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Based on the organization of axons within a peripheral nerve, one might logically think that axons are located more superficially when their pathway is short and more centrally when their trajectory is more extensive. However, this is not the case [1–3].

Within fascicles, axons form intraneural plexuses, in which they take up different positions in different fascicles along their paths. If one made successive cuts alongside the nerve a few millimeters apart, the topographic map of the fascicles would vary from section to section. Sunderland and coworkers [4–7] observed how the topography of fascicles varied 23 times over just 46 mm. This type of distribution, as the intraneural plexus, possibly is related to embryonic development.

The topography of fascicles at a given location in a nerve may be almost, but not entirely, identical between individuals. The difference in fascicle topography along a nerve is explained by the exchange of axons between fascicles. Axon transfer begins in the proximal region of the spinal nerve root

cuffs, close to the dural sac (at sites more proximal to dorsal root ganglia) [8, 9].

Spinal nerve roots advance along their subarachnoid course inside special coverings known as nerve root cuffs, which extend up to the beginning of the spinal ganglion; these contain axons from the anterior and posterior roots. Here, the transfer of axons from the anterior and posterior roots begins.

Along the ganglion, communication occurs that facilitates the passage of groups of axons between both anterior and posterior roots at the level of the vertebral foramen. This exchange of axons gives rise to mixed nerve.

The initial portion of mixed nerves contains groups of fascicles and small fascicles that together with larger fascicles, form fascicular interconnections. These interconnections are more frequent among adjacent fascicle groups and absent among fascicles that belong to different groups (Figs. 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10, 6.11, 6.12, 6.13, 6.14, 6.15, 6.16, 6.17, 6.18, 6.19, 6.20, 6.21, 6.22, 6.23, 6.24, 6.25, and 6.26).

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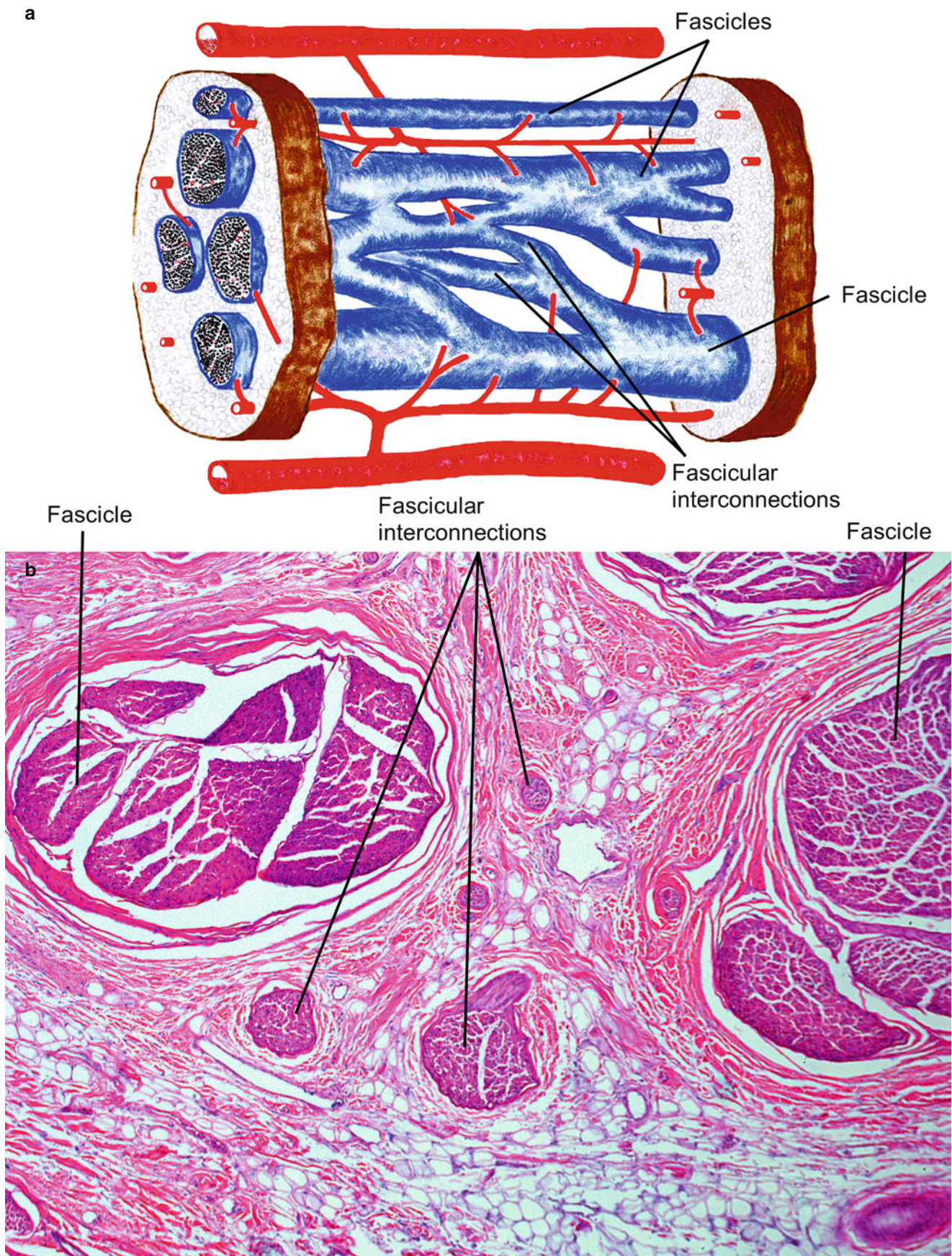


Fig. 6.1 Intraneural plexus. (a) Diagram. (b) Fascicle interconnections present in Fig. 6.5a (Panel a from De Andrés et al. [3]; with permission)

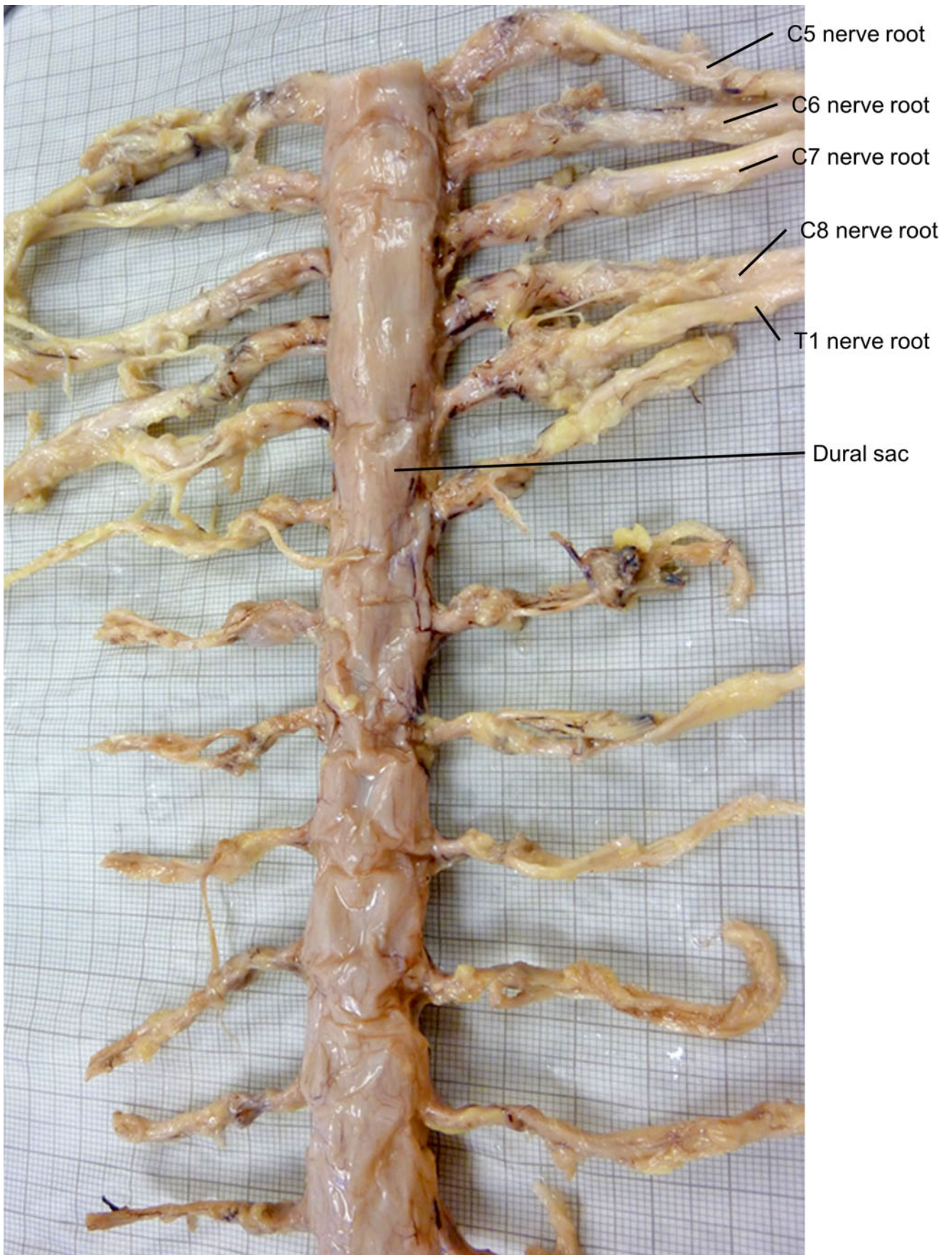


Fig. 6.2 Human dural sac and nerve root cuffs. Cervical roots forming the brachial plexus. Serial cuts from the 6th cervical (C6) nerve root

