ACVD Resident Forum- Clinically Relevant Ear Anatomy

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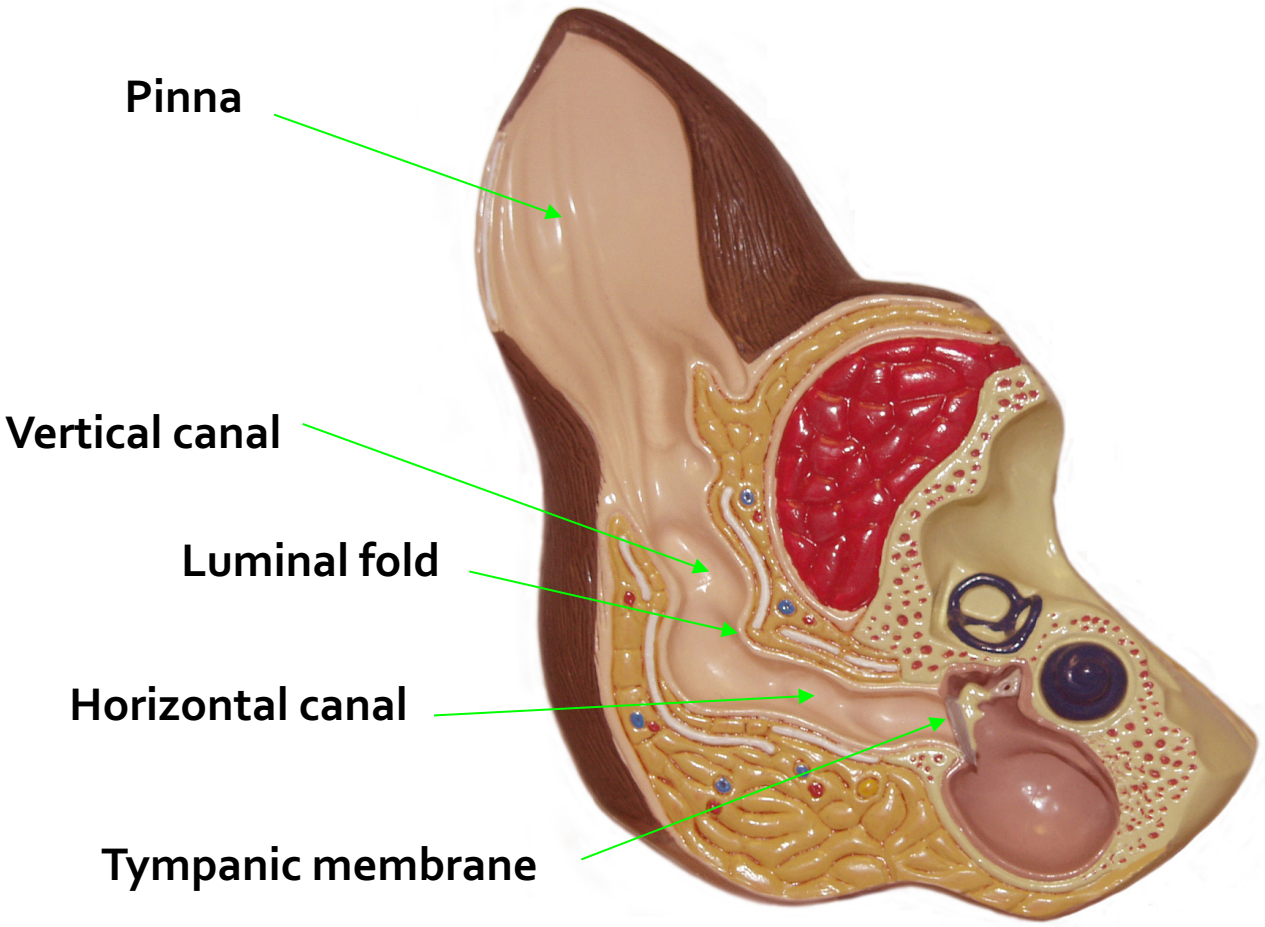
THE UNIVERSITY OF GEORGIA
College of Veterinary Medicine


Portland
Oregon
OLD TOWN

Ears, ears, ears…

Colorado State University
Veterinary Teaching Hospital

But why… Ears?


