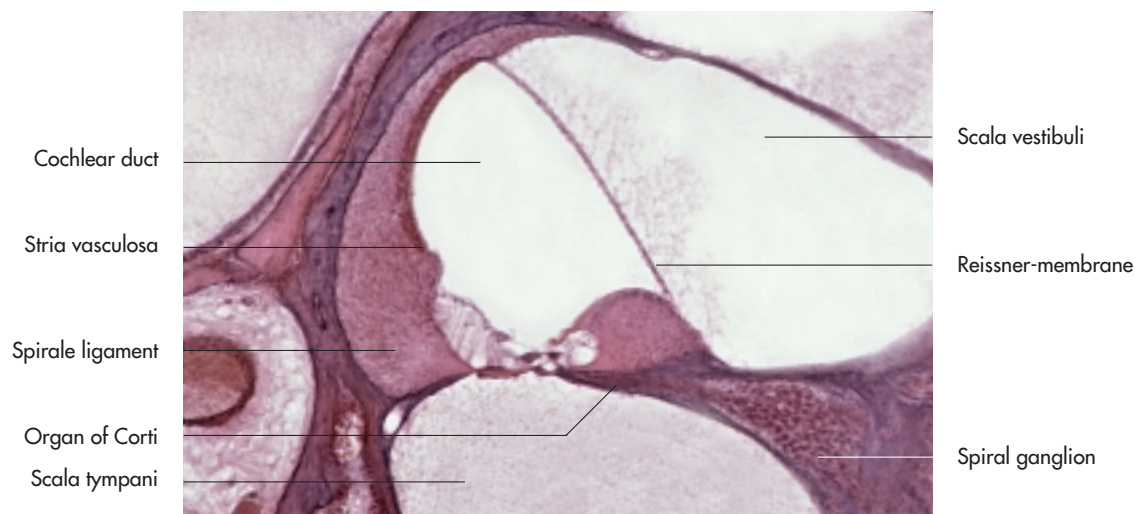


**Fig. 17-28.** Histological section of the cochlea of a pig in dorsal recumbency (Liebich, 2004).



**Fig. 17-29.** Histological section of the scala tympani, Scala vestibuli and the cochlear duct of a pig in dorsal recumbency (Liebich, 2004).

The **receptor cells of the vestibular labyrinth** receive their sensory nerve supply from the vestibular portion of the **vestibulocochlear nerve**. The related vestibular ganglion is located within the internal acoustic meatus and extends direct branches to the vestibular receptor cells.

### Cochlear labyrinth (pars auditiva labyrinthi)

The organ of hearing is located in the wall of the membranous cochlear labyrinth and consists of the **organ of Corti** (organum spirale) within the **cochlear duct** (ductus cochlearis) (Fig. 17-13 and 24, 25 and 27).

The spiral canal of the cochlea is divided into **three membranous ducts**, which spiral around the modiolus to the apex of the cochlea (Fig. 17-13 and 25 to 27):

- ◆ Scala vestibuli,
- ◆ Cochlear duct, also called the scala media,
- ◆ Scala tympani.

The upper channel is the **scala vestibuli**, the middle the **cochlear duct** and the lower the **scala tympani**. The two scallae communicate at the apex of the cochlea (**helicotrema**) around the blind end of the cochlear duct. At the base of the cochlea the scala vestibuli begins at the **vestibular window** and the scala tympani at the secondary tympanic membrane, which covers the **cochlear window**. Both scallae are lined with a single layered epithelium and filled with perilymph.

The cochlear duct begins blindly and passes up inside the spiral canal of the osseous cochlea and ends blindly at the apex of the modiolus. It is filled with endolymph and is in communication with the vestibular labyrinth via the ductus reuniens.