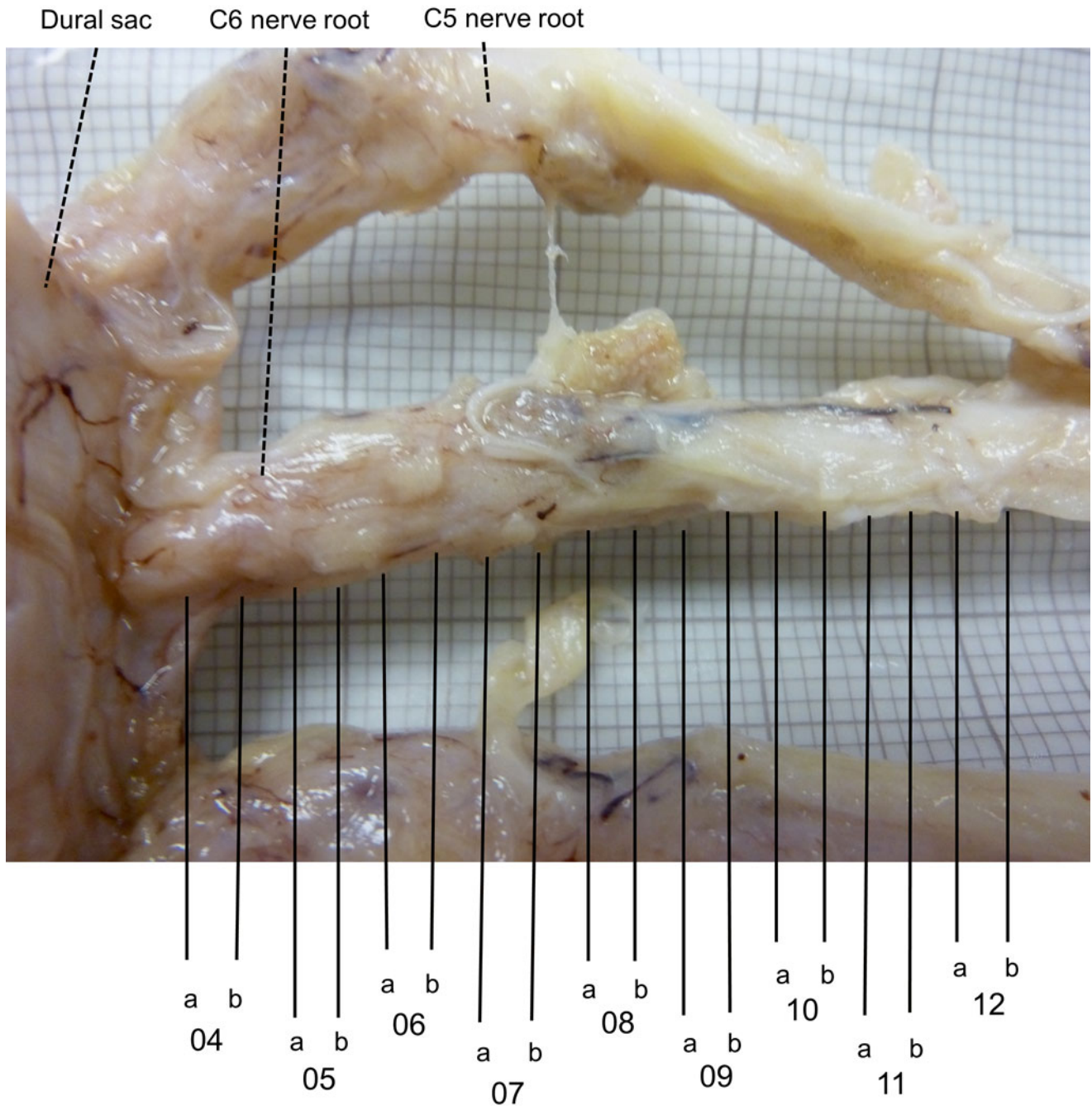


Fig. 6.3 Root cuff from the C6 nerve. Sites where serial cuts were made

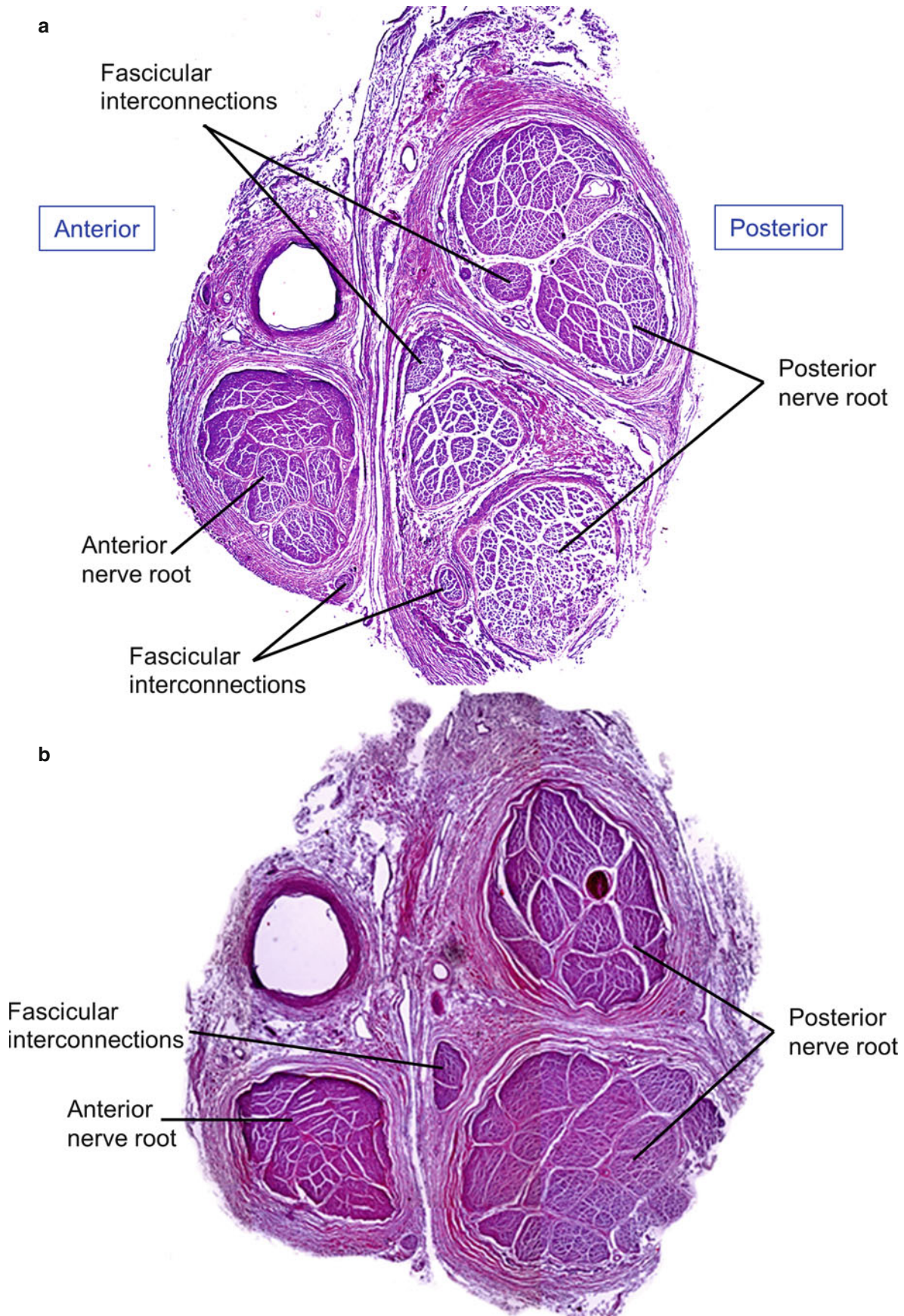


Fig. 6.4 Anterior and posterior nerve roots. Transverse section of C6 nerve at the level shown in Fig. 6.3. (a, b) First and second cuts proximal to the dural sac. Interconnecting fascicles may be seen. Hematoxylin and eosin (H&E) stain (Panel a from Reina et al. [2]; with permission)

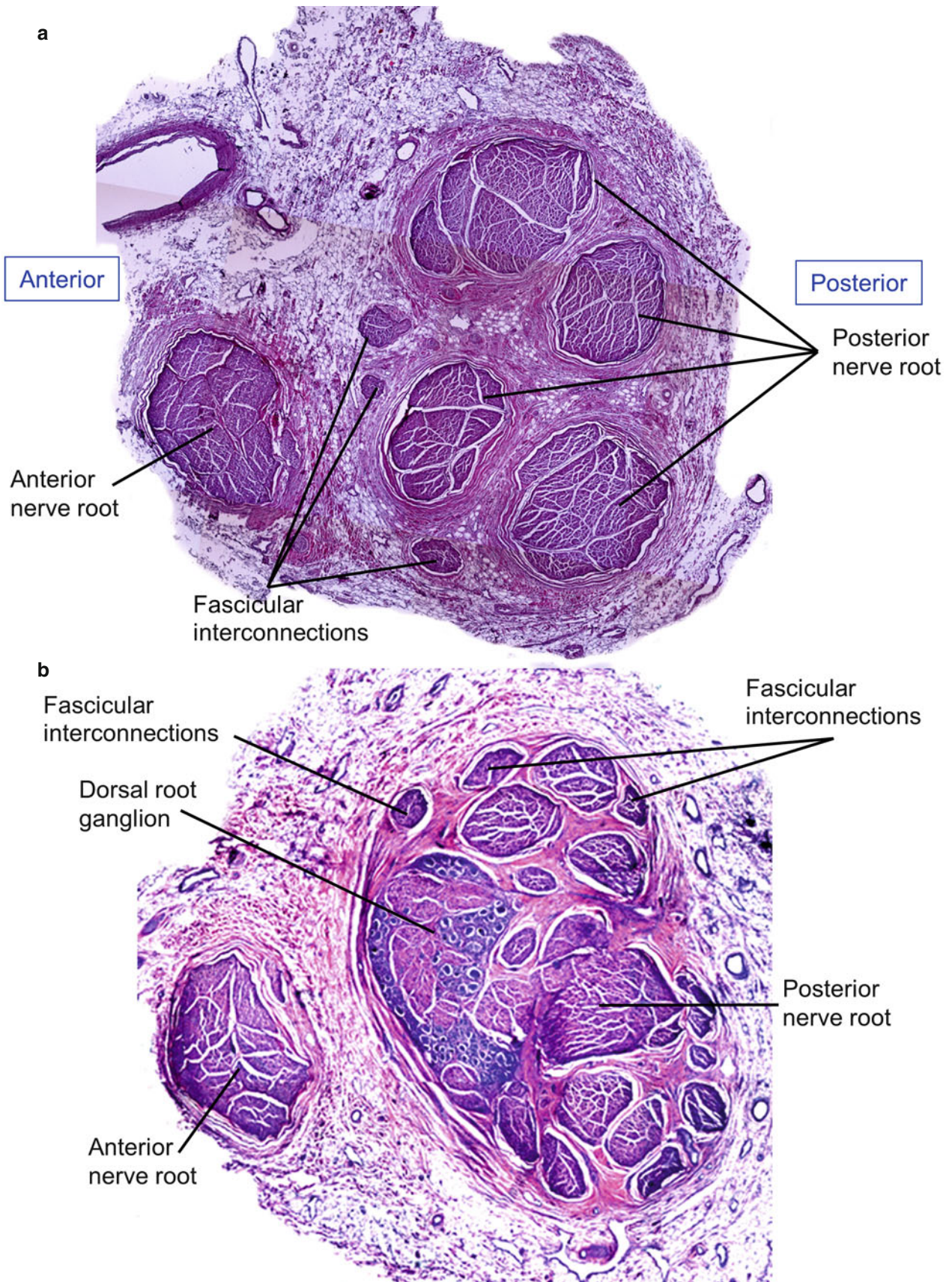


Fig. 6.5 Anterior and posterior nerve roots. Transverse section of C6 nerve. (a, b) Interconnecting fascicles. (b) Minute portion of a dorsal root ganglion (DRG). H&E stain

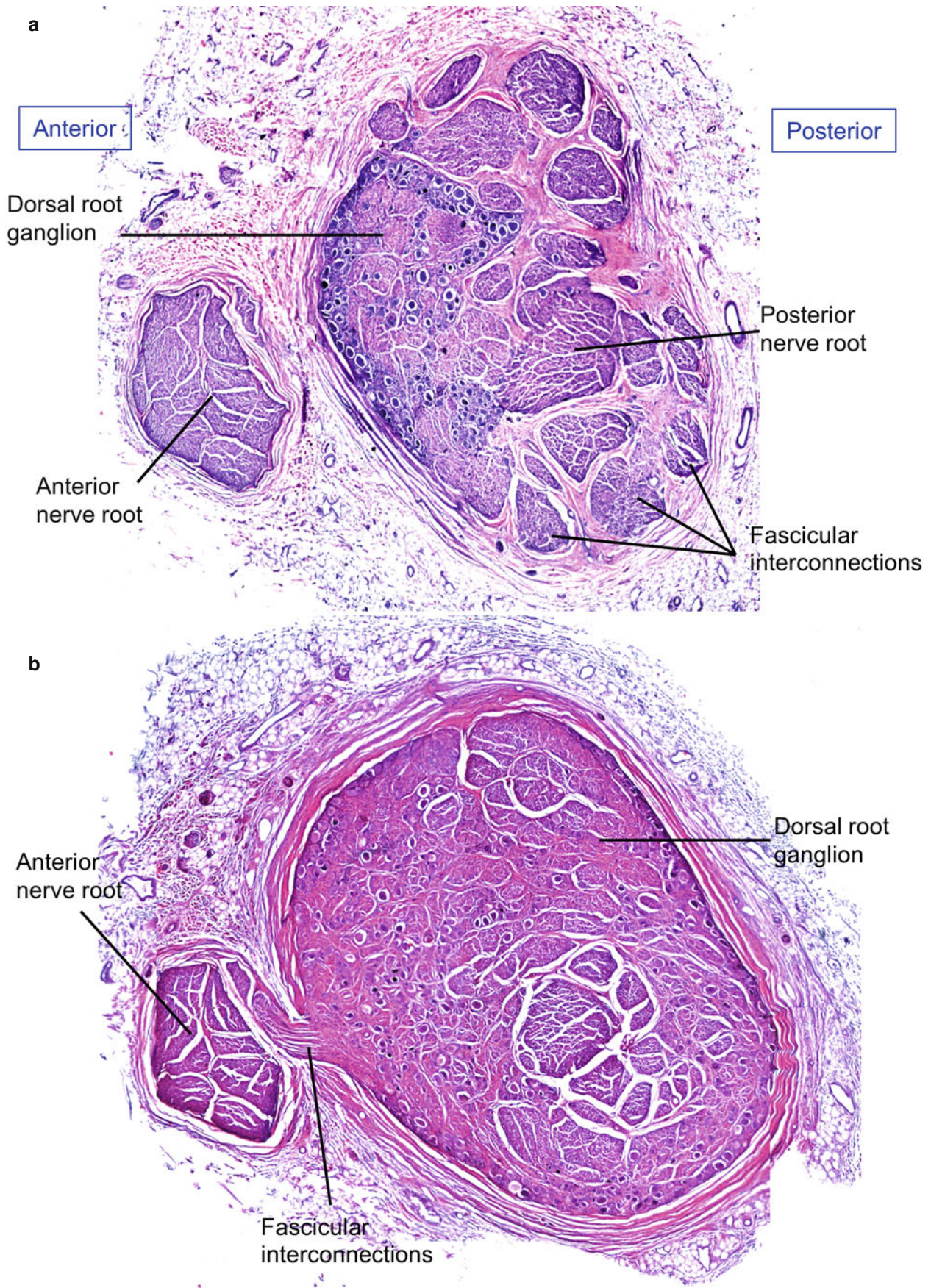


Fig. 6.6 Anterior and posterior nerve roots. Transverse section of C6 nerve. (a) A portion of the root ganglion is shown. (b) Cut from the DRG and passage of axons between dorsal and anterior nerve roots. H&E stain

