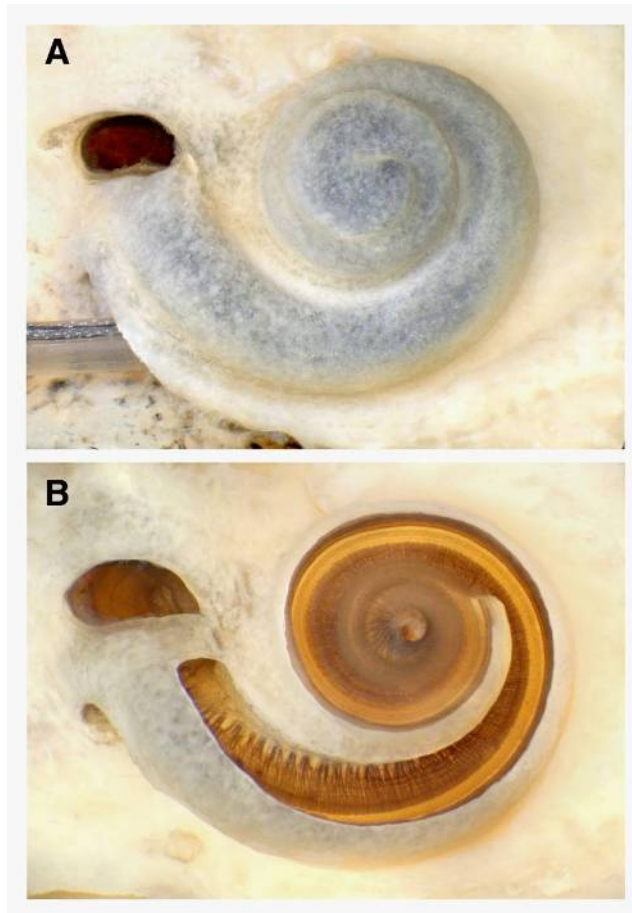


**A:** Otic capsule bone drilled to a thin shell to reveal contours of the cochlea. The membranous labyrinth has been stained with osmium so that it appears dark through the thinned bone. An implant electrode array had been inserted into this specimen and a portion of the array can be seen at lower left.

**B:** Similar preparation in which the bone overlying scala vestibuli has been removed to show the osmium-stained basilar membrane and osseous spiral lamina.

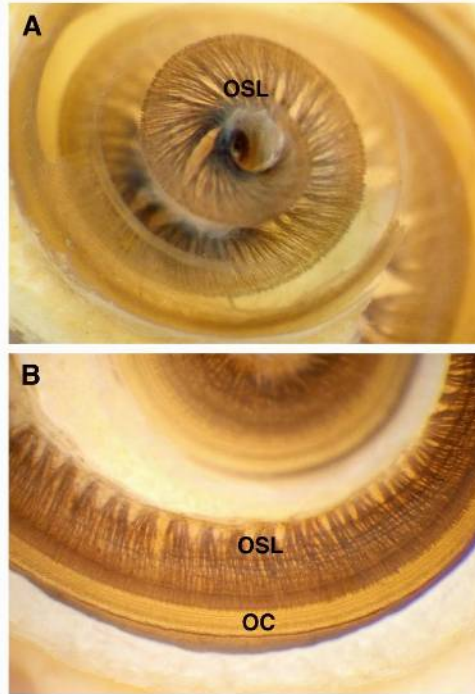
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**A:** Apical cochlear turn showing myelinated nerve fibers within the osseous spiral lamina (OSL).

**B:** Basal turn. The organ of Corti (OC) is seen as a lightly-stained band lying adjacent to the osseous lamina.

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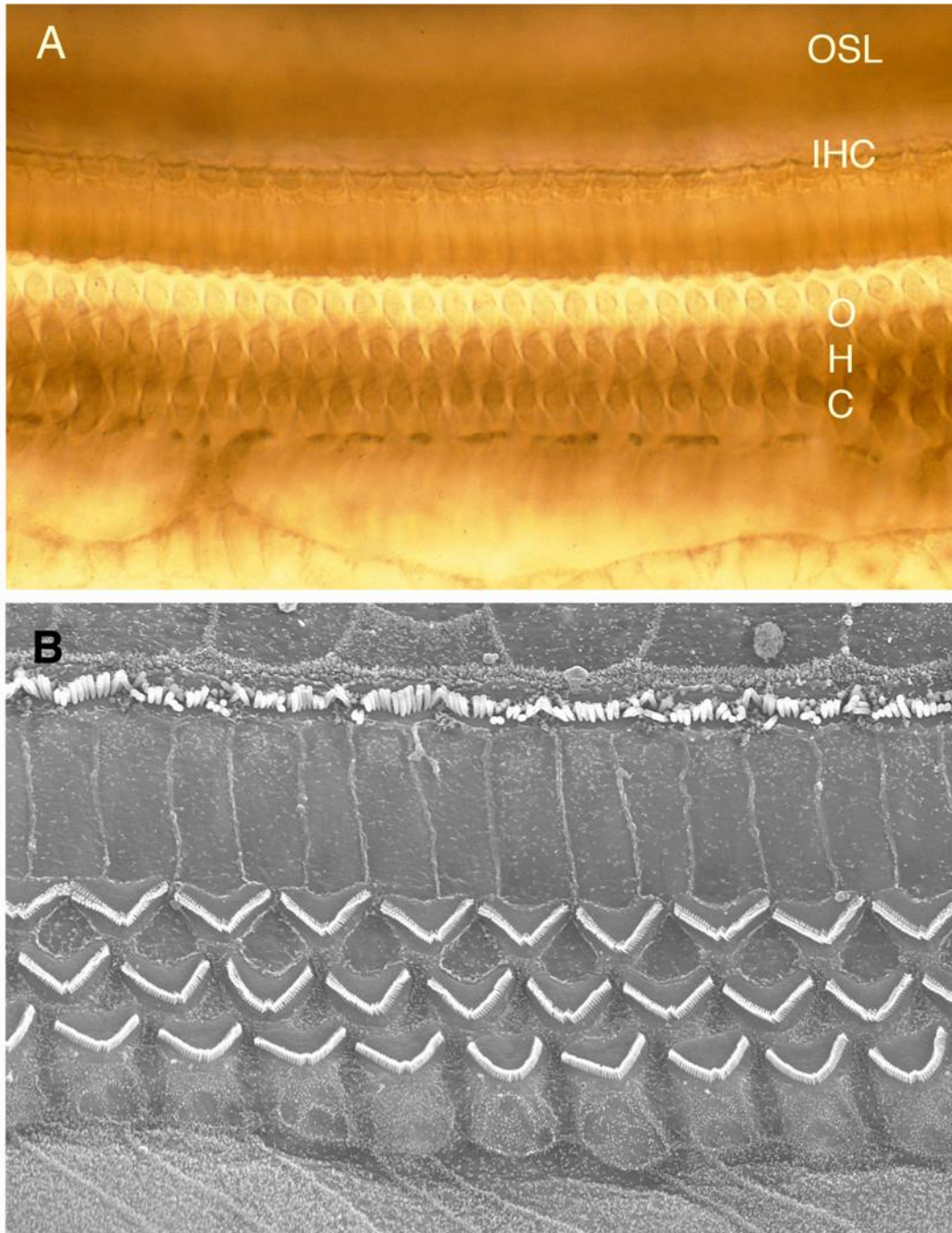
Micrograph shown in "B" from Wright CG, Roland PS. Temporal bone microdissection for anatomic study of cochlear implant electrodes. *Cochlear Implants International* 2005;6(4):159-168. Copyright John Wiley & Sons Limited. Reproduced with permission.

