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and anterior regions of the differentiating dermatomyotome of each somite.

Simultaneously, derivatives of neural crest cells (cells derived from neural folds during formation of the neural tube) differentiate into neurons on each side of the neural tube and extend processes both medially and laterally (Fig. 1.35):

- Medial processes pass into the posterior aspect of the neural tube.
- Lateral processes pass into the differentiating regions of the adjacent dermatomyotome.

Neurons that develop from cells within the spinal cord are **motor neurons** and those that develop from neural crest cells are **sensory neurons**.

Somatic sensory and somatic motor fibers that are organized segmentally along the neural tube become parts of all spinal nerves and some cranial nerves.

The clusters of sensory nerve cell bodies derived from neural crest cells and located outside the CNS form sensory ganglia.

Generally, all sensory information passes into the posterior aspect of the spinal cord, and all motor fibers leave anteriorly.

Somatic sensory neurons carry information from the periphery into the CNS and are also called **somatic sensory afferents** or **general somatic afferents (GSAs)**. The modalities carried by these nerves include temperature, pain, touch, and proprioception. Proprioception is the sense of determining the position and movement of the musculoskeletal system detected by special receptors in muscles and tendons.

Somatic motor fibers carry information away from the CNS to skeletal muscles and are also called **somatic motor efferents** or **general somatic efferents** (**GSEs**). Like somatic sensory fibers that come from the periphery, somatic motor fibers can be very long. They extend from cell bodies in the spinal cord to the muscle cells they innervate.

Dermatomes

Because cells from a specific somite develop into the dermis of the skin in a precise location, somatic sensory fibers originally associated with that somite enter the posterior

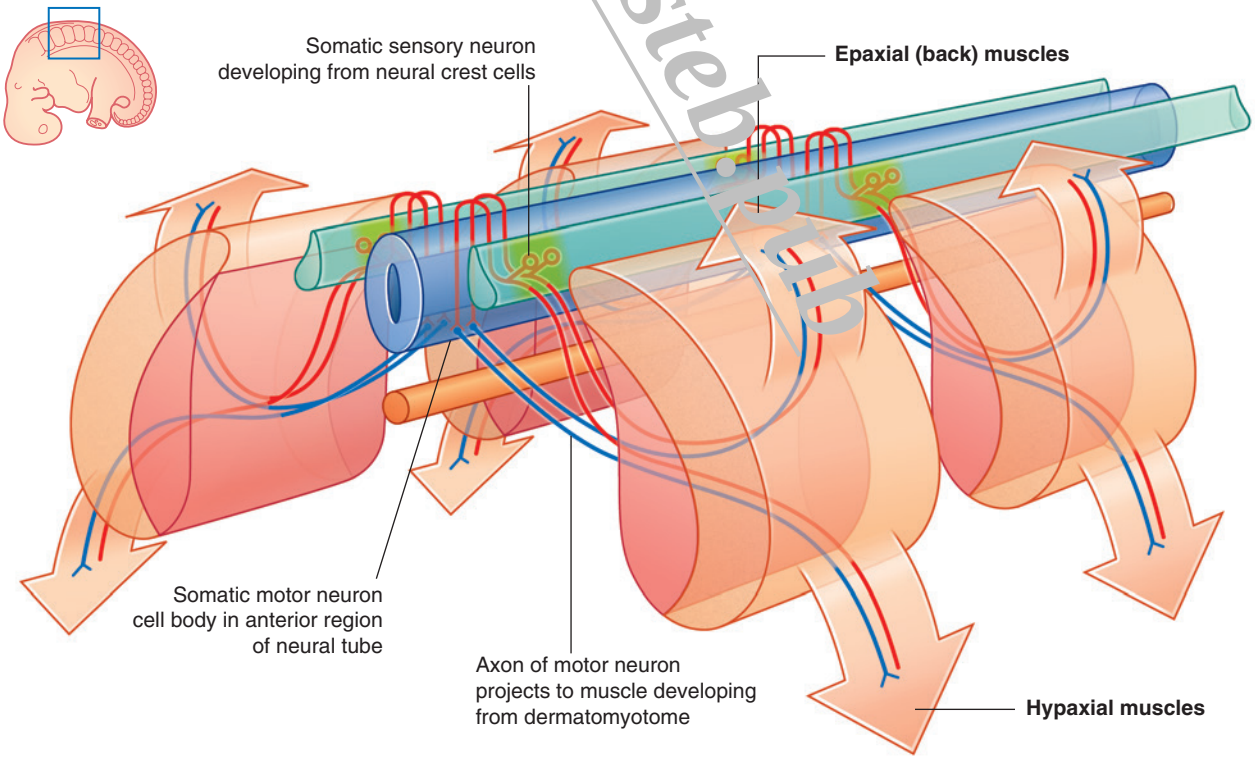

Fig. 1.35 Somatic sensory and motor neurons. Blue lines indicate motor nerves and red lines indicate sensory nerves.

region of the spinal cord at a specific level and become part of one specific spinal nerve (Fig. 1.36). Each spinal nerve therefore carries somatic sensory information from a specific area of skin on the surface of the body. A **dermatome** is that area of skin supplied by a single spinal cord level, or on one side, by a single spinal nerve.