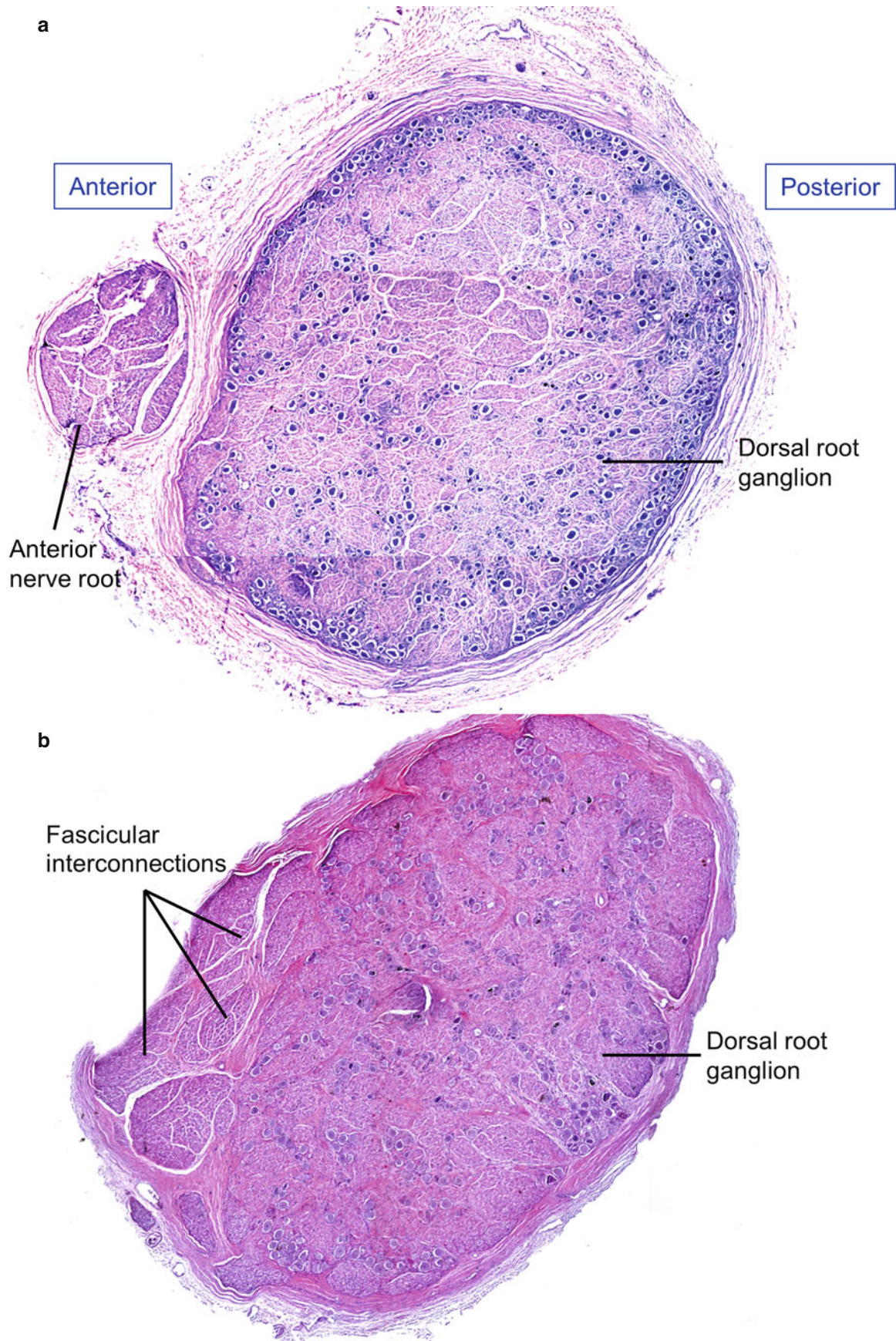


Fig. 6.7 Dorsal root ganglion. Transverse section of C6 nerve. (a) Cut at the level of the dorsal nerve ganglion. (b) Anterior and posterior roots are not identified. Shown are the nerve fascicles and a portion of the DRG. H&E stain (Panel a from Reina et al. [2]; with permission)

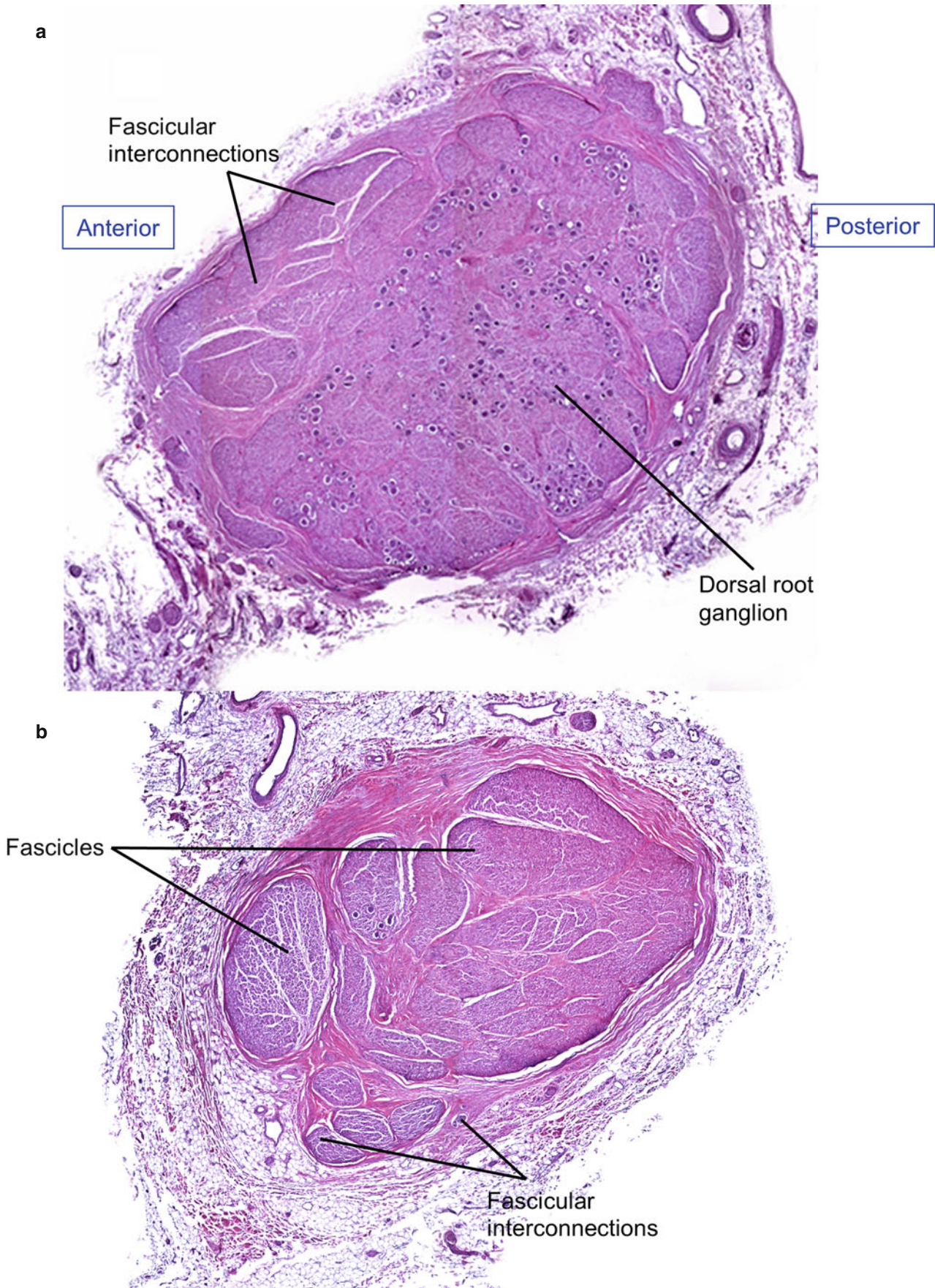


Fig. 6.8 Dorsal root ganglion. Transverse section of C6 nerve. (a) DRG and fascicles. (b) Nerve fascicles from a mixed peripheral nerve. H&E stain

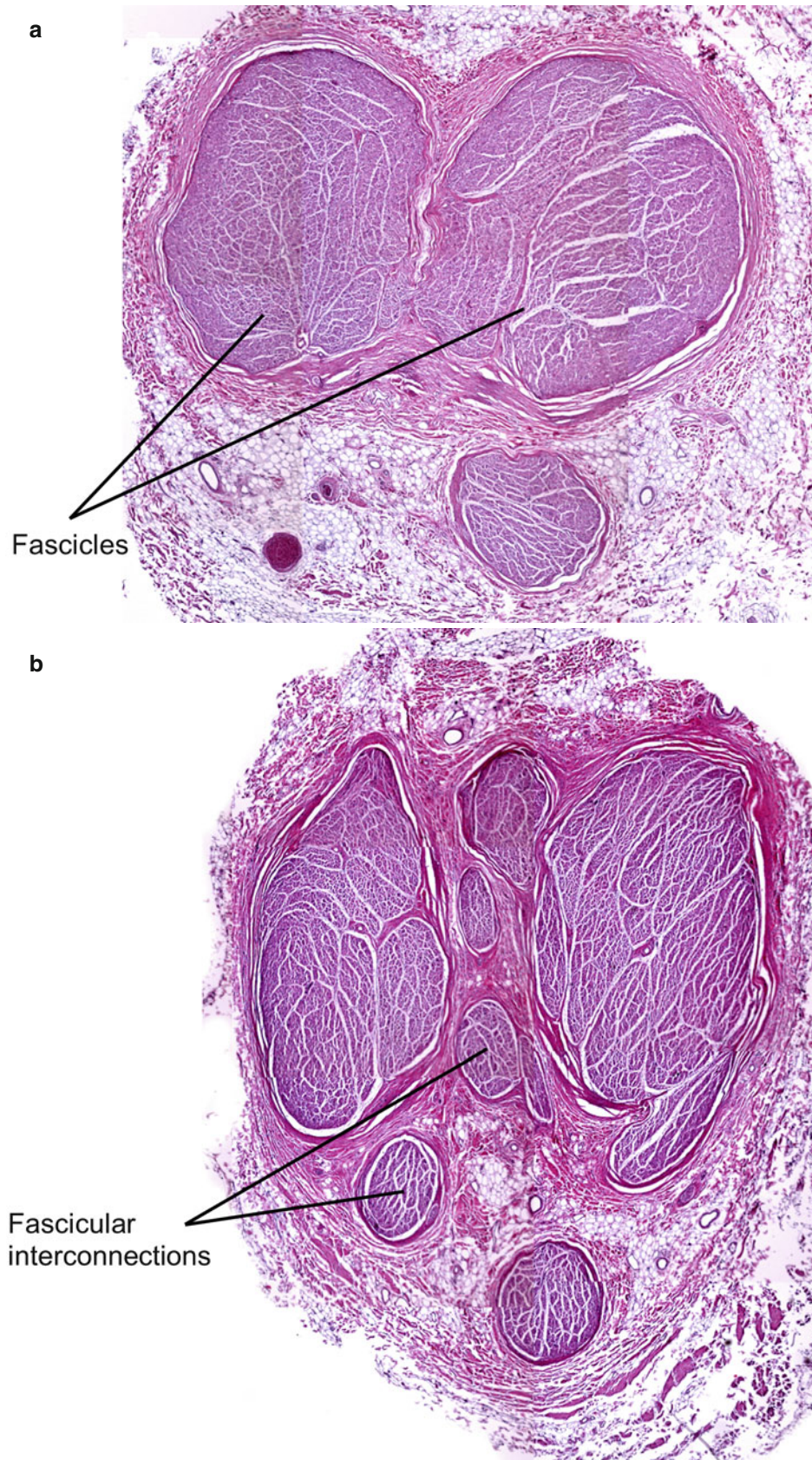


Fig. 6.9 Mixed peripheral nerve. Transverse section of C6 nerve. (a, b) Fascicles and interconnecting fascicles. H&E stain

