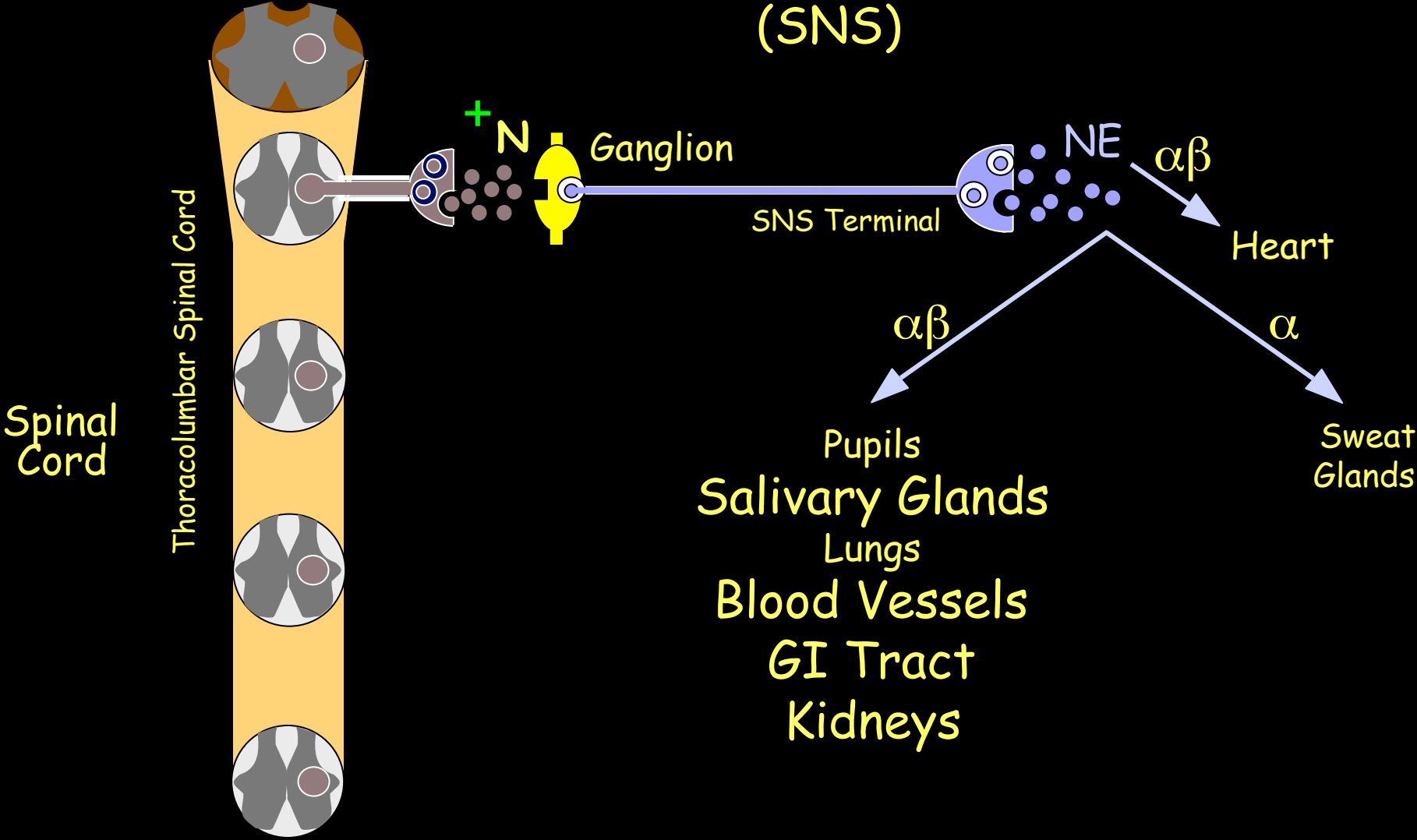


Spinal Cord

Thoracolumbar Spinal Cord

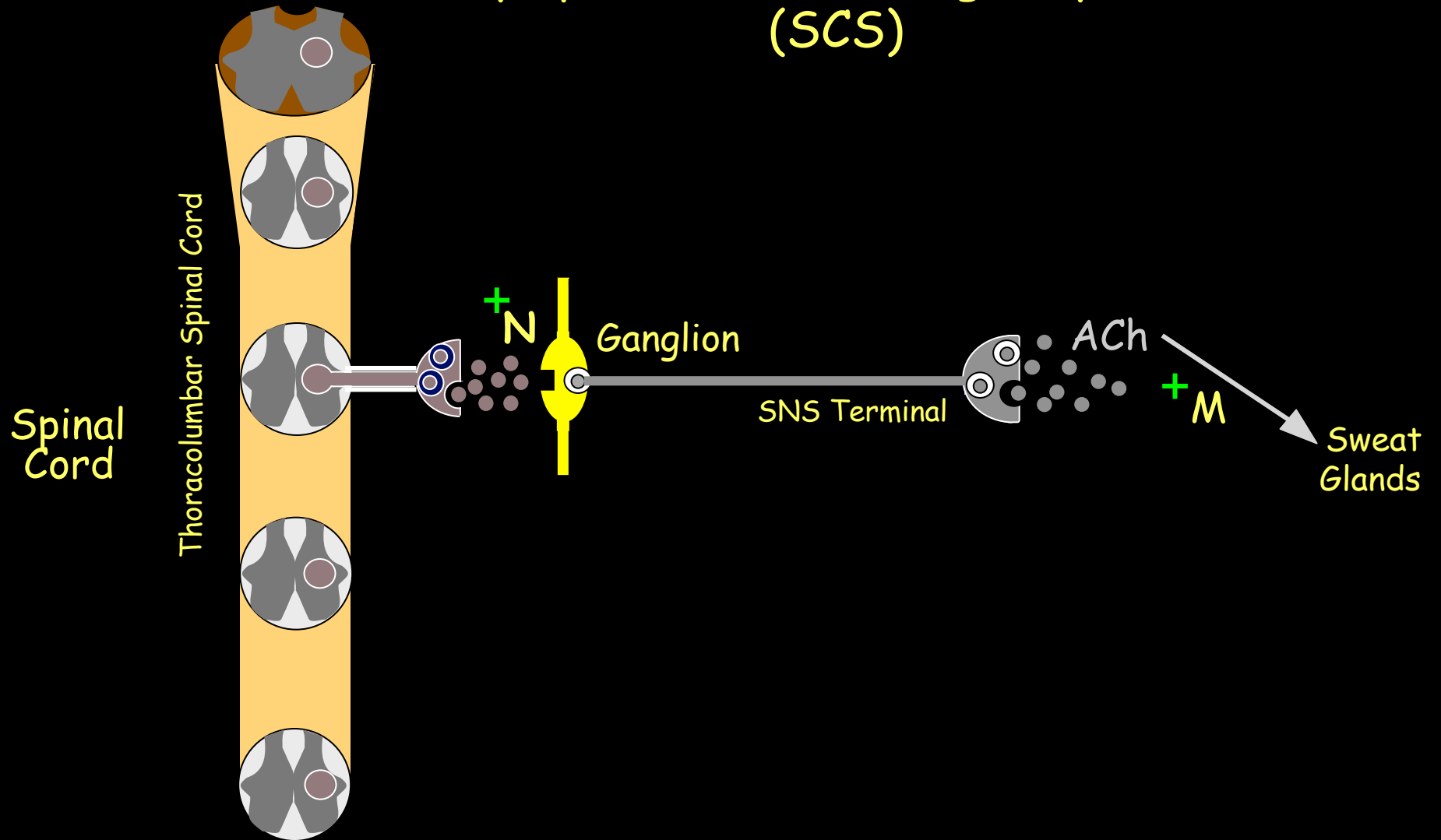


