Autonomic Nervous System

ANS

1

Introduction

Control the visceral function
- = arterial pressure
- = gastrointestinal motility and secretion
- = urinary bladder emptying
- = sweating
- = body temperature

- Divisions of ANS : → **Sympathetic Division**
  → **Parasympathetic Division**

ANS: → **Preganglionic fibers**
→ **Postganglionic fibers**

The Autonomic nervous system

Activated by centers located in:

-the spinal cord

- brain stem

- hypothalamus

- the limbic cortex

- The Autonomic nervous system operates by means of visceral reflexes

- The efferent Autonomic signals are transmitted to the body through two major subdivisions called
- The sympathetic nervous system .
- The parasympathetic nervous system.

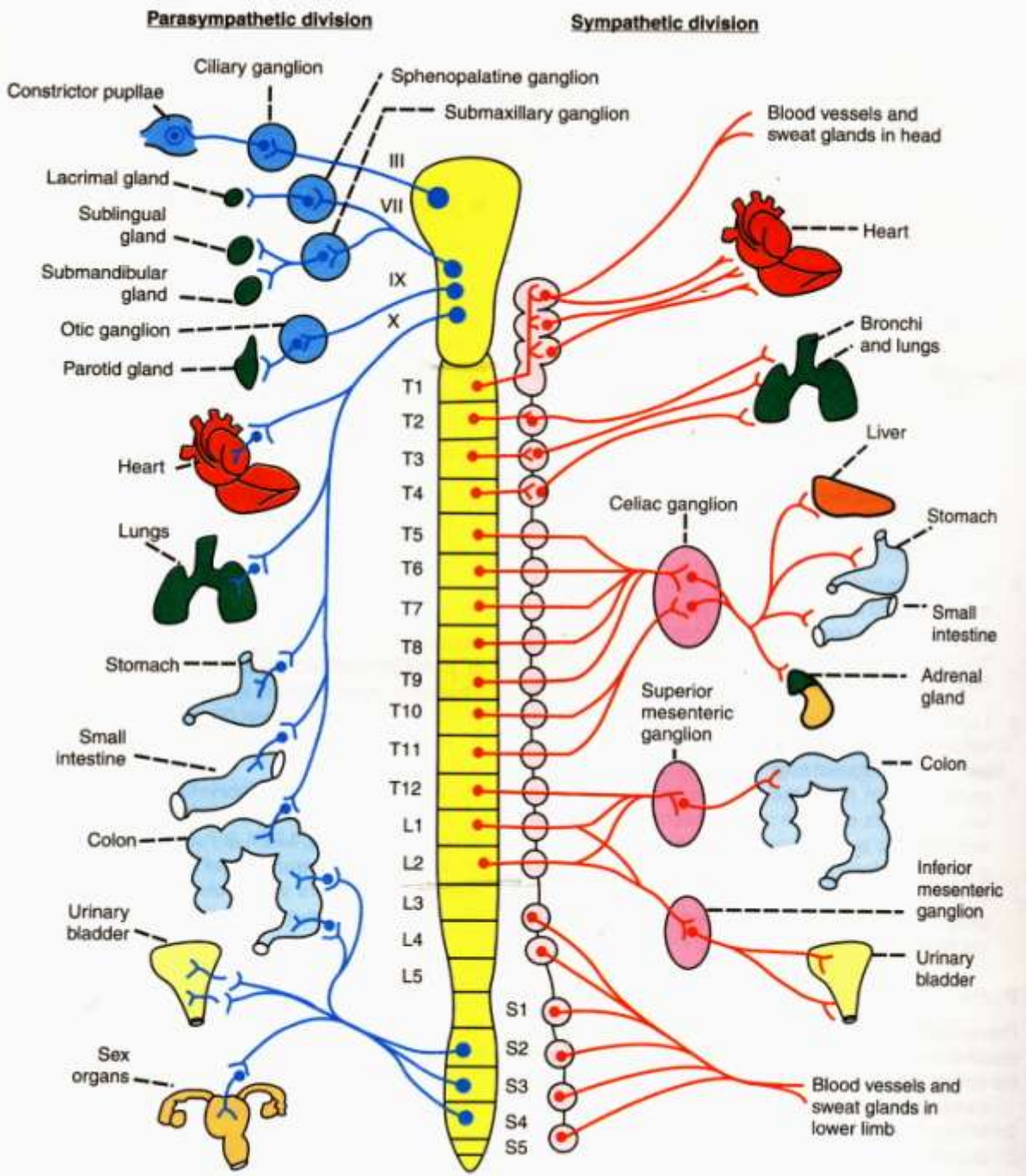
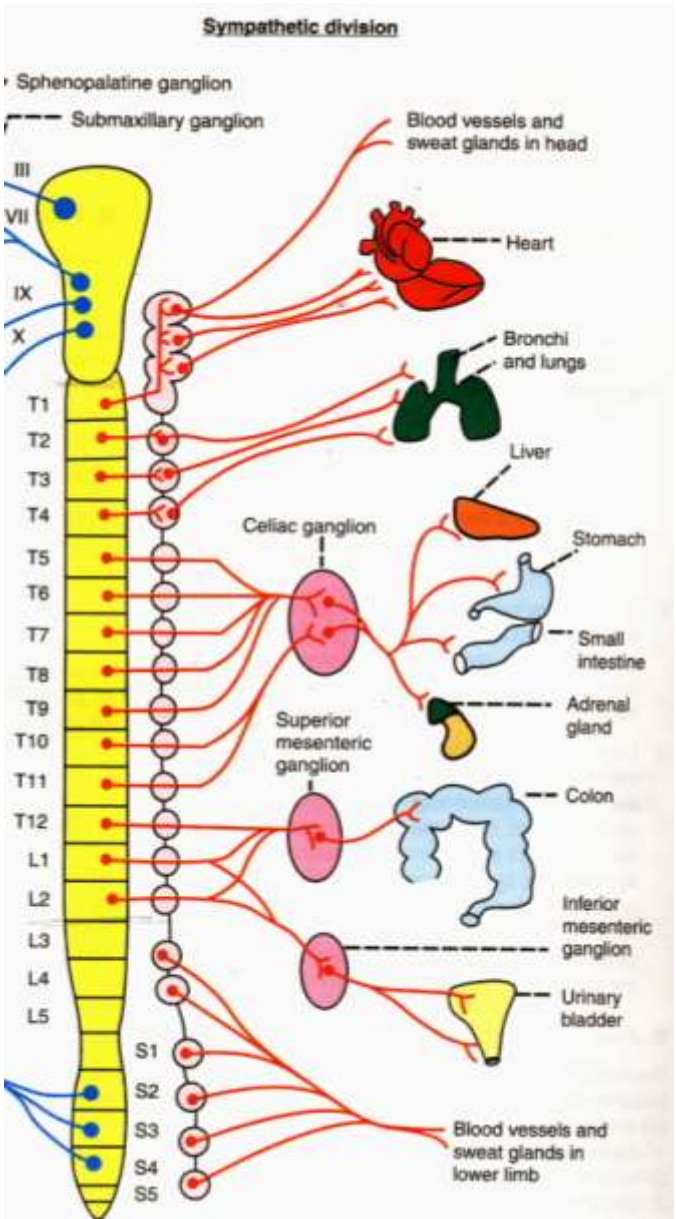