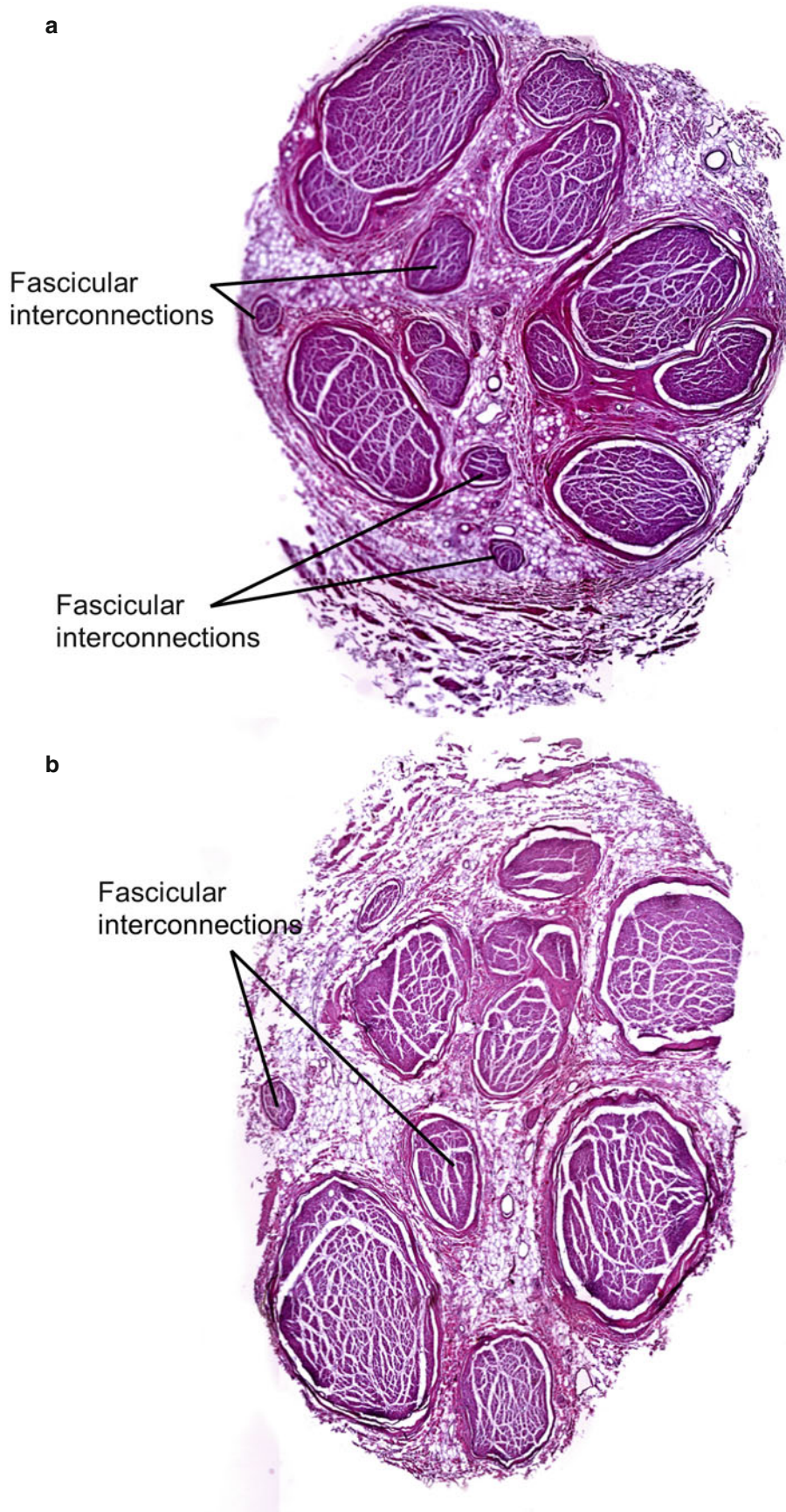


Fig. 6.10 Mixed peripheral nerve. Transverse section of C6 nerve. (a, b) Fascicles and interconnecting fascicles. H&E stain

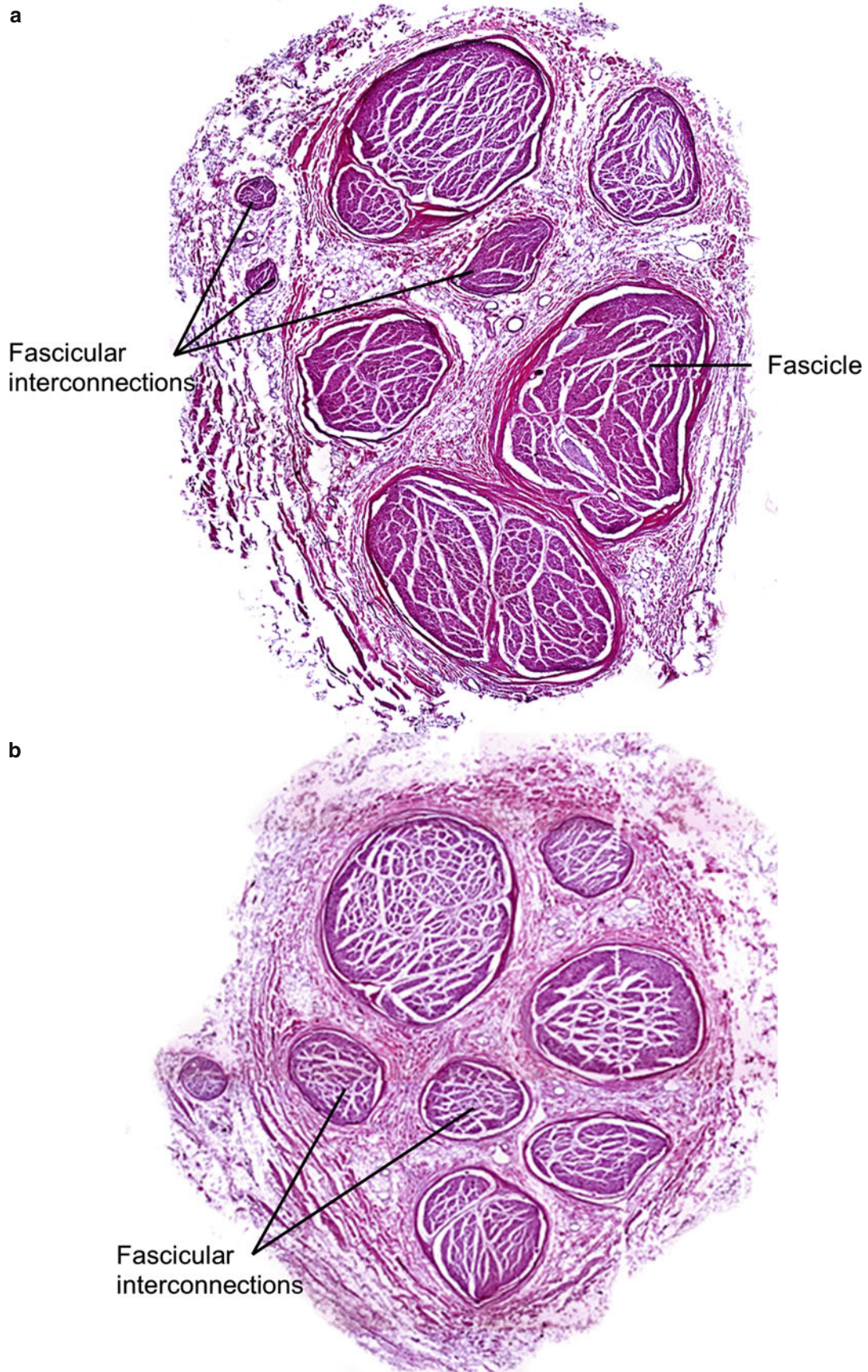


Fig. 6.11 Mixed peripheral nerve. Transverse section of C6 nerve. (a, b) Fascicles and interconnecting fascicles. H&E stain (Panel a from Reina et al. [2]; with permission)

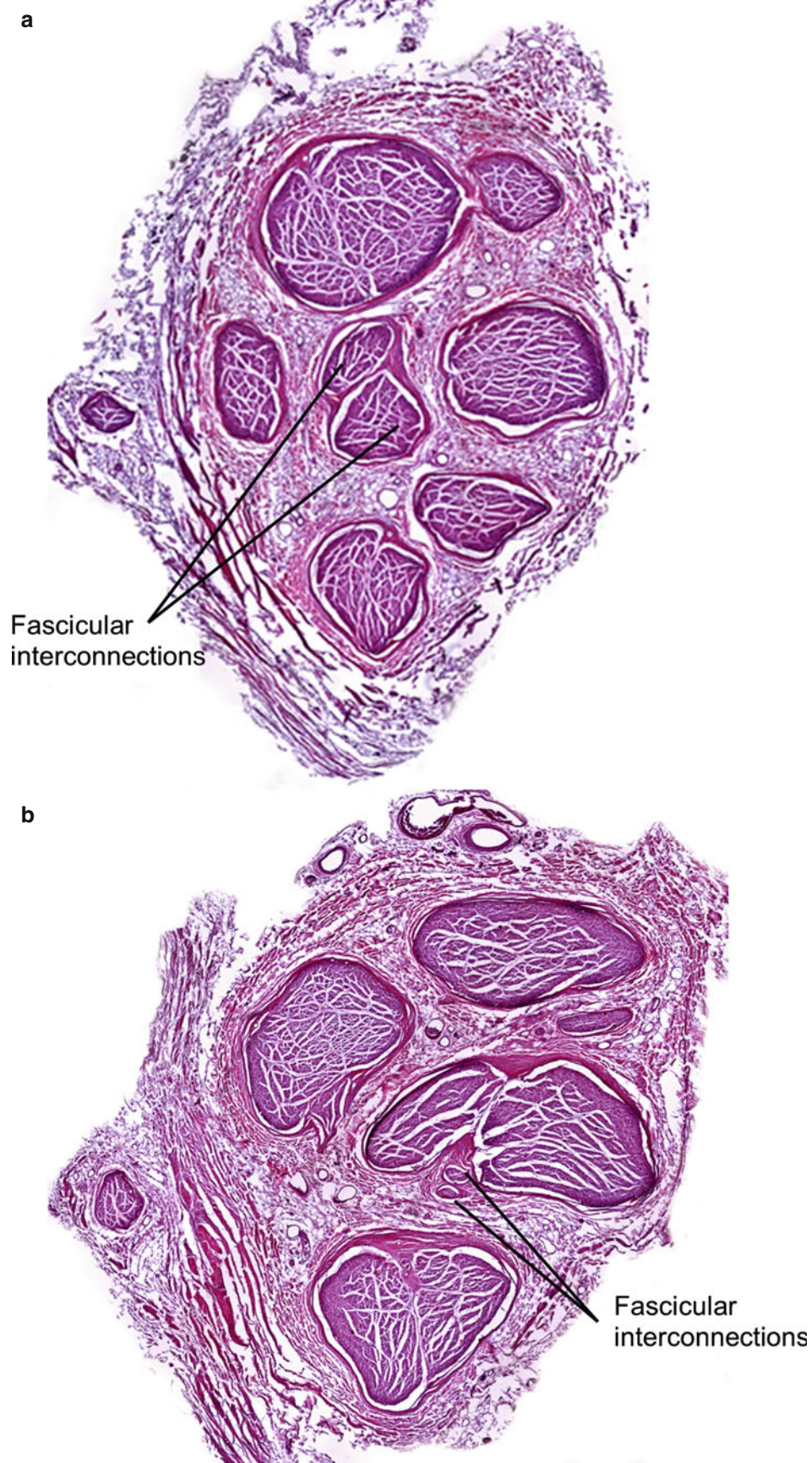


Fig. 6.12 Mixed peripheral nerve. Transverse section of C6 nerve. (a, b) Fascicles and interconnecting fascicles. H&E stain

