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The perineurium is composed of multiple concentric single-cell layers enclosing individual nerve fascicles. Each layer has a thickness equivalent to the width of a perineurial cell. Groups of these cells join by means of tight junctions and desmosomes to form layers that function as a barrier against diffusion of particles across them. Perineurial internal layers have more of these specialized unions among perineurial cells, which are proximal to nerve fascicles [1–4].

Perineurial cells have basal laminas constituted by glycoproteins such as fibronectin, as well as heparin sulfate and laminin, and their nuclei are flattened. The cytoplasm is granular and contains few mitochondria and pinocytotic vesicles. Measurements of the thickness of the perineurium are related to the number of layers contributing to its shape,

which ranges from 8 to 16 perineurial layers. Extracellular matrix, together with collagen fibers and a few fibroblasts, occupies the spaces between perineurial laminas [1–6].

The membrane allows the axons a certain degree of mobility within the nerve fascicles, and it becomes progressively thinner as the number of fascicles increases. Tension exerted on the perineurium is transmitted successively toward the endoneurium, affecting the intracellular pressure in the axon. The perineurium, together with endothelial cells of intrafascicular capillaries, contributes to the blood–nerve barrier (Figs. 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14, 4.15, 4.16, 4.17, 4.18, 4.19, 4.20, 4.21, 4.22, 4.23, 4.24, 4.25, 4.26, 4.27, 4.28, 4.29, 4.30, 4.31, and 4.32) [7–10].

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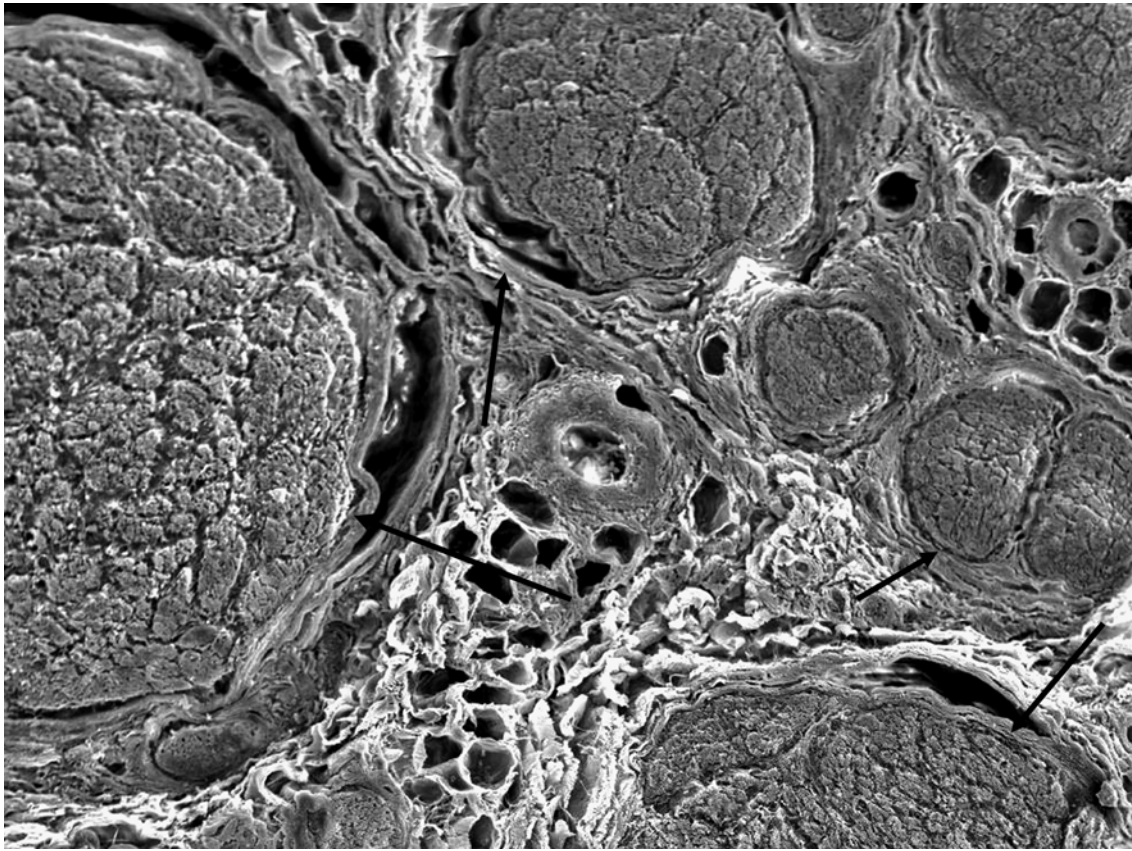
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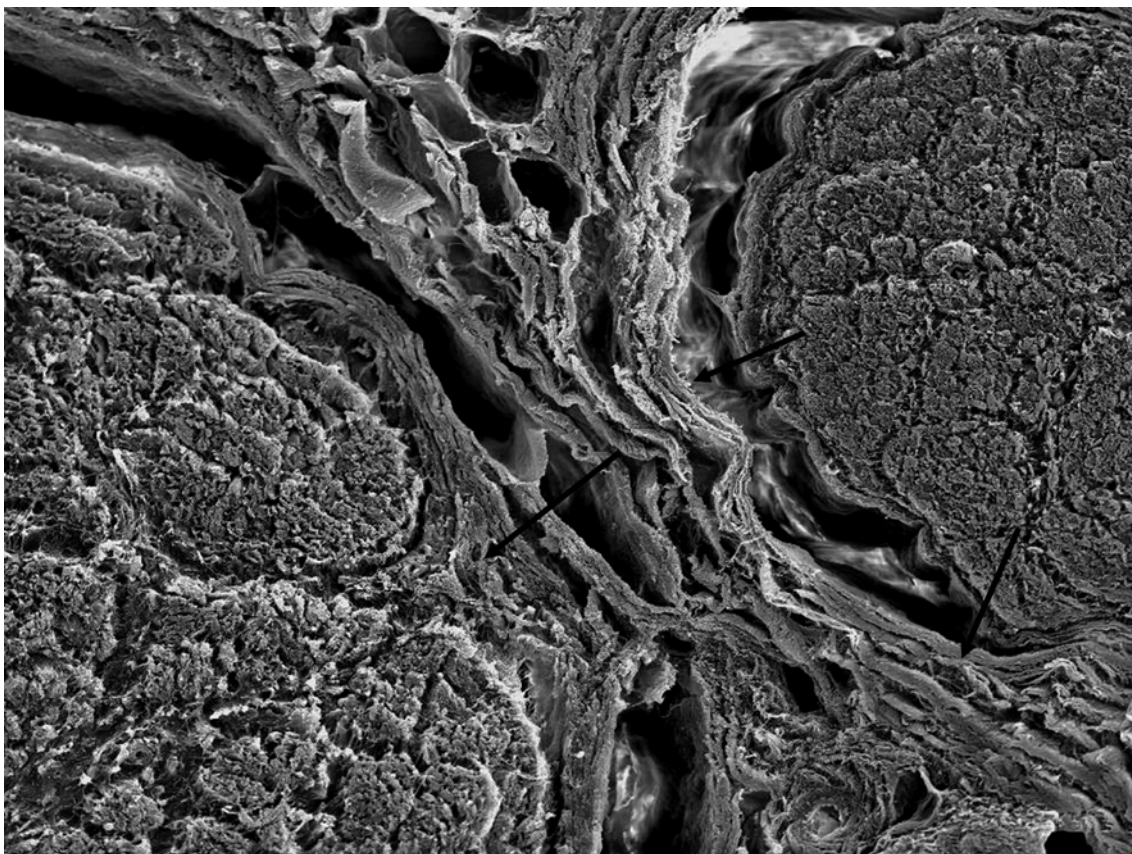
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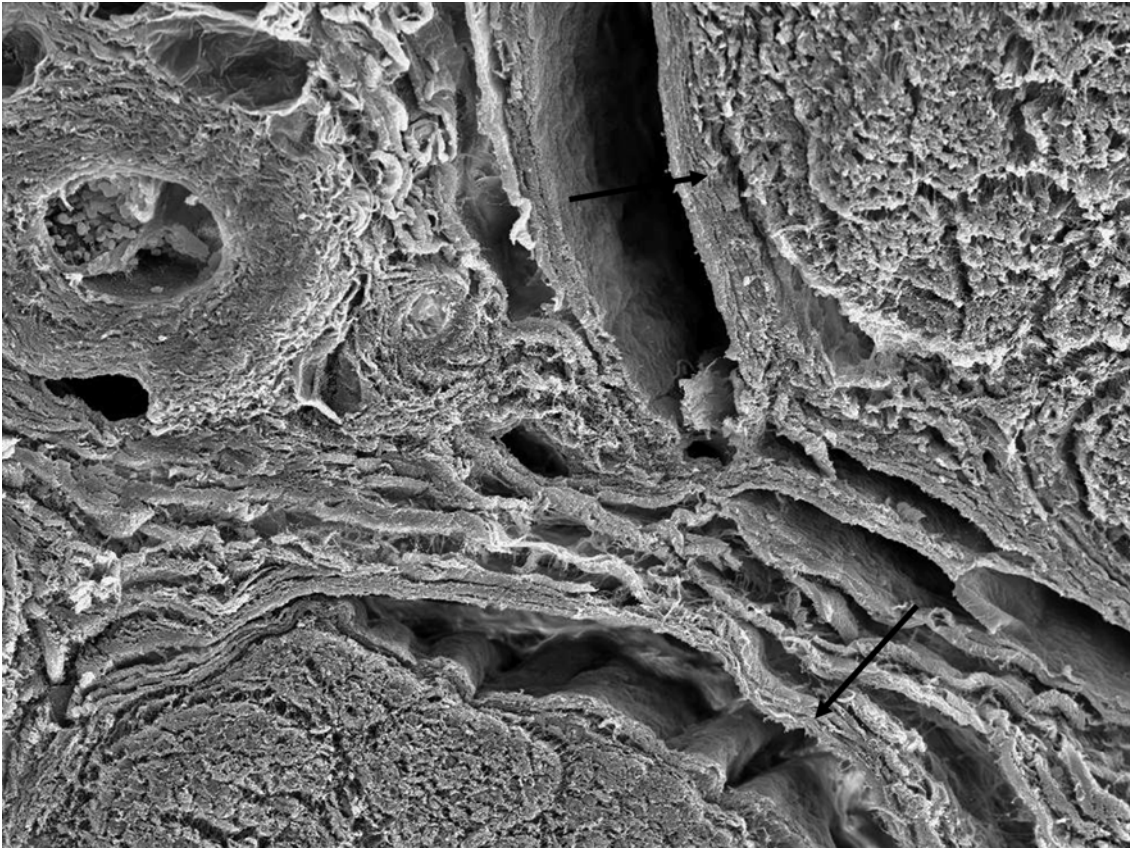
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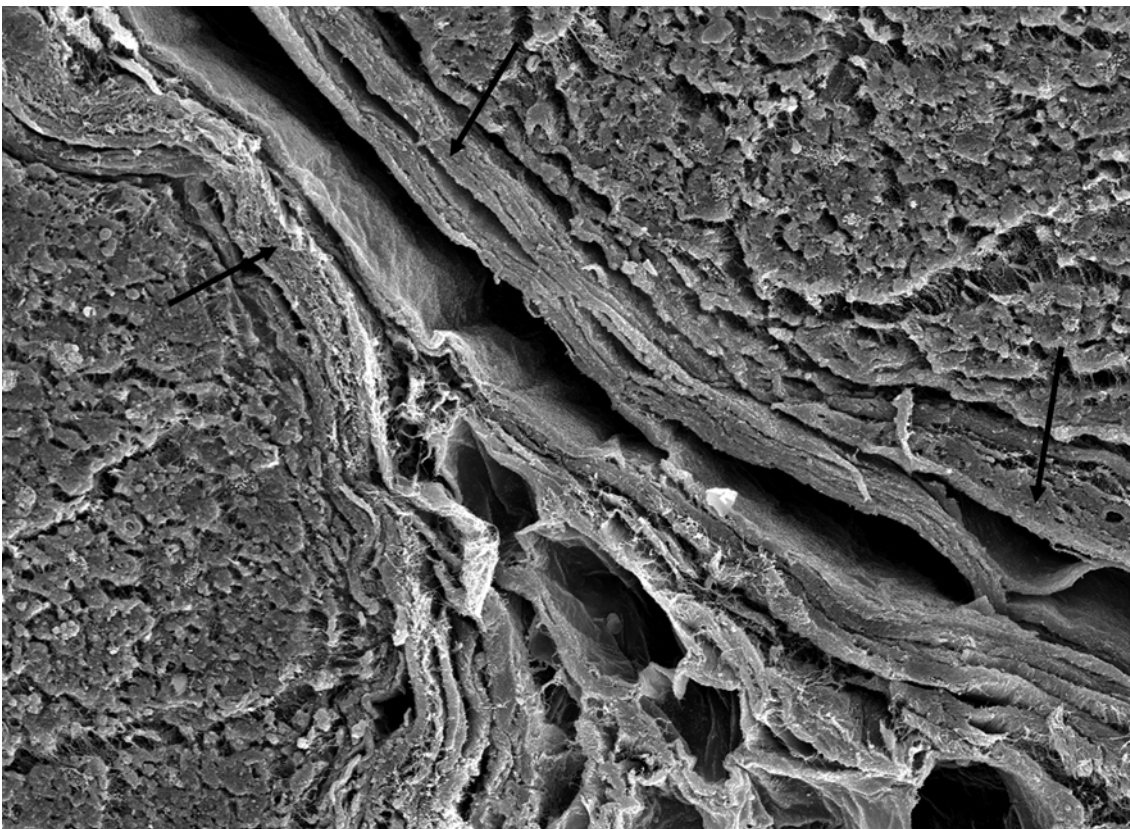
**Fig. 4.1** Perineurium. A few nerve fascicles are enclosed in perineurium from a human sciatic nerve. *Arrows* indicate the perineurial layer. Scanning electron microscopy, magnification:  $\times 70$  (From Reina [3]; with permission)