Higher power view of osseous lamina and basilar membrane/organ of Corti in a preparation from an elderly individual in which there has been mild thinning of the myelinated nerve fibers within the osseous lamina. The spirally oriented nerve fibers in the osseous lamina are nicely displayed in this specimen.



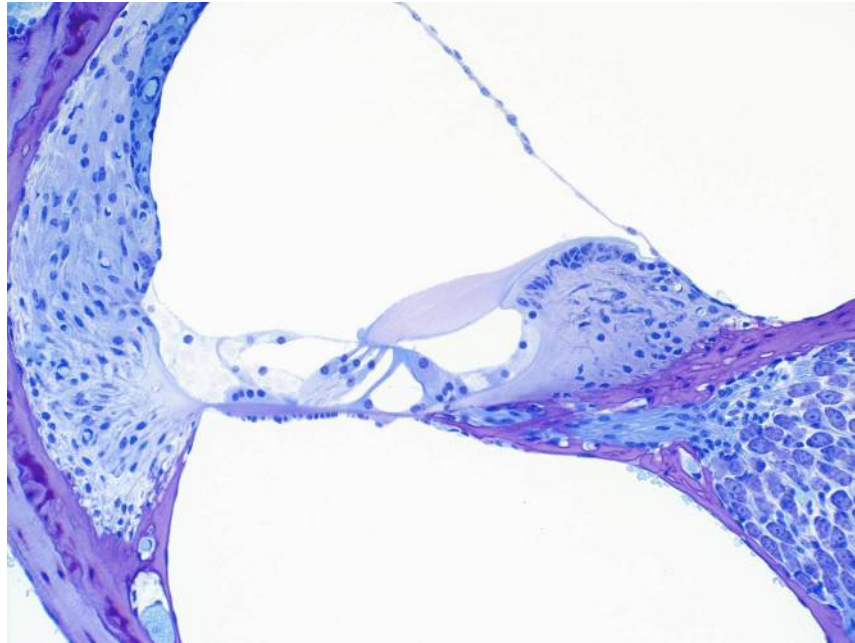
Whole-mount, osmium-stained preparations of organ of Corti as seen by light **(A)** and scanning electron **(B)** microscopy. The level of focus in "A" is such that the cell bodies (rather than apical surfaces) of the outer hair cells (OHC) are seen. These preparations are from laboratory animals.

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Cross section of mouse cochlear duct, basal turn, showing internal structure of organ of Corti to complement surface views seen in the previous images.

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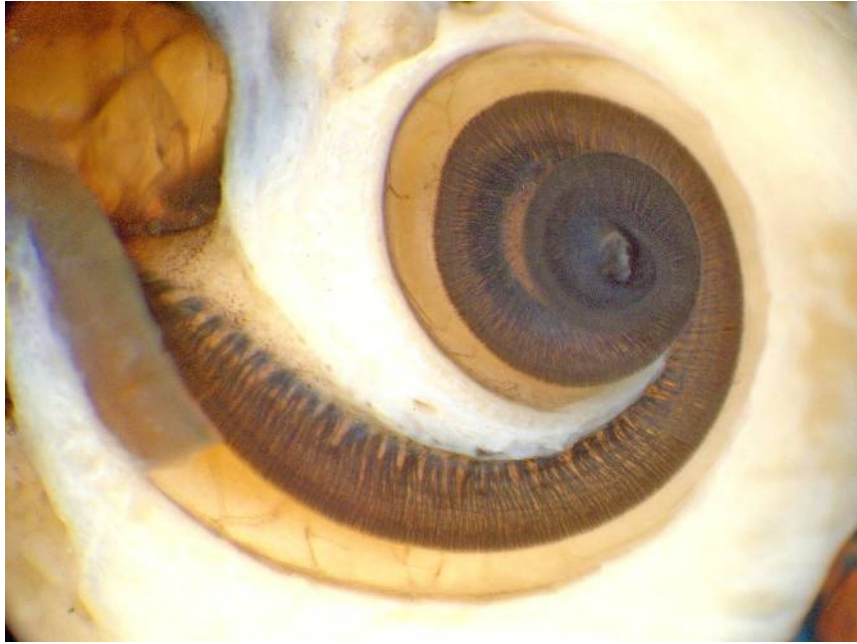
A preparation in which the modiolus and osseous lamina are seen in profile after removal of the otic capsule bone covering the human cochlea.

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Osseous lamina with its nerve fibers in a specimen oriented in nearly horizontal plane.

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Cochlear dissection after insertion of a cochlear implant electrode array (Advanced Bionics Thin Helix). The array has been colored blue to provide better contrast of the silicon carrier. The array lies in scala tympani and is situated beneath the translucent basilar membrane. The apical cochlear turn has been removed to provide an unobstructed view of the basal turn.

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From Wright, CG, Roland PS, Kuzma J. Advanced Bionics Thin Lateral and Helix II electrodes: a temporal bone study. *Laryngoscope* 115(11);2005:2041-2045. Copyright Lippincott, Williams and Wilkins. Reproduced with permission. Website: <http://lww.com>



Cochlear dissection after insertion of an Advanced Bionics Thin Lateral electrode array designed to track the lateral wall of scala tympani. With this array, contacts are placed immediately beneath the basilar membrane.