Pinna
Vertical canal
Luminal fold
Horizontal canal
Tympanic membrane

Literature

Veterinary Dermatology

DOI: 10.1111/j.1365-3164.2009.00849.x

Anatomy and physiology of the canine ear

Lynette K Cole, 2009

Practical Otic Anatomy and Physiology of the Dog and Cat

Bradley L. Njaa, DVM, MVSc[a,*], Lynette K. Cole, DVM, MS[b],
Natalie Tabacca, DVM, MS[c]

Veterinary Clinics North America 2012

Physical exam - Palpation

A. Neuber

Pinna

Pictures A. Neuber

Pendulous vs. Erect ears

- Purebred dogs w pendulous and hirsute ears- more ear infections compared to mongrel dogs
- Purebred dogs w erect ears (w or w/o ear canal hair)- less infections compared with mongrel dogs

Predisposing factors

- Pendulous ears with hair- retain heat and moisture?
- Increased humidity- more frequent otitis?
- Hayes et al.- neither are correlated:
  - Ear canal formation
  - Hair
  - Temperature
  - Humidity
- Rather:
  - Breed
- Hirsute ear canals- lower temp.
- No temp. diff. between erect and pendulous ears
- GSHD- higher anal temp than other dogs
- Diseased vs normal ear canals- no temp. and humidity difference
- Environmental humidity- no affect on humidity or canal

Breed variations

> J Am Vet Med Assoc. 2002 Oct 1;221(7):1000-6. doi: 10.2460/javma.2002.221.1000.

Breed variations in histopathologic features of chronic severe otitis externa in dogs: 80 cases (1995-2001)

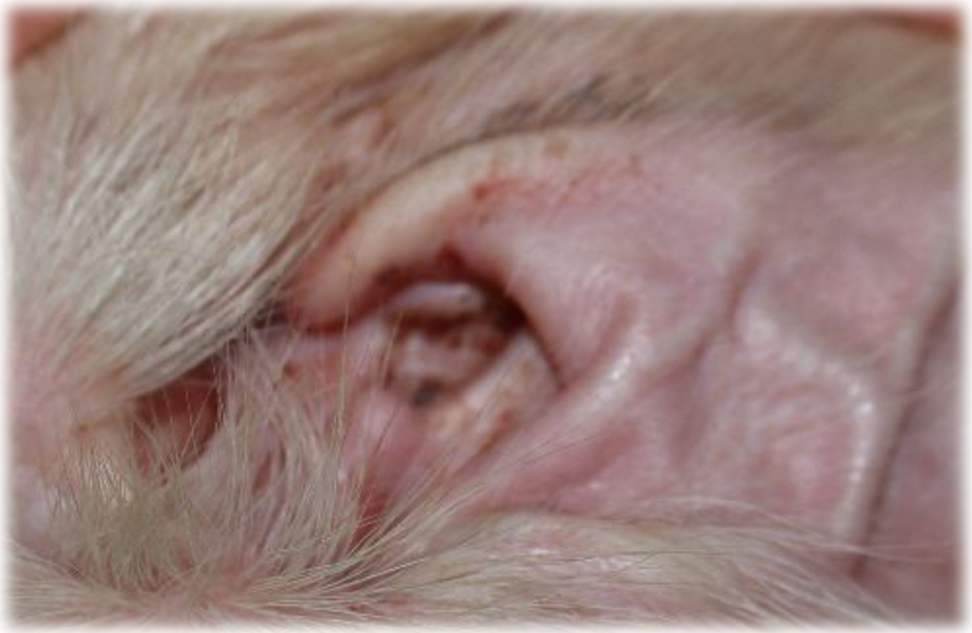
John C Angus [1], Carol Lichtensteiger, Karen L Campbell, David J Schaeffer