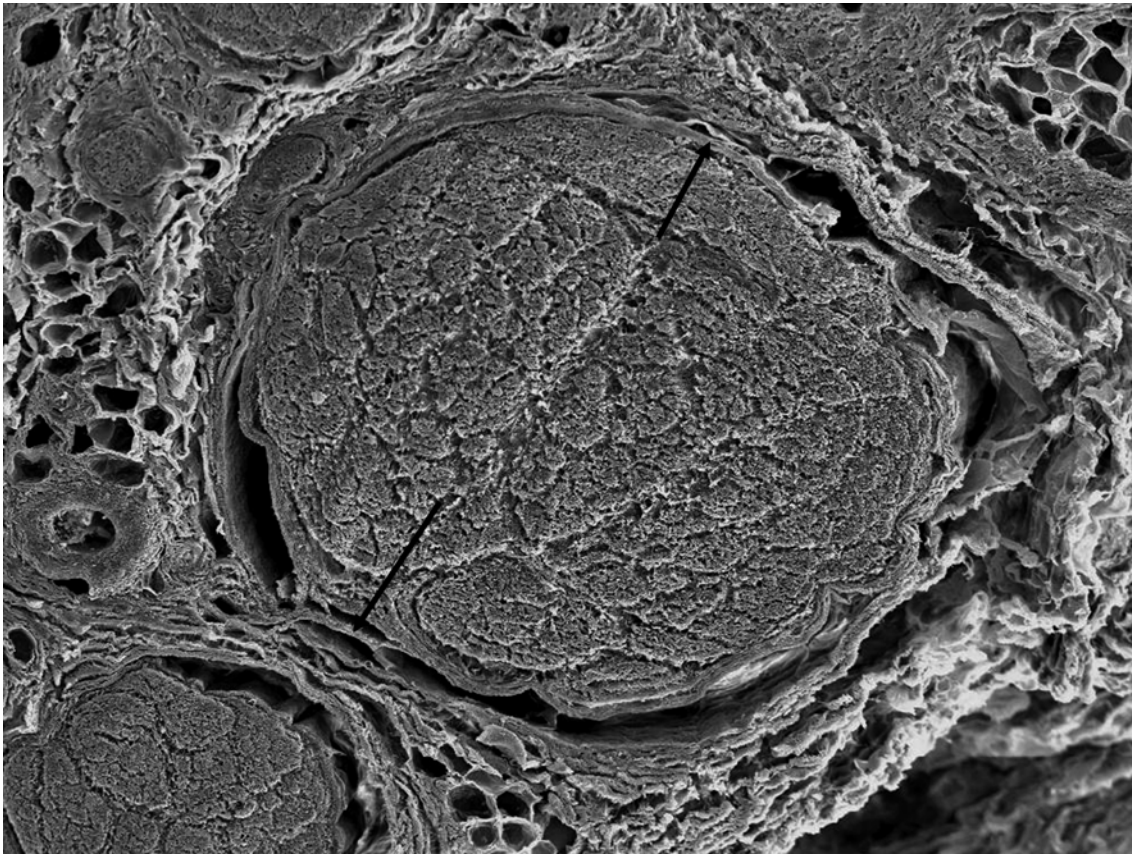
**Fig. 4.2** Perineurium. Two fascicles are surrounded by perineurium from a human sciatic nerve. Tridimensional view shows details of the perineurial layers (*arrows*). Scanning electron microscopy, magnification:  $\times 150$  (From Reina et al. [1]; with permission)



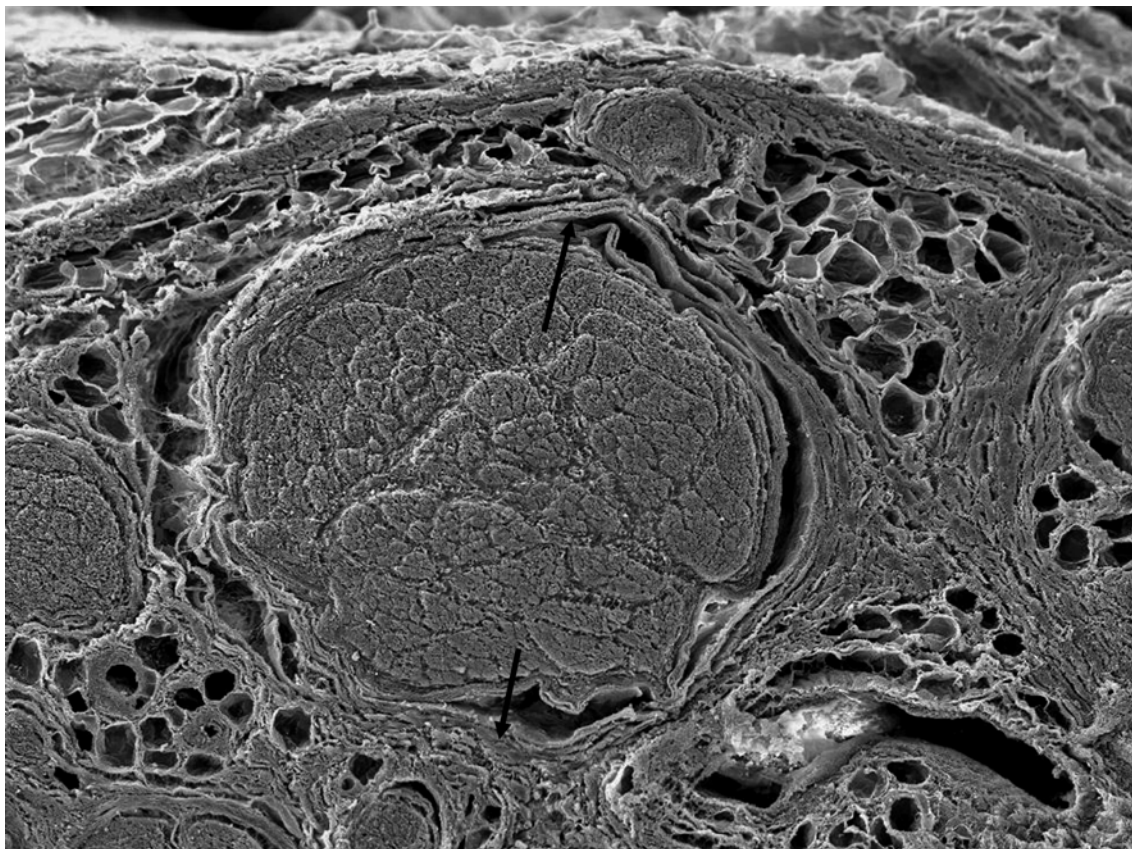
**Fig. 4.3** Perineurium. Two fascicles are surrounded by perineurium from a human sciatic nerve. Tridimensional view shows details of the perineural layers (*arrows*). Scanning electron microscopy, magnification:  $\times 200$  (From Reina [3]; with permission)



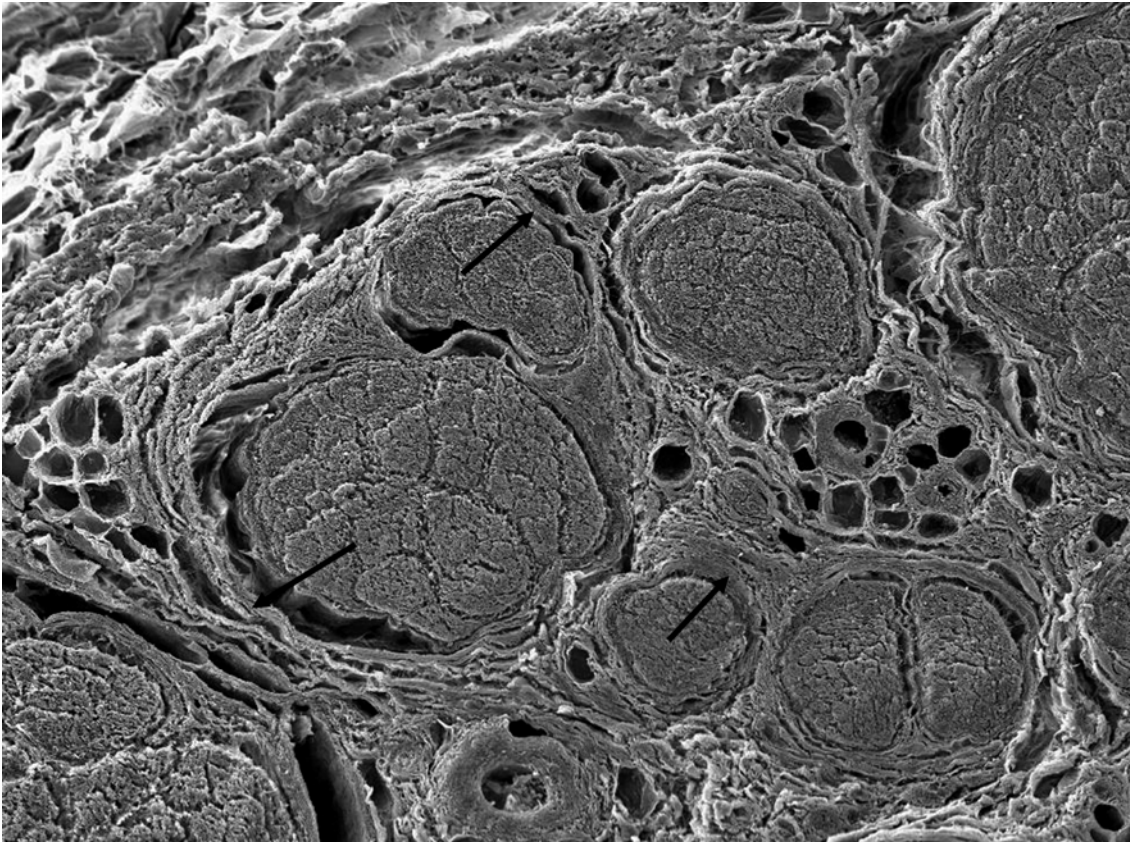
**Fig. 4.4** Perineurium. Two fascicles are surrounded by perineurium from a human sciatic nerve. Tridimensional view shows details of the perineural layers (*arrows*). Scanning electron microscopy, magnification:  $\times 300$



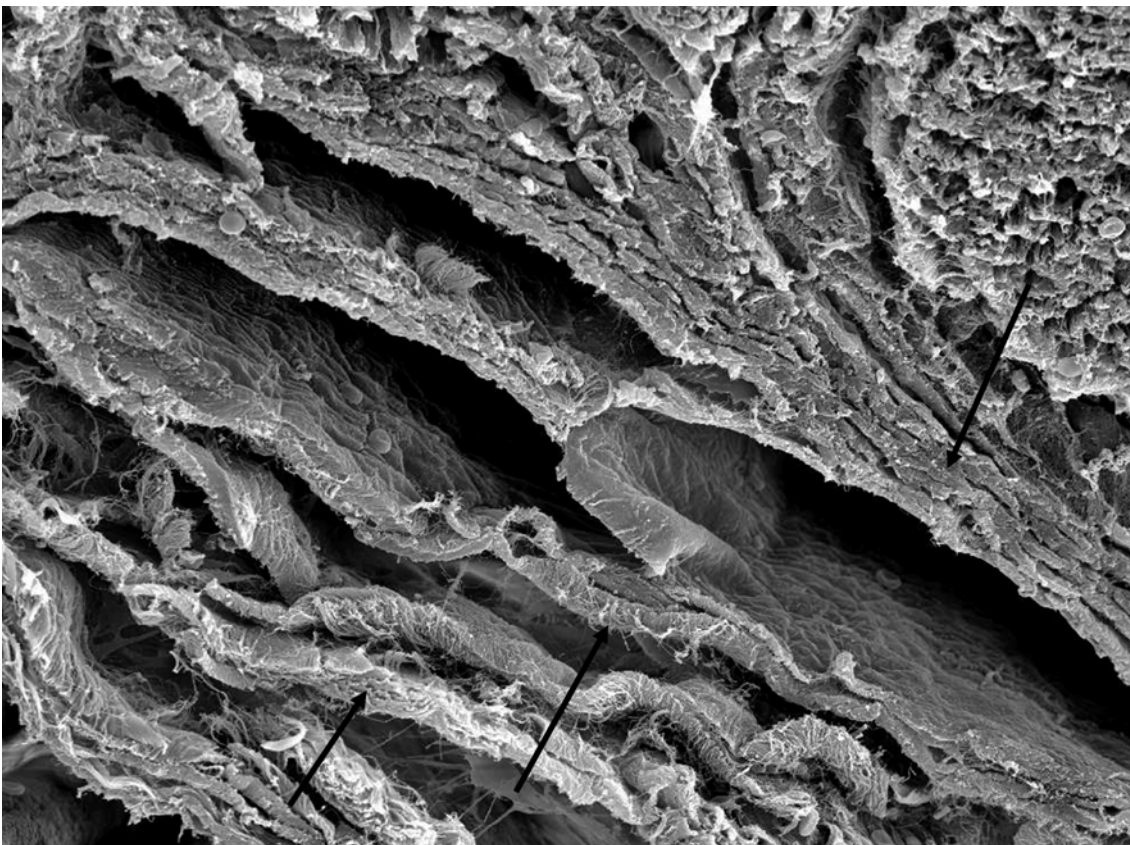
**Fig. 4.5** Perineurium. Fascicles are surrounded by perineurium from a human sciatic nerve. Tridimensional view shows details of the perineurial layers (*arrows*). Scanning electron microscopy, magnification:  $\times 70$



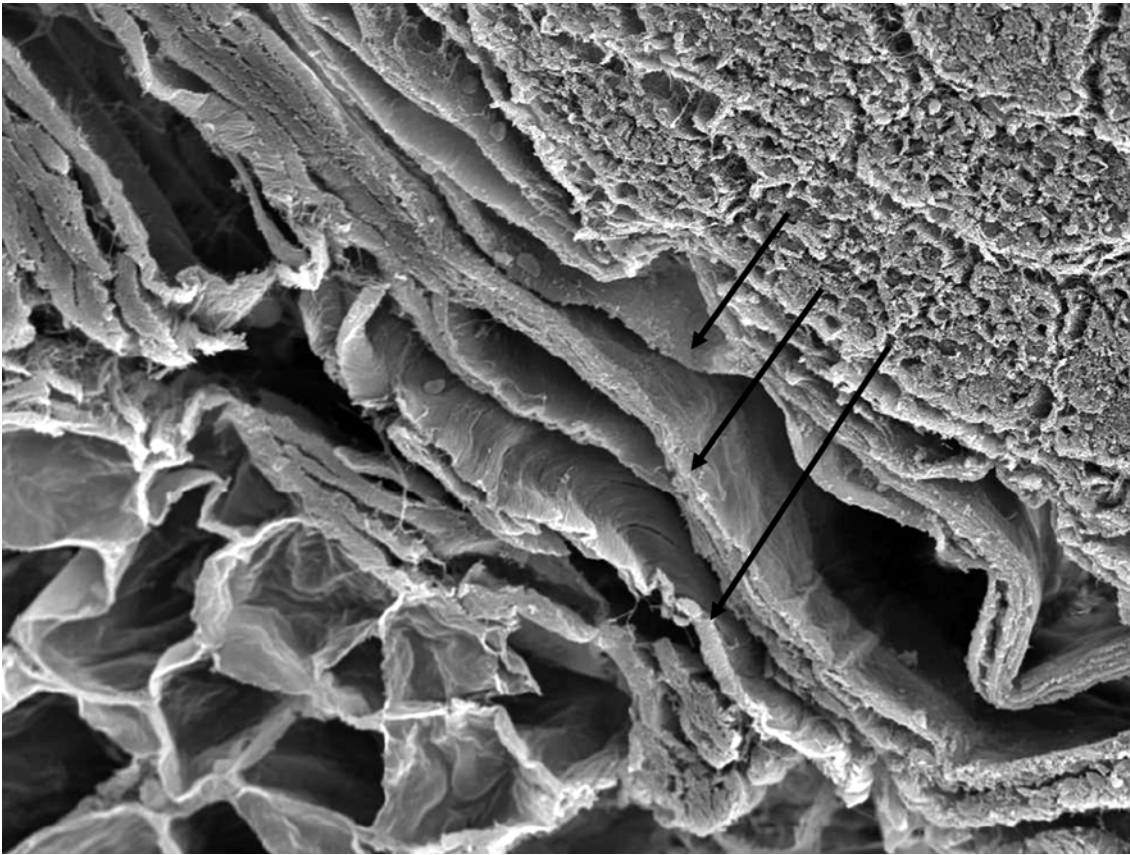
**Fig. 4.6** Perineurium. Fascicles are surrounded by perineurium from a human sciatic nerve. *Arrows* indicate a perineurial layer. Scanning electron microscopy, magnification:  $\times 70$