FIGURE 164-1: Autonomic nervous system

Sympathetic Division



Physiological Anatomy of the sympathetic nervous system

- two para vertebral sympathetic chains of ganglia in sides of the spinal column
- two pre vertebral ganglia inside the abdomen and nervous extending from the ganglia to the different internal organs
- the sympathetic nervous originate in the spinal cord between the segments T1 - L2 and pass from here first in to the sympathetic chain and then to the tissues and organs

The cell body of each pre ganglion nervous lies in the inter media lateral from of the spinal cord , and its fibers passes through an anterior root of the cord and the spinal nerve.

The pre ganglion sympathetic fibers leave the nerve and pass into one of the ganglia of the sympathetic chain

Sympathetic Ganglia:

A - Paravertebral or Sympathetic chain ganglia

B - Prevertebral or Collateral ganglia

C - Terminal or Peripheral ganglia

A - Paravertebral or Sympathetic chain ganglia :

Cervical ganglia, Thoracic ganglia, Lumbar & Sacral ganglia

Cervical ganglia:

Superior Cervical ganglia: (largest) 1^{st} + 2^{nd} + 3^{rd} + 4^{th} cervical ganglia

Middle Cervical ganglia: 5^{th} + 6^{th} cervical ganglia

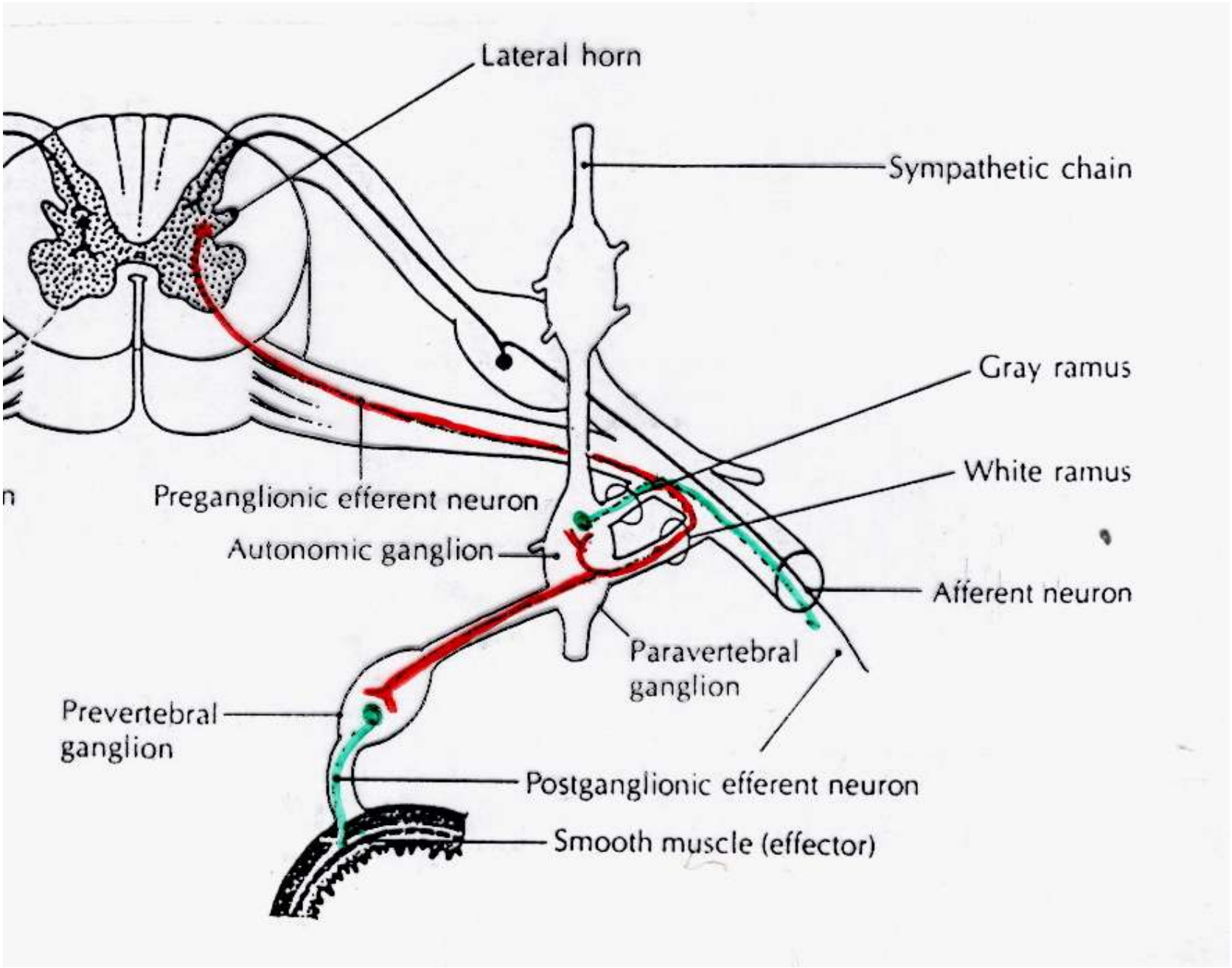
Inferior Cervical ganglia: 7^{th} + 8^{th} cervical ganglia (+1^{st} thoracic form Satellite ganglion)