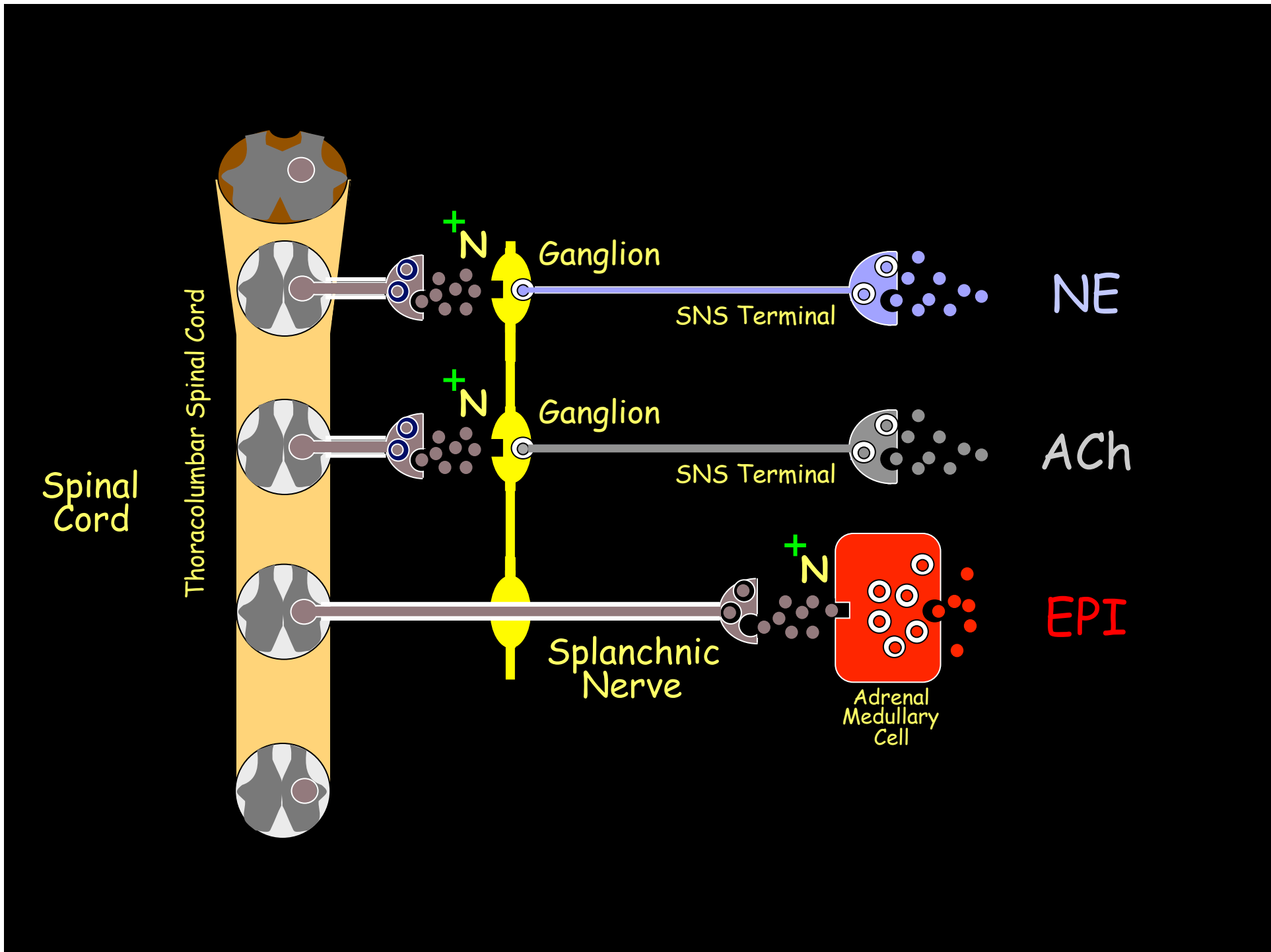
# Sympathetic Noradrenergic System (SNS)



