Sympathetic

The primary motor function of the sympathetic system is to supply vasoconstrictor fibres throughout the body and, more specifically, sudomotor and pilomotor control to the skin via the spinal nerves. In addition it has specific actions such as dilating the pupil. It also has afferent fibres that detect sensation from visceral structures. The following description is an outline of the general plan of the sympathetic nervous system.

Sympathetic outflow from the spinal cord takes place only from preganglionic cell bodies in the lateral horns of T1 to L2. Between these two levels the white (myelinated) rami communicantes emerge with the anterior rami and enter the ganglia of the sympathetic chain. Below this level in the lumbosacral region there is a ganglion at the level of each spinal nerve but the white ramus communicans reaches it by passing down from the T1–L2 region in the sympathetic chain. Above T1 there are three cervical ganglia (superior, middle and inferior) that relay the sympathetic supply via the white rami communicantes from the T1–L2 region (mostly from the upper few thoracic levels) to the cervical somatic nerves and the rest of the head and neck. If the inferior cervical ganglion is fused with the uppermost thoracic ganglion it is termed the 'stellate ganglion'.

Thus, the efferent *preganglionic* white rami (shown in black) have the following alternative pathways on reaching a ganglion in the sympathetic chain:

1 They can synapse with grey (unmyelinated) rami communicantes (green) which then supply sympathetic fibres to the spinal nerves (yellow) at the same level.

2 They can pass upwards or downwards to synapse at another level in the manner described in 1.

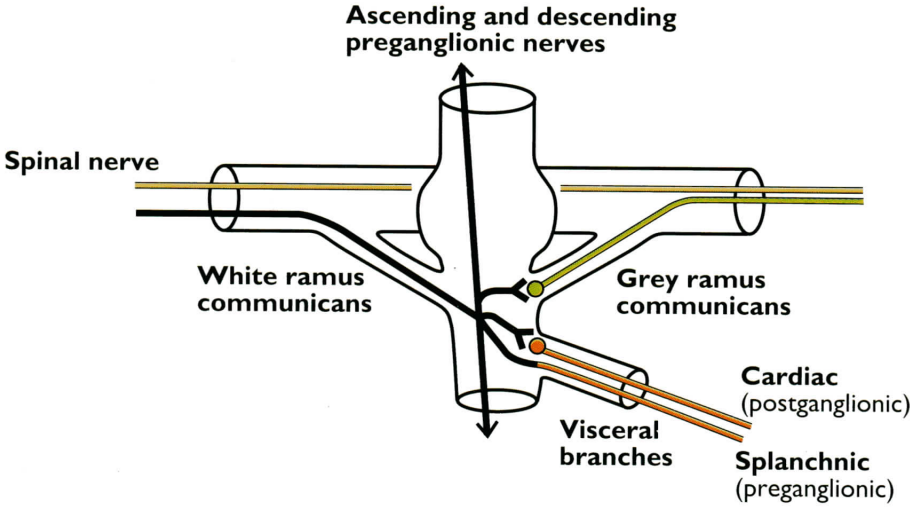
3 They can pass out of the ganglion as a visceral branch (red) to reach a smaller collateral ganglion, such as in the coeliac plexus, which is nearer the organ of its destination where they then synapse to become postganglionic nerves. Some visceral branches, such as the cardiac nerves in the upper thoracic and cervical regions, synapse in the ganglia of the sympathetic chain and are then distributed distally as postganglionic fibres (also red).