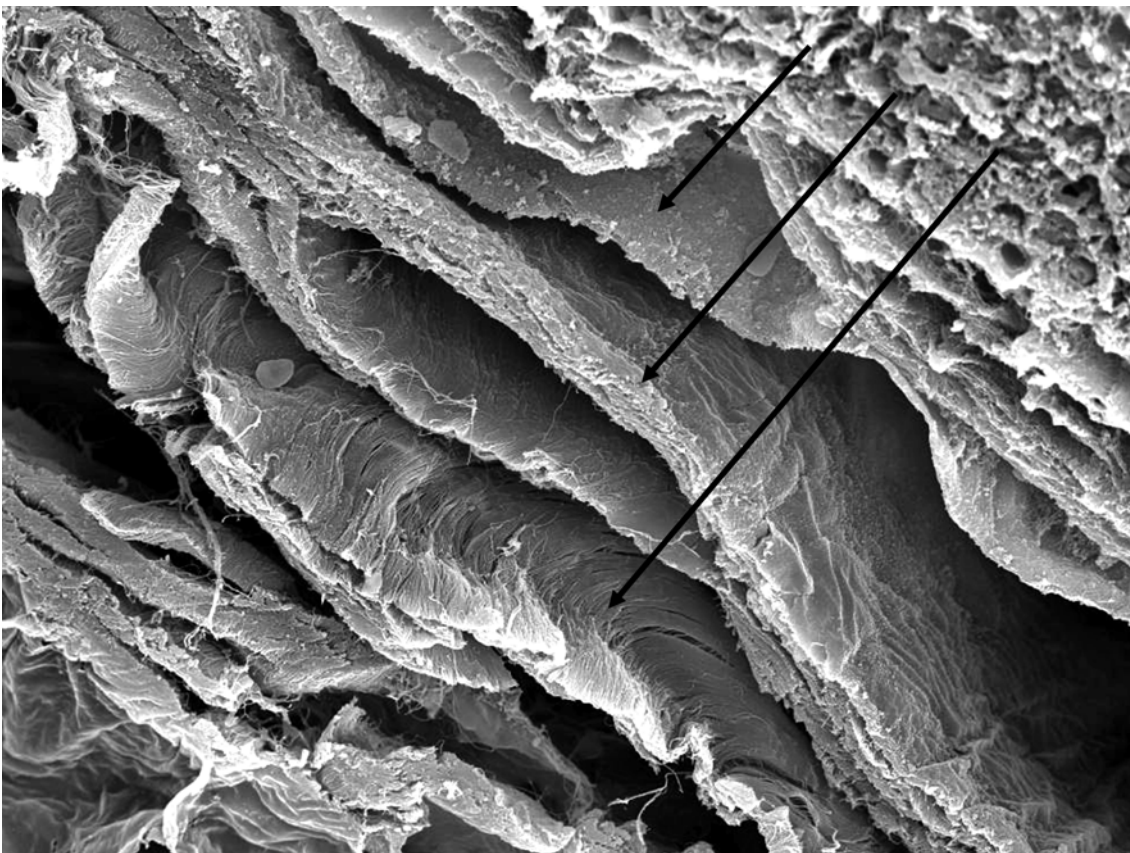
**Fig. 4.7** Perineurium. Fascicles are surrounded by perineurium from a human sciatic nerve. *Arrows* point toward a perineurial layer. Scanning electron microscopy, magnification:  $\times 75$  (From Reina et al. [11]; with permission)



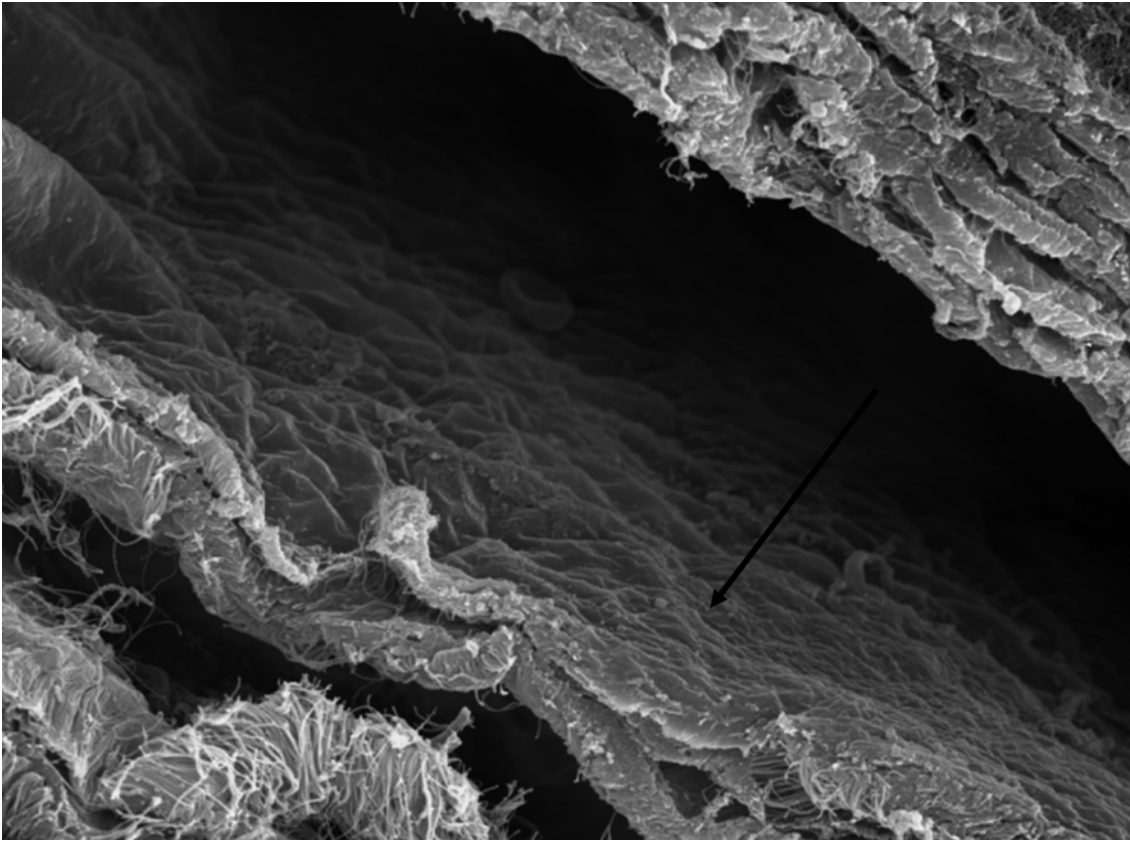
**Fig. 4.8** Perineurium. Perineurial layers from a human sciatic nerve. Shown is a tridimensional view of the perineurial layers (*arrows*). Scanning electron microscopy, magnification:  $\times 500$  (From Reina et al. [11]; with permission)



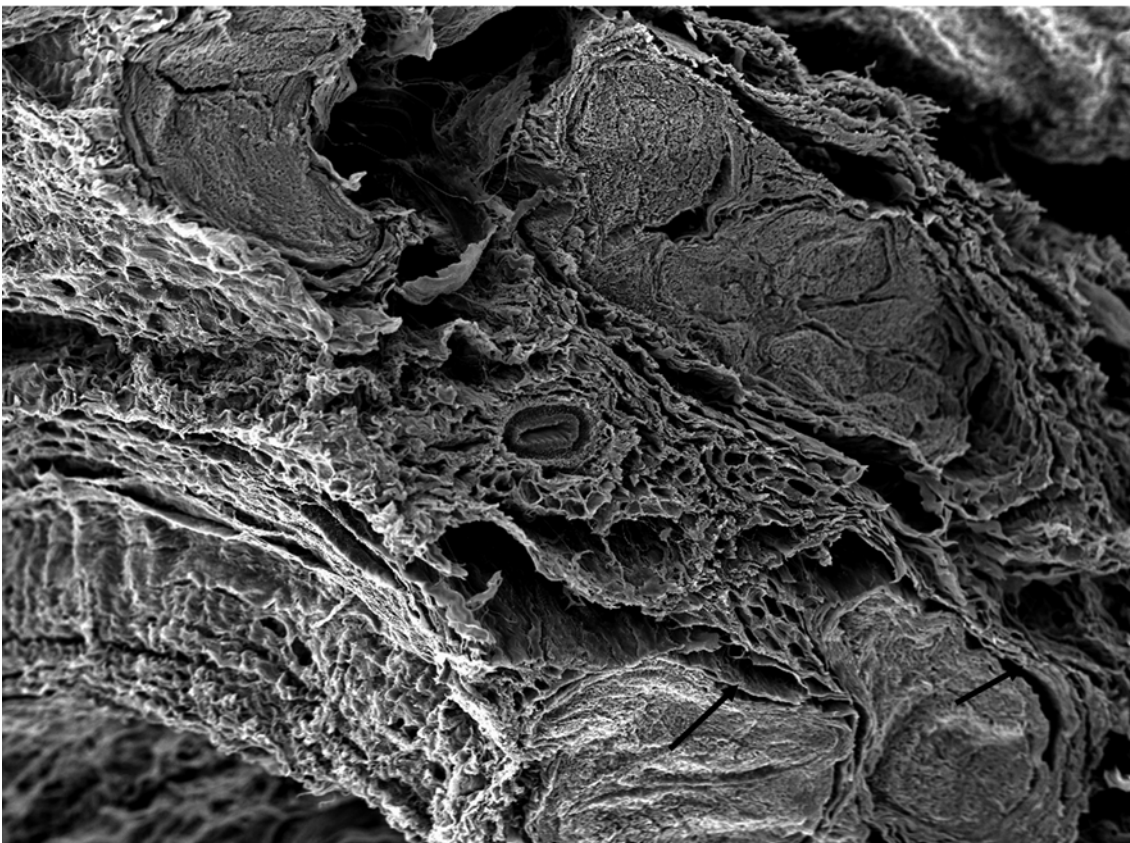
**Fig. 4.9** Perineurium. Perineurial layers from a human sciatic nerve. Shown is a tridimensional view of the perineurial layers (*arrows*). Scanning electron microscopy, magnification:  $\times 350$



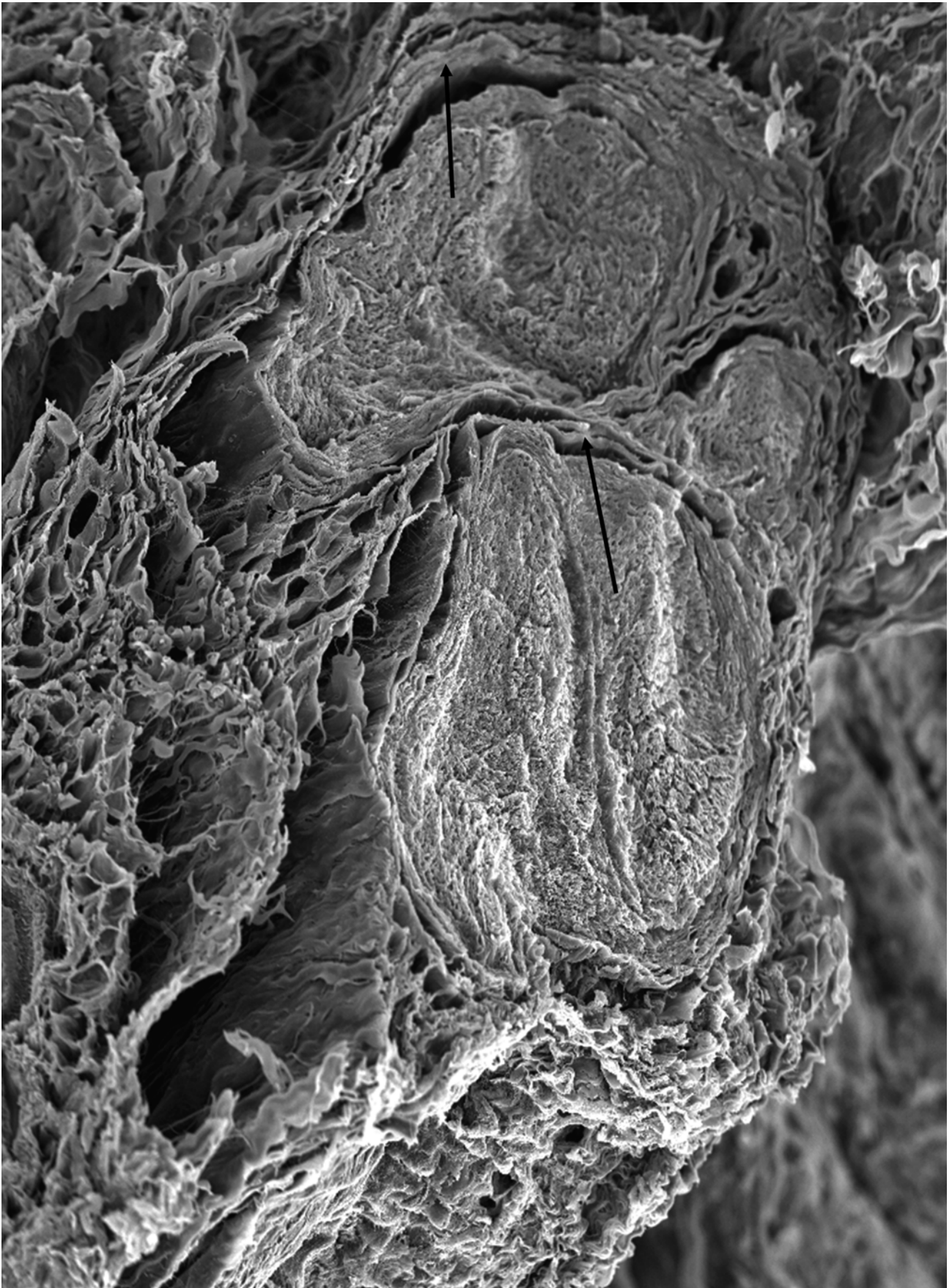
**Fig. 4.10** Perineurium. Perineurial layers from a human sciatic nerve. Shown is a tridimensional view of the perineurial layers (*arrows*). Scanning electron microscopy, magnification:  $\times 650$