There is overlap in the distribution of dermatomes, but usually a specific region within each dermatome can be identified as an area supplied by a single spinal cord level. Testing touch in these autonomous zones in a conscious patient can be used to localize lesions to a specific spinal nerve or to a specific level in the spinal cord.

Myotomes

Somatic motor nerves that were originally associated with a specific somite emerge from the anterior region of the spinal cord and, together with sensory nerves from the same level, become part of one spinal nerve. Therefore each spinal nerve carries somatic motor fibers to muscles that originally developed from the related somite. A **myotome** is that portion of a skeletal muscle innervated by a single spinal cord level or, on one side, by a single spinal nerve.

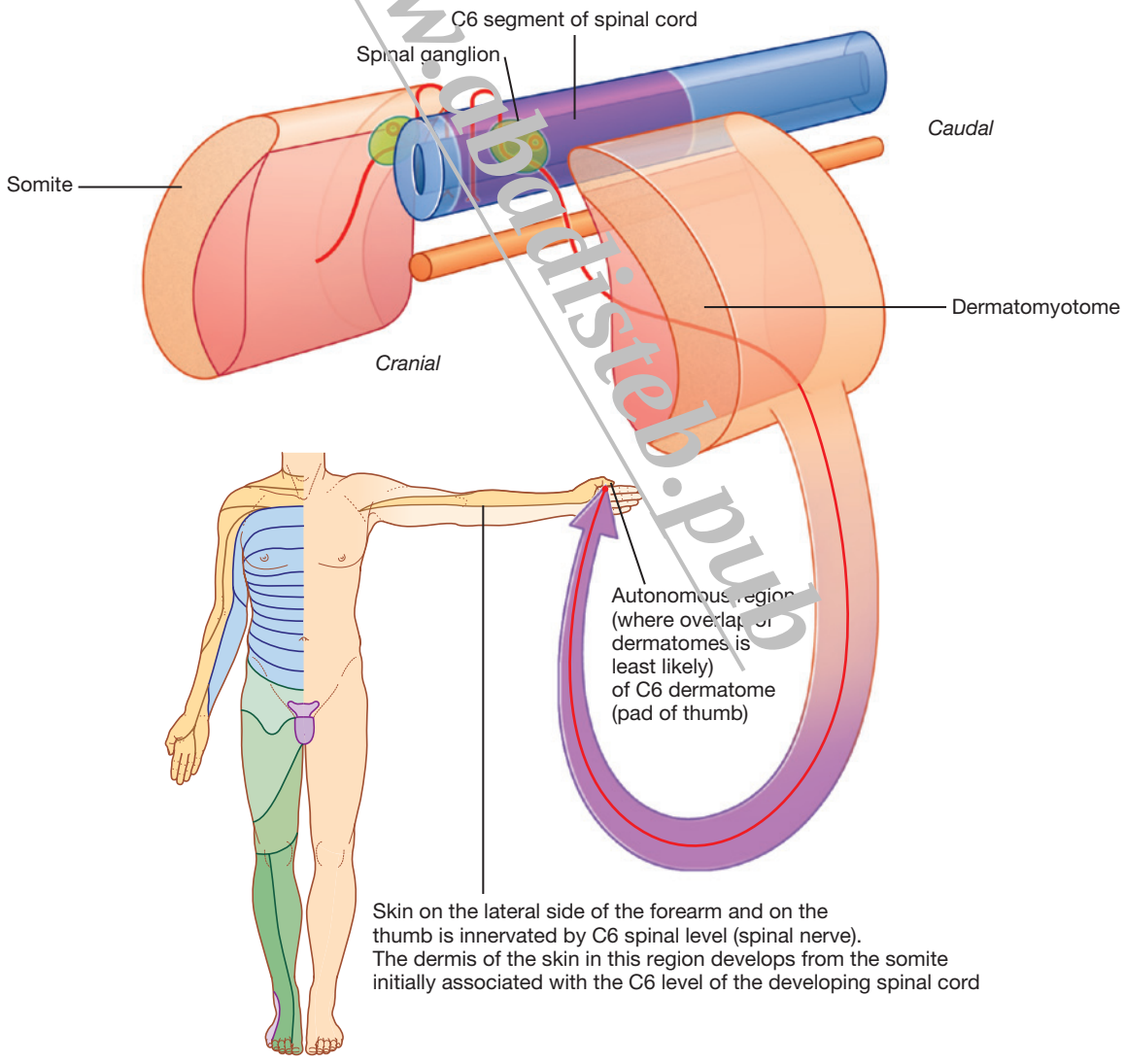

Fig. 1.36 Dermatomes.