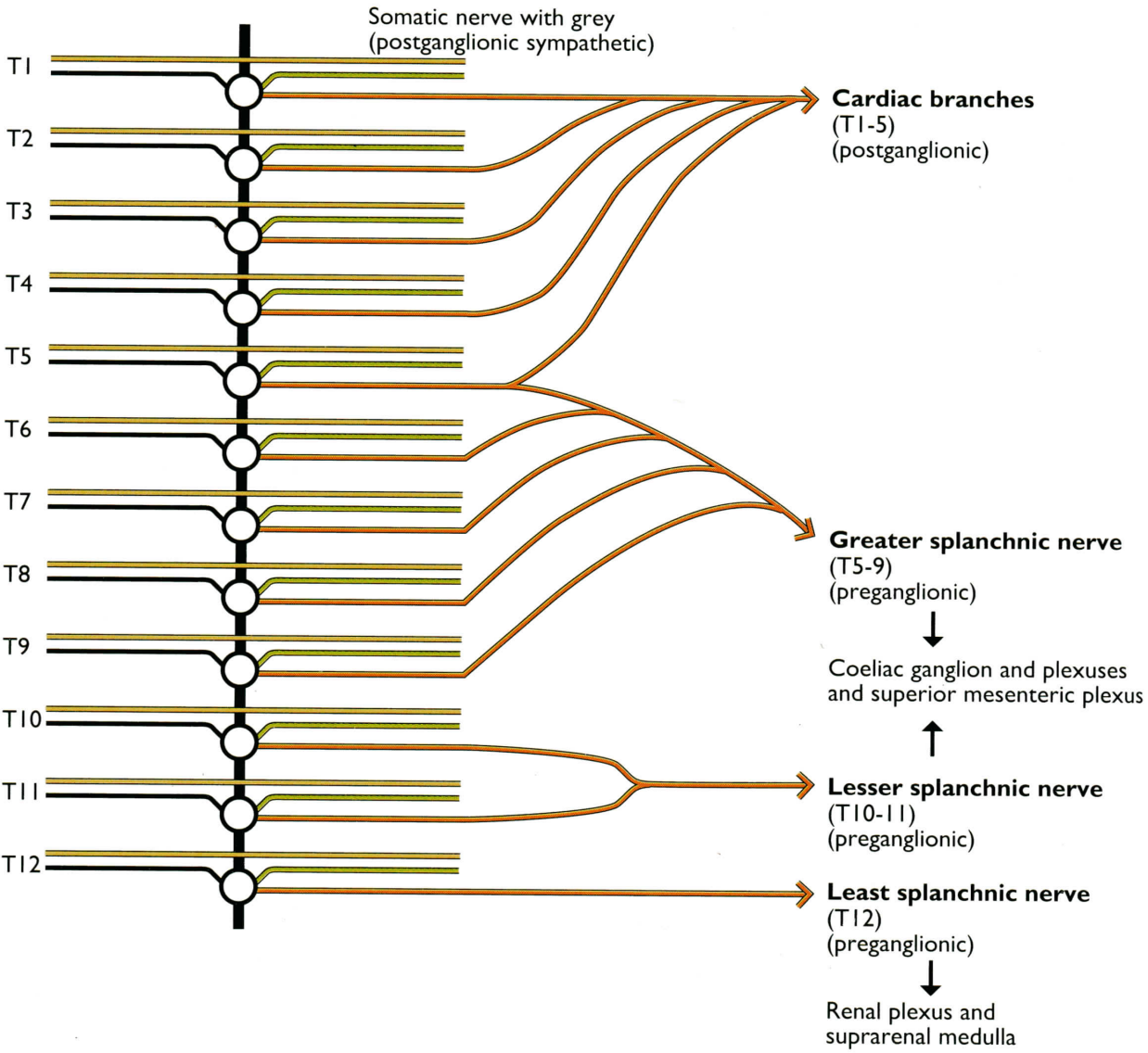
4 They can synapse in a cervical ganglion and pass out as a postganglionic vascular branch (grey).

5 A few preganglionic fibres reach the suprarenal gland to synapse with the cells of the medulla.

Each ganglion has a somatic and visceral branch but in addition, the three cervical ganglia have a vascular branch which allows for a wider distribution via the arteries than would be possible via cervical somatic nerves alone.