**Fig. 4.11** Perineurium. Perineural layers from a human sciatic nerve. Shown is a tridimensional view of the perineural layers (*arrows*). Scanning electron microscopy, magnification:  $\times 1,600$

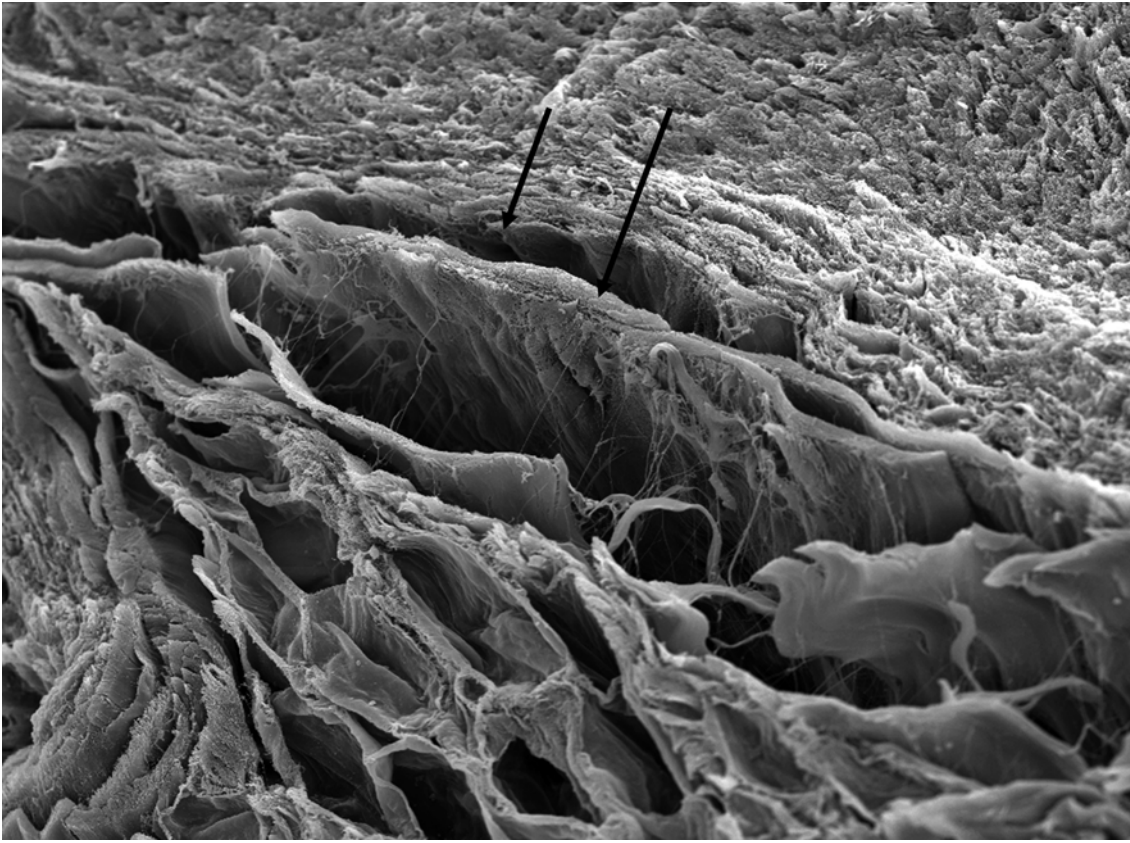


**Fig. 4.12** Perineurium. Fascicles are surrounded by perineural layers of human sciatic nerve. Shown is a tridimensional view of perineural layers (*arrows*) and interfascicular tissue. Scanning electron microscopy, magnification:  $\times 50$

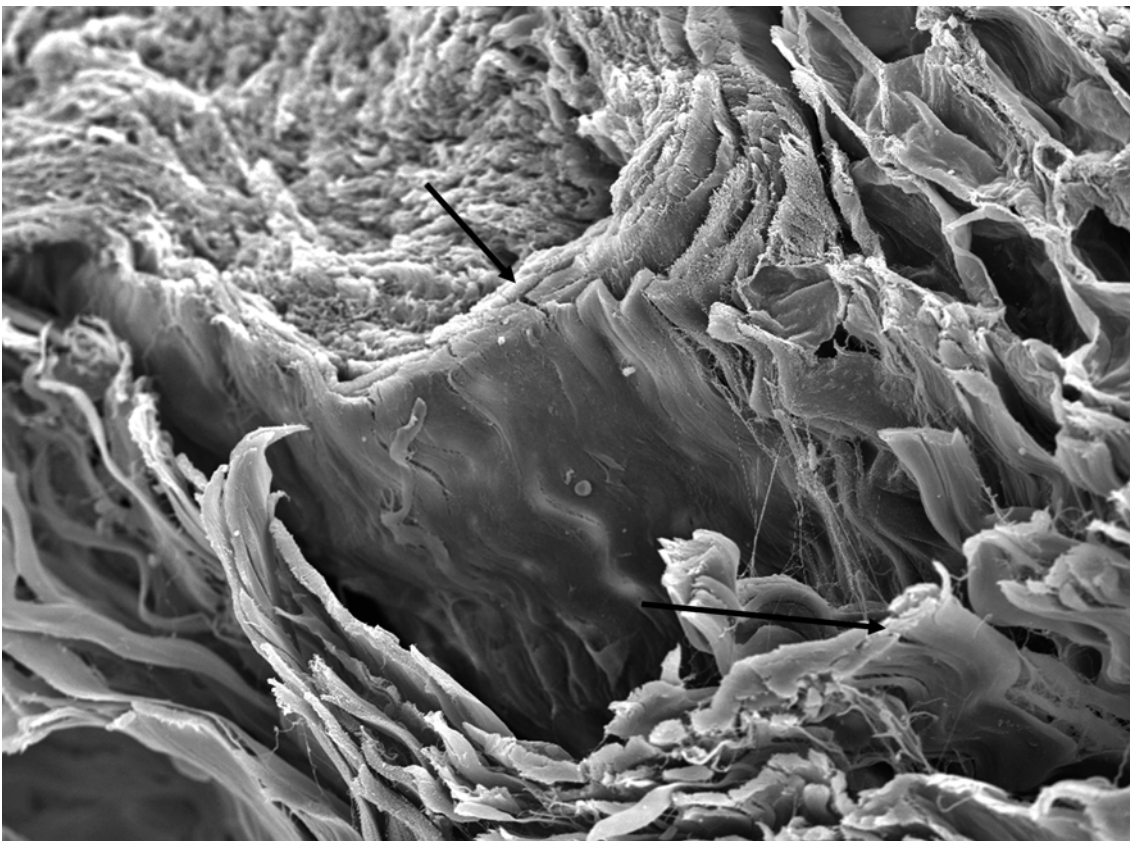


**Fig. 4.13** Perineurium. Fascicles are surrounded by perineurial layers of human sciatic nerve. Shown is a tridimensional view of the perineurial layers (*arrows*) and interfascicular tissue. Scanning electron microscopy, magnification:  $\times 75$

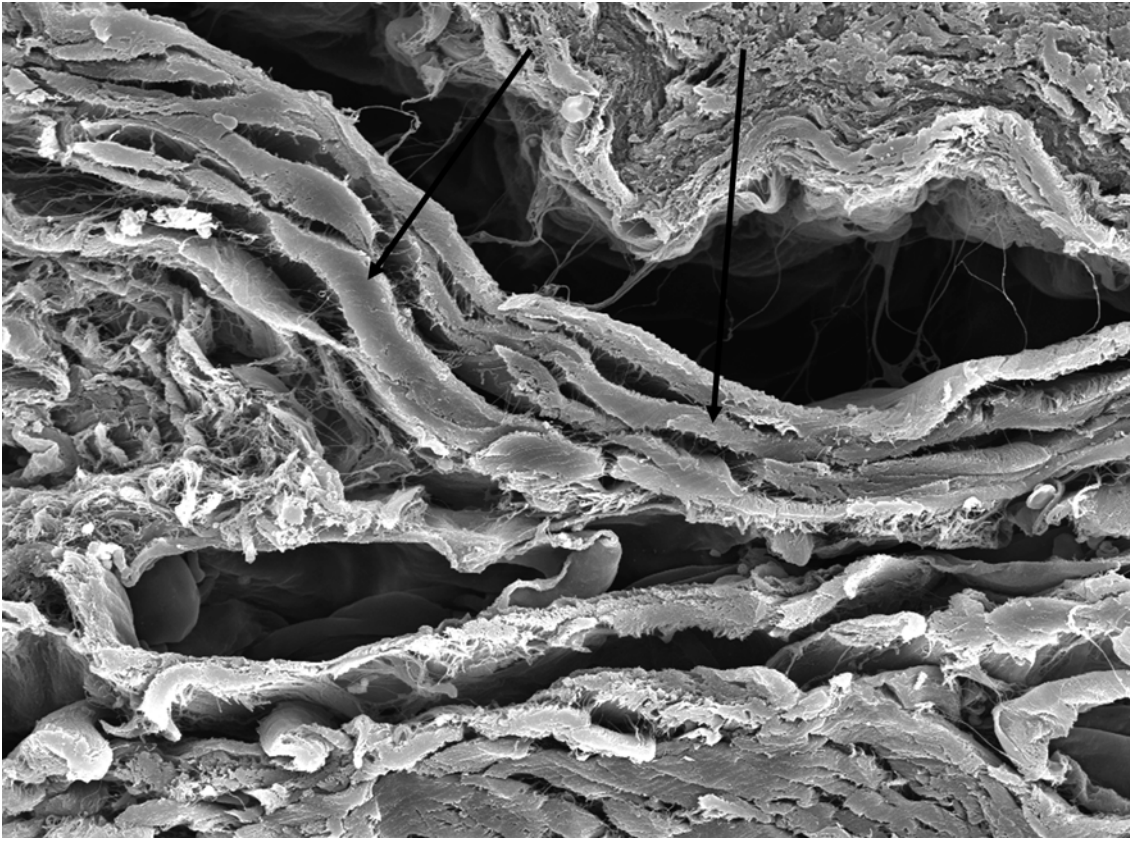




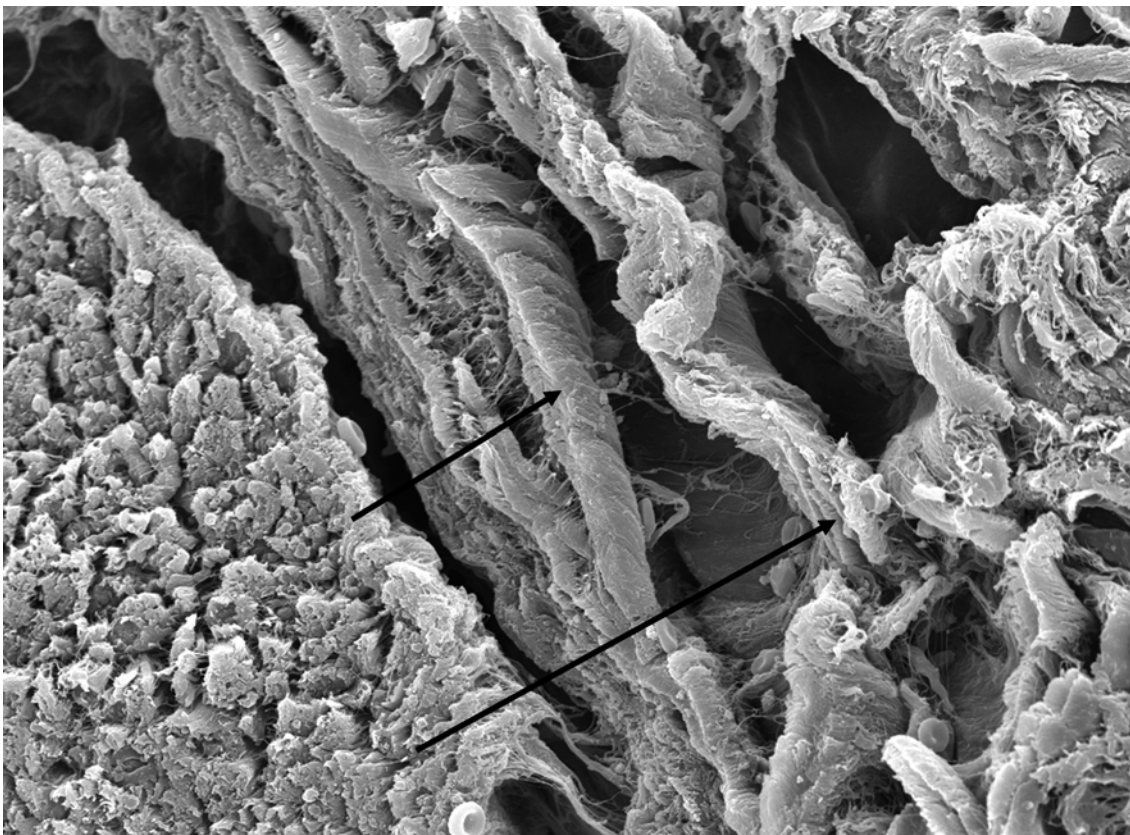
**Fig. 4.14** Perineurium. Perineural layers of human sciatic nerve. Shown is a tridimensional view of the perineural layers (*arrows*). Scanning electron microscopy, magnification:  $\times 300$