Affiliations + expand

PMID: 12369678 DOI: 10.2460/javma.2002.221.1000

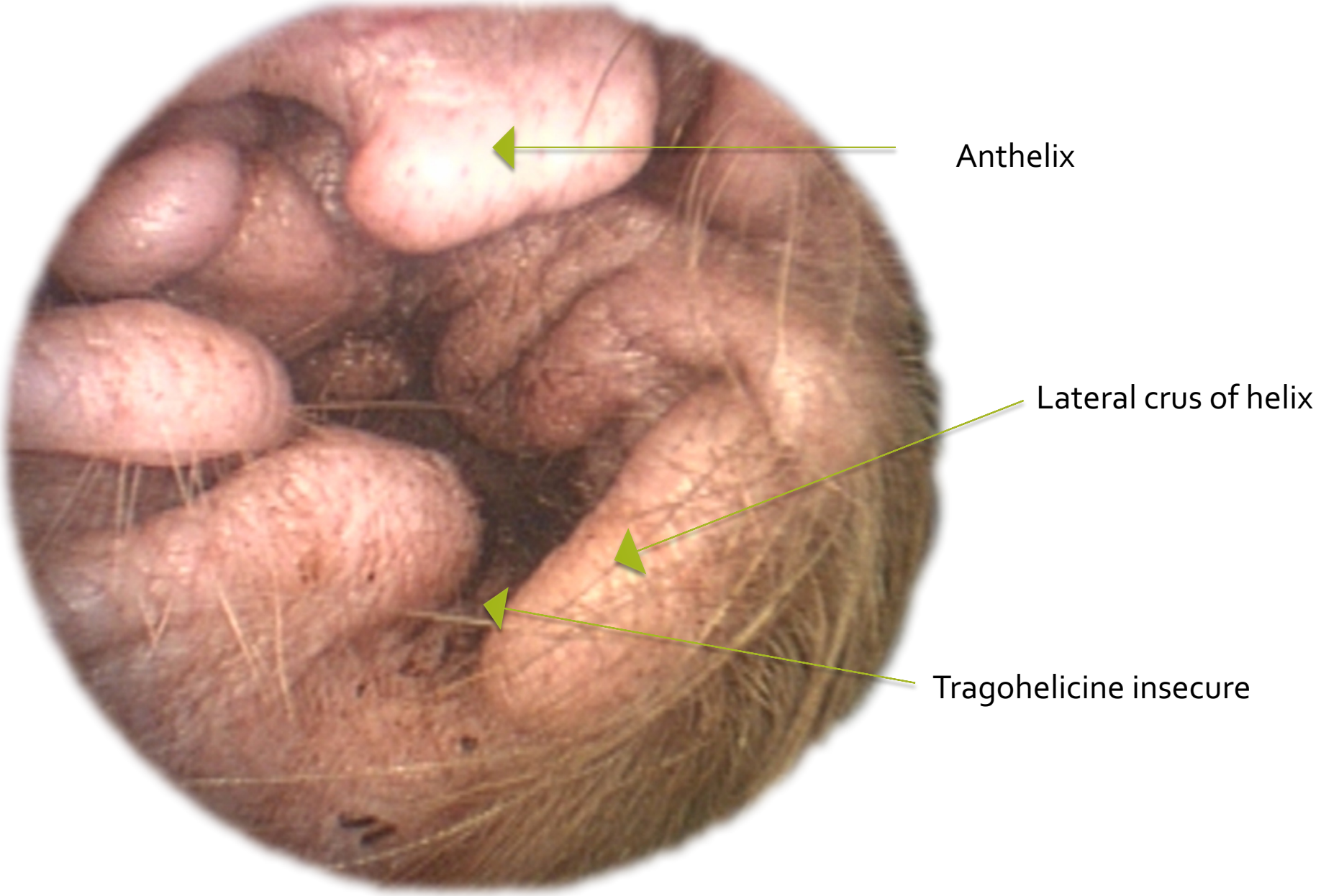
Free article

Entrance Ear Canal

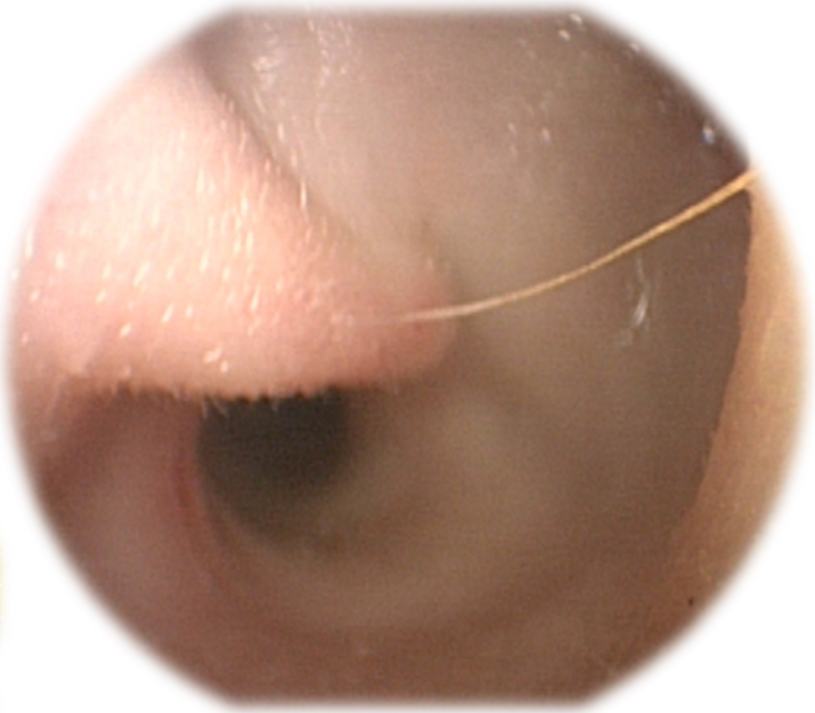


- Two elastic cartilages
  - Auricular
  - Annular
- Anthelix
  - Transverse ridge on medial wall
- Tragus
  - Quadrangular plate, lateral