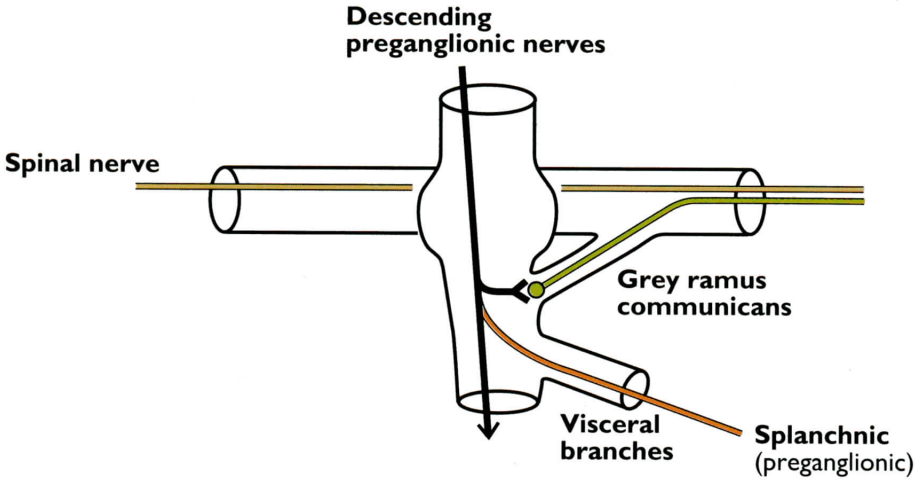
Afferent (sensory) fibres (not shown here) in the sympathetic system travel back via the sympathetic chain to the T1–L2 region where they pass via the white ramus communicans to the posterior root ganglion of the spinal nerve in which their cell bodies are situated. To reach the sympathetic ganglia these afferent nerves travel either on blood vessels, somatic nerves or the sympathetic nerves supplying the various plexuses. Thus, the white rami communicantes contain both preganglionic sympathetic fibres and afferent sympathetic fibres.