Myotomes are generally more difficult to test than dermatomes because each skeletal muscle in the body often develops from more than one somite and is therefore innervated by nerves derived from more than one spinal cord level (Fig. 1.37).

Testing movements at successive joints can help in localizing lesions to specific nerves or to a specific spinal cord level. For example:

- Muscles that move the shoulder joint are innervated mainly by spinal nerves from spinal cord levels C5 and C6.
- Muscles that move the elbow are innervated mainly by spinal nerves from spinal cord levels C6 and C7.
- Muscles in the hand are innervated mainly by spinal nerves from spinal cord levels C8 and T1.

Visceral part of the nervous system

The visceral part of the nervous system, as in the somatic part, consists of motor and sensory components:

- Sensory nerves monitor changes in the viscera.
- Motor nerves mainly innervate smooth muscle, cardiac muscle, and glands.

The visceral motor component is commonly referred to as the **autonomic division of the PNS** and is subdivided into **sympathetic** and **parasympathetic** parts.

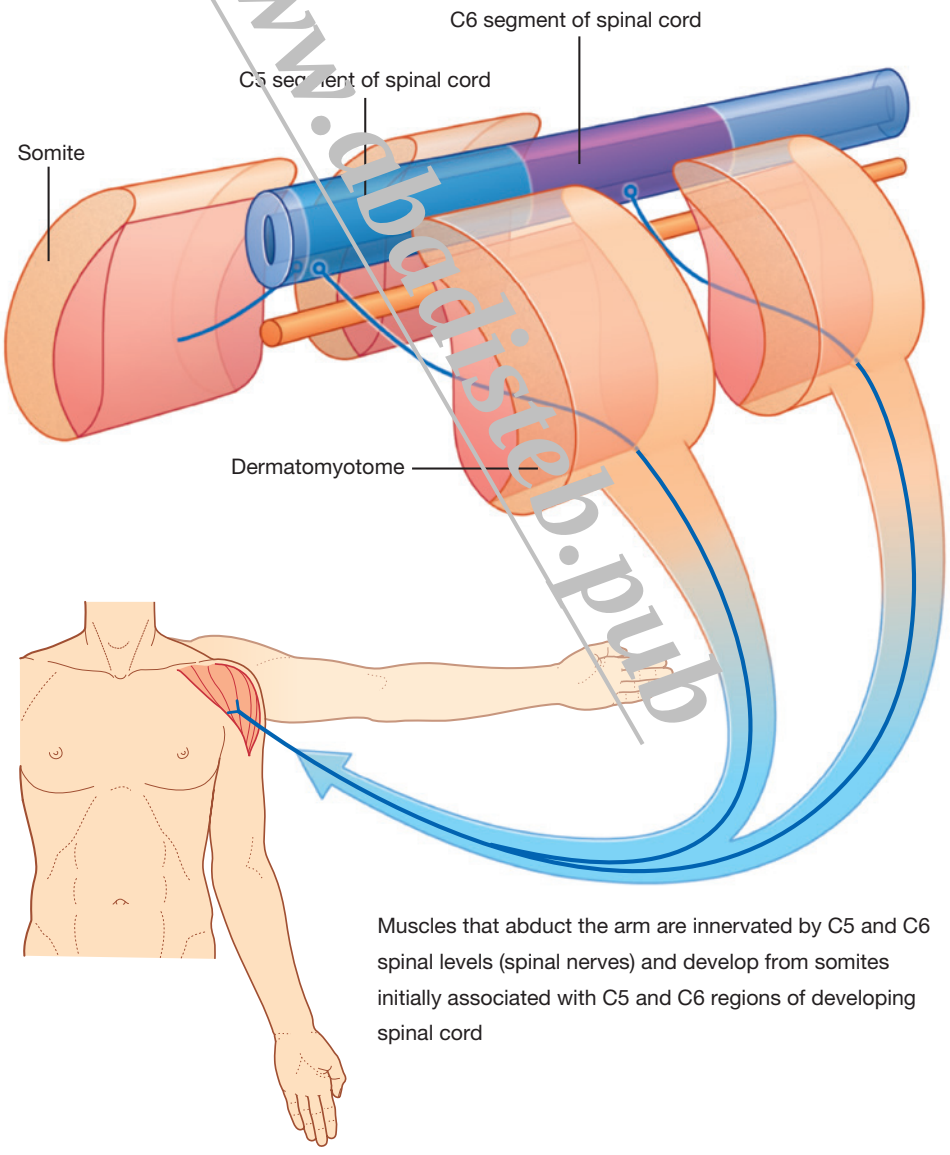

Fig. 1.37 Myotomes.