Thoracic ganglia:

12 thoracic ganglia

Lumbar & Sacral ganglia:

5 lumbar ganglia & 5 sacral ganglia


Lateral horn
Sympathetic chain
Gray ramus
White ramus
Preganglionic efferent neuron
Autonomic ganglion
Afferent neuron
Paravertebral ganglion
Prevertebral ganglion
Postganglionic efferent neuron
Smooth muscle (effector)

B - Prevertebral or Collateral ganglia :

Situated in Thorax, Abdomen & Pelvis in relation to Aorta & its branches

Celiac ganglion

Superior mesenteric ganglion

Inferior mesenteric ganglion

C - Terminal or Peripheral ganglia :

near the structure they innervate

Sympathoadrenergic System:

Includes the Sympathetic Division + Adrenal Medulla

Sympathetic activity increase = increase secretion of Catecholamine from adrenal medulla

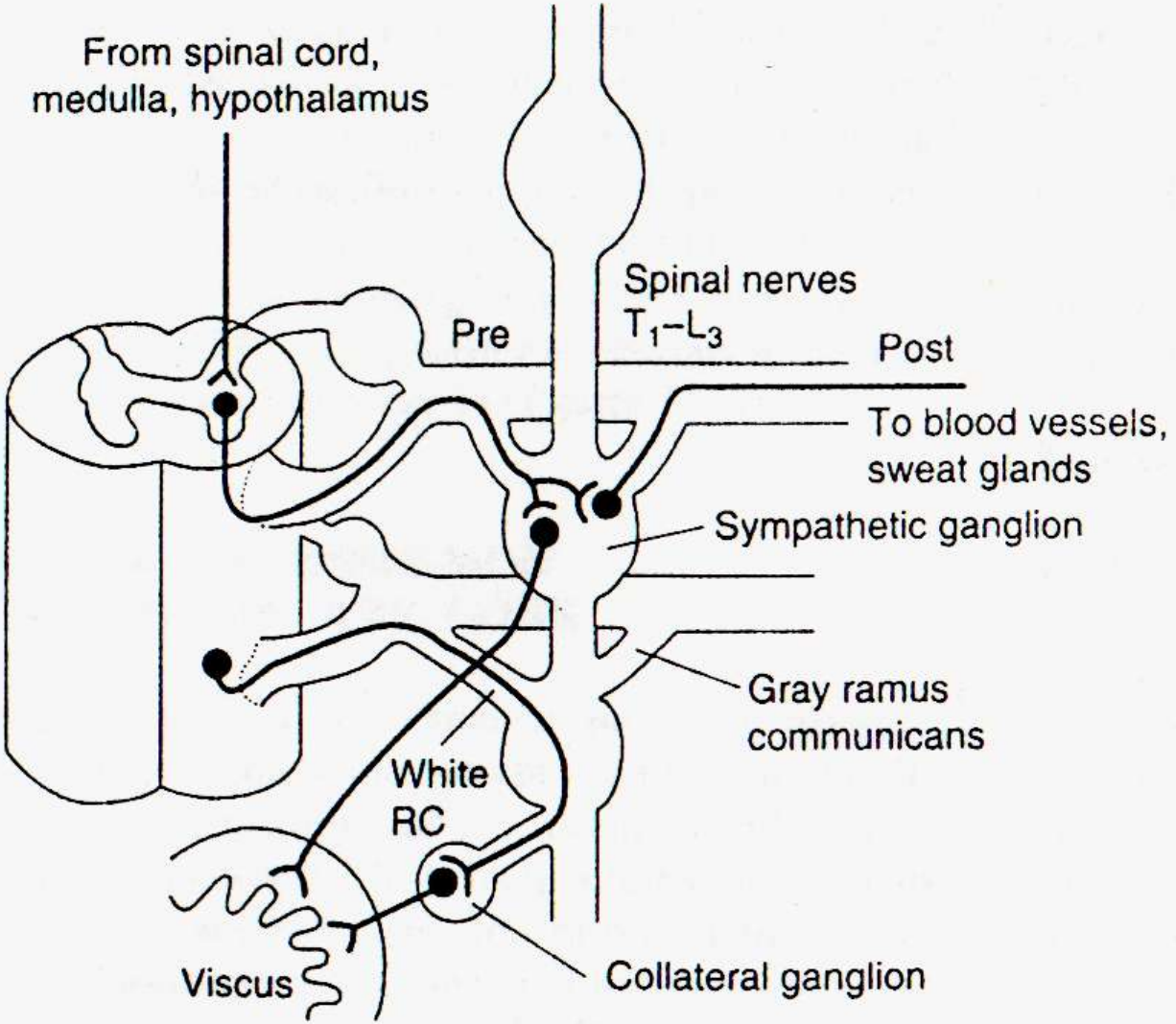
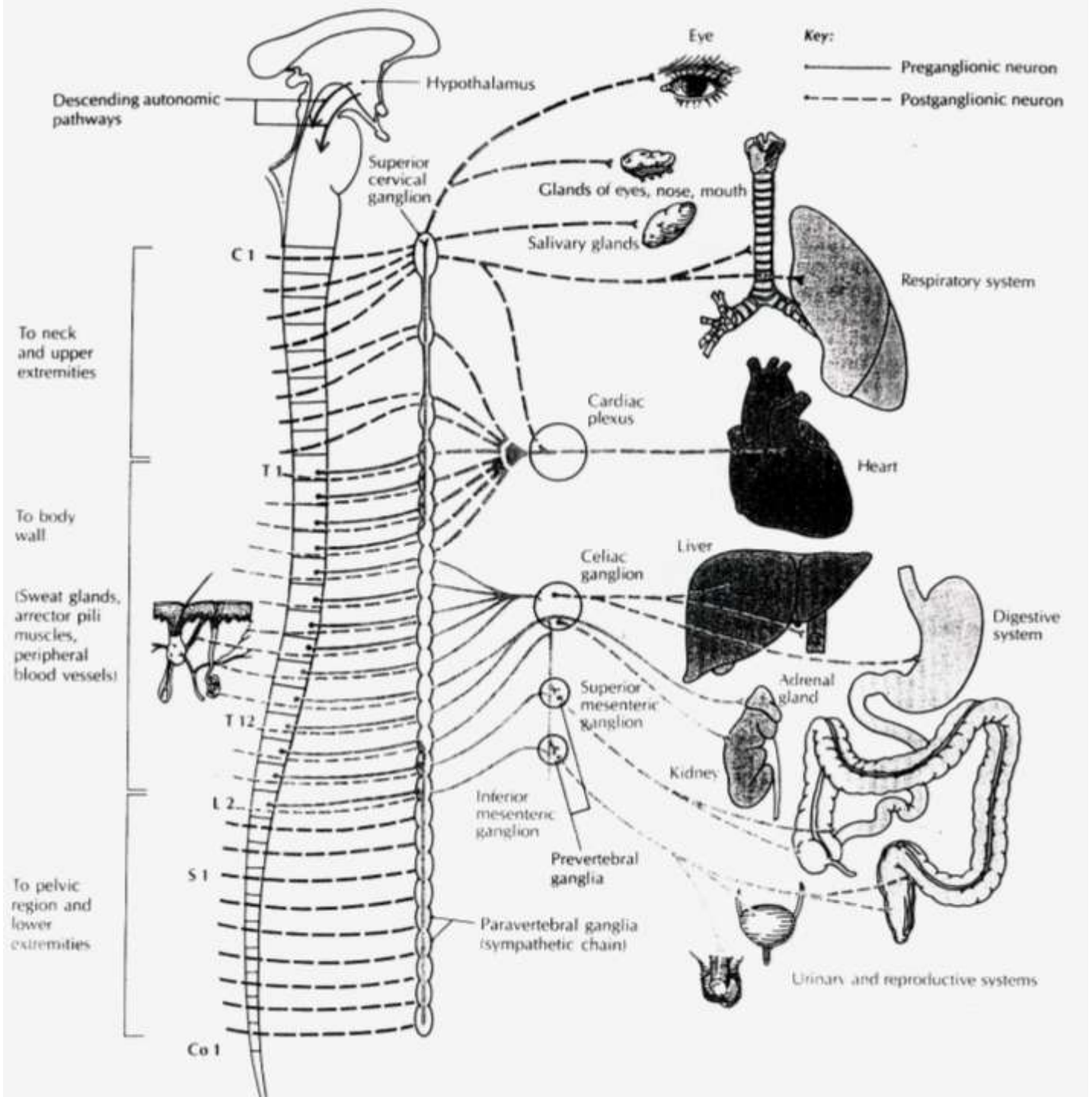