- Antitragus
- Cavum conchae
  - Formed by the tree
    - Basal portion twists and forms vertical canal
    - Proximal portion auricular cartilage

Tragus/ Tragohelicine incisure

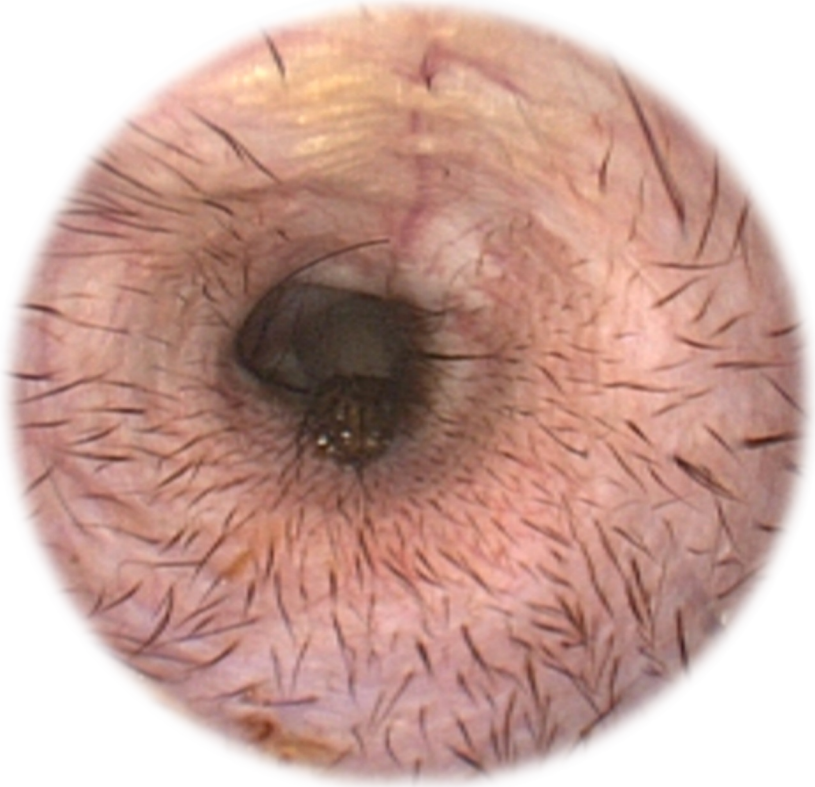

Anthelix
Lateral crus of helix
Tragohelicine insecure

Luminal fold… How?