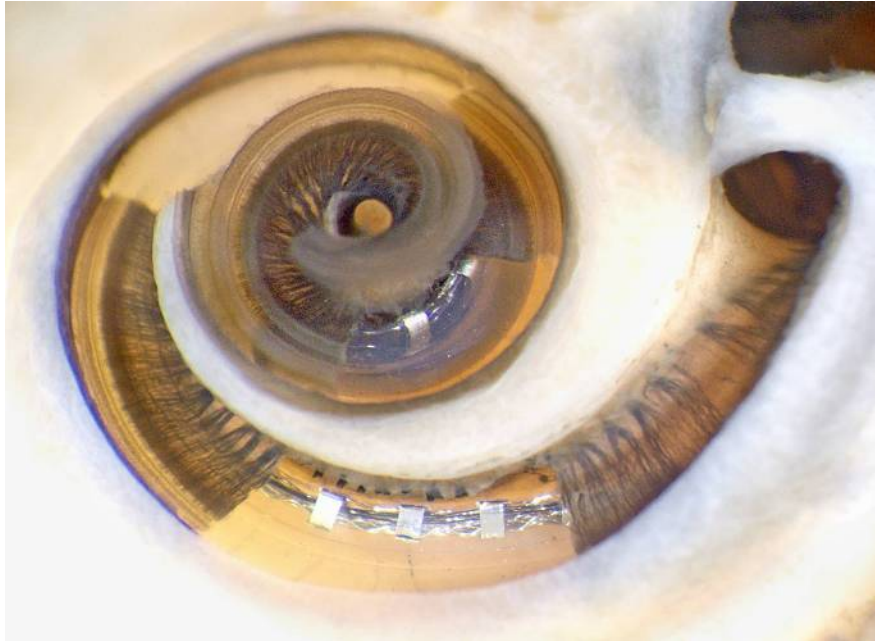
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From Wright, CG, Roland PS, Kuzma J. Advanced Bionics Thin Lateral and Helix II electrodes: a temporal bone study. *Laryngoscope* 115(11);2005:2041-2045. Copyright Lippincott, Williams and Wilkins. Reproduced with permission. <http://lww.com>

Cochlear dissection after insertion of a perimodiolar type electrode array (Advanced Bionics standard Helix). Segments of the osseous lamina and basilar membrane have been removed to more clearly show the array in scala tympani. The apical portion of the silicone carrier is darkened due to osmium staining.

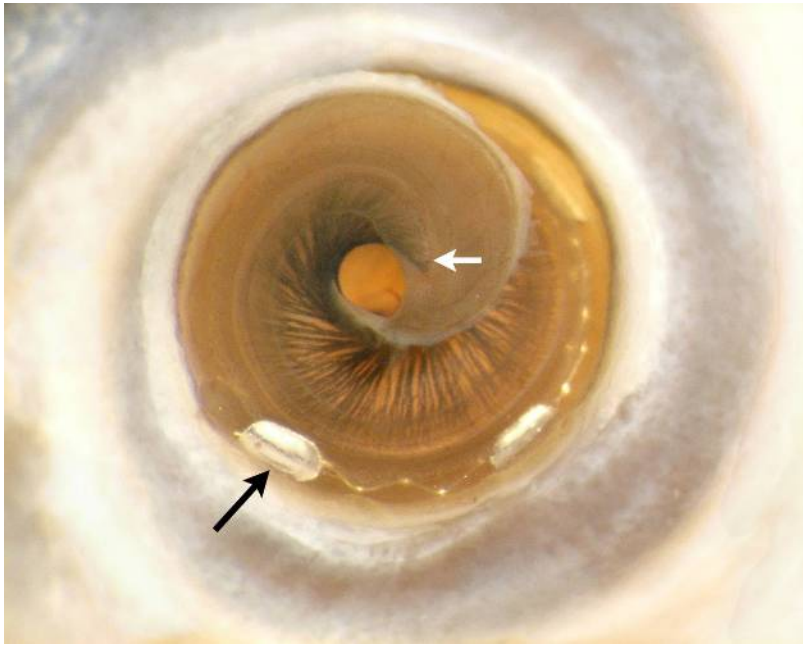
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From Wright CG, Roland PS. Temporal bone microdissection for anatomic study of cochlear implant electrodes. *Cochlear Implants International* 2005;6(4):159-168. Copyright John Wiley & Sons Limited. Reproduced with permission.

Apical cochlear turn showing a Med-El electrode array inserted to near the apical tip of the basilar membrane (white arrow). The black arrow indicates the apical-most electrode contact which is situated beneath the semi-transparent basilar membrane.

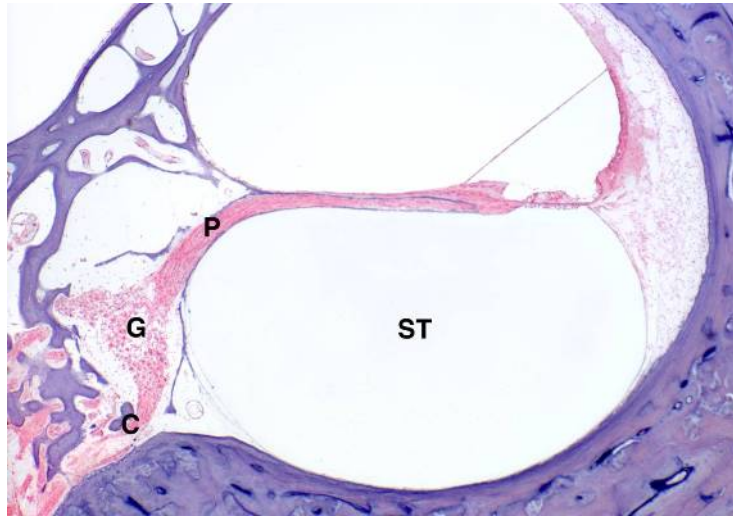
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From Wright CG, Roland PS. Temporal bone microdissection for anatomic study of cochlear implant electrodes. *Cochlear Implants International* 2005;6(4):159-168. Copyright John Wiley & Sons Limited. Reproduced with permission.

Cochlear cross section showing the spiral ganglion (**G**) with peripheral (**P**) and central (**C**) processes projecting from the ganglion to enter the osseous lamina and modiulus. Note the very thin bone overlying the spiral ganglion and under surface of the osseous lamina.

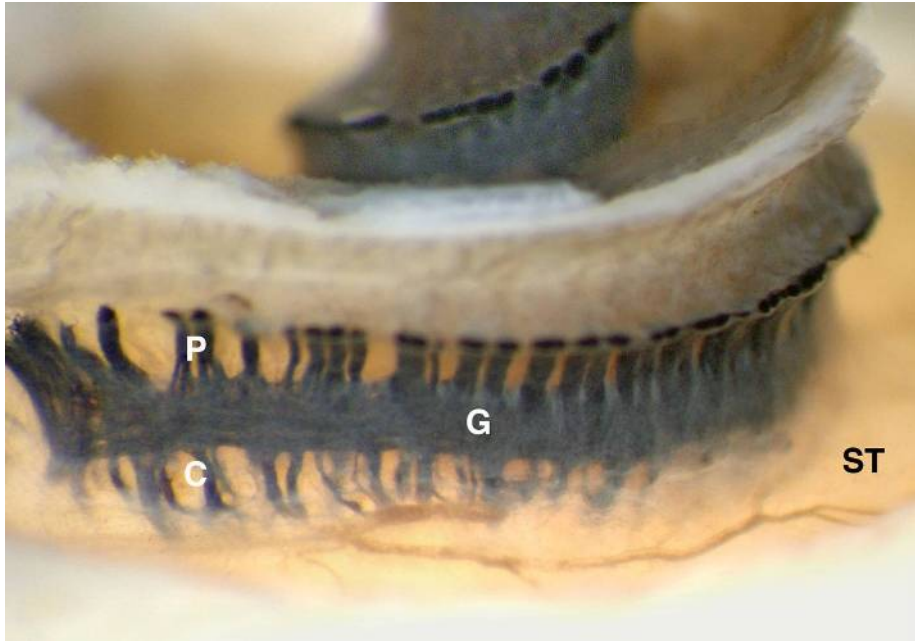
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From Roland PS, Wright C.G. Surgical aspects of cochlear implantation: Mechanisms of insertional trauma. *Adv Otorhinolaryngol* 2006;64:11-30. Copyright S. Karger AG, Basel. Reproduced with permission.