Figure 13–1. Autonomic nervous system. Pre, preganglionic neuron; P
nicans.


Eye
Key:
Preganglionic neuron
Postganglionic neuron
Hypothalamus
Descending autonomic pathways
Superior cervical ganglion
Glands of eyes, nose, mouth
Salivary glands
Respiratory system
C 1
To neck and upper extremities
Cardiac plexus
Heart
T 1
To body wall
(Sweat glands, arrector pili muscles, peripheral blood vessels)
Liver
Celiac ganglion
Digestive system
Adrenal gland
Superior mesenteric ganglion
T 12
Kidney
L 2
Inferior mesenteric ganglion
Prevertebral ganglia
S 1
To pelvic region and lower extremities
Paravertebral ganglia (sympathetic chain)
Urinary and reproductive systems
Co 1

Pre ganglion and post ganglion sympathetic nervous

- The sympathetic nervous are different from skeletal motor nervous :

Each sympathetic pathway from the cord to the stimulated tissue is composed of two nervous :

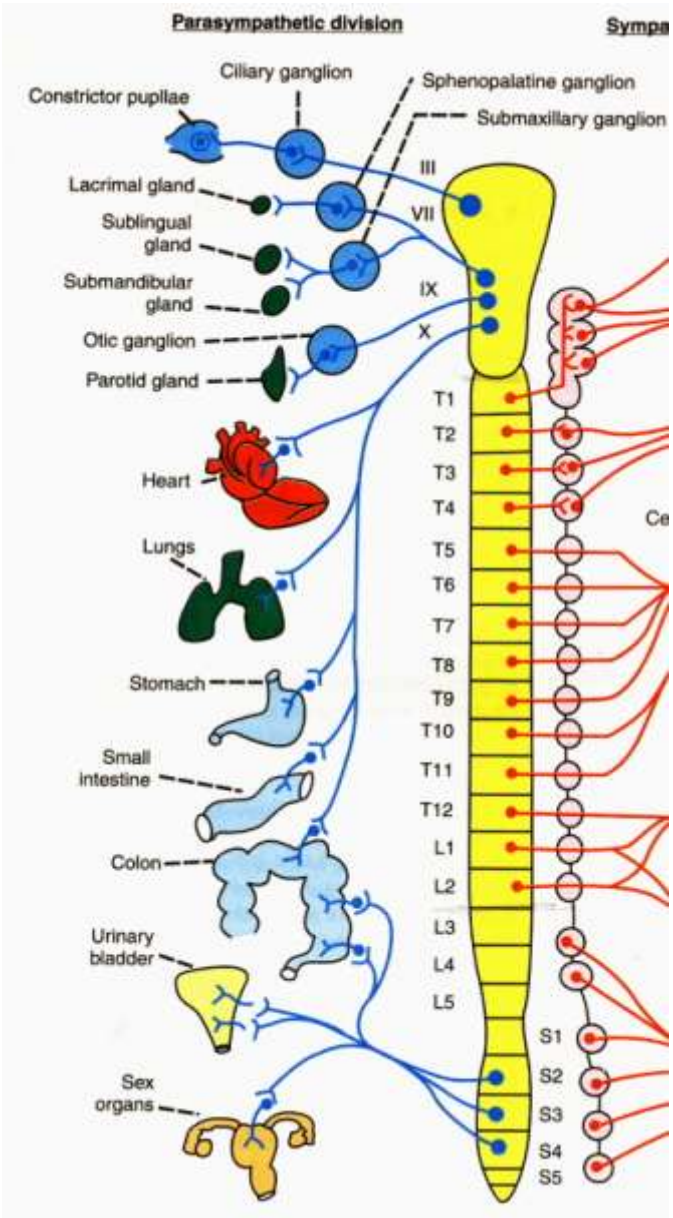
- Preganglionic neuron
- Postganglionic neuron
  contrast to only single neuron in the skeletal motor pathway

