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Otic disorders of backyard poultry

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The chicken ear is widely used as a model for human auditory pathology. Its use as a model system is ironic, as the inner ear of birds differs from that of mammals, not only in its detailed anatomy, but also in its development and response to injury. Hair cells are essential for hearing, and in mammals, they are only produced during development. Thus, any damage to these cells (e.g., loud noises, drug toxicity or infection) could result in permanent hearing loss. In birds, however, the hair cells can be reformed from epithelial supporting cells.

NORMAL ANATOMY

The external ear canal of chickens and other poultry species is short, ending in a tympanic membrane that, like mammals, absorbs sound waves and transmits them to the inner ear fluids. Rather than the three ossicles of the mammalian ear, there are only 2 in birds: the columella and the stapes. A muscle attached to the tympanic membrane is activated when stimulated by tension from the membrane and attenuates the sound conducted to the labyrinth. Thus, in a rather different way from that of mammals, the avian middle ear acts as an impedance-matching device that couples the energy of airborne sound waves to the movement of fluid in the labyrinth.

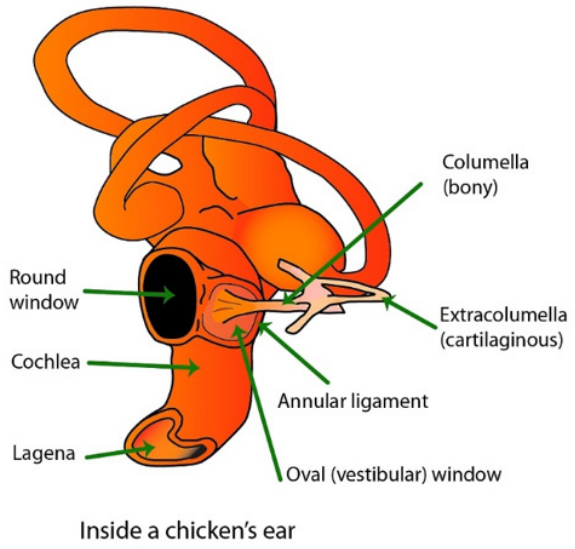


Figure 1: Anatomy of the ear of a chicken

As in all vertebrates, the auditory cavity of the avian ear has three chambers. The scala vestibuli and scala tympani contain perilymphatic fluid and lie on either side of the scala media, which contains endolymphatic fluid.

The differences in sodium and potassium concentrations between perilymph and endolymph maintain a voltage gradient (+15 mV), termed the endocochlear potential. The basilar papilla is the avian auditory receptor (compared with the organ of Corti in mammals), and in the domestic chicken, it is an elongated, curved structure approximately 3mm in length. It consists of around 10500 hair cells with associated supporting cells, nerve fibres, basement cells and the basilar membrane. The sensory band of the papilla is wide at the low-frequency end and narrows towards the high-frequency end.

The noise levels in a commercial poultry house may be of sufficient intensity to cause hearing loss in birds. Cochlear degeneration has been shown to be more severe in broilers than in layers, even at the same noise level, suggesting a genetic difference in susceptibility to cochlear damage. Most aural problems diagnosed in commercial and backyard flocks involve the external ear.

INFECTIOUS DISEASES

Birds will frequently present with a caseous plug in the auditory meatus, which is indicative of a bacterial infection. The diagnosis can be confirmed with cytology. The associated inflammation can cause considerable irritation, and affected individuals may self-traumatise the side of their head on rough surfaces. Topical medication is unlikely to resolve such lesions, and surgical debridement followed by packing with antibiotic ointment or systemic antibiotics may be necessary. Inflammation of the inner ear (labyrinthitis) often leads to vestibular signs, with birds circling and presenting with a head tilt. *Pasteurella multocida* is often the causative agent in such cases, and the resulting suppurative reaction can be severe and very difficult to treat. *Salmonella* spp. have been reported to cause otitis externa in turkey poults. The clinical signs seen in affected birds include paralysis, opisthotonus, torticollis, blindness and meningitis. Newcastle disease can cause similar signs and should be high on the list of differential diagnoses in such cases.

Systemic antibiotics and anti-inflammatory medication may be helpful in these birds; however, treatment is often unsuccessful, and euthanasia may be the best option in terms of the animal's welfare if the symptoms persist and become severe. Infection can also spread from the ear canal to cause osteomyelitis.

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Figure 2: AI-generated image showing crusting in and around the infected ear canal of a chicken

TRAUMA

Birds often have aggressive altercations, with long spurs in cockerels capable of causing severe trauma. Some breeds have large fleshy ear lobes that are particularly susceptible to injury. Treatment is supportive.

COCHLEAR DEGENERATION

Age-related cochlear degeneration in chickens, much like in other vertebrates, is a progressive condition that can lead to sensorineural hearing loss. As chickens age, the hair cells within the cochlea, particularly those responsible for detecting high-frequency sounds, begin to deteriorate due to cumulative oxidative stress, reduced cellular repair mechanisms, and metabolic decline. This degeneration impairs the transduction of sound vibrations into neural signals, resulting in diminished auditory sensitivity and eventual deafness. Older chickens may exhibit reduced responsiveness to environmental sounds, vocalisations, or human interaction, which can affect their behaviour, social dynamics, and welfare.

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QUESTION 1

How many ossicles are there in the avian ear?

a. 0
b. 1
c. 2
d. 3
e. 4

QUESTION 2

How many chambers does the avian auditory cavity contain?

a. 1
b. 2
c. 3
d. 4
e. 5

QUESTION 3

What is responsible for the voltage gradient between the perilymph and endolymph?

a. Calcium-gated channels
b. Differences in sodium and potassium concentrations
c. Potassium channels
d. Differences in sodium and chloride concentrations
e. Magnesium concentrations

QUESTION 4

What is the endocochlear potential?

a. -10 mV
b. -15 mV
c. +10 mV
d. +15 mV
e. +20 mV

QUESTION 5

Which of the following is the avian auditory receptor?

a. Semi-circular canals
b. Stapes
c. Columella
d. Basilar papilla
e. Organ of Corti

QUESTION 6

What is the approximate length of the avian auditory receptor?

a. 3mm
b. 5mm
c. 7mm
d. 10mm
e. 13mm

QUESTION 7

What is the approximate number of hair cells in the avian auditory receptor?

a. 500
b. 10000
c. 10500
d. 15000
e. 12500

QUESTION 8

Which organism is most often implicated in labyrinthitis?

a. *E. coli*
b. *Pasteurella multocida*
c. *Ornithobacterium rhinotracheale*
d. *Salmonella spp*
e. Newcastle Disease Virus

QUESTION 9

A Rhode Island Red bantam chicken is presented to you with caseous plugs around both ears and has vestibular signs. What differential diagnosis should you consider?

a. Zinc deficiency
b. Trauma
c. Marek's disease
d. Newcastle disease
e. Infectious coryza

QUESTION 10

In which types of chickens are you likely to encounter ear lobe injuries?

a. Cockerels with large, flashy ear lobes
b. Laying hens
c. Broilers
d. Cockerels with small ear lobes
e. Young chicks

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