Dissection in which the osseous lamina and basilar membrane have been removed so as to show the modiolar wall in the basal cochlear turn of an osmium-stained specimen. Neural elements associated with the modiolar wall are well displayed. "G" indicates the spiral ganglion. Peripheral (P) and central (C) processes of spiral ganglion cells are seen emerging from the ganglion along the length of the basal turn. ST, floor of scala tympani. This preparation shows the same anatomical features shown in slide 12 from the perspective of microdissection. The specimen received light decalcification, but no bone was removed from the modiolar wall.

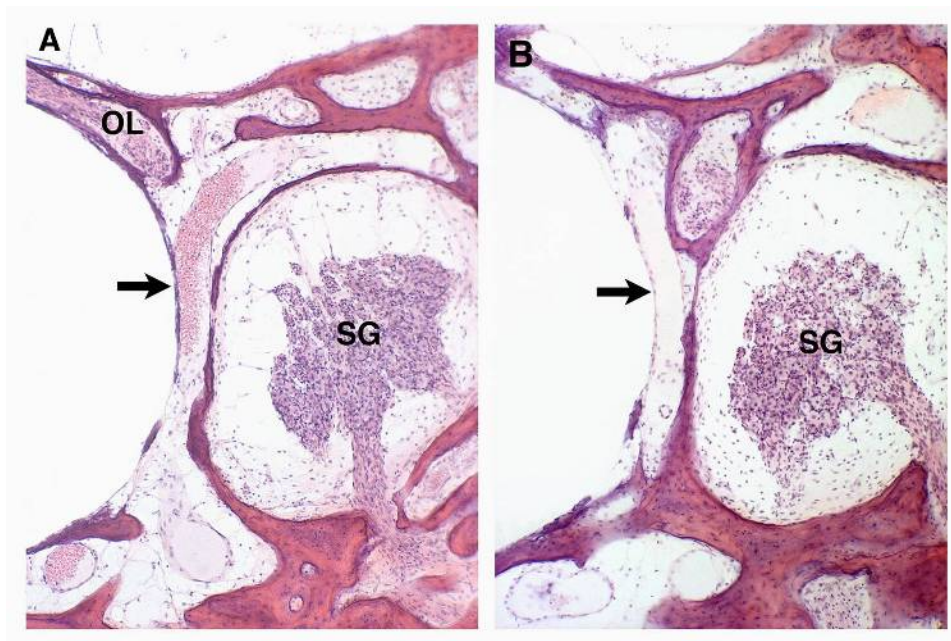
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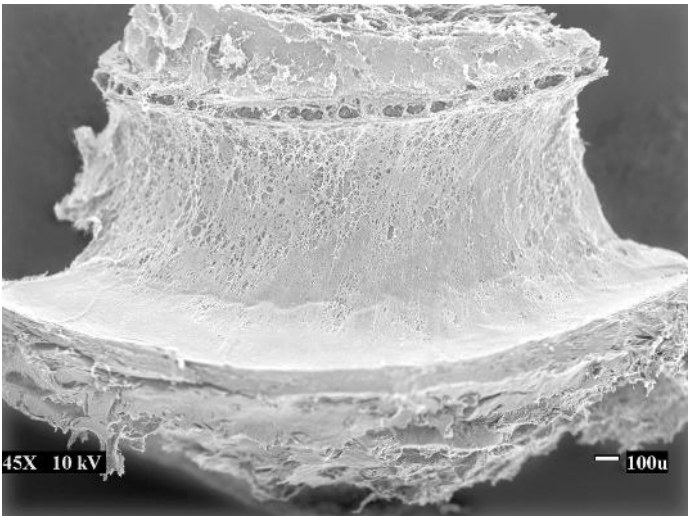


Cross sections of the modiolus region showing veins coursing near the surface of the modiolar wall. In "A" the vein indicated by the arrow has a very thin covering of bone. In an adjacent section, shown in "B" , a similar vein (arrow) appears entirely exposed to the perilymphatic space. (In this case the vein does not contain RBC's, but it certainly does appear to be a vein .) It would seem that such vessels might easily be injured by a perimodiolar electrode. OL, osseous lamina; SG, spiral ganglion. See slide 23 for a view of this anatomy in a dissection.

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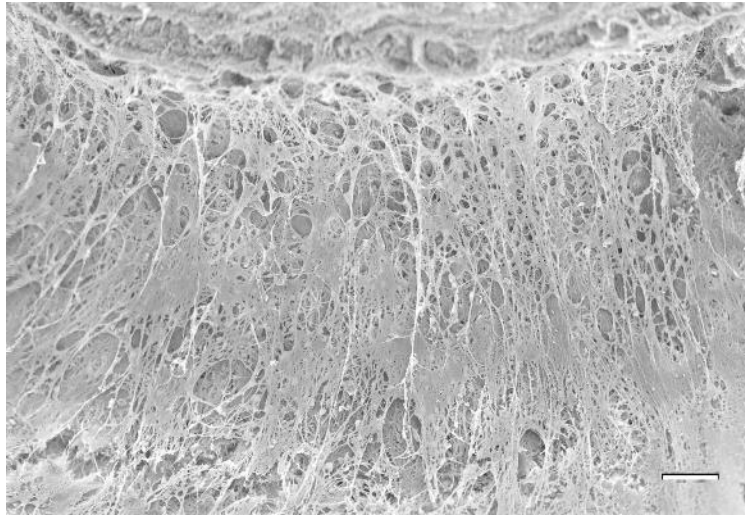


Scanning electron micrograph of the modiolar wall in the basal cochlear turn.



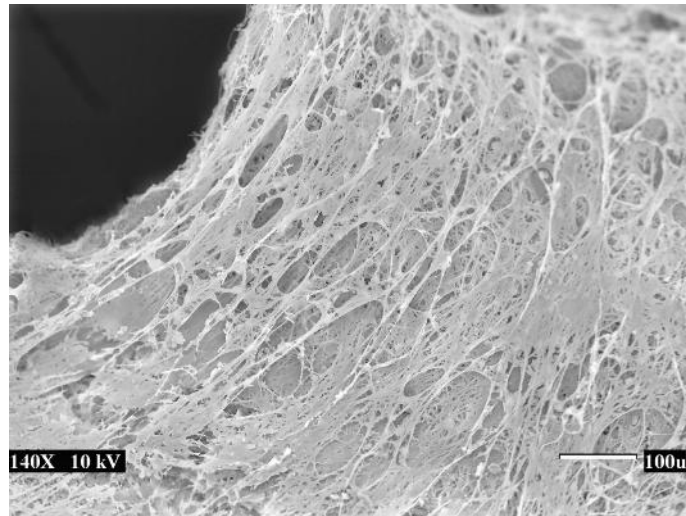
Higher power SEM view of modiolar wall.