The postganglionic sympathetic fibers are all very small type c fibers that extend to all parts of the body in the skeletal nerves.

They control :

- The blood vessels
- Sweat glands
- Pilo erector muscles of the hairs

Parasympathetic Division



Parasympathetic Division

- Cranial portion : in brainstem

  the cranial nerves of parasympathetic division are:

  Oculomotor **III** nerve } **Midbrain or tactile Level**

  Facial **VII** nerve } **Bulbar Level**

  Gloss pharyngeal **IX** nerve

  Vague **X** nerve } **Sacral outflow**

- Sacral portion : in sacral segments of spinal cord

The preganglionic fibers arise from 2 levels:

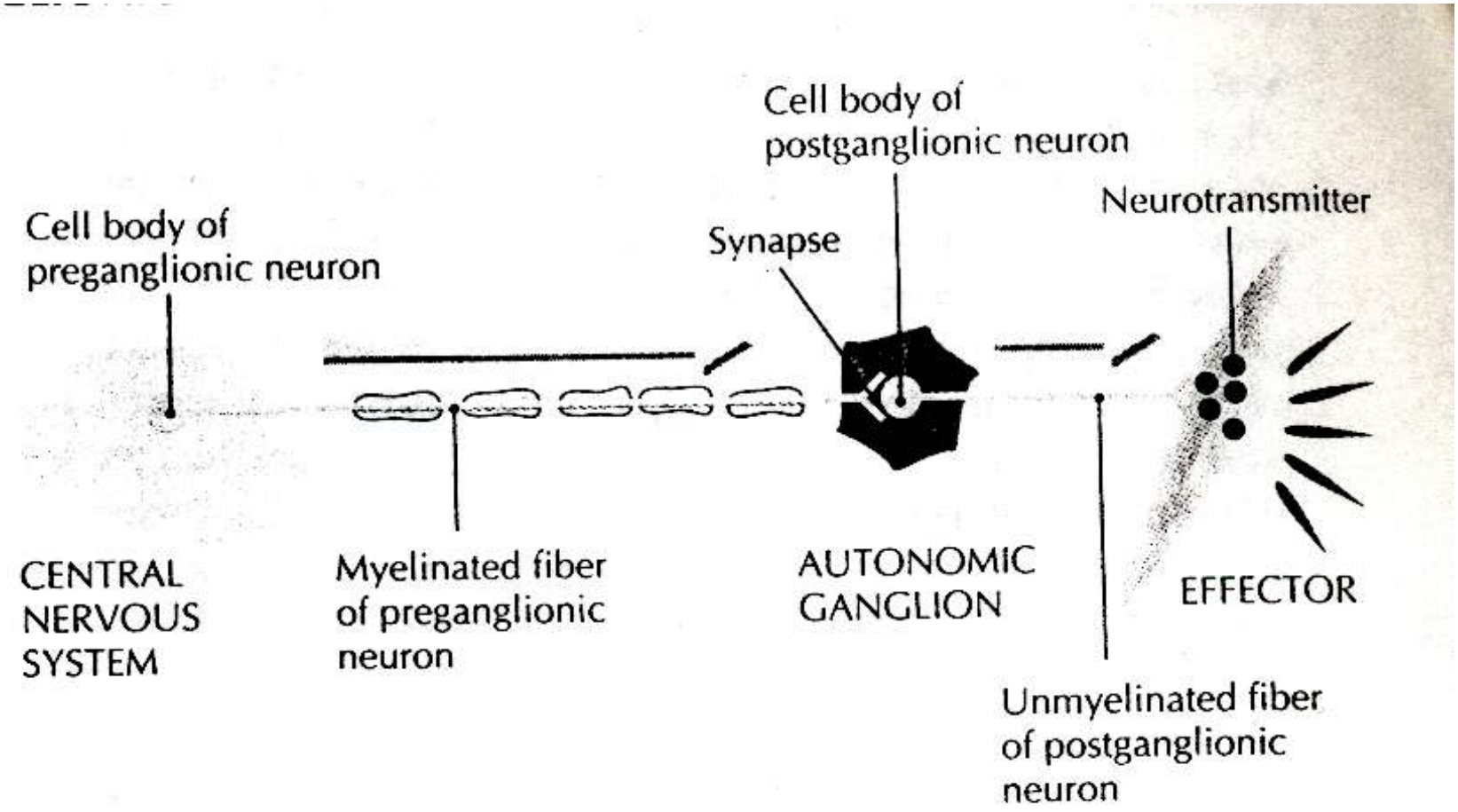
Bulbar Level

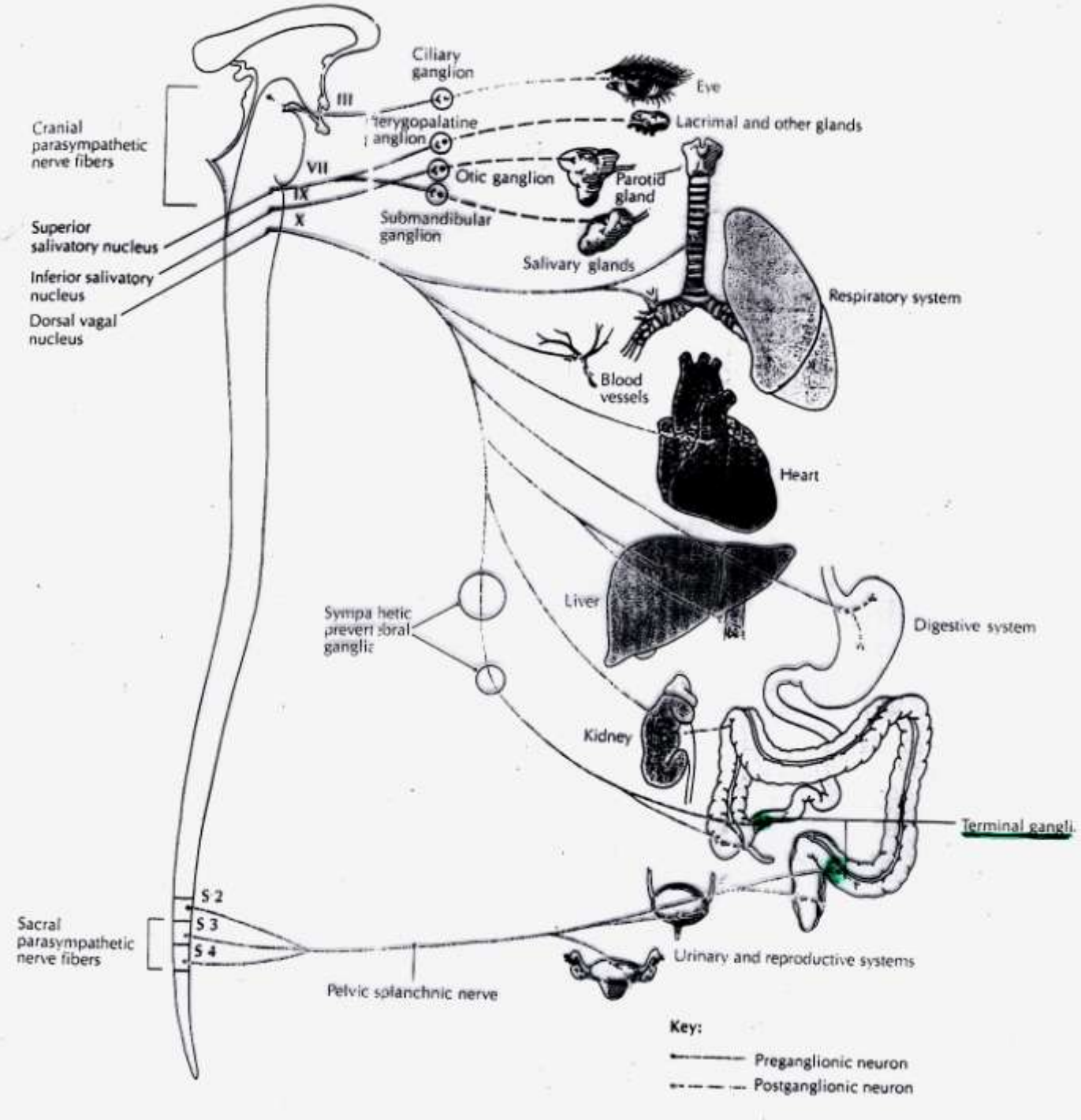
Sacral outflow

The Cranial parasympathetic fibers leave in the :

- The III nerve pass to:
  The papillary sphincters
  The ciliary's muscles of the eyes
- The VII nerve pass to: -
  The lachrymal ,nasal, and sub mandibles glands.
- The IX nerve pass to the parotid gland
- The X nerve pass to :