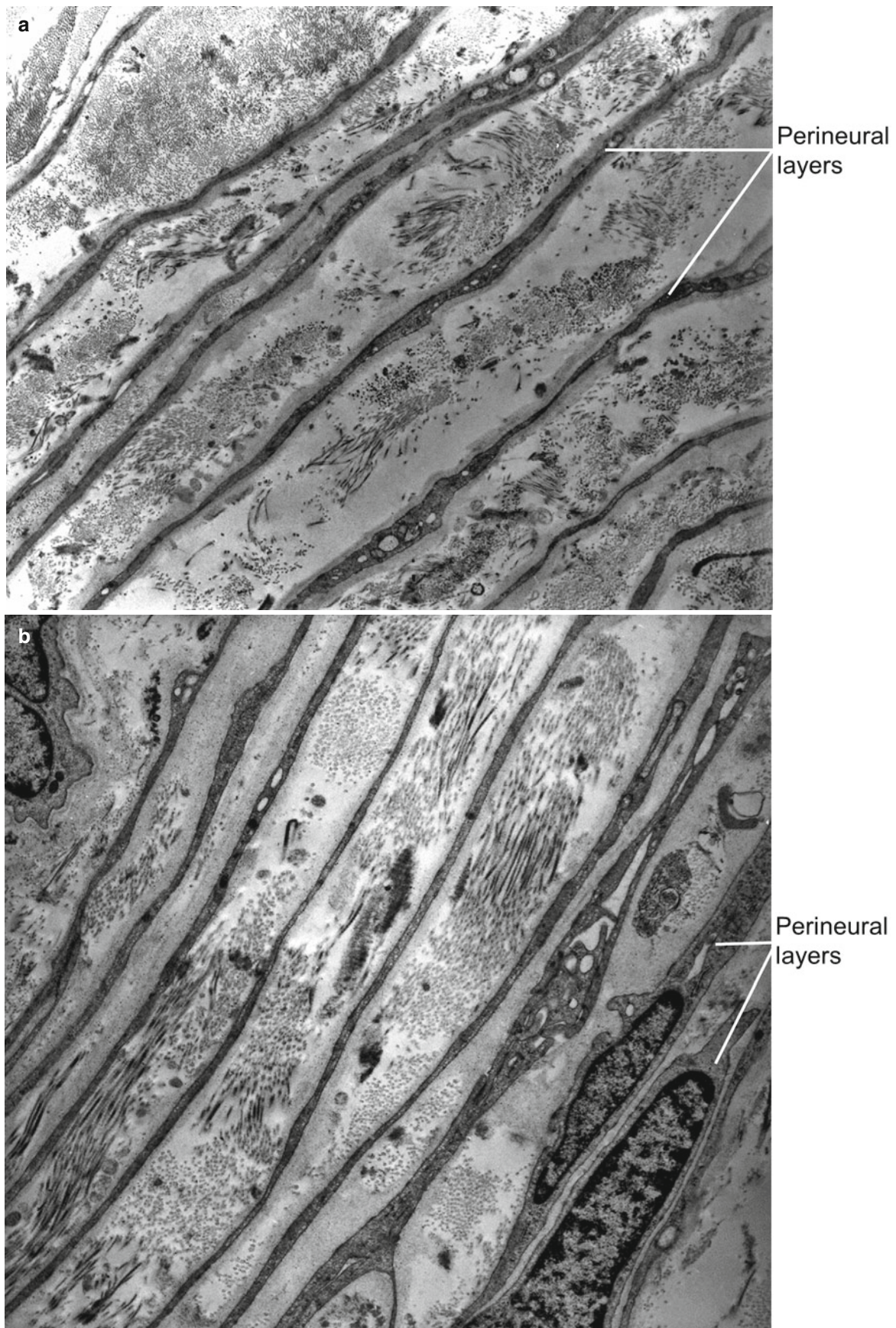
**Fig. 4.15** Perineurium. Perineural layers of human sciatic nerve. Shown is a tridimensional view of the perineural layers (*arrows*). Scanning electron microscopy, magnification:  $\times 300$



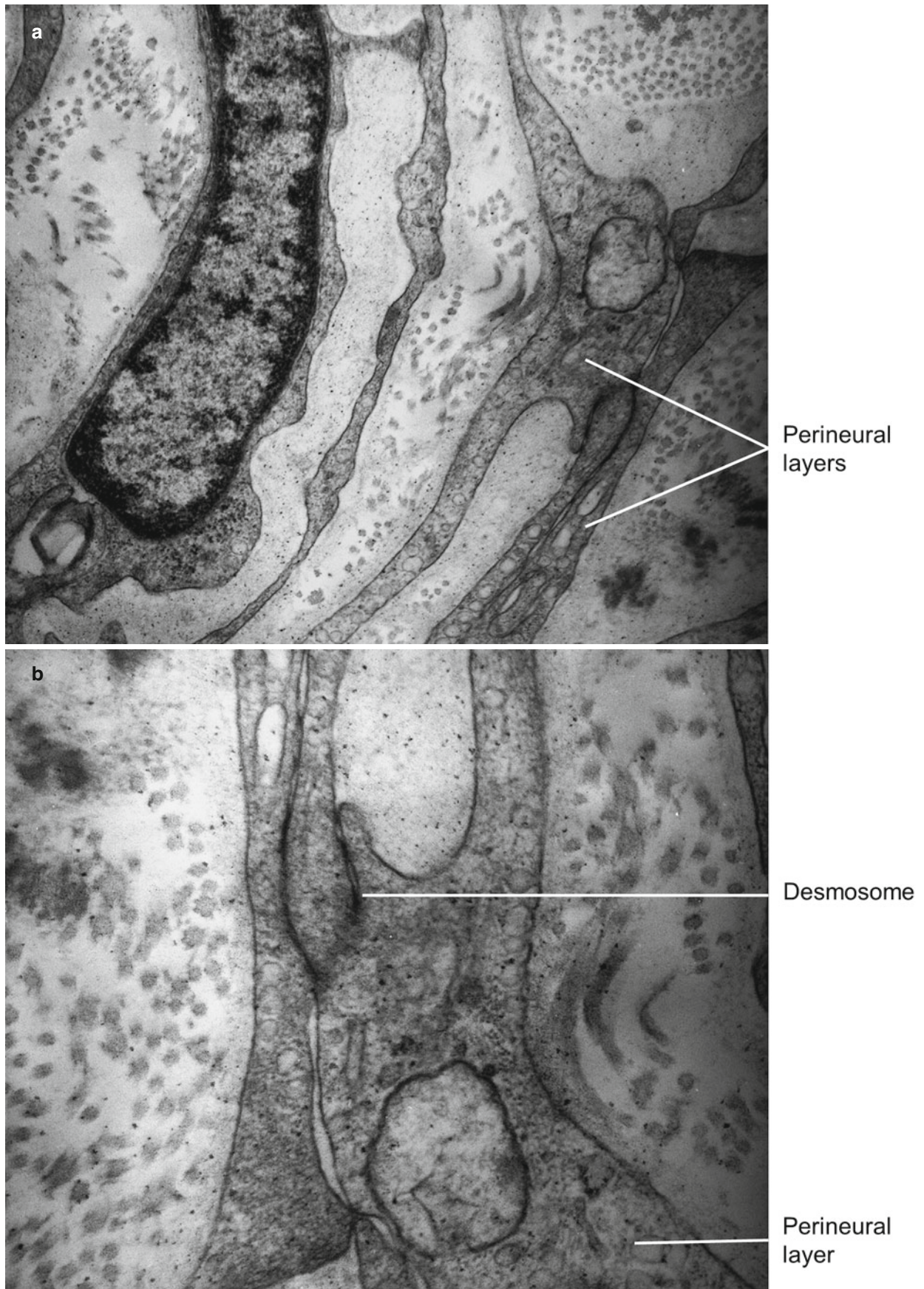
**Fig. 4.16** Perineurium. Perineurial layers of human sciatic nerve. Shown is a tridimensional view of the perineurial layers (*arrows*). Scanning electron microscopy, magnification:  $\times 600$



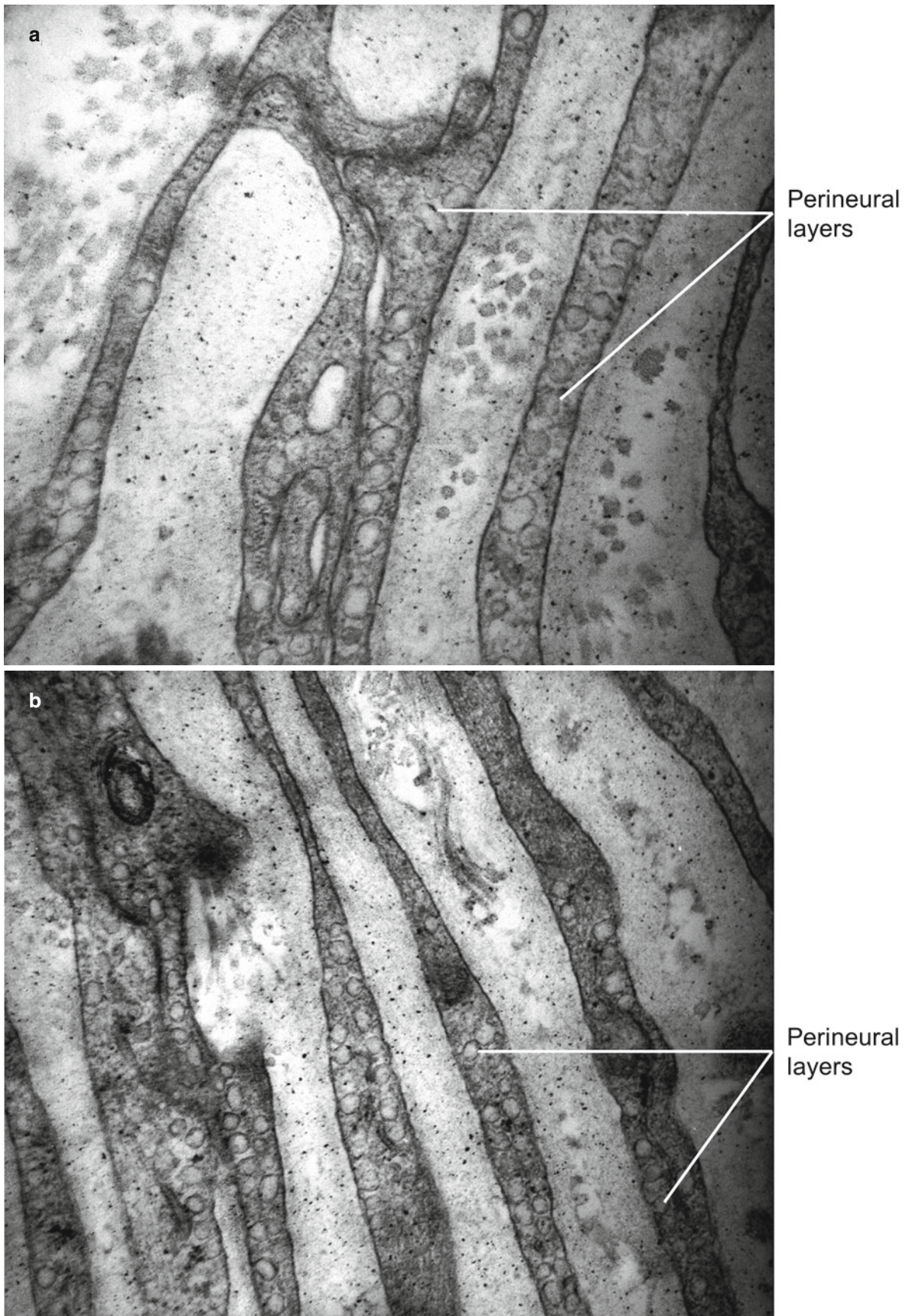
**Fig. 4.17** Perineurium. Perineurial layers of human sciatic nerve. Shown is a tridimensional view of the perineurial layers (*arrows*). Scanning electron microscopy, magnification:  $\times 750$



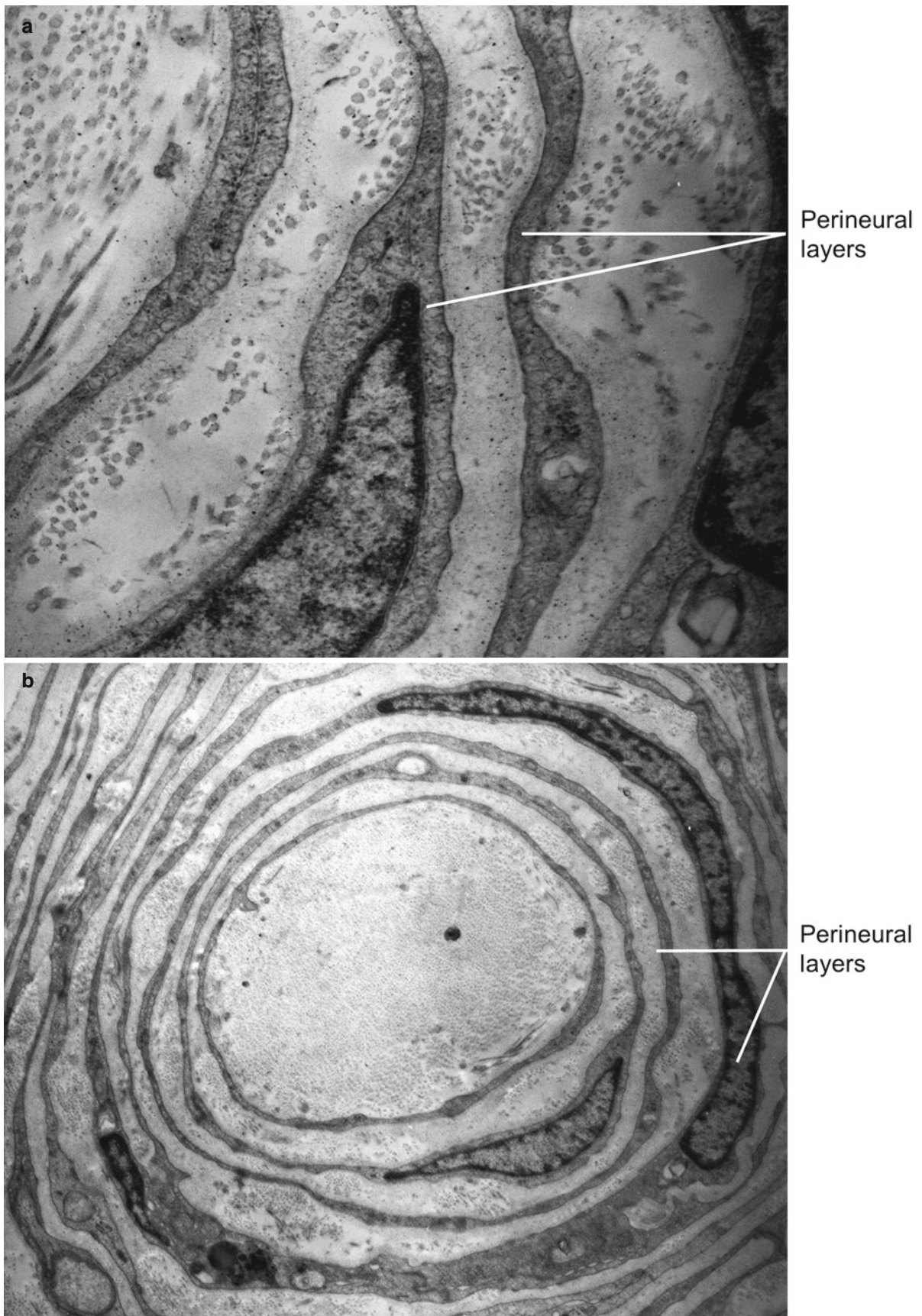
**Fig. 4.18** Perineurium. Perineural layers of human sciatic nerve. Transmission electron microscopy, magnification:  $\times 3,000$  (a);  $\times 7,000$  (b) (Panel b from Reina et al. [9]; with permission)