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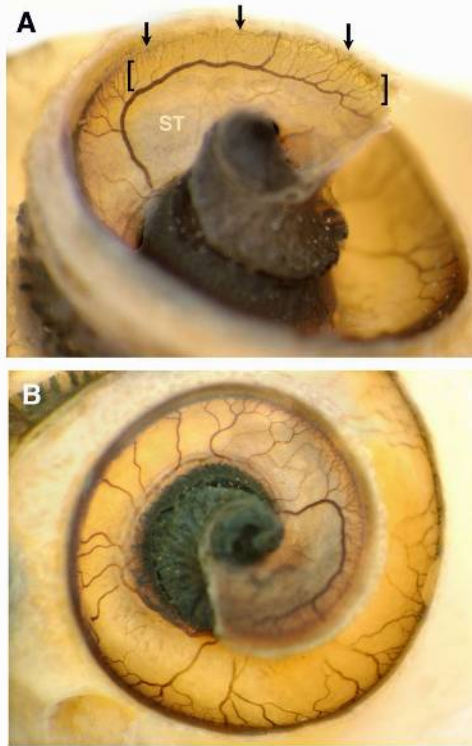
Highly textured surface of modiolar wall seen in profile.

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Overview of veins in scala tympani. In this dissection, the osseous lamina and basilar membrane have been removed to provide a direct view into scala tympani (ST). The apical portion of the cochlea is shown in "A". "B" shows the middle and upper basal turns. The arrows in "A" indicate the attachment zone of the basilar membrane and the brackets indicate the approximate area of the lower portion of the spiral ligament which contains the venules that drain the lateral wall tissues.

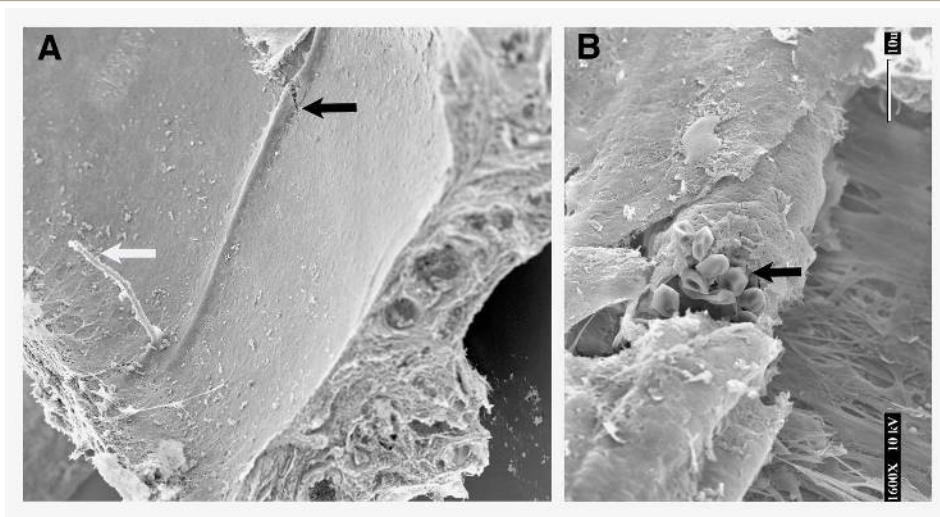
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**A:** The black arrow indicates a vein on the floor of scala tympani as seen by SEM. A small vessel crossing the perilymphatic space is indicated by the white arrow.

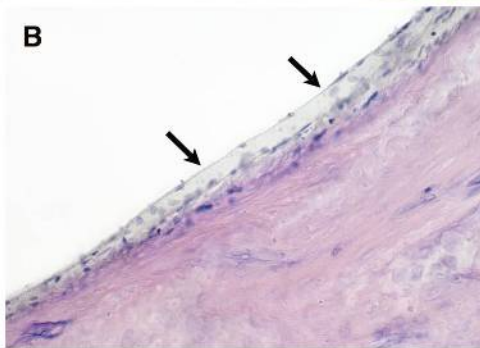
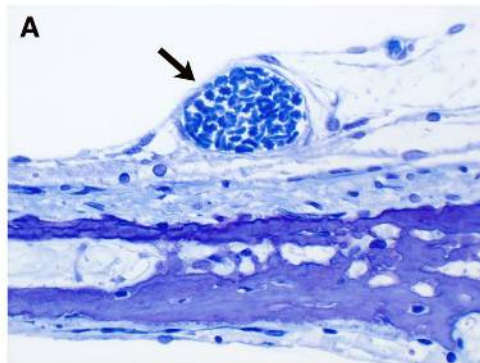
**B:** Higher power view of the area indicated by the black arrow in "A". Here there is a crack in the tissue revealing RBC's inside the vein (arrow).



**A:** Cross section of a vein (arrow) on the floor of scala tympani. Note that it has only a thin connective tissue covering.

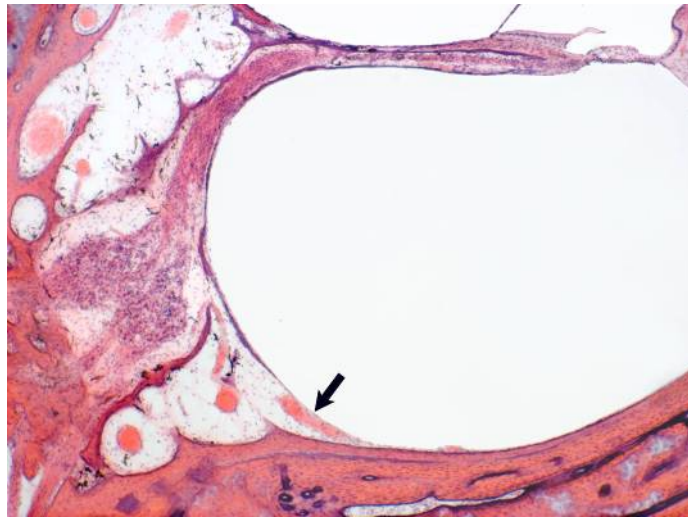
**B:** Longitudinal section of a vein (arrows) on floor of scala tympani. The vessel appears completely exposed to the perilymphatic space.