  The heart ,lungs ,esophagus ,stomach ,entire small intestine ,proximal half of the colon ,liver ,gallbladder ,pancreas ,and the upper portions of the ureters

The sacral parasympathetic fibers leave the sacral plexus on each side of the cord in sacral nerves 2 , 3 ,4 distribute to the descending colon ,rectum ,bladder ,lower portions of the ureters and the external genitalia to cause sexual erection


Cell body of postganglionic neuron
Neurotransmitter
Cell body of preganglionic neuron
Synapse
CENTRAL NERVOUS SYSTEM
Myelinated fiber of preganglionic neuron
AUTONOMIC GANGLION
EFFECTOR
Unmyelinated fiber of postganglionic neuron


Ciliary ganglion
Eye
III
Pterygopalatine ganglion
Lacrimal and other glands
Cranial parasympathetic nerve fibers
VII
IX
X
Otic ganglion
Parotid gland
Submandibular ganglion
Salivary glands
Superior salivatory nucleus
Inferior salivatory nucleus
Dorsal vagal nucleus
Respiratory system
Blood vessels
Heart
Liver
Sympathetic prevertebral ganglia
Digestive system
Kidney
Terminal ganglia
S 2
S 3
S 4
Sacral parasympathetic nerve fibers
Urinary and reproductive systems
Pelvic splanchnic nerve
Key:
Preganglionic neuron
Postganglionic neuron