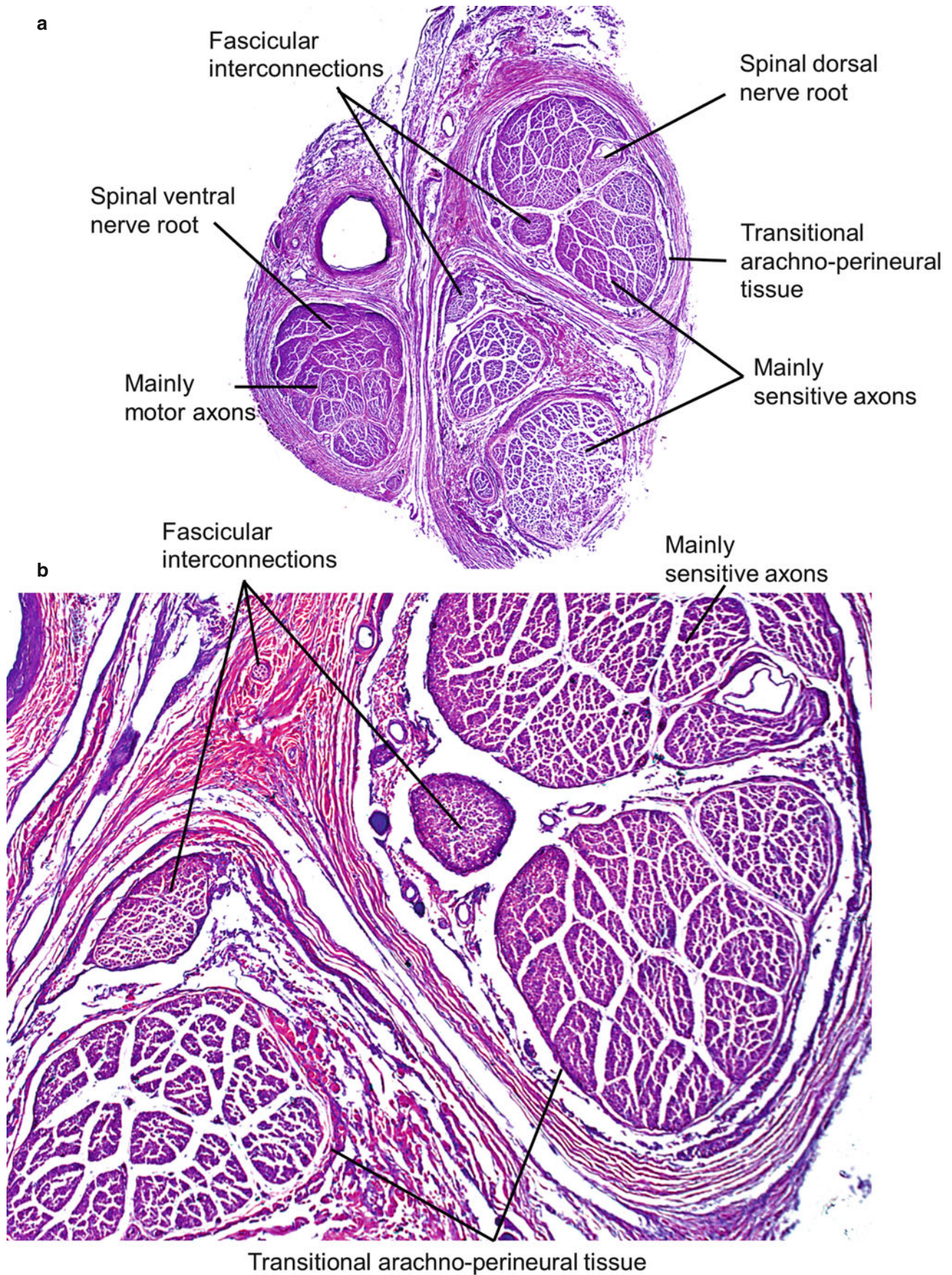
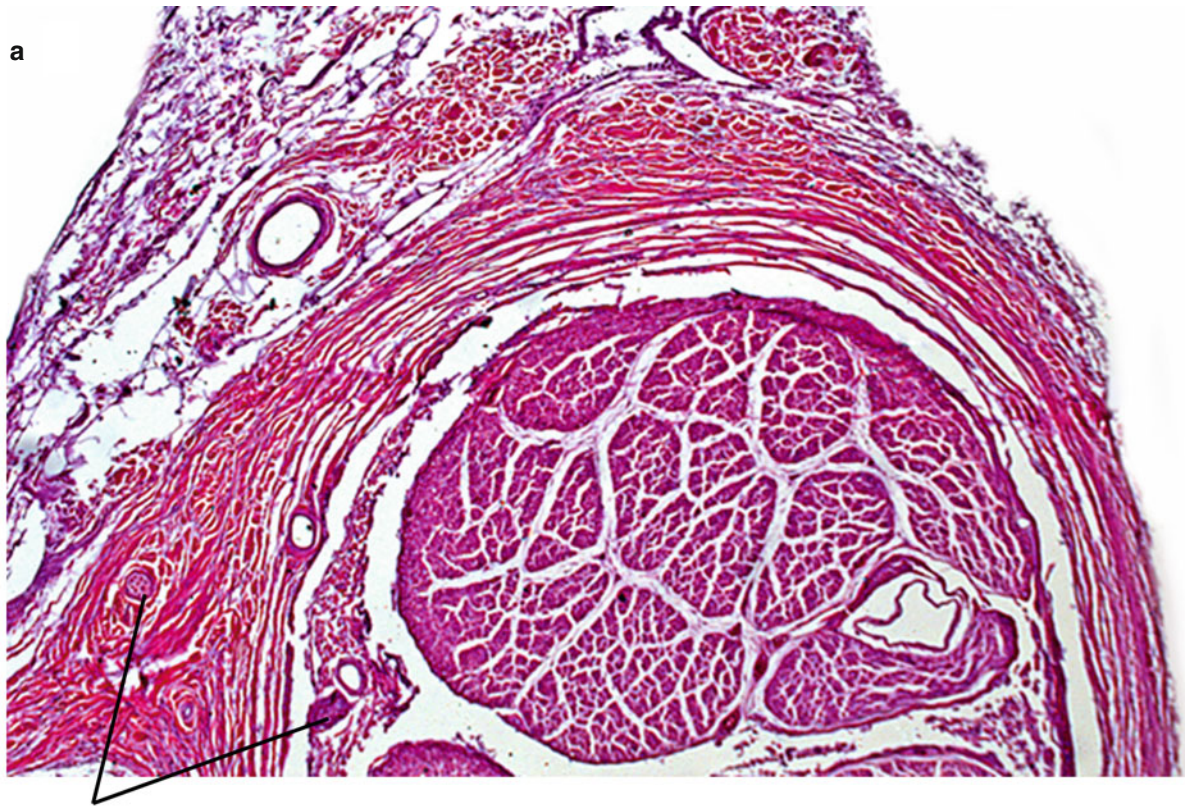
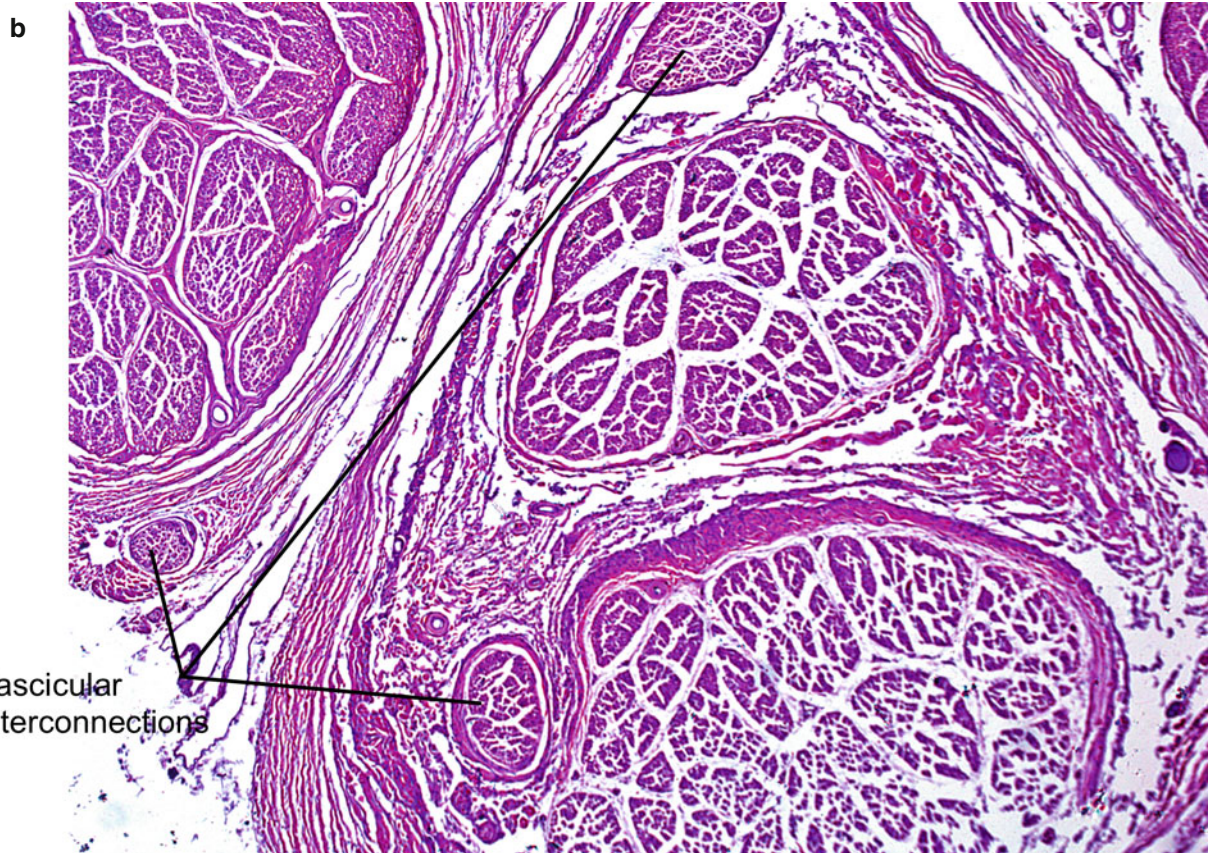


Fig. 6.13 Intraneural plexus. (a, b) Transverse section of C6 nerve. Details of the interconnecting fascicles in Fig. 6.4a. H&E stain



Fascicular interconnections

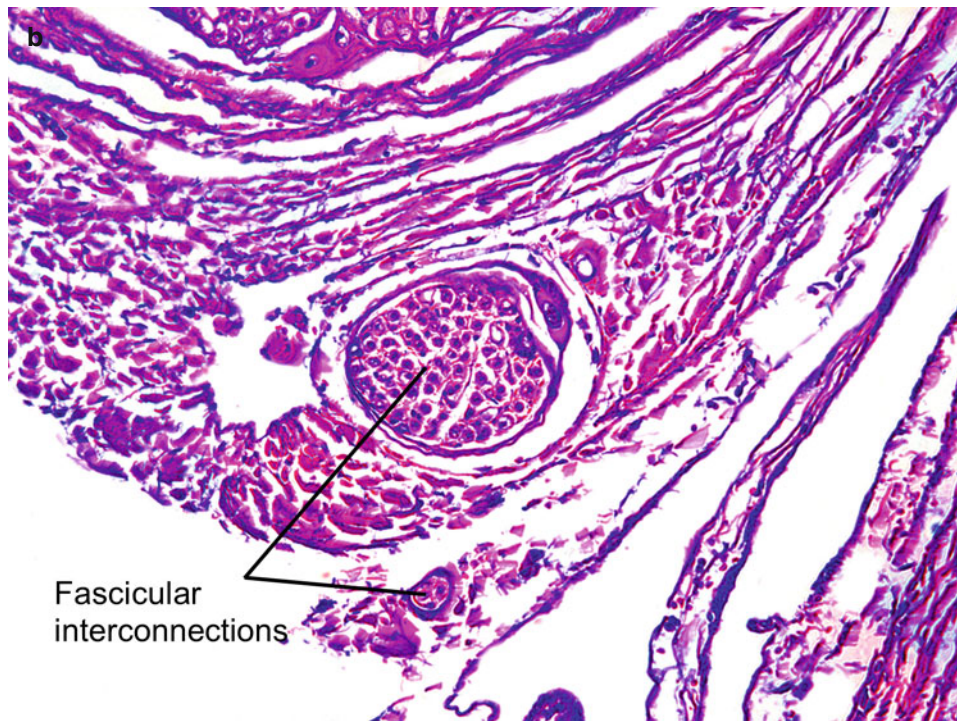


Fascicular interconnections

Fig. 6.14 Intraneural plexus. (a, b) Transverse section of C6 nerve. Details of the interconnecting fascicles in Fig. 6.4a. H&E stain



Fascicular interconnections



Fascicular interconnections

Fig. 6.15 (a, b) Transverse section of C6 nerve. Details of the interconnecting fascicles in Fig. 6.4b. H&E stain