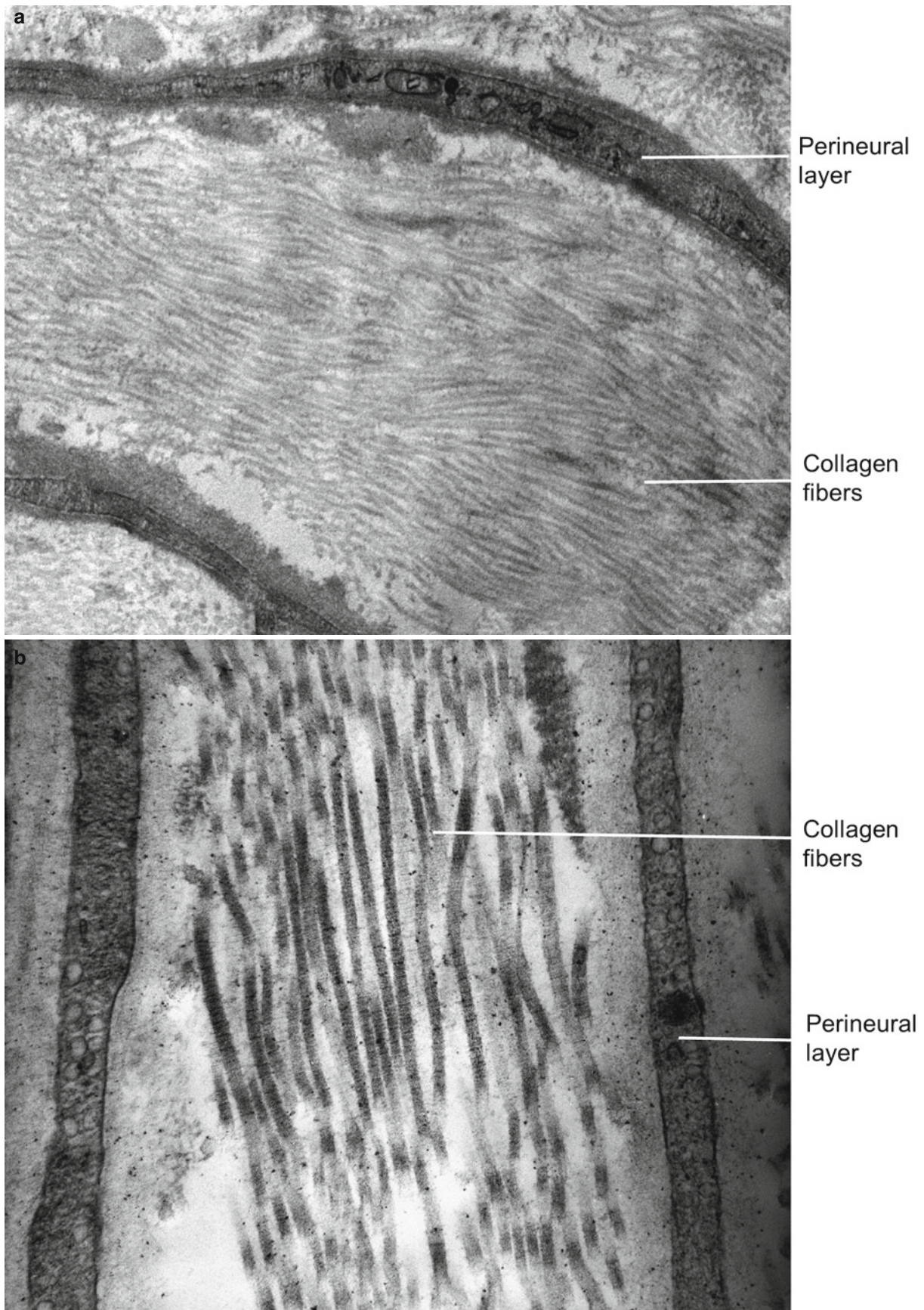
**Fig. 4.19** Perineurium. (a, b) Perineural layers of human sciatic nerve. Transmission electron microscopy, magnification:  $\times 3,000$  (a);  $\times 1,100$  (b) (Panel b from Reina et al. [9]; with permission)



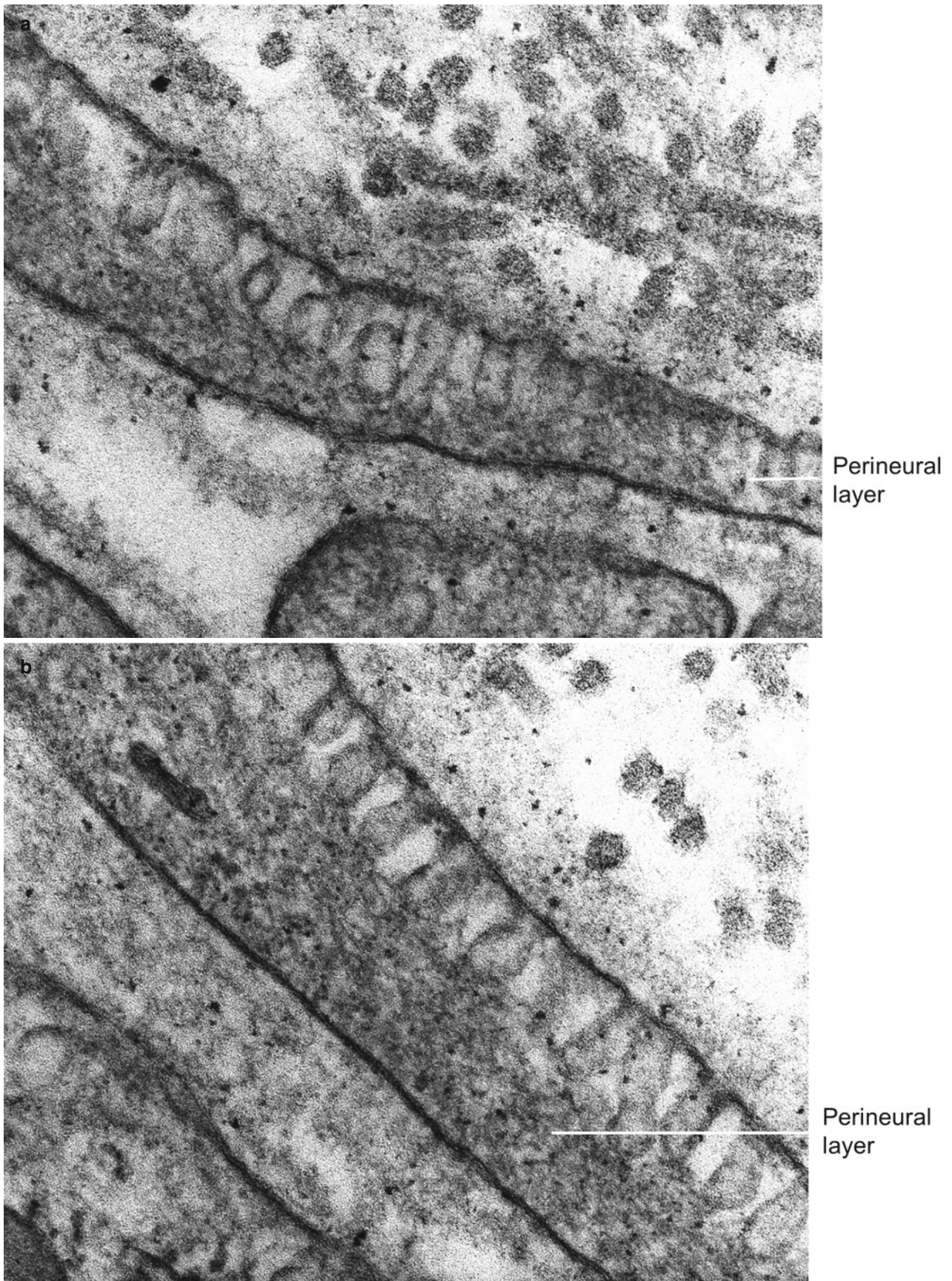
**Fig. 4.20** Perineurium. (a, b) Perineurial layers of human sciatic nerve. Specialized membrane junctions are shown in detail. Transmission electron microscopy, magnification: ×20,000 (a); ×50,000 (b) (Panel a from Reina et al. [1]; with permission. Panel b from Reina et al. [9]; with permission)



**Fig 4.21** Perineurium. (a, b) Perineural layers of human sciatic nerve. Specialized membrane junctions and pinocytotic vesicles are shown in detail. Transmission electron microscopy, magnification  $\times 50,000$  (a);  $\times 30,000$  (b) (Panel b from Reina et al. [1]; with permission)

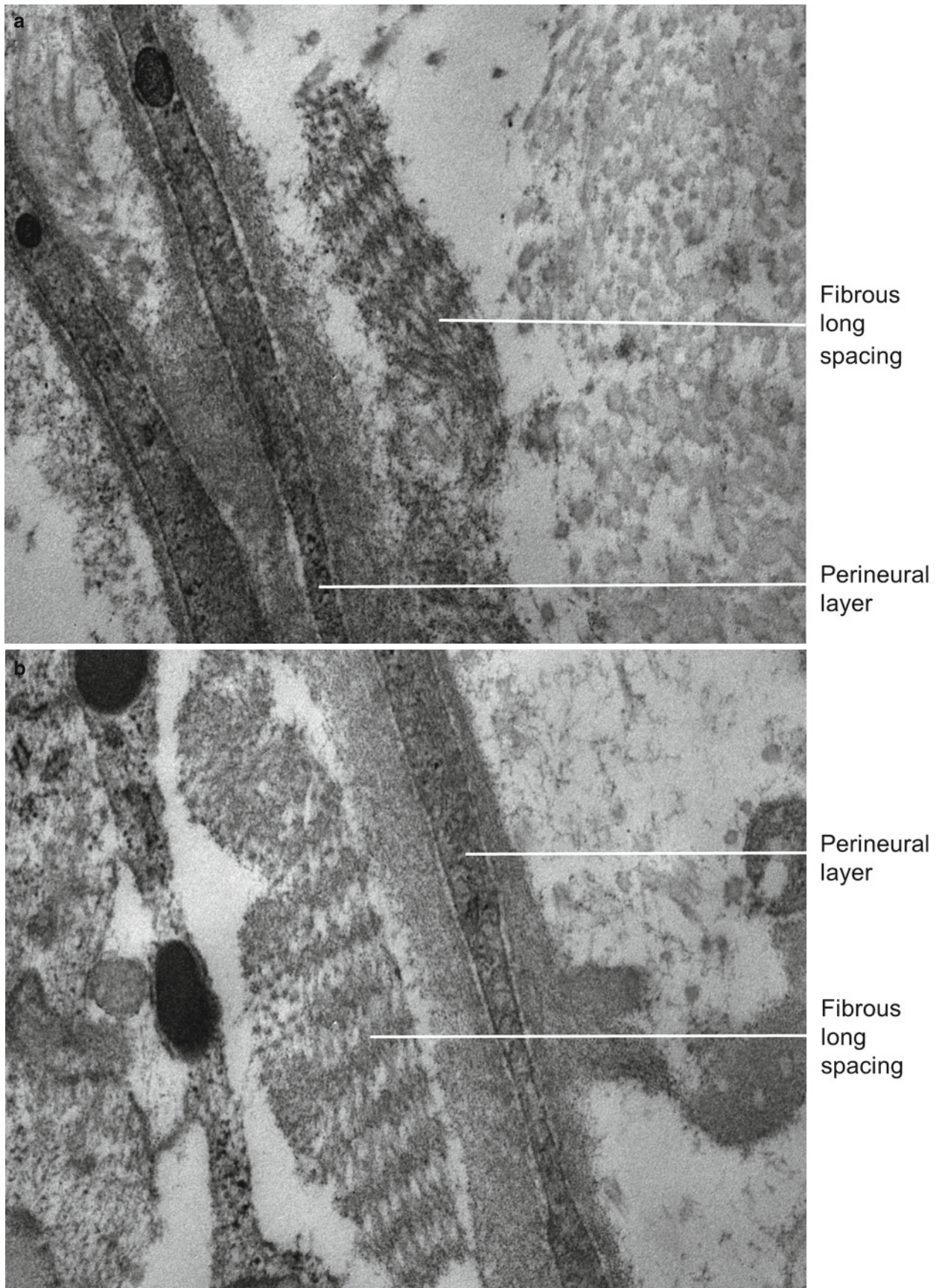


**Fig. 4.22** Perineurium. (a, b) Perineural layers of human sciatic nerve. Transmission electron microscopy, magnification:  $\times 20,000$  (a);  $\times 7,000$  (b)

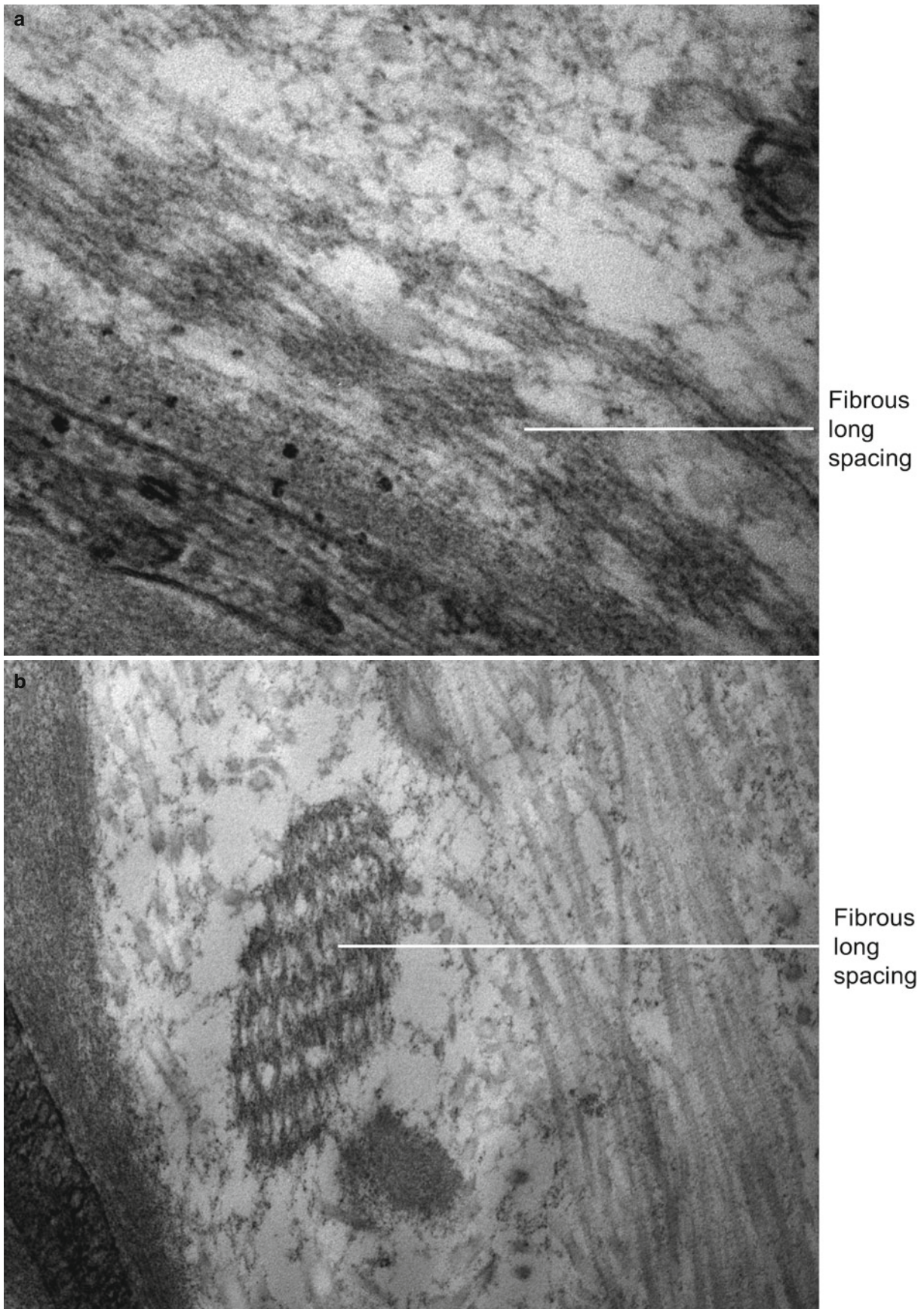


**Fig. 4.23** Perineurium. (a, b) Perineural layers of human sciatic nerve. Collagen fibers between perineural layers are shown in detail. Transmission electron microscopy, magnification:  $\times 25,000$  (a);  $\times 30,000$  (b)