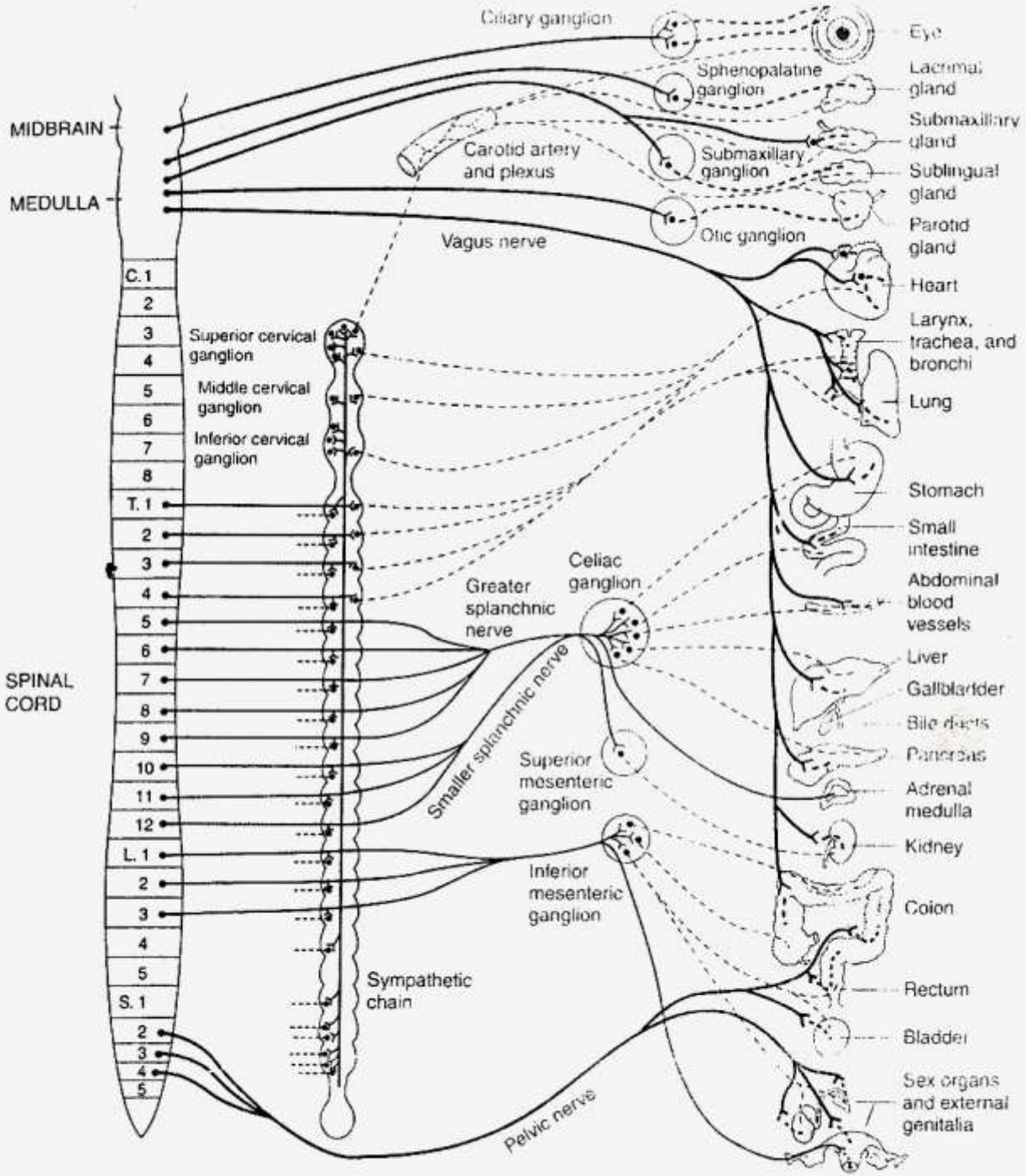
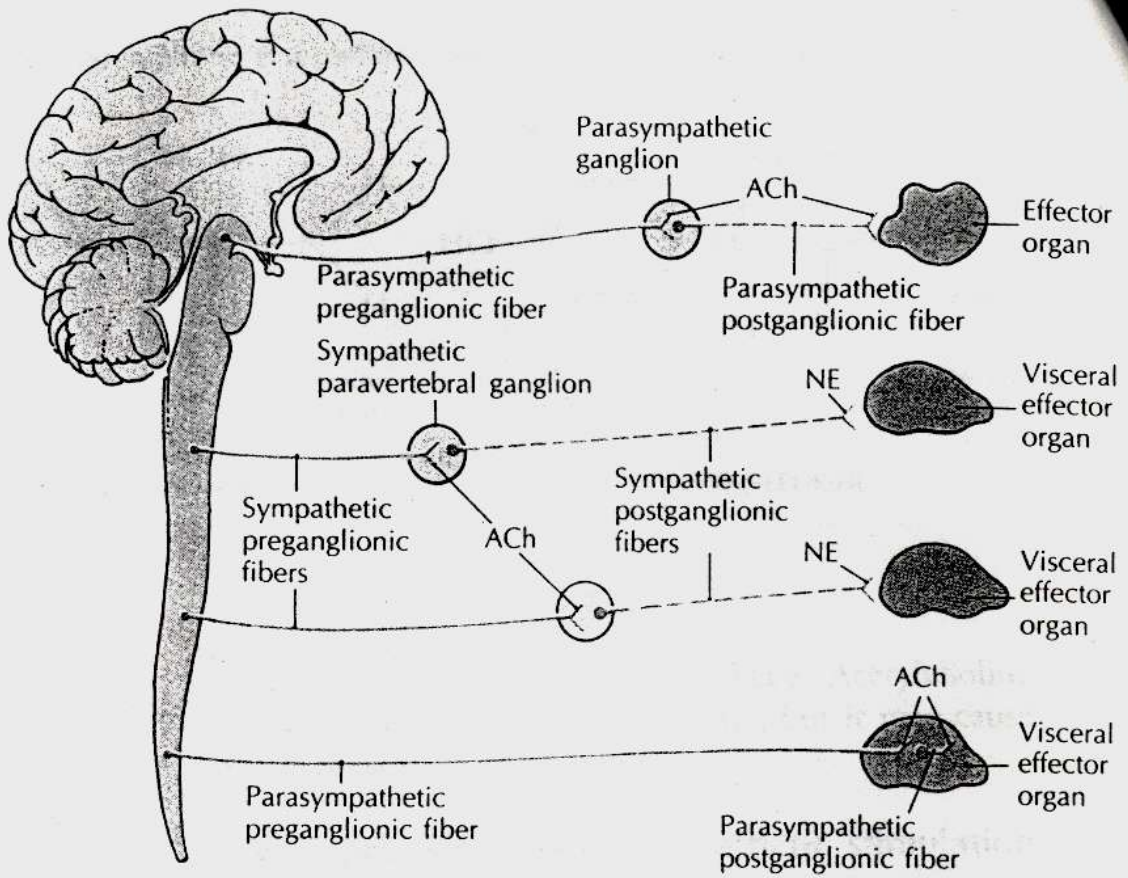