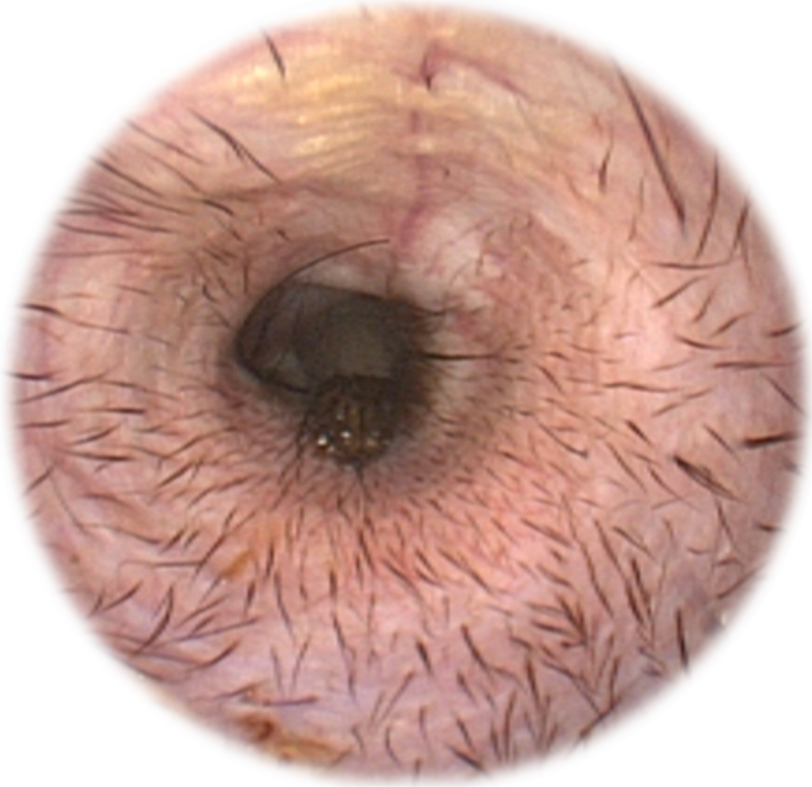
- Prominent cartilaginous ridge
- Junction vertical/ horizontal canal
- Cytology sample area
- Annular cartilage
  - Overlaps with osseus external acoustic meatus
  - Articulates through ligamentous tissue
    - Flexibility

Canal… hair



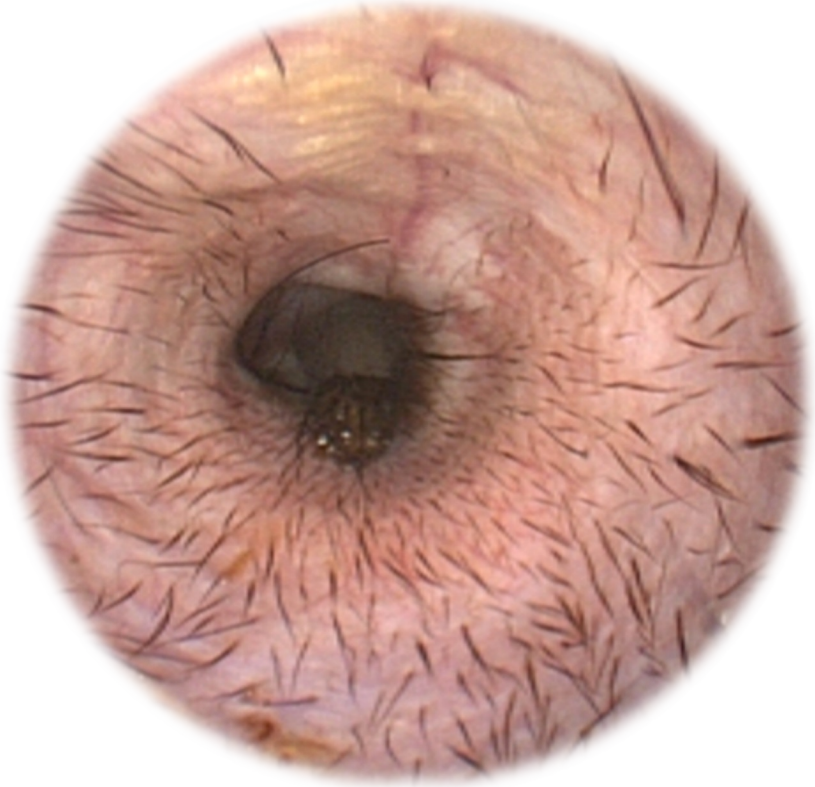
- Decreasing #'s from distal to proximal
- Few fine hairs distal to TM
  - Landmark for location of TM
- Cocker Spaniel
  - Numerous compound hair follicles
- Greyhound, mongrel
  - Sparse, single follicles
- Histo:
  - Resembles pinna
    - less hair
    - Does not extend length of canal