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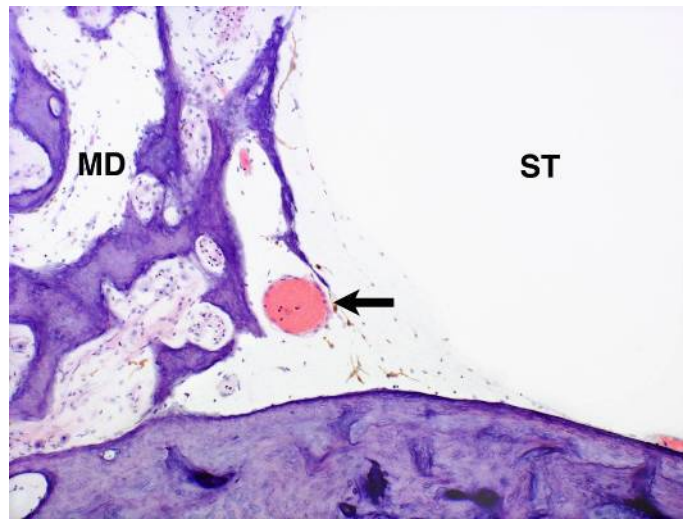
Cochlear cross section showing a vein (arrow) traversing the floor of scala tympani and approaching the posterior spiral vein. The vein has no bony covering.

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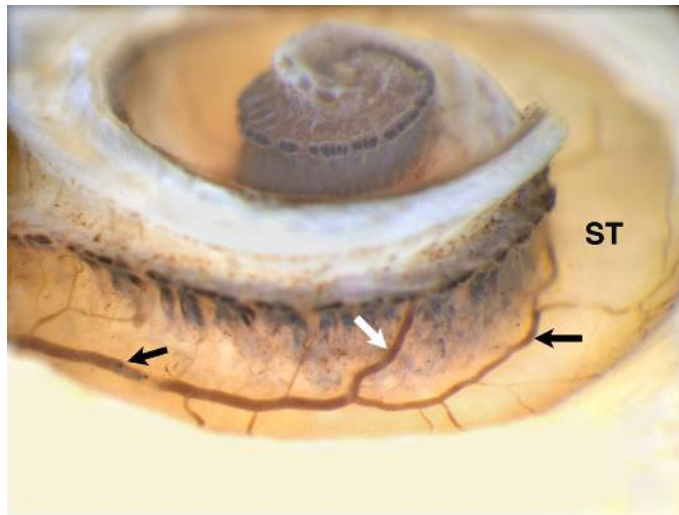
Cross section of the posterior spiral vein (arrow) in the basal turn. In this location the vein has virtually no bony covering. ST, scala tympani; MD modiolus.

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Dissection view of scala tympani and modiolum in the basal turn showing the posterior spiral vein (black arrows). A vein (white arrow) on the side of the modiolum joins the posterior spiral vein. Compare this image with the modiolar cross sections seen in slide 14. This preparation received light decalcification but no bone was removed from the modiolar wall. ST, floor of scala tympani.

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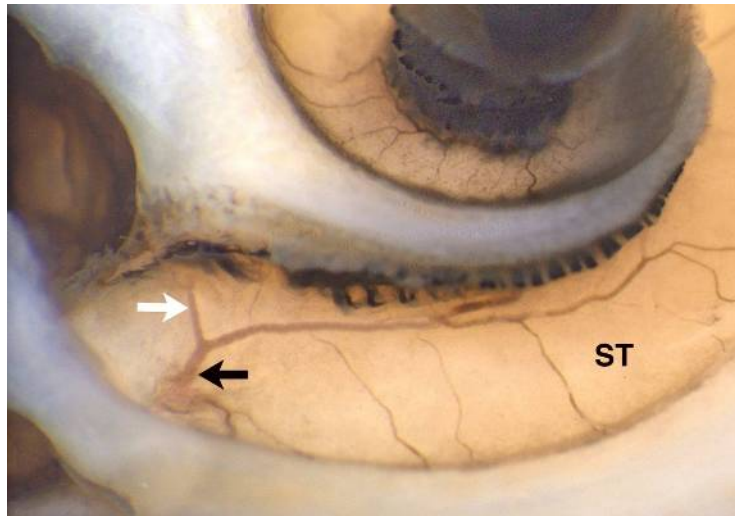


From Roland PS, Wright C.G. Surgical aspects of cochlear implantation: Mechanisms of insertional trauma. *Adv Otorhinolaryngol* 2006;64:11-30. Copyright S. Karger AG, Basel. Reproduced with permission.



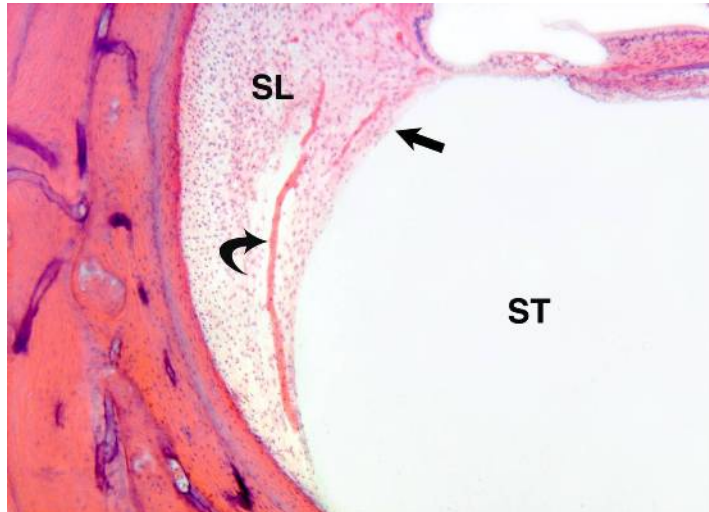
Lower basal cochlear turn showing the common modiolar vein as it enters the cochlear aqueduct (arrow). The white arrow indicates the vestibulocochlear vein which joins the common modiolar vein. ST, floor of scala tympani.