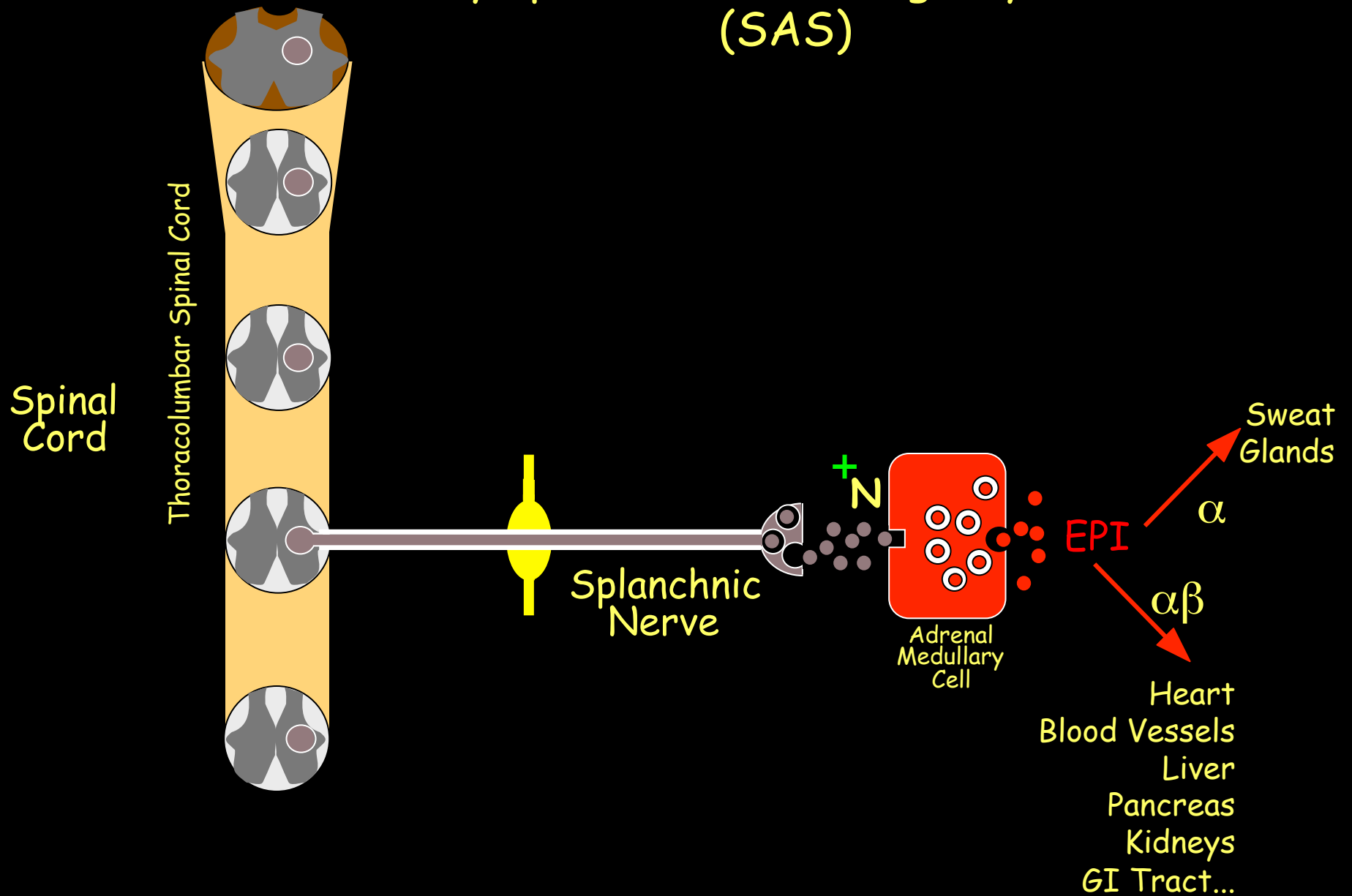