Ciliary ganglion
Eye
Sphenopalatine ganglion
Lacrimal gland
MIDBRAIN
Submaxillary gland
Carotid artery and plexus
Submaxillary ganglion
Sublingual gland
MEDULLA
Otic ganglion
Parotid gland
Vagus nerve
Heart
C. 1
2
3
4
5
6
7
8
T. 1
2
3
4
5
6
7
8
9
10
11
12
L. 1
2
3
4
5
S. 1
2
3
4
5
SPINAL CORD
Superior cervical ganglion
Middle cervical ganglion
Inferior cervical ganglion
Larynx, trachea, and bronchi
Lung
Stomach
Small intestine
Celiac ganglion
Greater splanchnic nerve
Abdominal blood vessels
Liver
Gallbladder
Bile ducts
Pancreas
Smaller splanchnic nerve
Superior mesenteric ganglion
Adrenal medulla
Kidney
Inferior mesenteric ganglion
Colon
Sympathetic chain
Rectum
Bladder
Sex organs and external genitalia
Pelvic nerve

FIGURE 16.6 COMPARISON OF SYMPATHETIC AND PARASYMPATHETIC SYSTEMS AND THEIR NEUROTRANSMITTERS



The para sympathetic system has both

Preganglionic and postganglionic neurons .

-The long preganglionic fibers pass the way to the organ that is to be controlled.

-The short postganglionic fibers are located in the wall of the organ

Cholinergic and adrenergic fibers those that secrete:

- Acetylcholine are said to be cholinergic
- Nor epinephrine are said to be adrenergic

All preganglionic neuron are cholinergic in both the sympathetic and parasympathetic

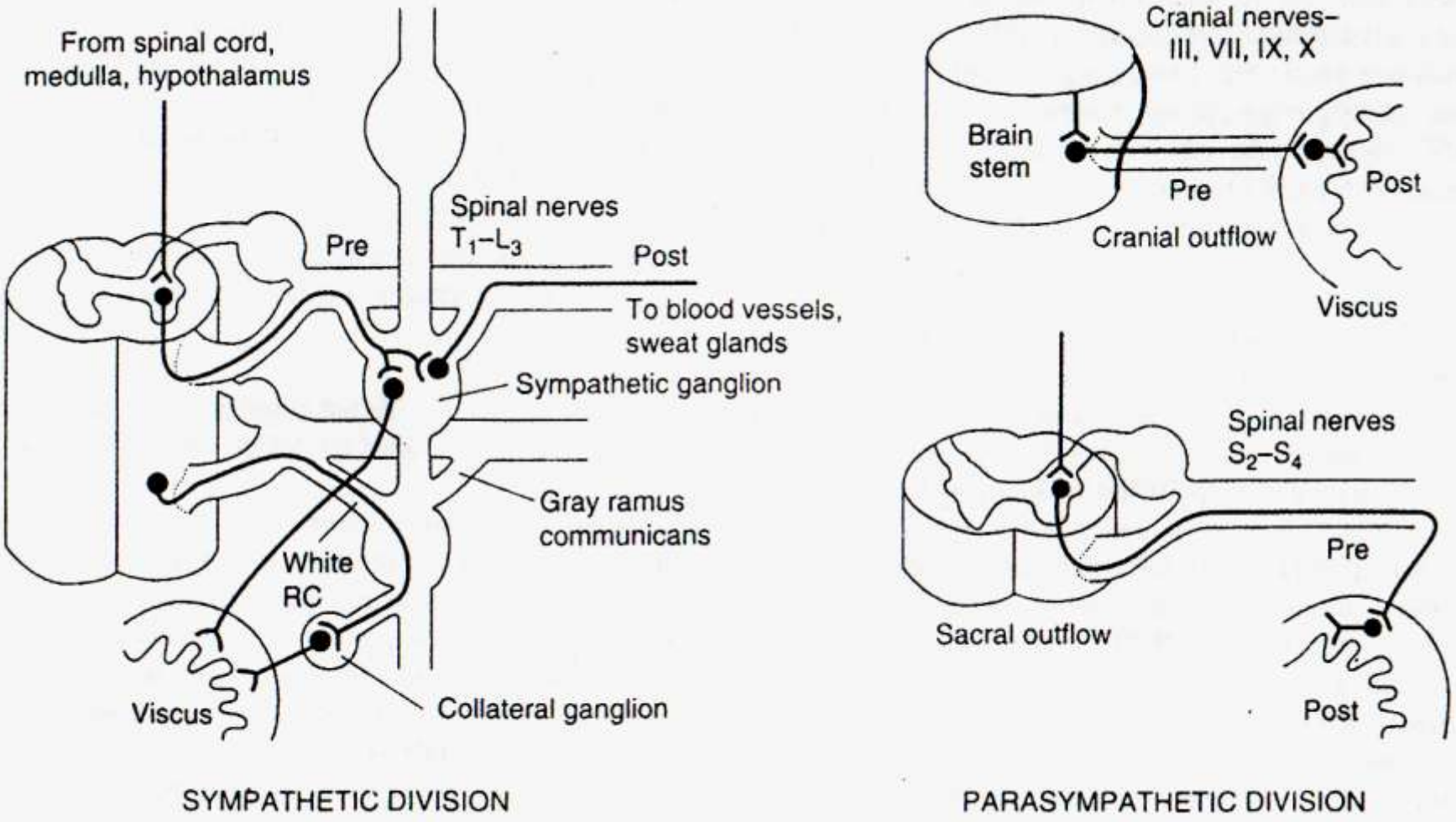


Figure 13–1. Autonomic nervous system. Pre, preganglionic neuron; Post, postganglionic neuron; RC, ramus communicans.