Canal…glands



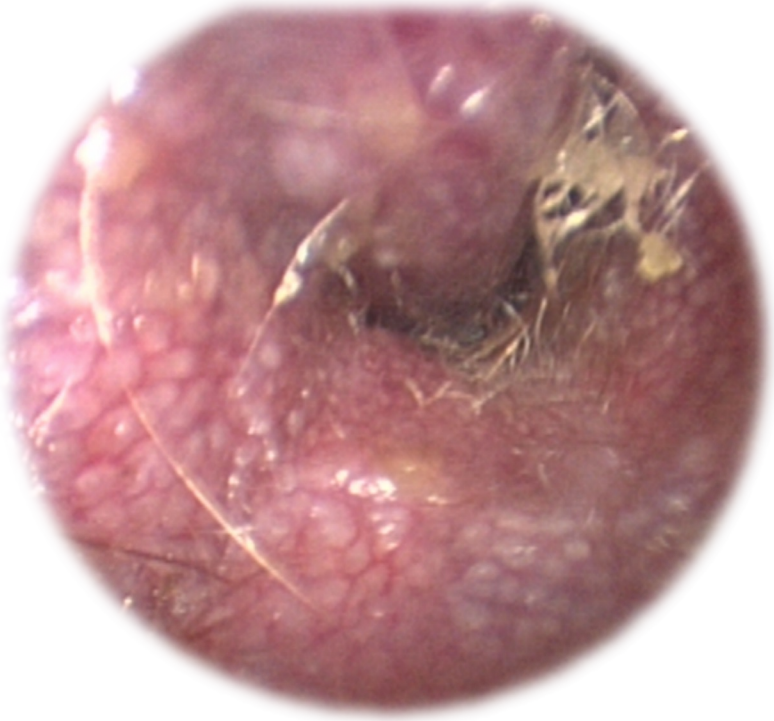
- General:
  - # vary among breeds
  - Longhair breeds more glandular tisue
- Sebaceous glands
  - 6-10 club shaped acini
  - Prominent & numerous in distal section of canal
  - Ducts open into follicle