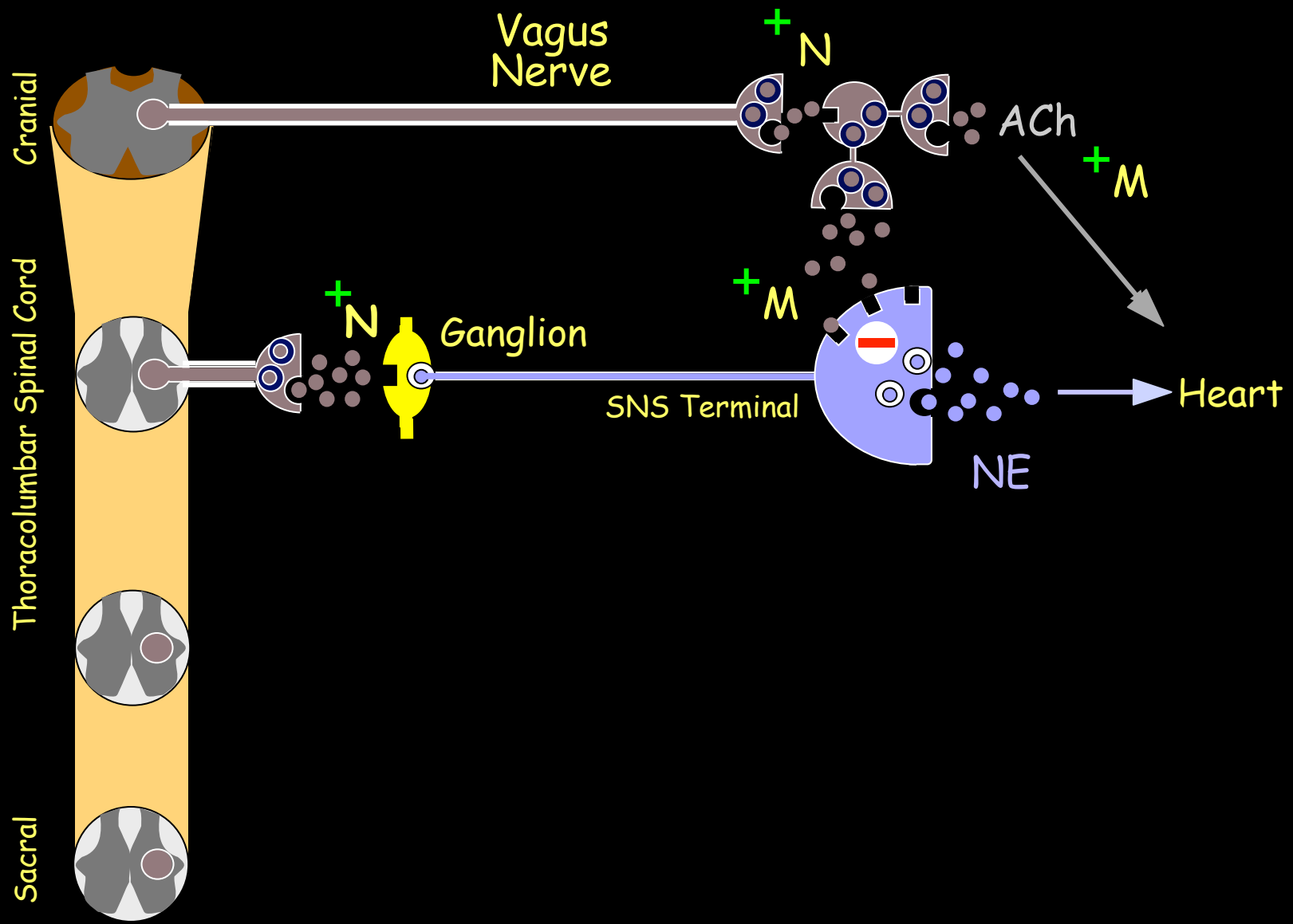
# Sympathetic Cholinergic System (SCS)