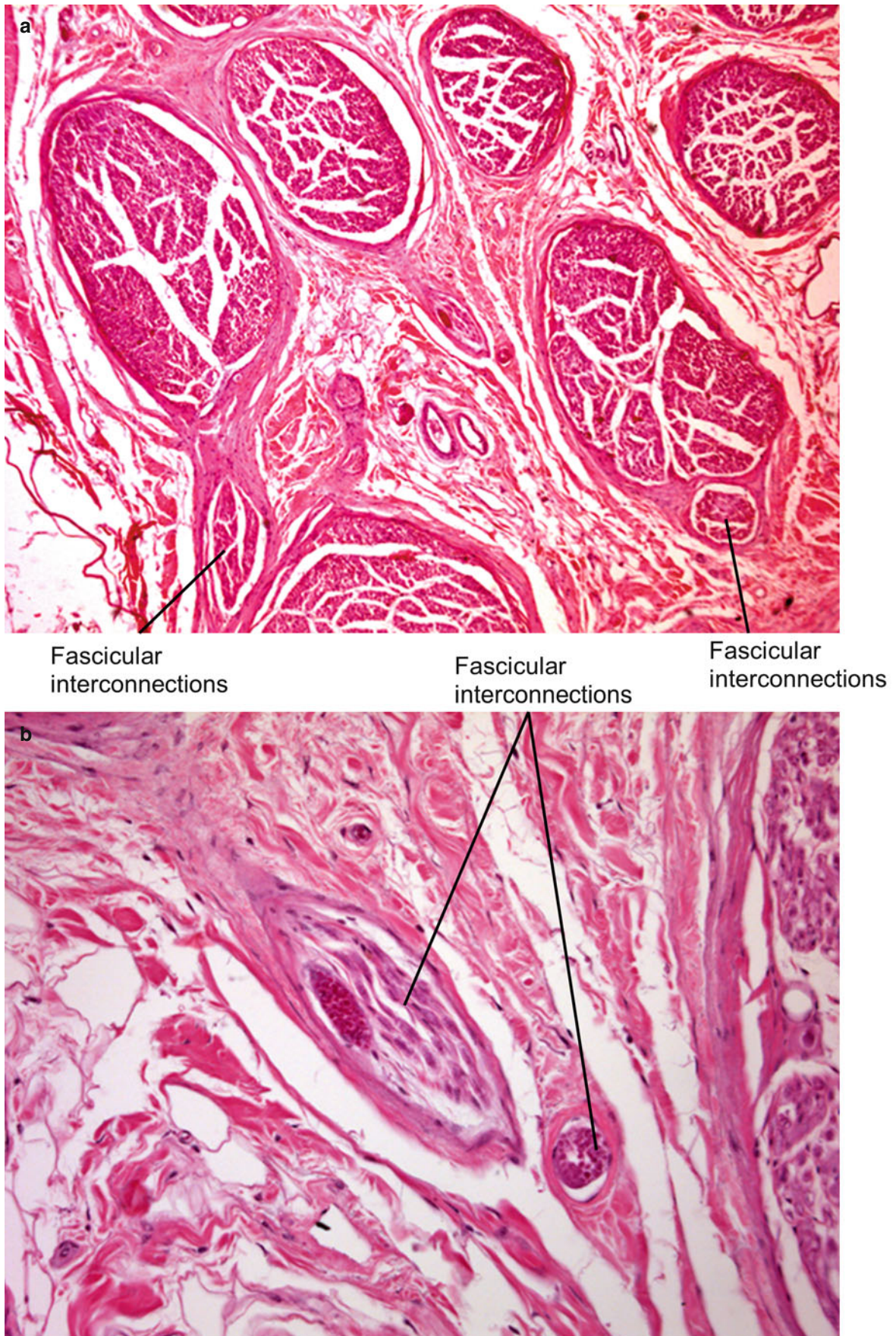


Fig. 6.16 Fascicles and interconnecting fascicles. (a, b) Detail of interconnecting fascicles at a location similar to that of Fig. 6.5a. H&E stain



Fascicular interconnections

Fascicular interconnections

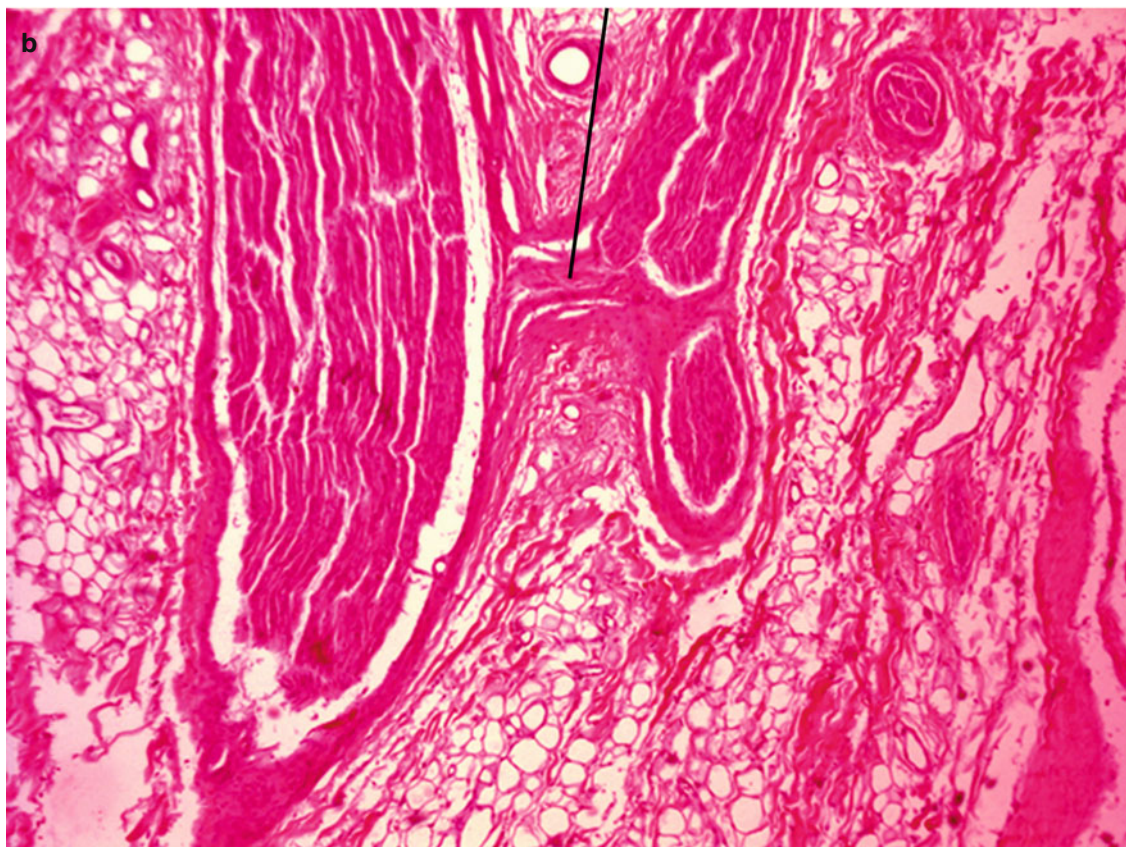


Fig. 6.17 Intraneural plexus. (a, b) Longitudinal section of C6 nerve. Detail of interconnecting fascicles at a location similar to that of Figs. 6.4 and 6.5. H&E stain

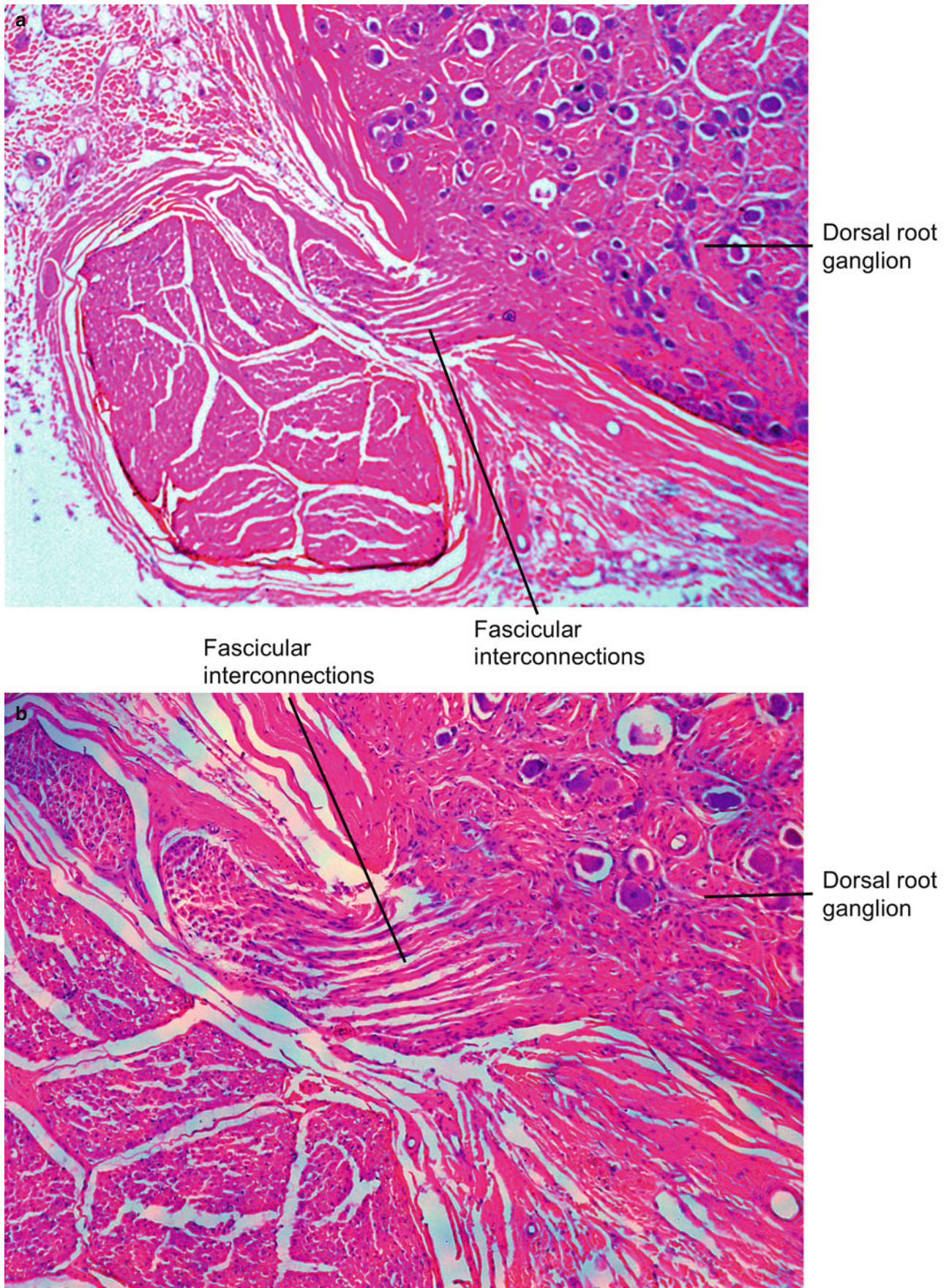


Fig. 6.18 Intraneural plexus. (a, b) Transverse section of C6 nerve. Details of interconnecting fascicles from Fig. 6.66b. H&E stain (Panel a from Reina et al. [1]; with permission)

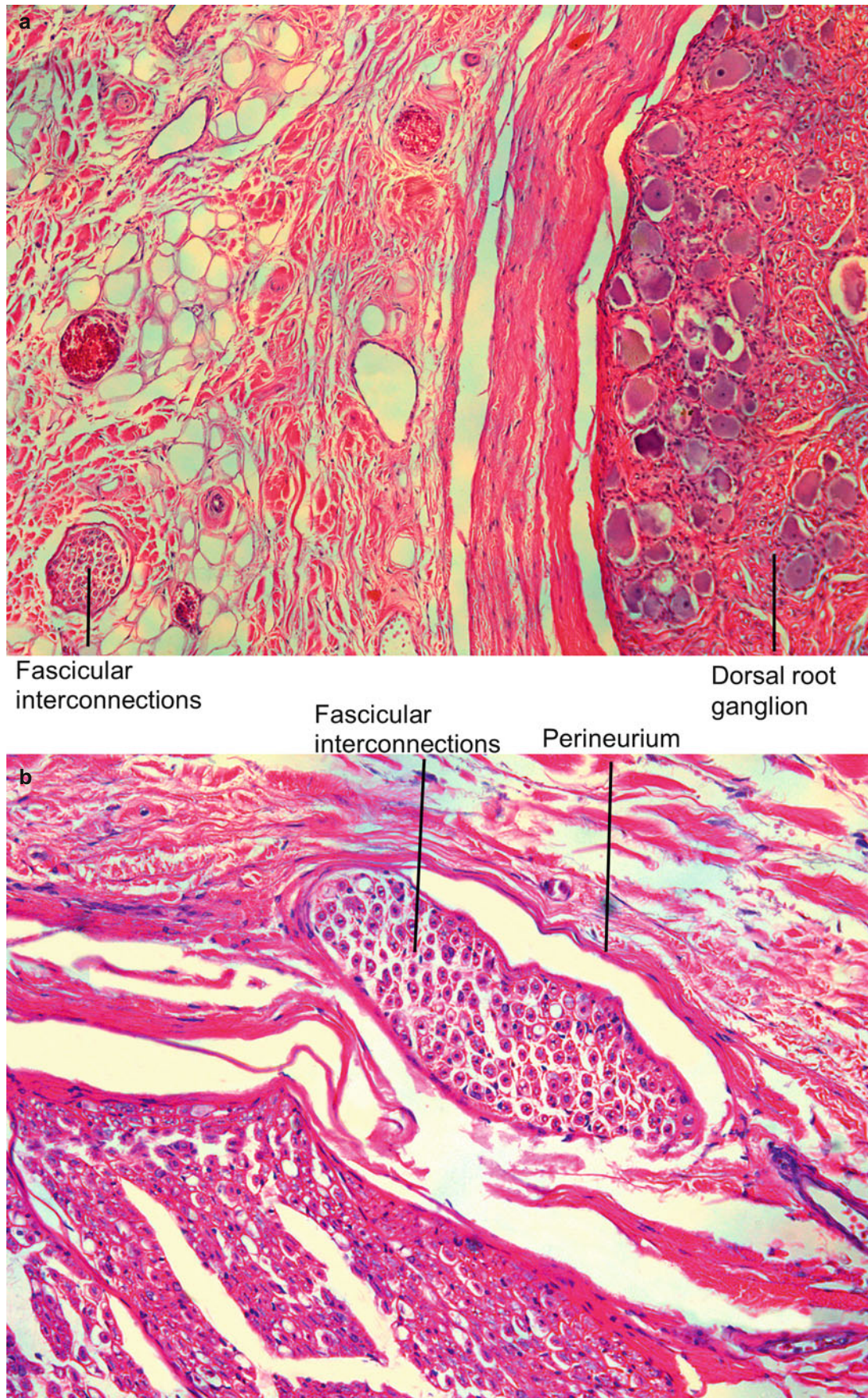


Fig. 6.19 Intraneural plexus. (a, b) Transverse section of C6 nerve. Details of interconnecting fascicles from (a) Fig. 6.6b and (b) Fig. 6.5a. H&E stain