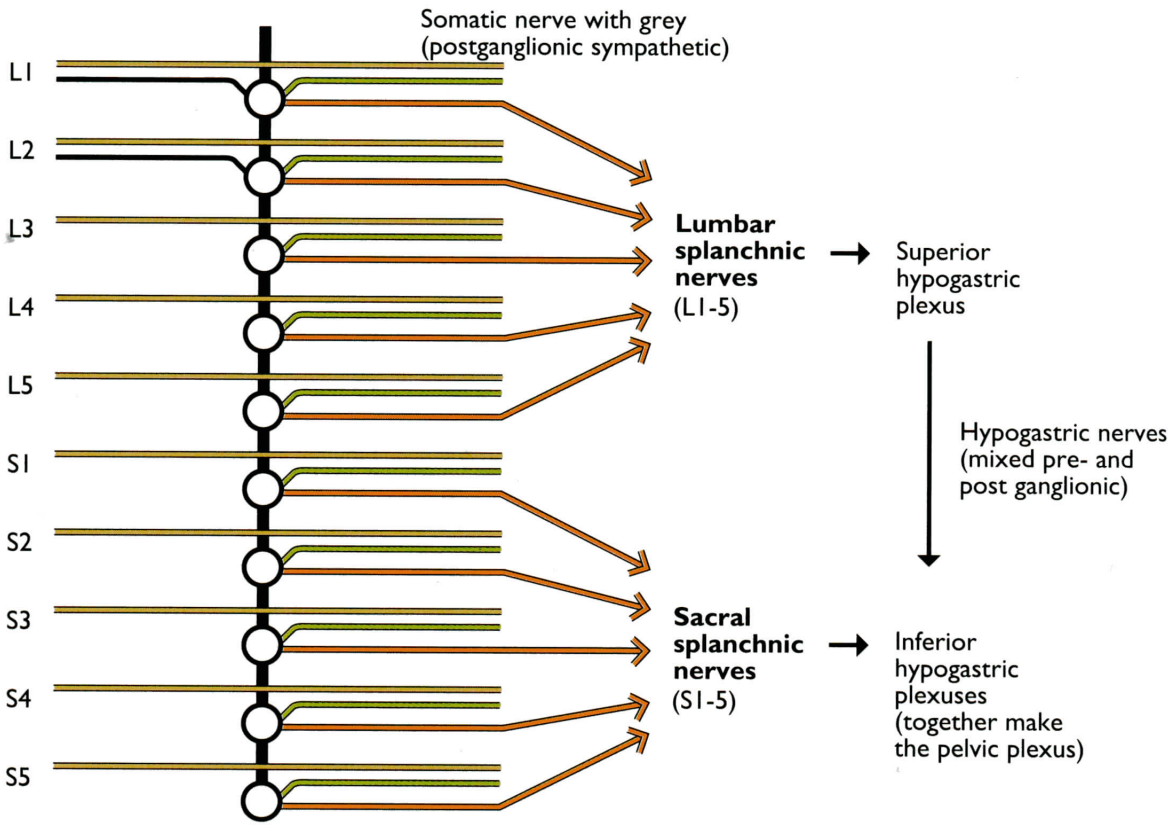




Thoracic sympathetics (T1–12)

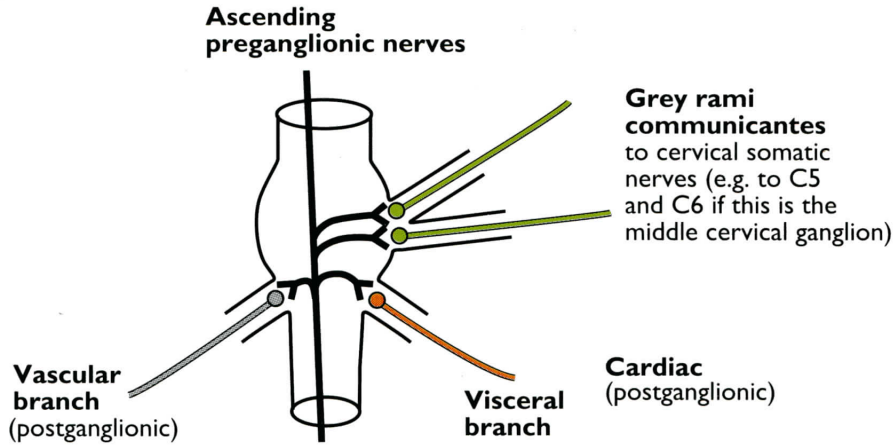
Note: All splanchnic nerves synapse in collateral ganglia