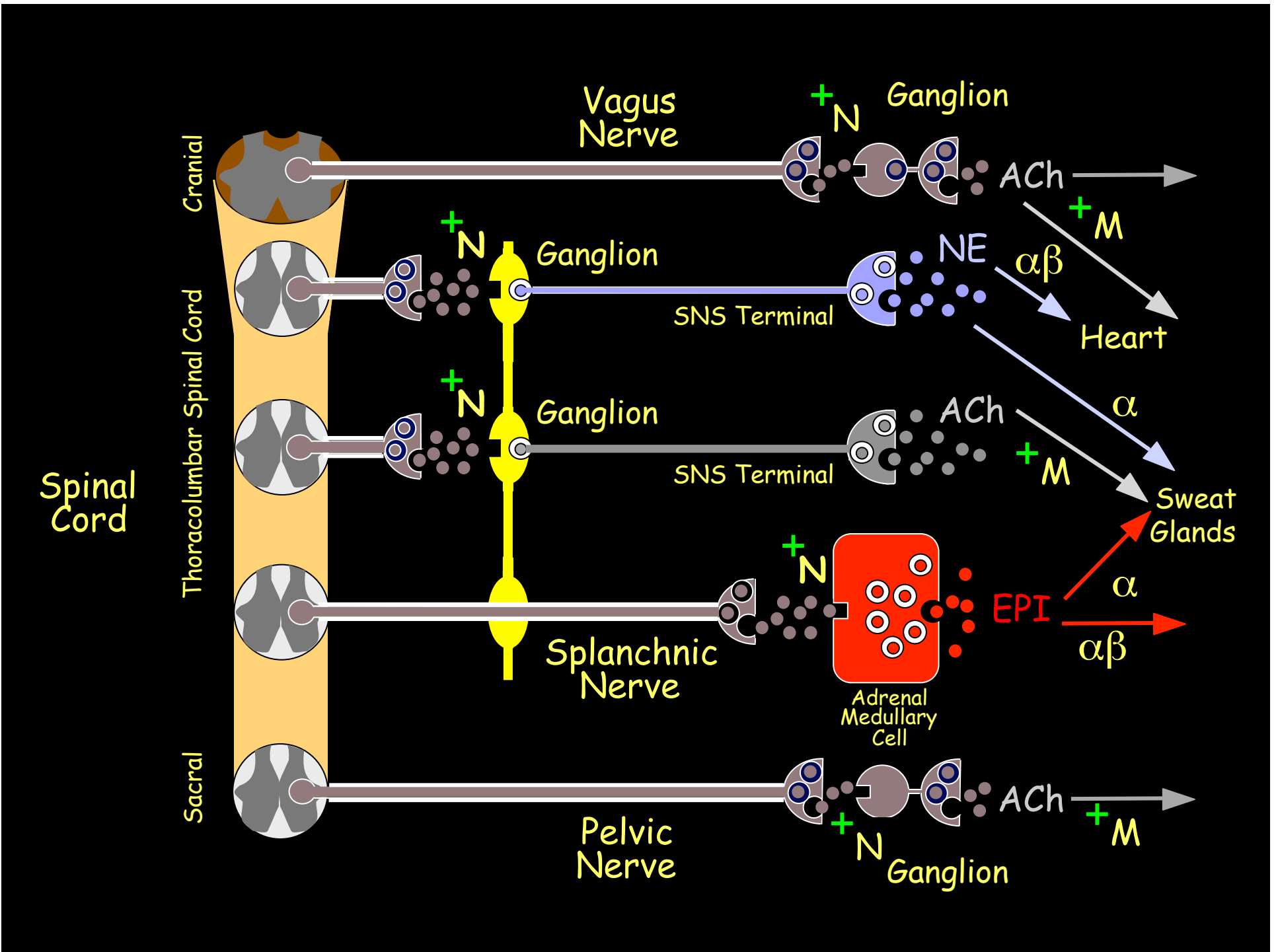


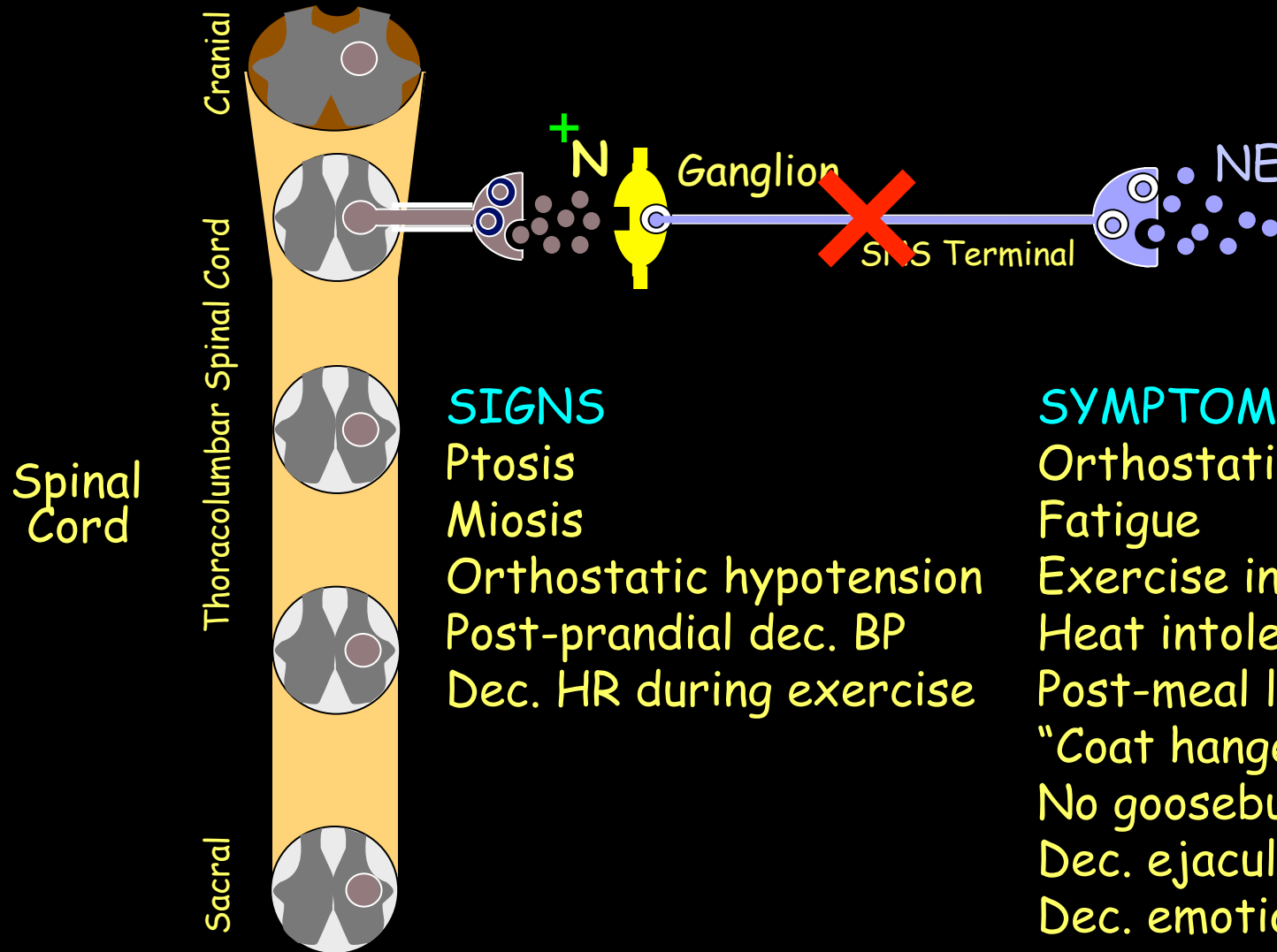


# Sympathetic Adrenergic System (SAS)







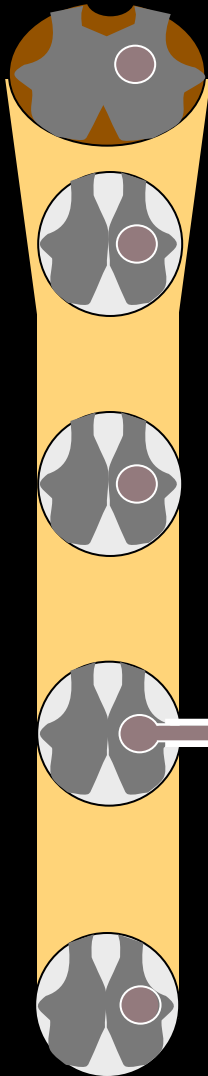


Spinal  
Cord

Cranial

Thoracolumbar Spinal Cord

Sacral



## SIGNS

Mydriasis  
Bronchodilation  
Cut. vasoconstriction  
Skel. muscle vasodilation  
Dec. GI transit  
Hyperventilation  
Inc. systolic BP  
Tachycardia  