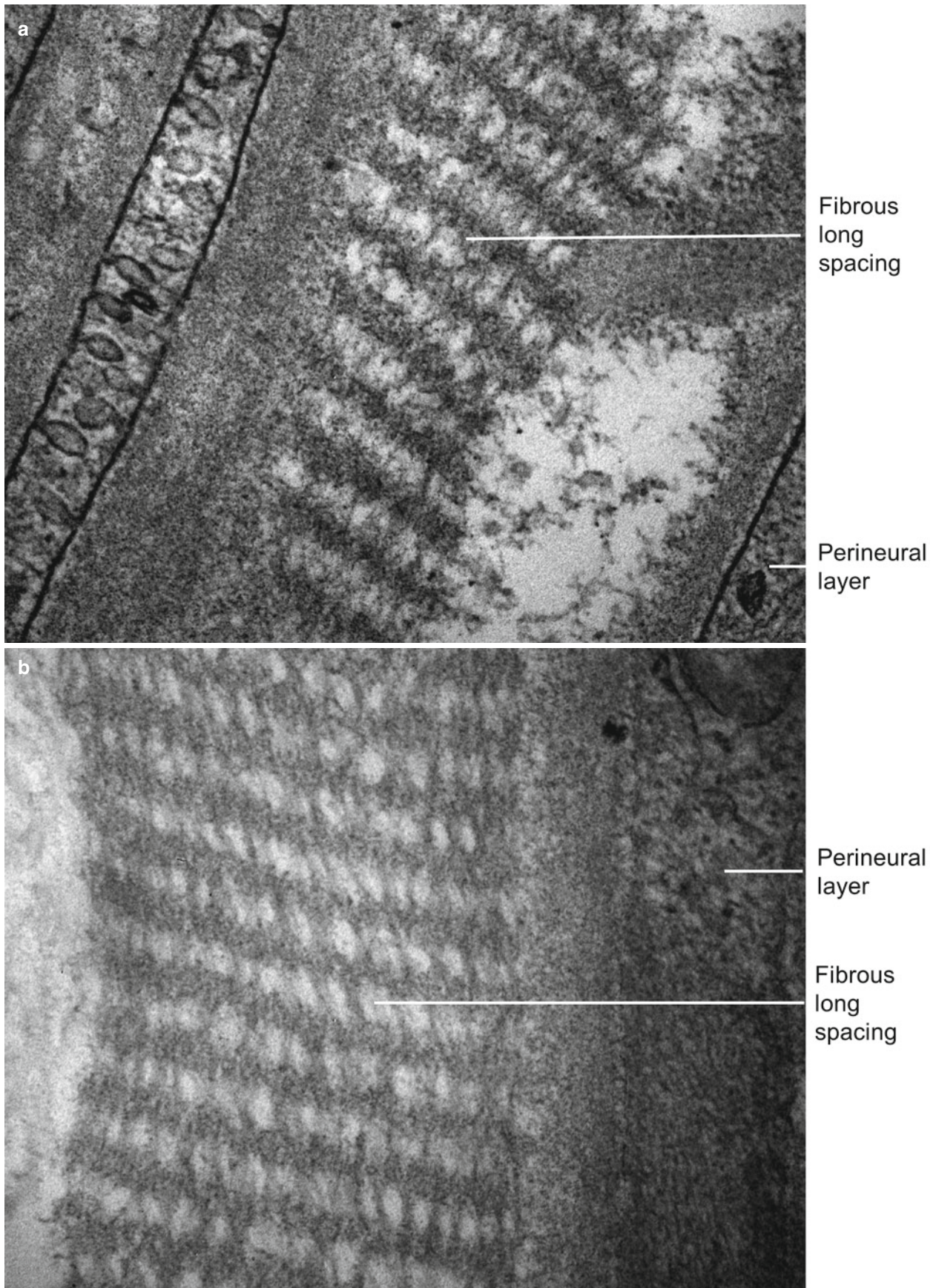




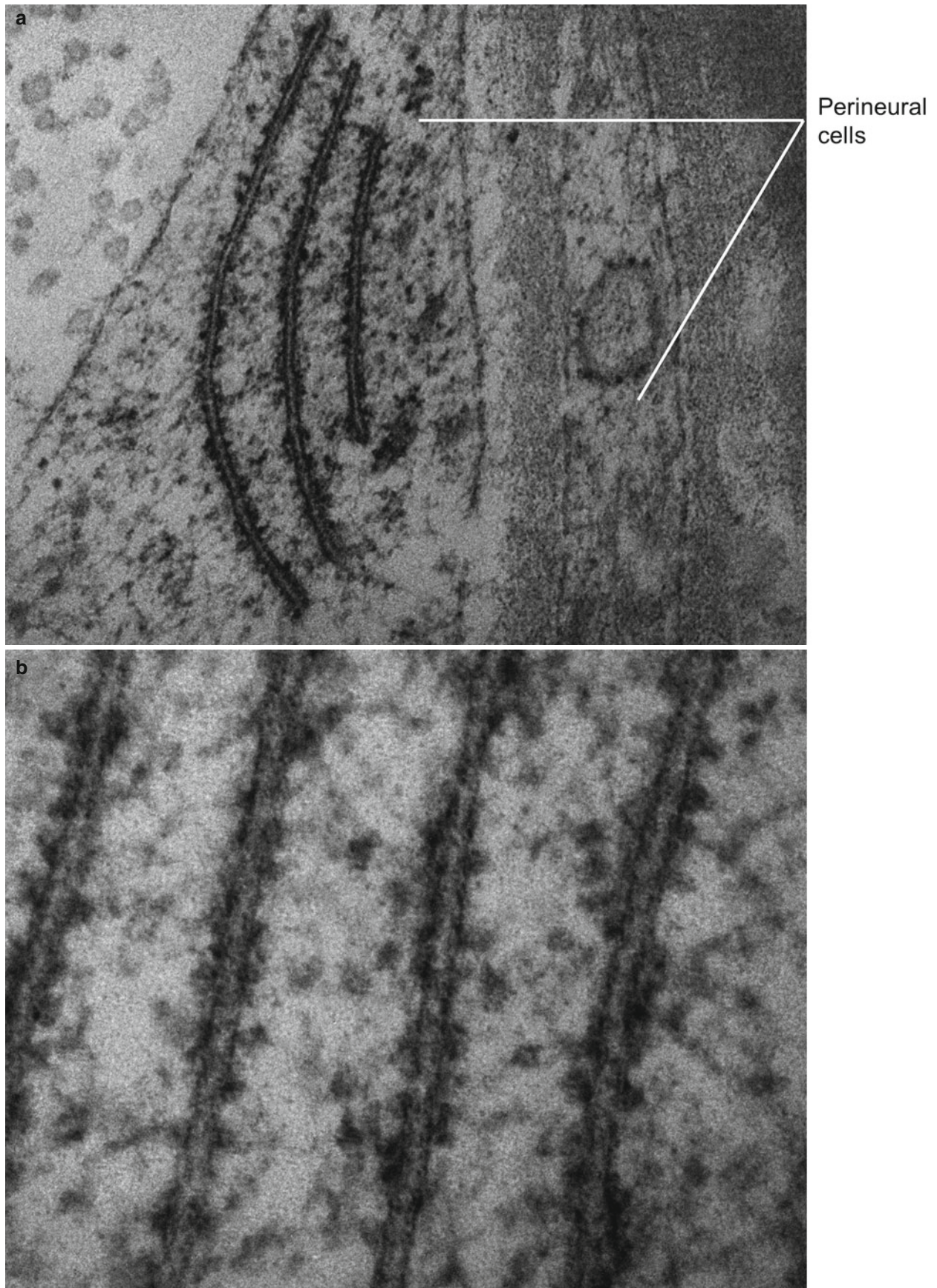
**Fig. 4.24** Perineurium. (a, b) Perineural layers of human sciatic nerve. The pinocytotic vesicles are shown in detail. Transmission electron microscopy, magnification:  $\times 80,000$  (a);  $\times 80,000$  (b) (Panel b from Reina et al. [2]; with permission)



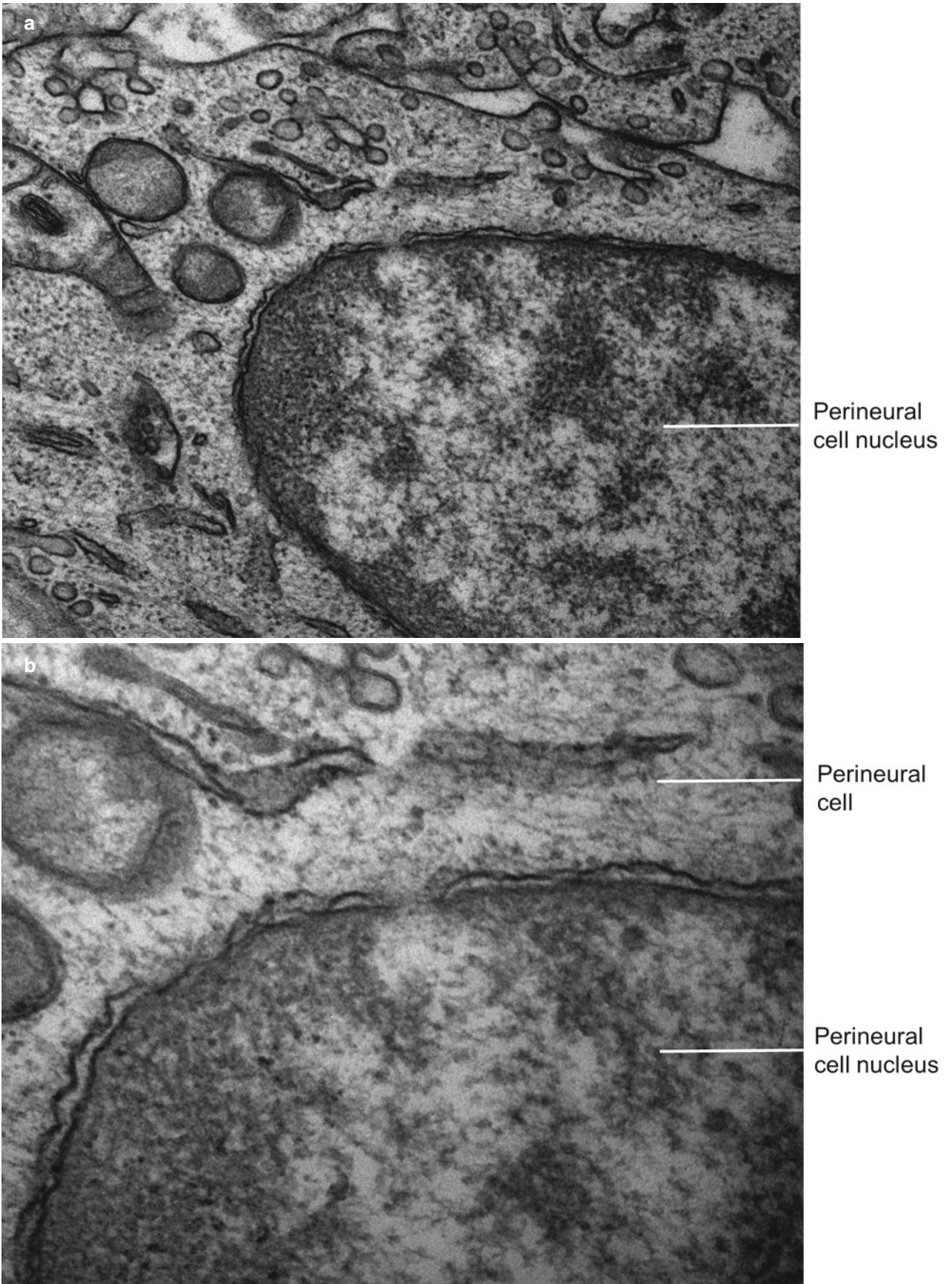
**Fig. 4.25** Perineurium. Fibrous long spacing (FLS) collagen is seen among perineural layers of human sciatic nerve. Transmission electron microscopy, magnification:  $\times 60,000$  (a, b)