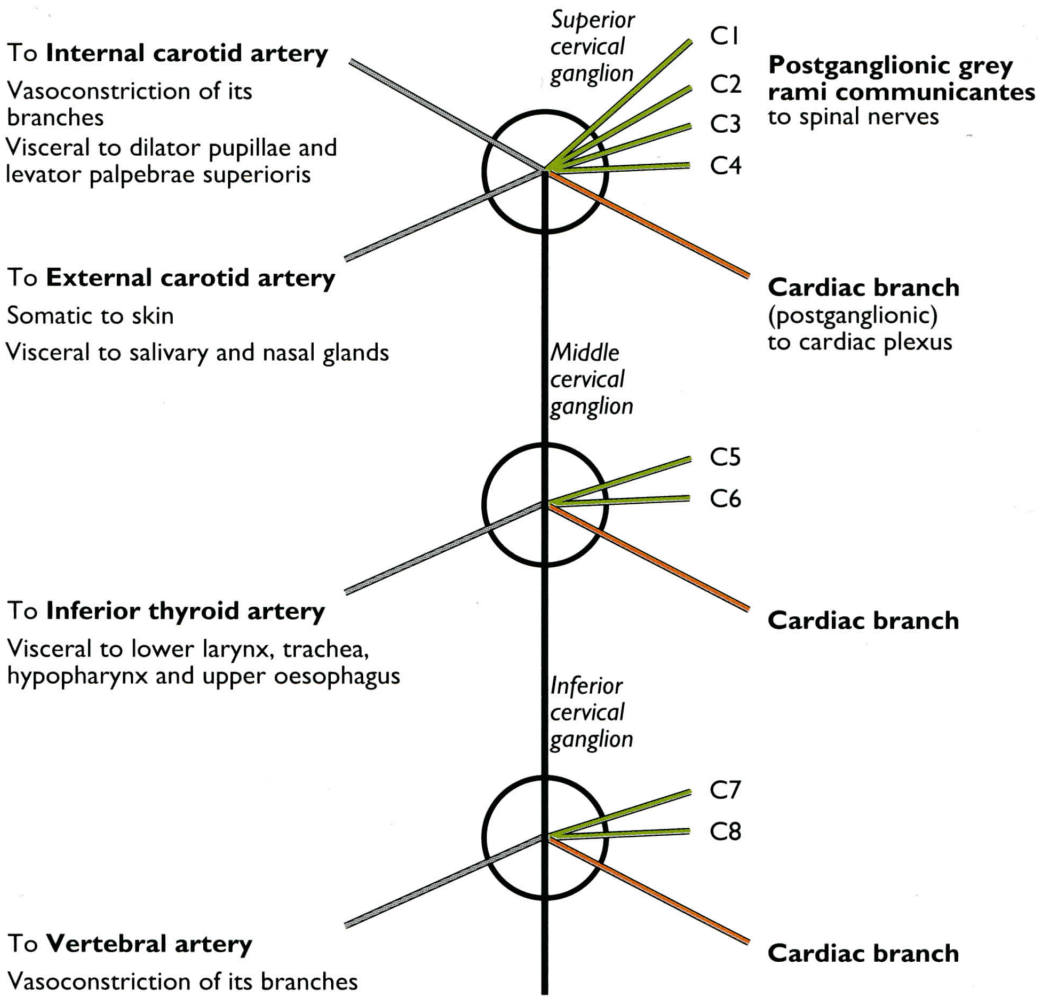




Lumbosacral sympathetics (L1–S5)

Note: L1–2 have white rami communicans. Lumbar and sacral splanchnic nerves are all preganglionic. They synapse in either the superior or inferior hypogastric plexuses





Cervical sympathetics (C1–8)

Parasympathetic

The parasympathetic system is supplied primarily by four cranial nerves (III, VII, IX and X) with the addition of some outflow from S2, 3 and 4.

In the head and neck the myelinated preganglionic efferent fibres (red) run with the fibres of their relevant cranial nerve (III, VII and IX) to synapse in peripheral named ganglia close to the organ of their destination. They synapse within these ganglia distributing unmyelinated postganglionic fibres to the organ (also red). The fibres may run separately for a period or may associate with other cranial nerve fibres, notably those of the various divisions of the 5th cranial nerve (trigeminal) to reach their final destinations.

The vagal (X) and pelvic parasympathetic fibres (S2, 3 and 4) supplying the viscera below the thoracic inlet always run independently but are distributed to peripheral ganglia where they also synapse. The distribution of these postganglionic fibres is usually very short into the visceral organs of their destination. In *these* nerves there is a much greater degree of ramification of fibres than in those distributed only to the head and neck.

Afferent parasympathetics consist of taste (special visceral sensory) fibres from the tongue, palate and vallecula. In the case of the anterior two thirds of the tongue and palate, the fibres pass through the submandibular and pterygopalatine ganglia respectively without synapsing and their cell bodies are in the geniculate ganglion on the facial nerve (VII). The taste fibres from the posterior third of the tongue are carried in the glossopharyngeal nerve (IX) with the cell bodies in the inferior ganglion on that nerve. Taste from the vallecula is carried by the vagus (X) with the cell bodies in the inferior ganglion of that nerve.

In addition the glossopharyngeal nerve (IX) receives afferent parasympathetic fibres from the carotid body and sinus whose cell bodies are also in the inferior ganglion of that nerve.

Finally, the vagus carries general visceral afferent fibres from the thorax and abdomen, probably to the nucleus solitarius, with the cell bodies also in the inferior vagal ganglion.