Canal…glands



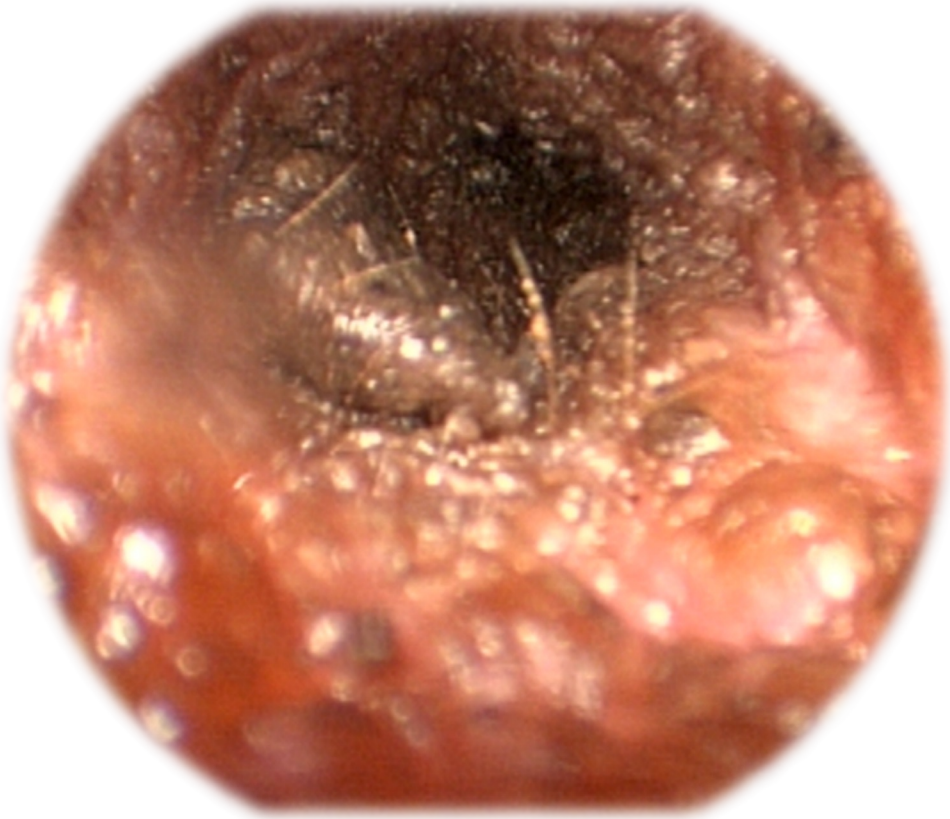
- Ceruminous glands
  - Simple, coiled tubular glands/ resemble apocrine seat glands
    - Inner secretory layer
    - Myoepithelial surrounding
    - Basement membrane
    - Located below sebaceous glands
    - Increased # in lower third / proximal external canal
  - Open into follicle or skin surface
    - Secretory portion
      - High columnar cells
    - Tubular portion
      - Single row, flat, elongated cells, faintly stained nuclei

Otitis externa



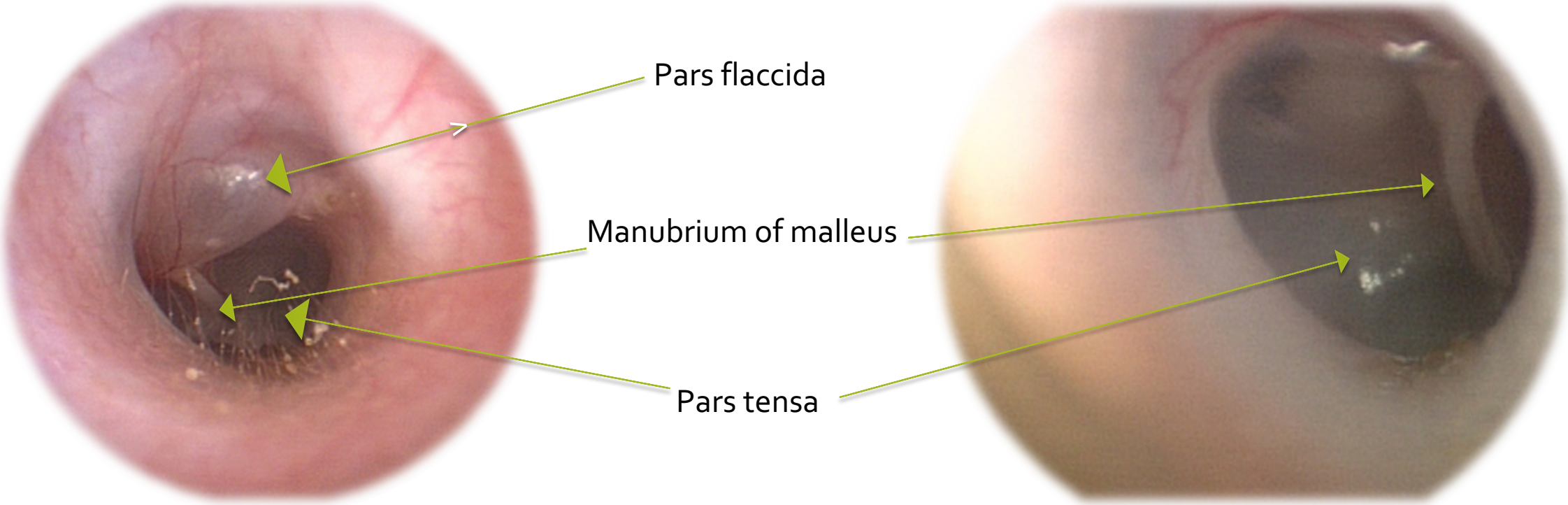
- Otitis:
  - Epidermal and follicular hyperplasia
  - Dermal inflammation
  - Less active sebaceous glands
  - Dilated ceruminous glands
- Dogs prone to Otitis
  - Total area of ceruminous glands increases, sebaceous glands stay the same
  - Am. Cocker:
    - Ceruminous gland hyperplasia and ectasia

