**Organisation of the parasympathetic nervous system**

Unlike in the sympathetic nervous system where the cell bodies are found in the thoracic and lumbar spinal cord, the cell bodies of the parasympathetic are found in the cranial and sacral regions. In the cranial region the cell bodies are found in the medulla, pons and midbrain. These ganglionic neurons form four cranial nerves; oculomotor nerve, facial nerve, glossopharyngeal nerve and vagus nerve. In the sacral region, the cell bodies are found in segments S2 to S4 of the spinal cord and these ganglia distribute to form pelvic splanchnic nerves. Like the sympathetic nervous system, the preganglionic parasympathetic motor neurons make synaptic contact with the postganglionic neurons but these are found in the terminal ganglia, which are located within the wall of the target organs. In comparison to the sympathetic ganglia the terminal ganglia are more peripherally located and are more widely distributed. Another difference is that the postganglionic neurons of the parasympathetic division are short in comparison the sympathetic nervous system.

**Effects of the autonomic nervous system on visceral targets**

The innervation of skeletal muscle by the somatic nervous system is always excitatory. Whereas for visceral targets that are innervated by the autonomic nervous system the response can be excitatory or inhibitory. This is because both the sympathetic and parasympathetic nervous system make individual synaptic contacts with the target. For organs that are stimulated during physical activity such as the heart, innervations by the sympathetic division triggers an excitatory response which results in the heart rate increasing whereas, if the parasympathetic division innervated the heart rate it would lead to the heart rate slowing down. However the opposite is true for organs whose activity increases while the body is at rest. For example, the parasympathetic division triggers the peristalsis of the gut whereas the sympathetic division inhibits it.

During periods of fear and exercise the sympathetic division innervates all the end organs simultaneously and leads to the inhibition of the parasympathetic nervous system. This occurs as it allows the body to prepare for life threatening situations by making it more alert and this response is known as the ‘fight or flight response.’ This response involves the following things: increase in heart rate, cardiac contractility, blood pressure, ventilation of the lungs, and liberation of glucose into blood. This mass response is essential for survival but it can also be triggered spontaneously during panic attacks.

The parasympathetic nervous system is switched on during periods of rest and unlike the sympathetic nervous system it innervates discrete organs. This allows it to control simple reflexes such as urination in response to bladder distension, salivation in response to sight or smell and contraction of the colon in response to food in the stomach.

Both the cardiac and smooth muscle are target tissues that are innervated by the autonomic system. Before discussing how they are innervated their structure and function will be considered.