Hyperglycemia  
Hypokalemia  
Inc. core temp.

## SYMPTOMS

Inc. emotional intensity  
Trembling  
Salivation (proteinaceous)  
Air hunger  
Swollen abdomen  
Pallor  
Racing, pounding heart  
Sweating ("cold sweat")  
Anti-fatigue  
Dec. bleeding time

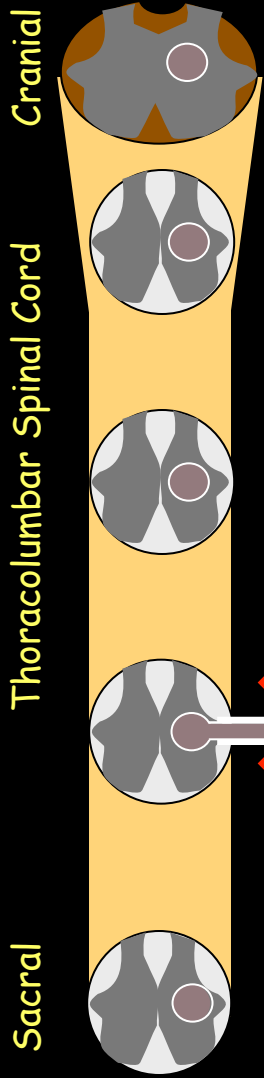
Splanchnic  
Nerve



EPI



Spinal Cord



SIGNS  
Hypoglycemia?

SYMPTOMS  
Dec. emotional intensity?