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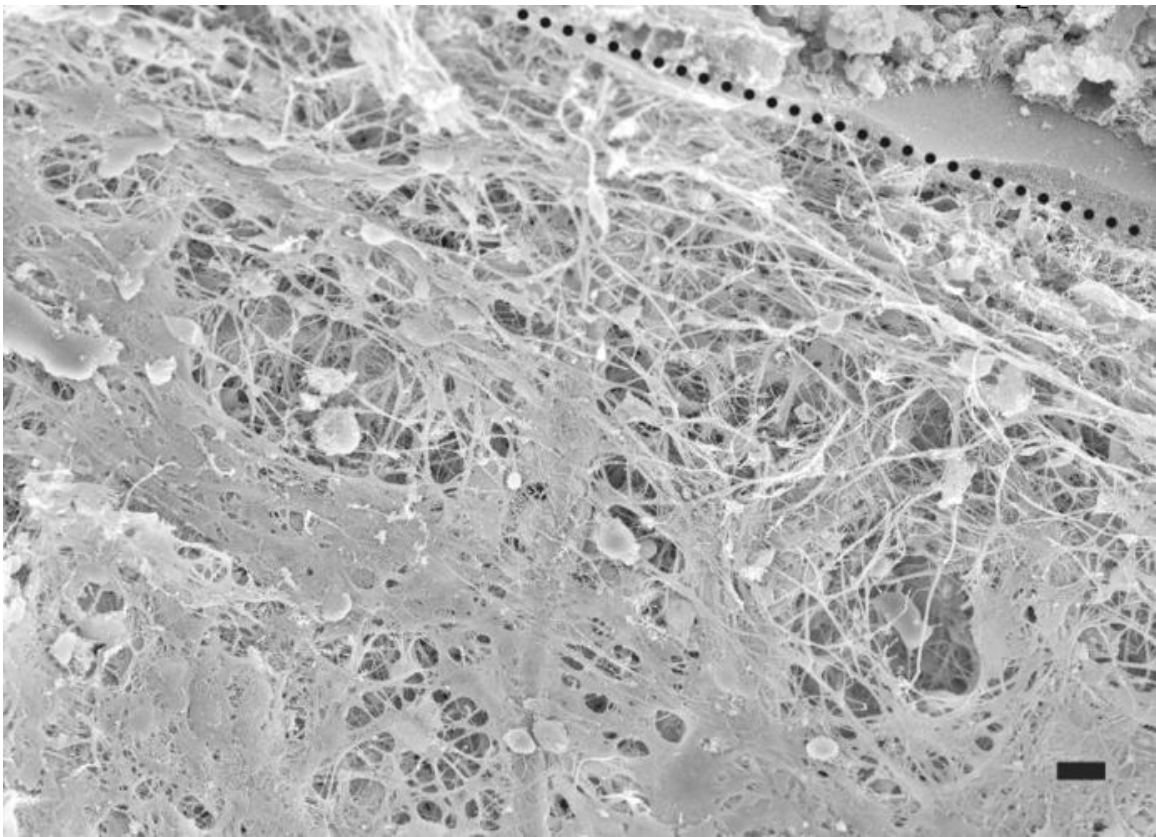
Cochlear cross section showing the lower portion of the spiral ligament (SL) facing scala tympani (ST). The curved arrow indicates a venule coursing through the spiral ligament toward the floor of scala tympani. The straight arrow indicates the portion of the spiral ligament seen in the next image.

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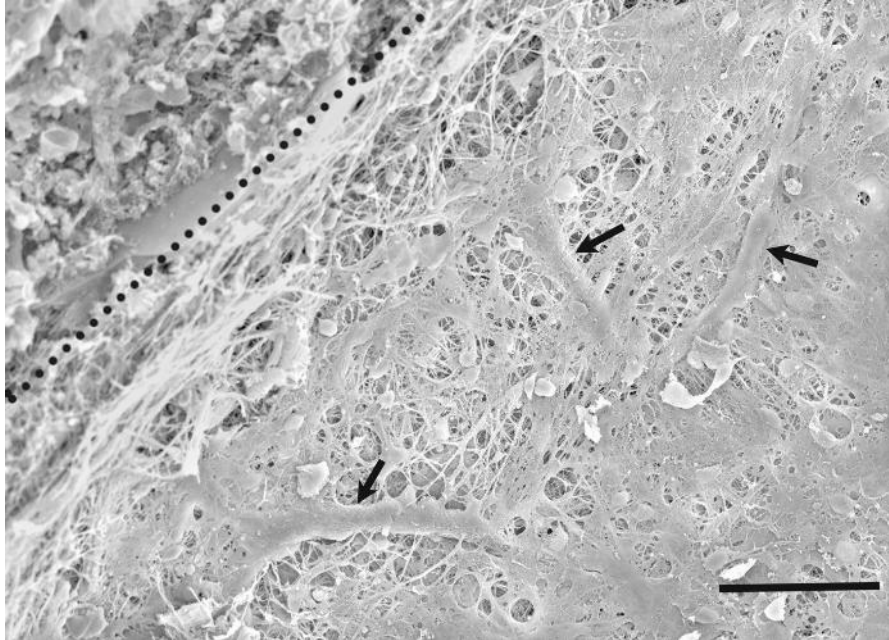
Scanning electron microscopic view of the surface of the spiral ligament in the area immediately below the attachment of the basilar membrane. (The site of attachment of the basilar membrane to the lateral wall tissues is indicated by the dotted line.) Note the highly porous, mesh-like structure of the spiral ligament surface.



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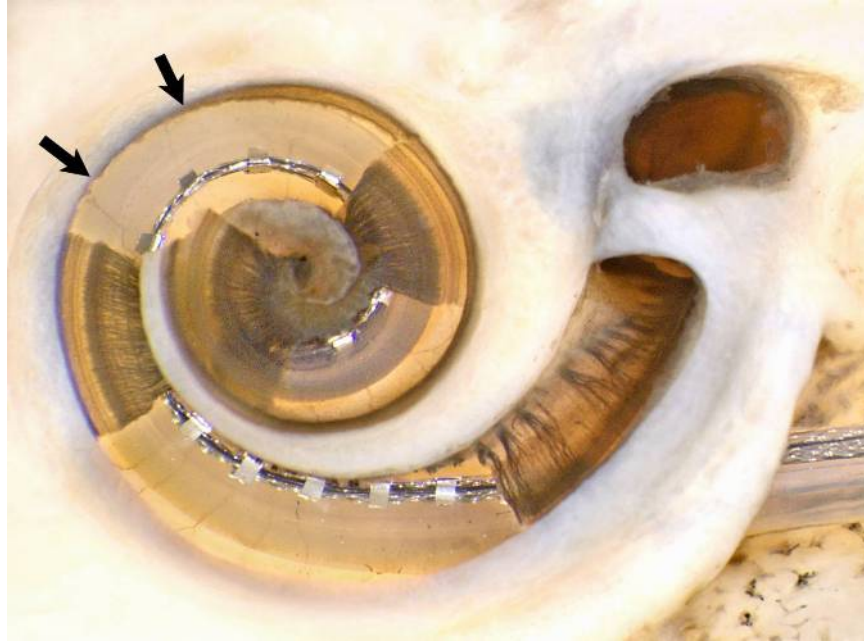
Scanning electron micrograph of the spiral ligament beneath the attachment of the basilar membrane to the lateral cochlear wall (the attachment zone of the basilar membrane is indicated by the dotted line at upper left). As in Figure 26, note the porous, mesh-like texture of the spiral ligament. In the region shown here three blood vessels (arrows) are seen coursing very near the surface of the spiral ligament.

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Cochlear dissection after insertion of an implant electrode array. Portions of the osseous lamina and basilar membrane have been removed to more clearly show the electrode lying in scala tympani. The silicone carrier of the array has been lightly stained with osmium so that it has a light brown color. Note that in the area indicated by the arrows the array is in direct contact with the lateral wall under the basilar membrane.