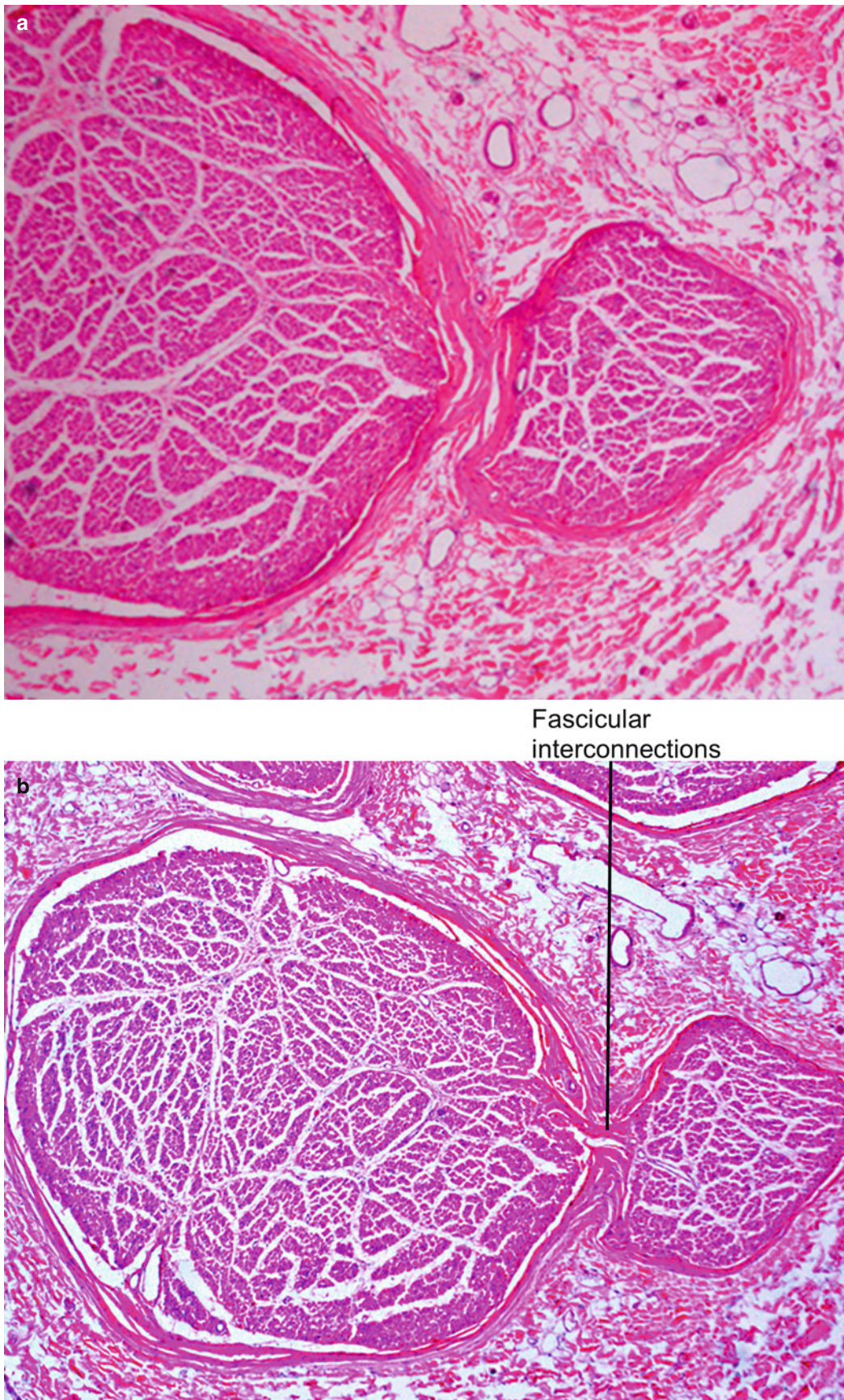


Fig. 6.20 Intraneural plexus. (a, b) Transverse section of C6 nerve. Details of interconnecting fascicles in a peripheral nerve distal to the DRG. H&E stain (Panel b from Reina et al. [1]; with permission)

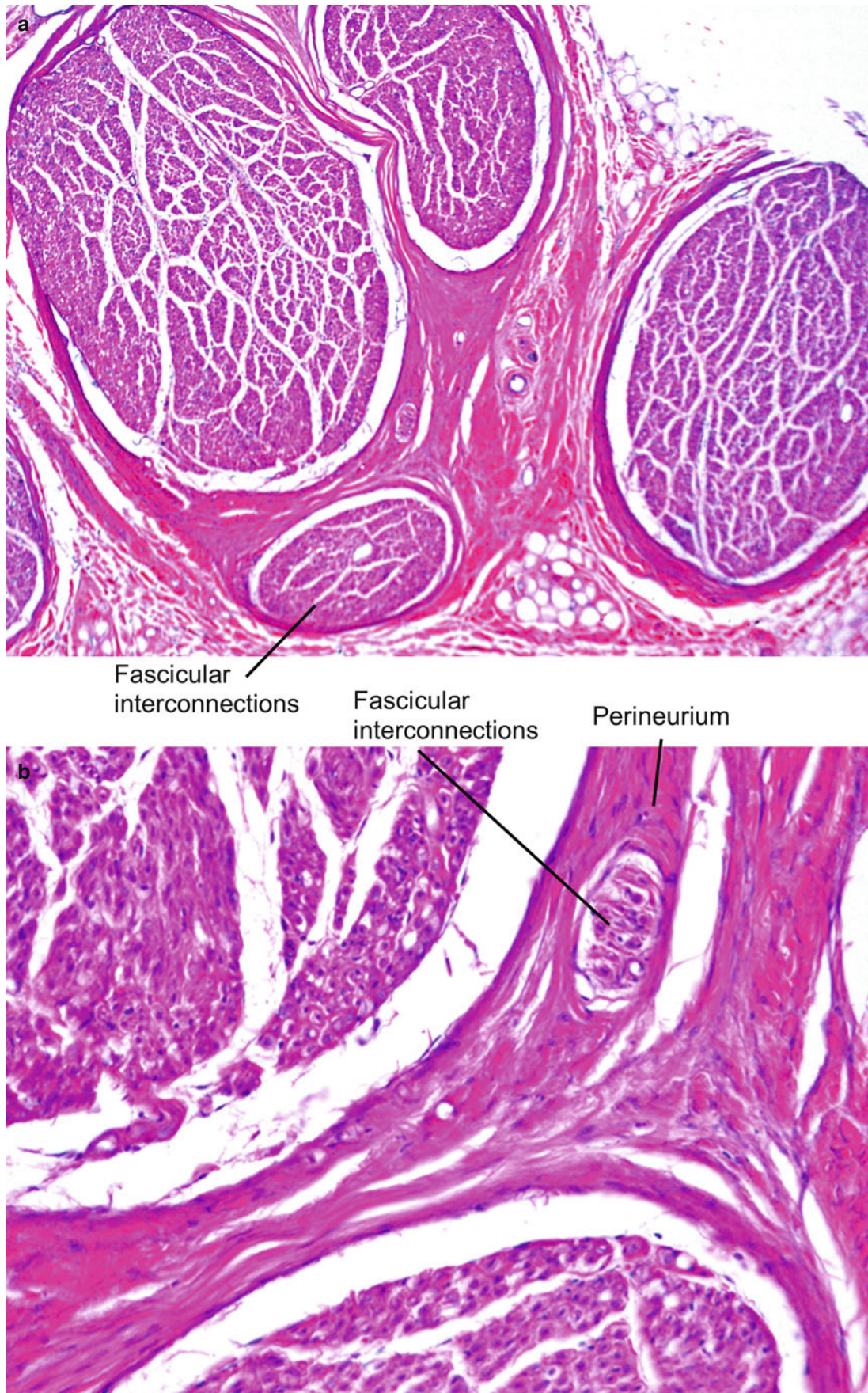


Fig. 6.21 Intraneural plexus. (a, b) Transverse section of C6 nerve. Details of interconnecting fascicles in a peripheral nerve distal to the DRG. H&E stain

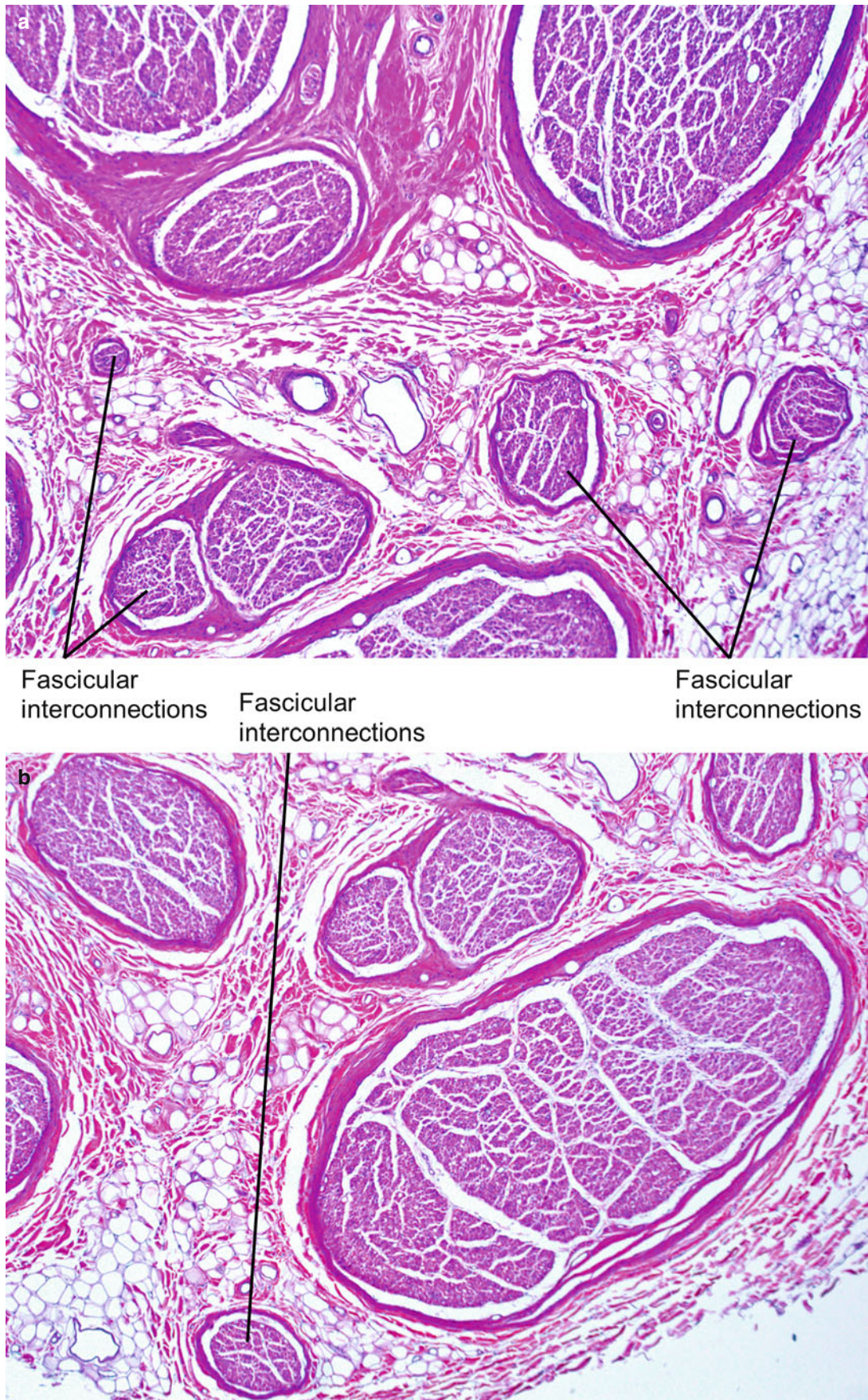


Fig. 6.22 Intraneural plexus. (a, b) Transverse section of C6 nerve. Details of interconnecting fascicles in a peripheral nerve distal to the DRG. H&E stain (Panel a from Reina et al. [1]; with permission)