Splanchnic Nerve

Adrenal Medullary Cell

EPI

# Sympathetic Noradrenergic System (SNS)

## Underactivity or Failure

### Drugs

Diabetes

Parkinson disease (PD)

Cancer (paraneoplastic)

Multiple system atrophy (MSA)

Spinal cord injury

Pure autonomic failure

Amyloidosis

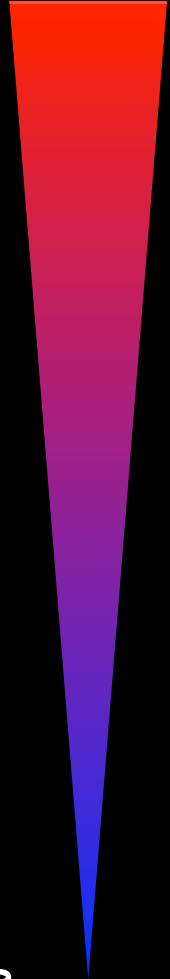
Familial dysautonomia

Dopamine-beta-hydroxylase deficiency

Acquired sensory and autonomic neuropathy

Autoimmune autonomic ganglionopathy

Common



Rare

# Parasympathetic Nervous System (PNS) Underactivity or Failure

## Drugs

Diabetes

Heart failure

Aging

Sjogren's syndrome

Parkinson disease (PD)

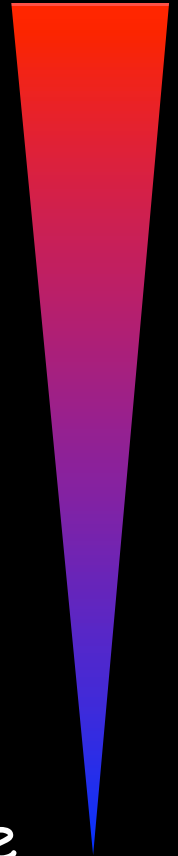
Multiple system atrophy (MSA)

Pure autonomic failure (PAF)

Autoimmune autonomic ganglionopathy

Common

Rare



**Chief Complaint:** In a few words, what's the main problem bothering you that brings you here today?

**HPI:** When was the last time you felt completely healthy?

What was the first thing that went wrong?

What happened next?

Have you noticed anything that makes the problem worse or better?

What treatments have been tried, and how did you respond?

**Autonomic Review of Systems:**

Who does your shopping? Are you able to tolerate standing, exercise, heat, a large meal?

Do you sweat like other people?

Do you make spit like other people?

Have you noticed any problems with urination?

Have you noticed any problems with bowel movements?

Have you noticed any problems with sexual function?

# Sympathetic Noradrenergic System (SNS) Failure

Orthostatic intolerance & hypotension

Post-prandial lightheadedness & hypotension

Heat intolerance & hypotension

Fatigue

Tendency to slow pulse rate during exercise

“Coat hanger” pain

Droopy eyelids (ptosis)

Decreased ability to ejaculate

Tendency to constricted pupils

No goosebumps

# Parasympathetic Nervous System (PNS) Failure

Dry mouth (decreased watery saliva)