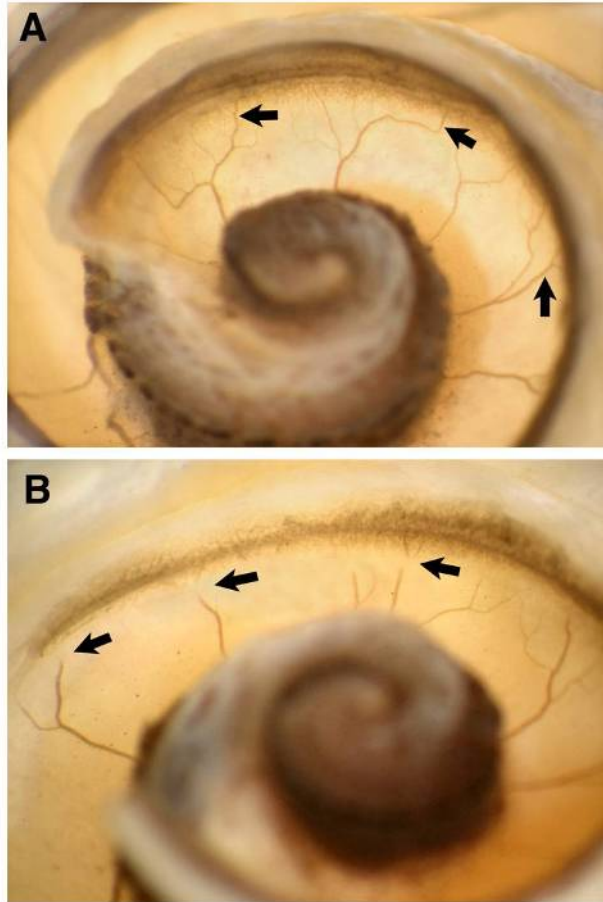
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From Roland PS, Wright C.G. Surgical aspects of cochlear implantation: Mechanisms of insertional trauma. *Adv Otorhinolaryngol* 2006;64:11-30. Copyright S. Karger AG, Basel. Reproduced with permission.

This is a temporal bone which had an implant electrode inserted at the time that the bone was fresh and unfixed. After fixation, osmium staining, and dissection the electrode was removed from scala tympani. "A" shows the apical turn in an area that the electrode did not reach. The arrows indicate normal-appearing venules in the lower part of the spiral ligament. "B" shows an area in the basal turn where the electrode was in contact with the lateral wall immediately below the basilar membrane (see preceding photograph). Close inspection shows that the electrode has compressed the collecting venules and "squeezed" blood from them just below the attachment area of the basilar membrane. Several of the spots of apparent compression are indicated by the arrows.

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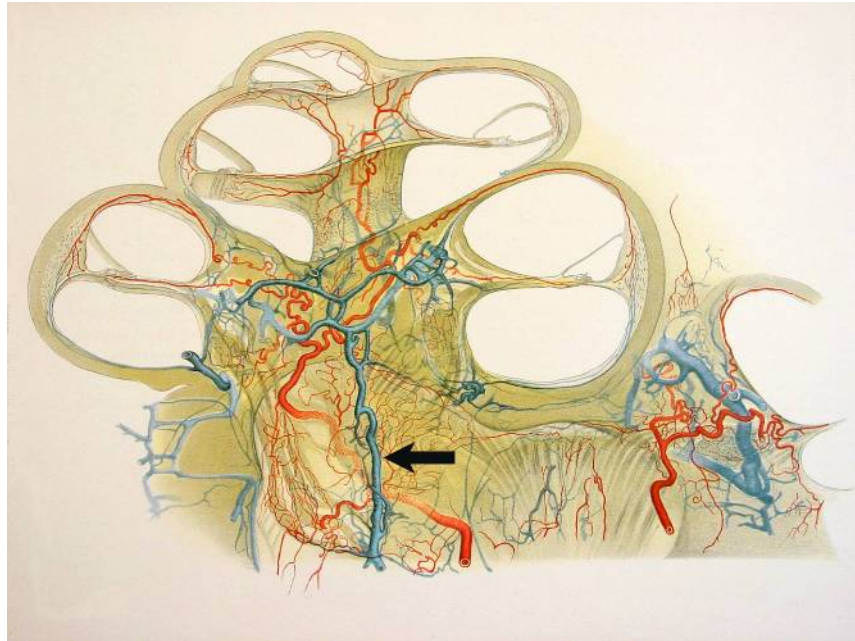
Another preparation in which an electrode array was inserted at the time the temporal bone was fresh and unfixed. After fixation and osmium staining, the array was removed from scala tympani. This SEM image shows the surface of the spiral ligament in an area where the array contacted the lateral wall. In the upper portion of the image the spiral ligament tissue is seen to be compressed and marked by grooves produced by the electrode. Below that area the normal porous surface of the spiral ligament is seen.

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Cochlear vasculature as Illustrated by Siebenmann (1894). The arrow indicates the central auditory vein, which when present, may provide collateral venous drainage for the vessels associated with scala tympani.

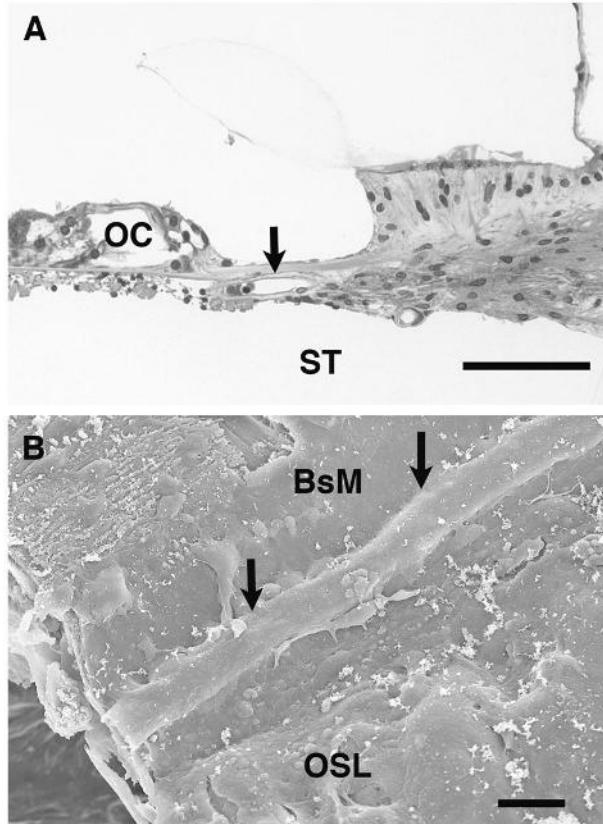
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**A:** Cross section showing a vessel (arrow) emerging from the edge of the osseous lamina. OC, organ of Corti; ST, scala tympani.

**B:** Scanning micrograph of the under surface of the basilar membrane (BsM) and osseous lamina (OSL). The arrows indicate the spiral vessel beneath the basilar membrane, which is exposed to the perilymphatic space.

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**A:** Whole-mount preparation of osseous lamina (OSL) and basilar membrane at a level of focus that shows a vessel (horizontal arrow) emerging from the OSL and joining the spiral vessel (vertical arrows) under the basilar membrane.

**B:** Scanning micrograph showing a similar situation in which a vessel (horizontal arrow) emerges from the OSL to join the spiral vessel (vertical arrows). As in the preceding micrograph (#32), the spiral vessel under the basilar membrane appears exposed to the perilymphatic space and therefore vulnerable to electrode injury.

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