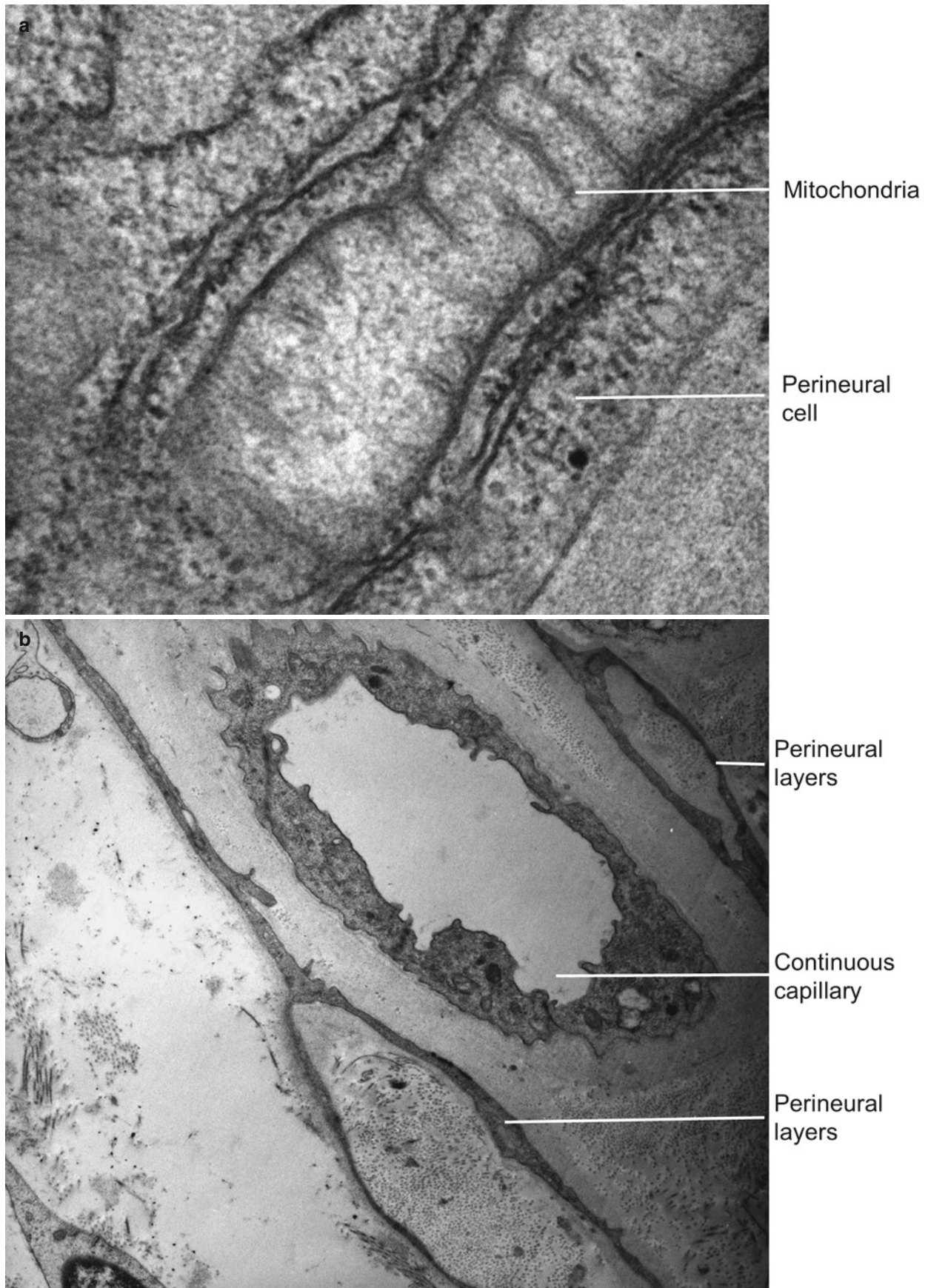
**Fig. 4.26** Perineurium. FLS collagen is seen among perineural layers of human sciatic nerve. Transmission electron microscopy, magnification:  $\times 150,000$  (a);  $\times 60,000$  (b)



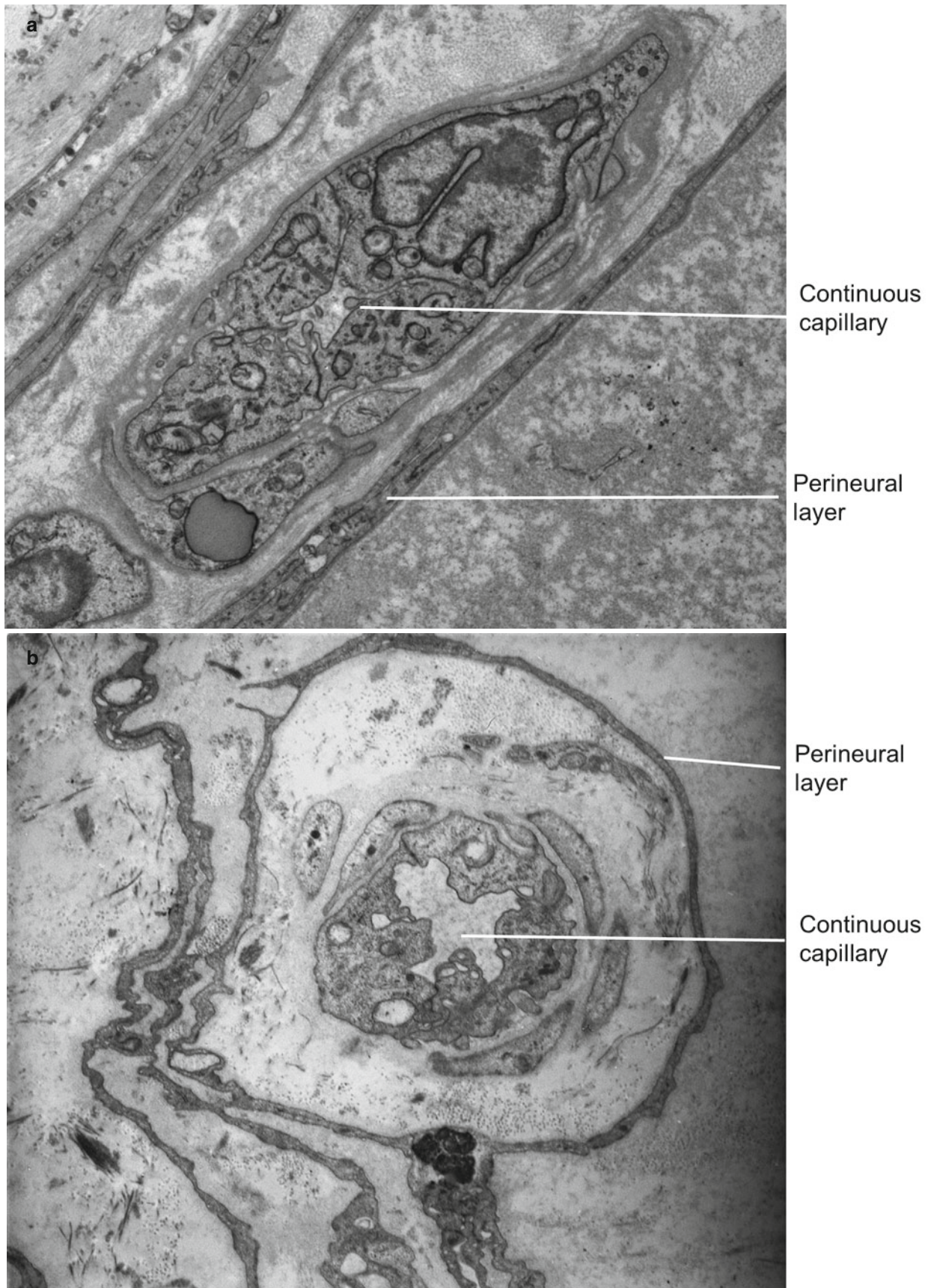
**Fig. 4.27** Perineurium. FLS collagen is seen among perineural layers of human sciatic nerve. Transmission electron microscopy, magnification:  $\times 100,000$  (a);  $\times 120,000$  (b) (Panel a from Reina et al. [1]; with permission)



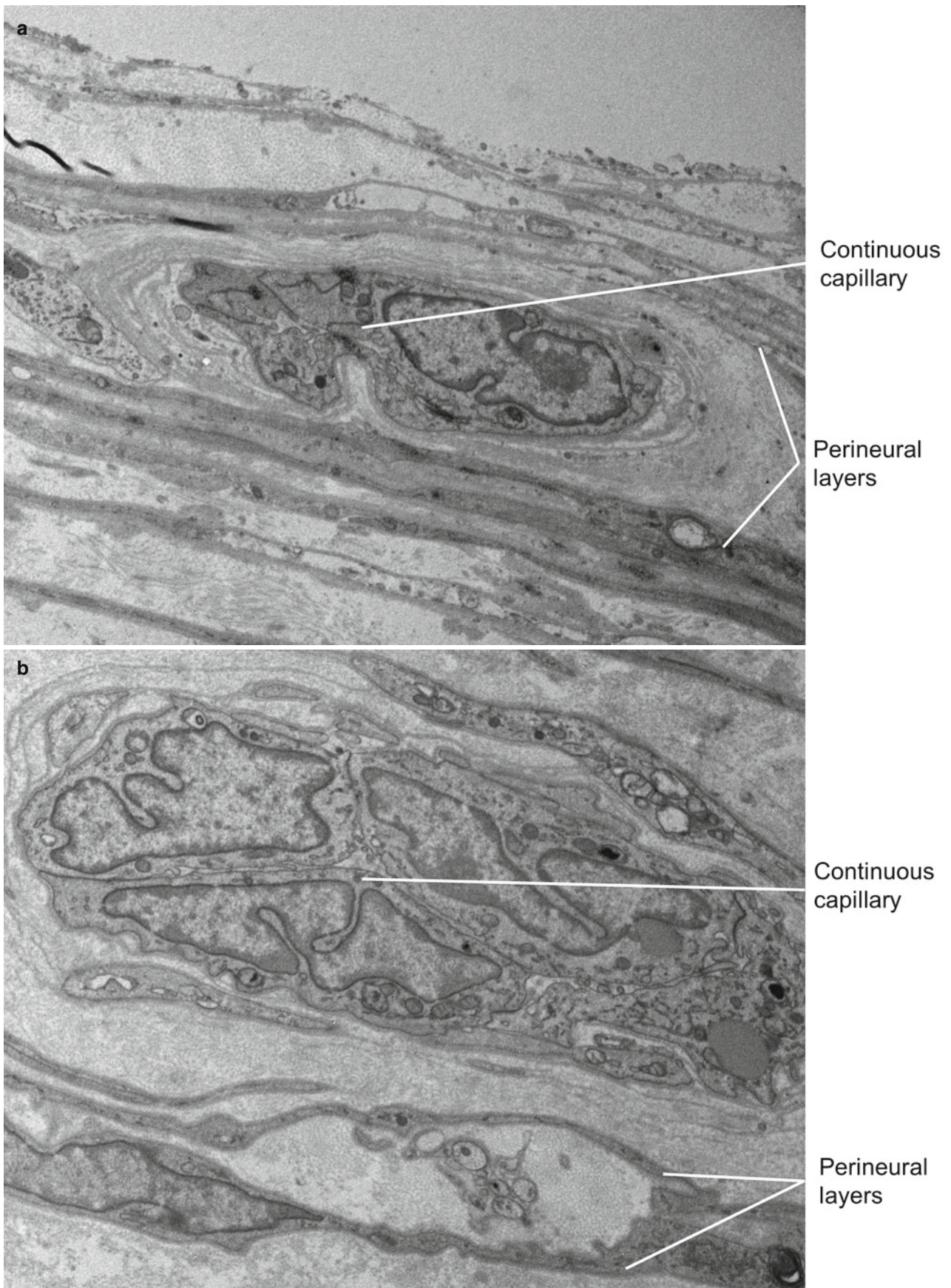
**Fig. 4.28** Perineural cell. The rough endoplasmic reticulum is shown in detail. Transmission electron microscopy, magnification:  $\times 100,000$  (a);  $\times 300,000$  (b)



**Fig. 4.29** Perineural cell. Pores on the membrane nucleus are shown in detail. Transmission electron microscopy, magnification:  $\times 50,000$  (a);  $\times 120,000$  (b)

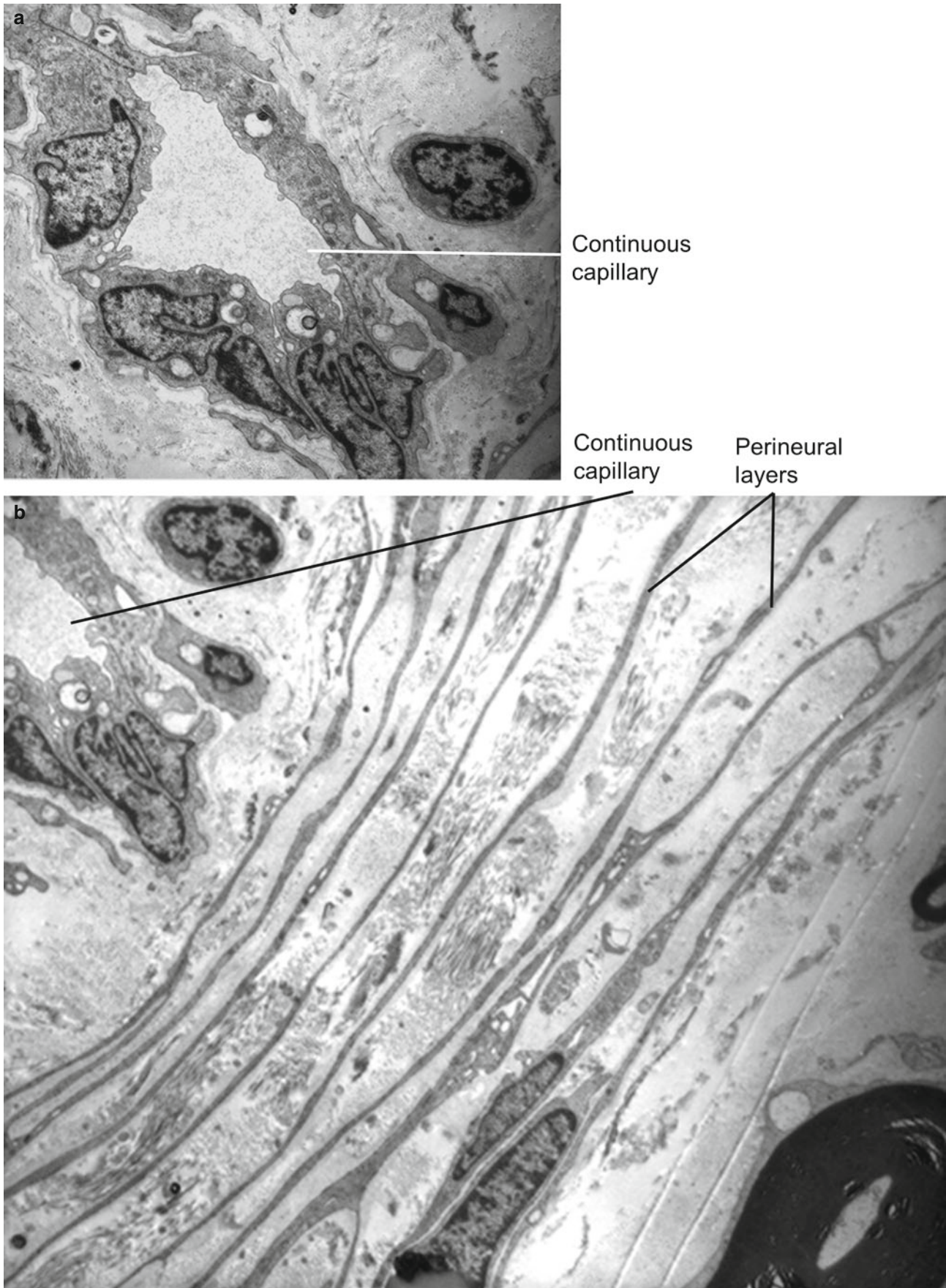


**Fig. 4.30** Perineurium. (a) Detail of mitochondria within a perineural cell. (b) Continuous capillary within perineural layers of human sciatic nerve. Transmission electron microscopy, magnification:  $\times 150,000$  (a);  $\times 7,000$  (b)



**Fig. 4.31** Perineurium. (a) Detail of a continuous capillary between perineural cells. (b) Detail of a continuous capillary surrounded by the same perineural layer. Transmission electron microscopy, magnification:  $\times 12,000$  (a);  $\times 7,000$  (b)





**Fig. 4.32** Perineurium. (a, b) Detail of a continuous capillary between perineural cells. Transmission electron microscopy, magnification:  $\times 8,000$  (a);  $\times 10,000$  (b)

## References

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