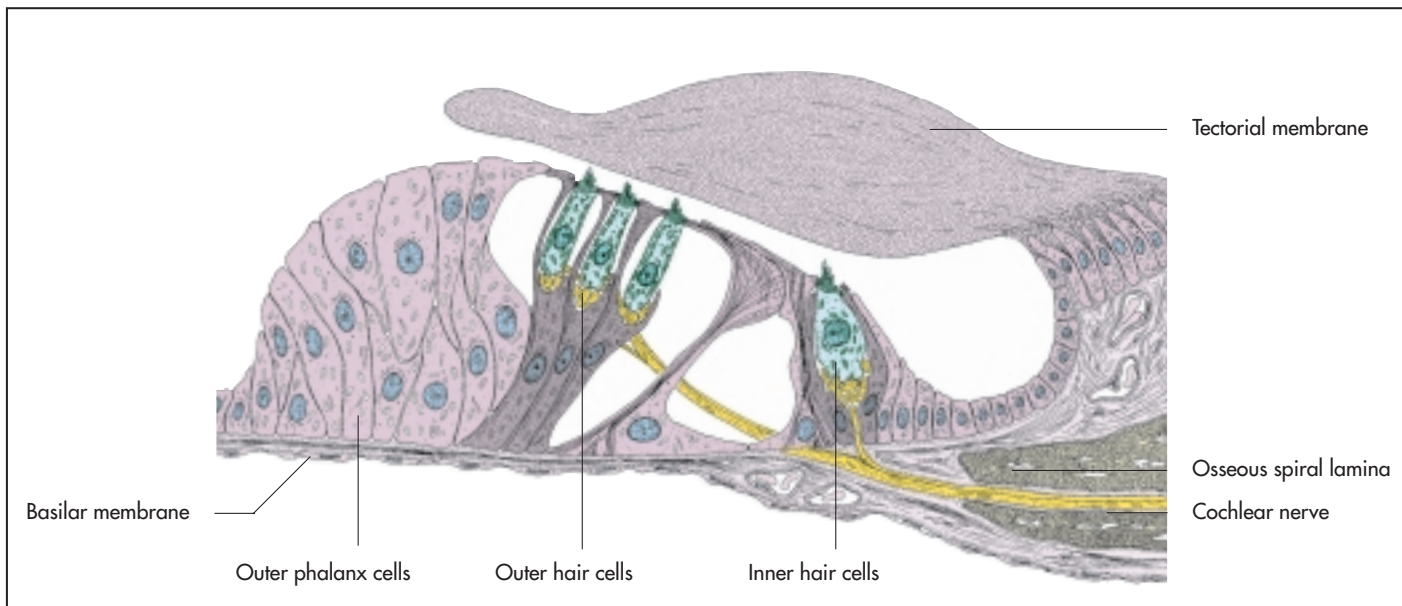


Fig. 17-30. Schematic illustration of the organ of Corti in an animal in dorsal recumbency (Liebich, 2004).

### Cochlear duct (ductus cochlearis)

The cochlear duct winds around the modiolus between the two scalae. It appears wedge-shaped in cross section with the apex pointing towards the modiolus. Within it lies the organ of Corti immersed in endolymphatic fluid (Fig. 17-28). The walls of the cochlear duct have **three distinct segments: tympanic membrane, vestibular membrane and lateral membrane** (Fig. 17-26 and 27). The very thin vestibular membrane forms the roof of the cochlear duct, separating it from the scala vestibuli of the cochlea. The **lateral wall of the cochlear duct** is formed by the **spiral ligament** (ligamentum spirale), which is firmly adherent to the underlying periosteum of the spiral lamina. It is richly vascularised and responsible for the production and the **secretion of endolymph**.

The **tympanic membrane** forms the floor of the cochlear duct and separates it from the scala tympani. The organ of Corti is part of the tympanic membrane. Its connective tissue component is the **basilar lamina**, which is derived from the periosteum of the spiral lamina and is continuous with the spiral ligament of the lateral wall of the cochlear duct.

### Organ of Corti (organum spirale)

The organ of Corti or spiral organ includes the **receptor cells for hearing**. It lies on the tympanic membrane of the cochlear duct and follows the spirals throughout the cochlea (Fig. 17-28). Towards the interior of the duct it is covered by a gel-like membrane (**membrana tectoria**).

The organ of Corti includes two different types of cells:

- ◆ Sensory cells,
- ◆ Supporting cells: Columnar and phalangeal cells.

The **columnar cells** contact the basilar membrane with one end, while the other end is extended to form plates, which provide stability to the receptor cells of the organ of Corti. The columnar cells are assisted by the **phalangeal cells**, which also support the receptor cells. The receptor cells are arranged in rows between the phalangeal cells. They are cylindrical cells, whose base synapse with one or more afferent and efferent neurons. Sensory hairs project from the free end of the receptor cells (Fig. 17-28).

Sounds are received by the external ear and provoke mechanical vibrations of the tympanic membrane, which are transmitted to the inner ear by the chain of auditory ossicles. Since the stapes is in direct contact with the vestibular window, the perilymph of the inner ear is set in motion. Due to the incompressible nature of fluids, the movement of the perilymph is transmitted via the scala vestibuli, the helicotrema and the scala tympani to the cochlear window, where it induces vibration of the secondary tympanic membrane. Different frequencies are transmitted to the endolymph of the cochlear duct by the vestibular membrane. Movement of the endolymph results in pressure on the tectorial membrane, which in turn induces pressure on the sensory hairs, that stimulate the receptor cells to send impulses to the spiral ganglion. The axons of the spiral ganglion unite to form the cochlear part of the vestibulocochlear nerve, which passes to the corresponding nuclei of the medulla oblongata.

**Clinical terms** related to the ear:

Otitis, otoscopy, auriculotemporal syndrome, tympanometry, tympanoscopy.