Constipation

Dry eyes

Urinary retention

Tendency to fast pulse rate with low variability

Slow gastrointestinal transit

Erectile failure

# Sympathetic Cholinergic System (SCS) Failure

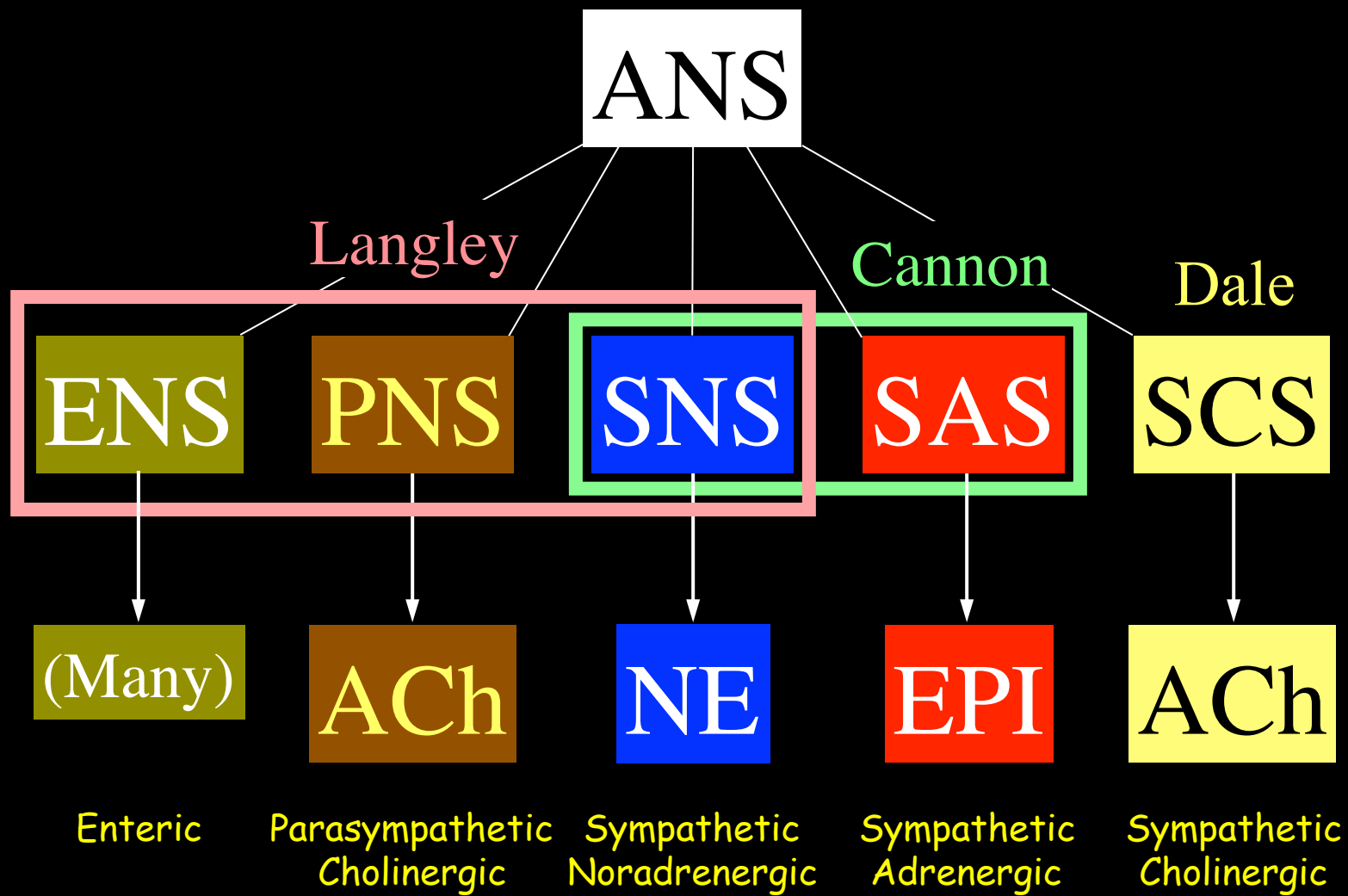
Decreased sweating

# Sympathetic Adrenergic System (SAS) Failure

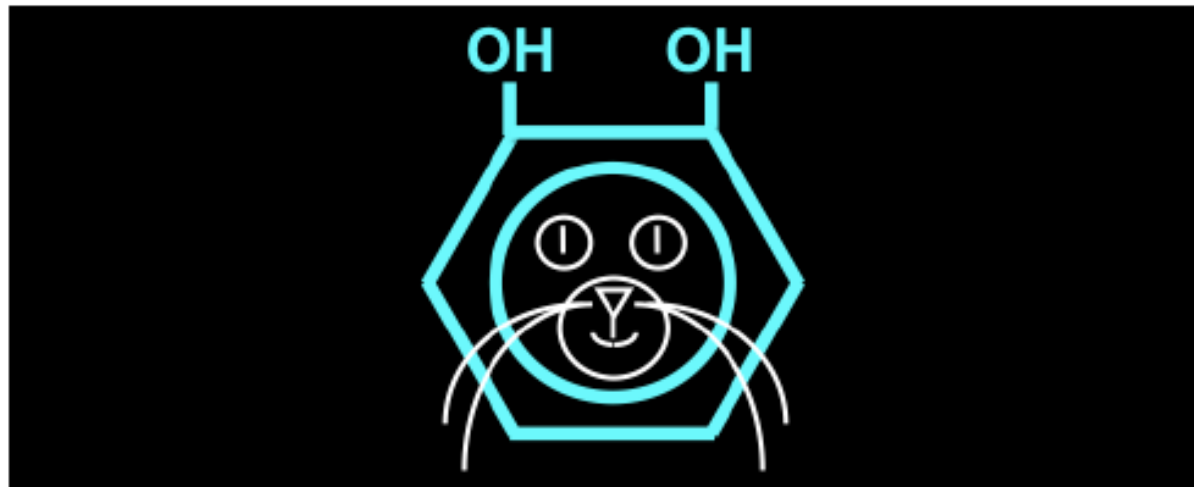
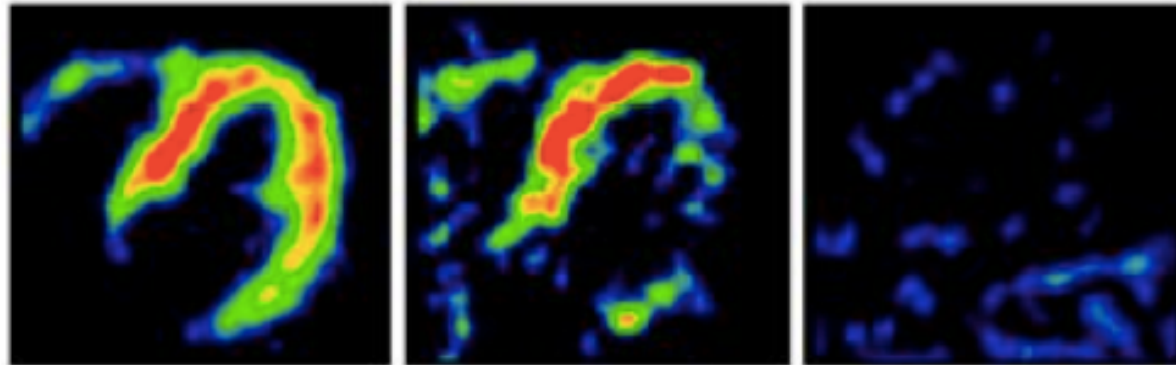
Tendency to hypoglycemia

Tendency to fatigue





# Principles of Autonomic Medicine



David S. Goldstein, MD PhD