Fig. 6.23 Intraneural plexus. (a, b) Transverse section of C6 nerve. Details of interconnecting fascicles in a peripheral nerve distal to the DRG. H&E stain

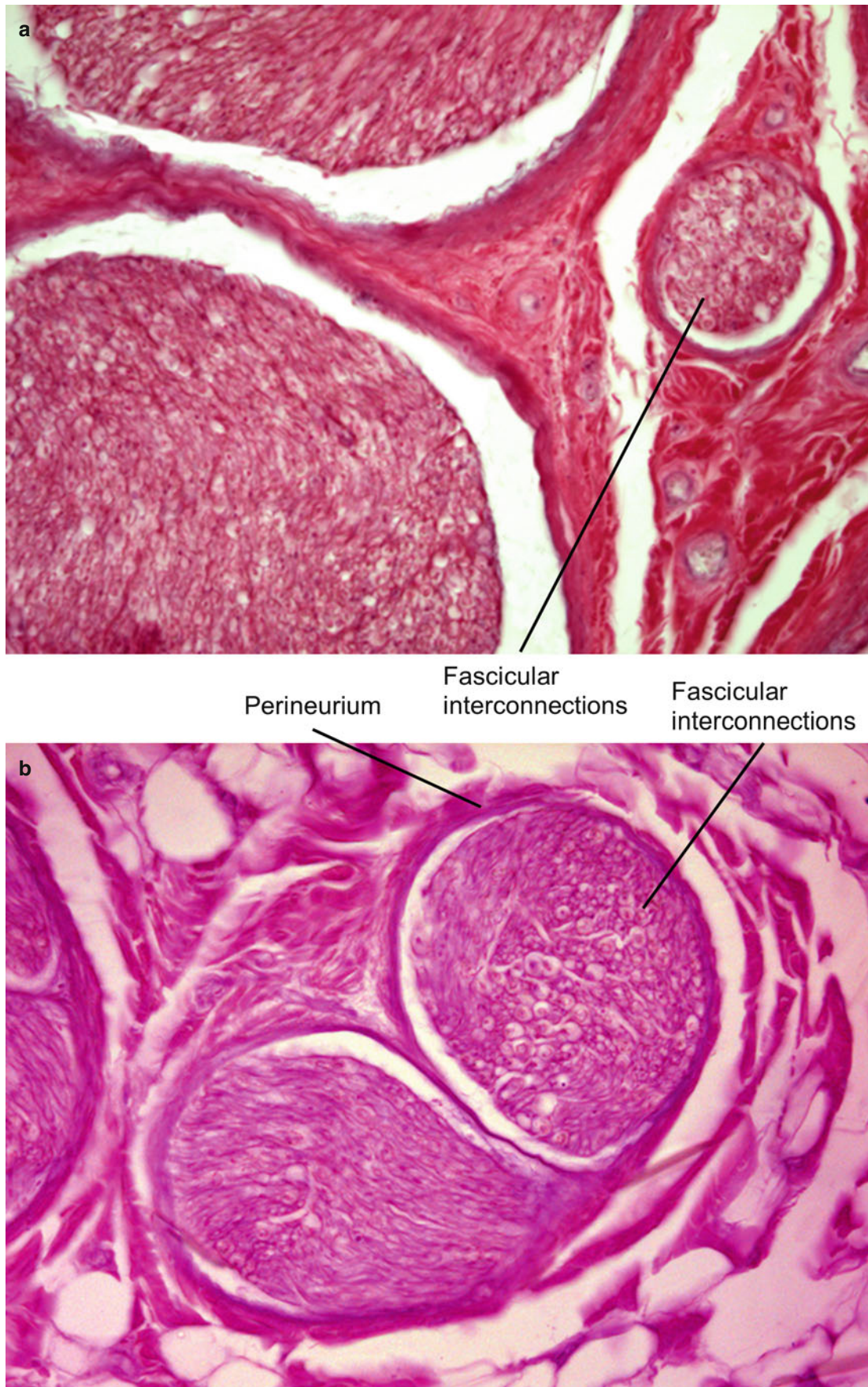


Fig. 6.24 Intraneural plexus. (a, b) Transverse section of C6 nerve. Details of interconnecting fascicles from the brachial plexus. H&E stain

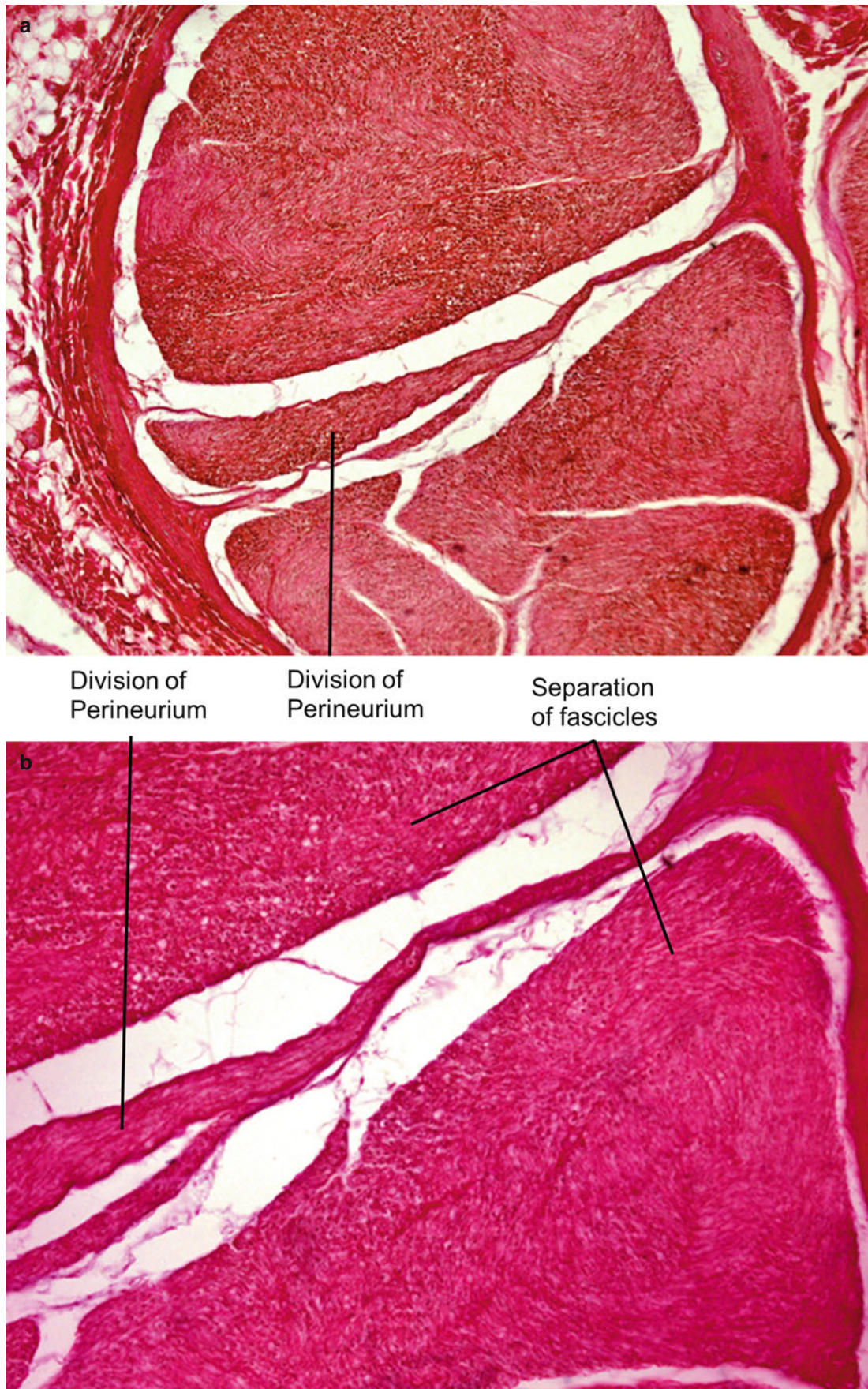


Fig. 6.25 Intraneural plexus. (a, b) Transverse section of C6 nerve. Details of interconnecting fascicles from the brachial plexus. H&E stain

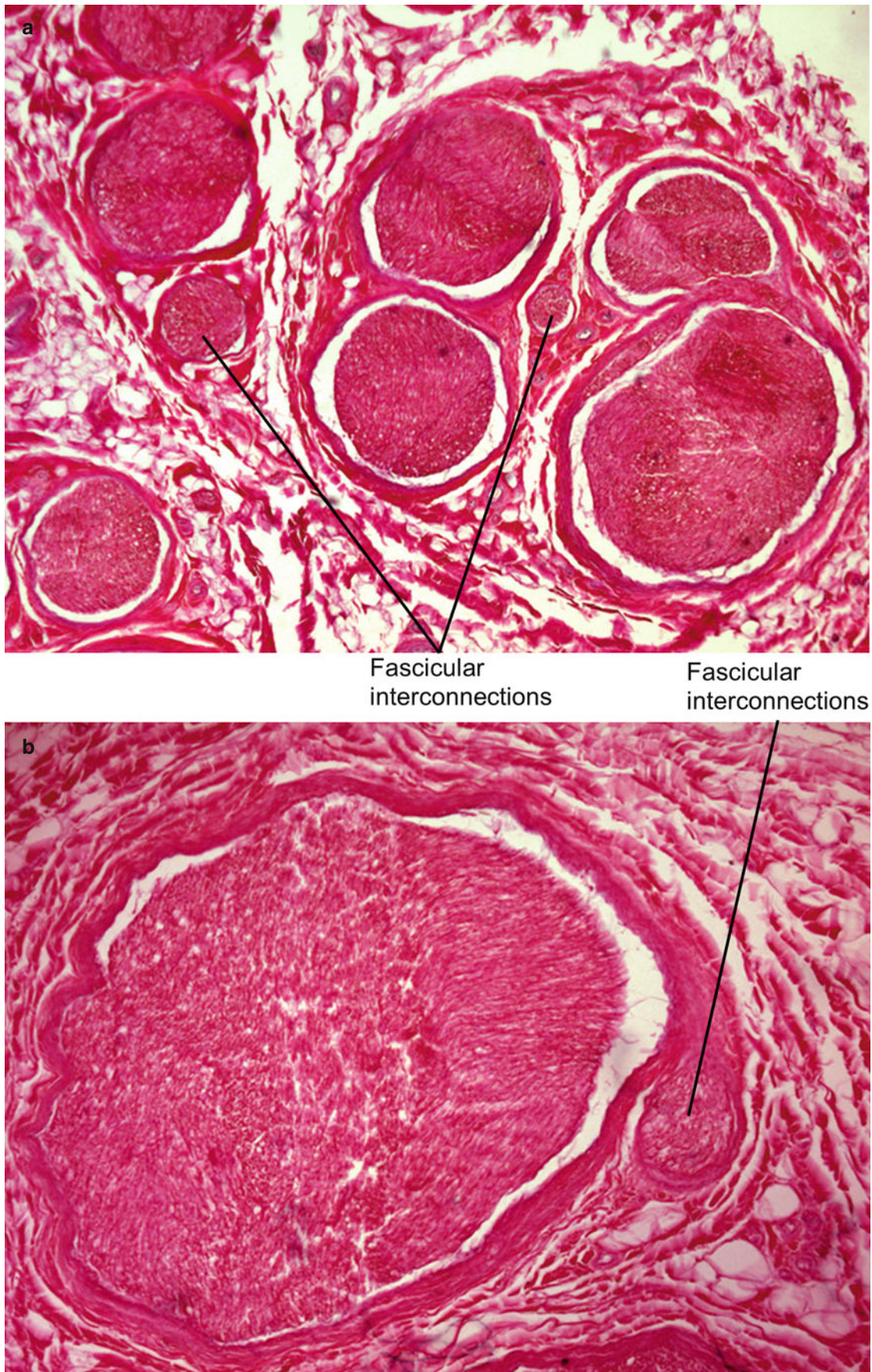


Fig. 6.26 Intraneural plexus. (a, b) Transverse section of C6 nerve. Details of interconnecting fascicles from the brachial plexus. H&E stain

References

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