Cerumen



- Emulsion
  - Coats ear canal
    - Desquamated keratinized squamous epithelial cells
    - Secretions from:
      - Sebaceous glands
      - Ceruminous glands
  - Normal ear:
    - Neutral lipids, majority, secreted by sebaceous glands
  - Otitis
    - Lipid content decreases
    - Main content secreted by ceruminous glands, more acetic

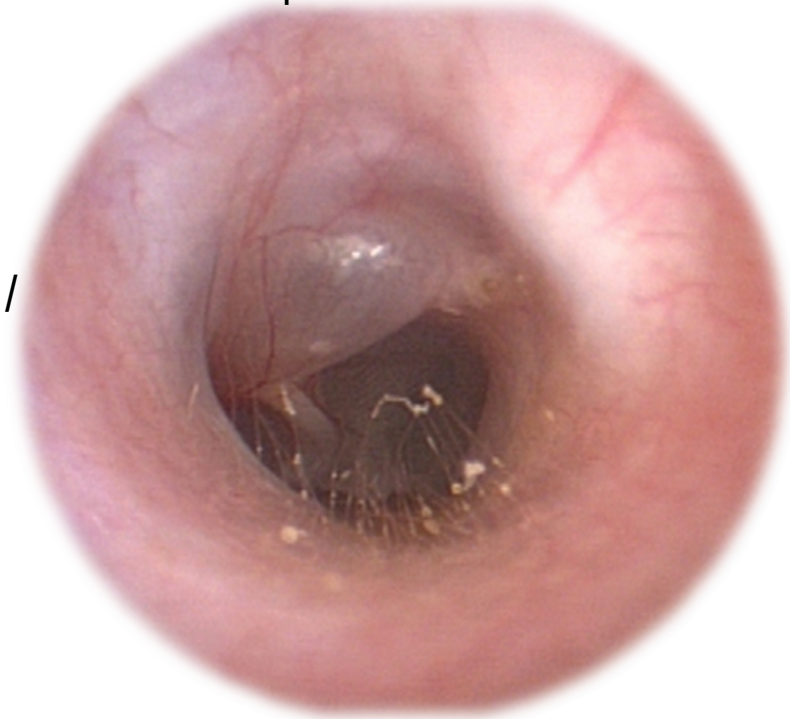
Tympanic membrane



Tympanic membrane

Superior/ dorsal

Anterior / rostral



Posterior/ caudal

Inferior/ ventral

- 45° angle to central axis of horizontal canal
- semitransparent three-layer membrane
  - Thin center
  - Thicker periphery
  - Inner epithelium pharyngeal pouch origin, Central layer fibrous connective tissue of pharyngeal wall
  - Outer stratified squamous epithelium from ectoderm of first pharyngeal groove

Tympanic membrane

- Pars flaccida
  - Collagen, rare mast cells and is keratinized
- Pars tensa
  - Thin, tough, gray structure
    - More collagen than elastin fibers, keratinized
  - Radiating strands
  - Concave shape
- Manubrium of malleus attaches to medial surface
  - Stria mallearis
  - Umbo
    - Point of greatest depression/opposite distal end of manubrium

Epithelial migration

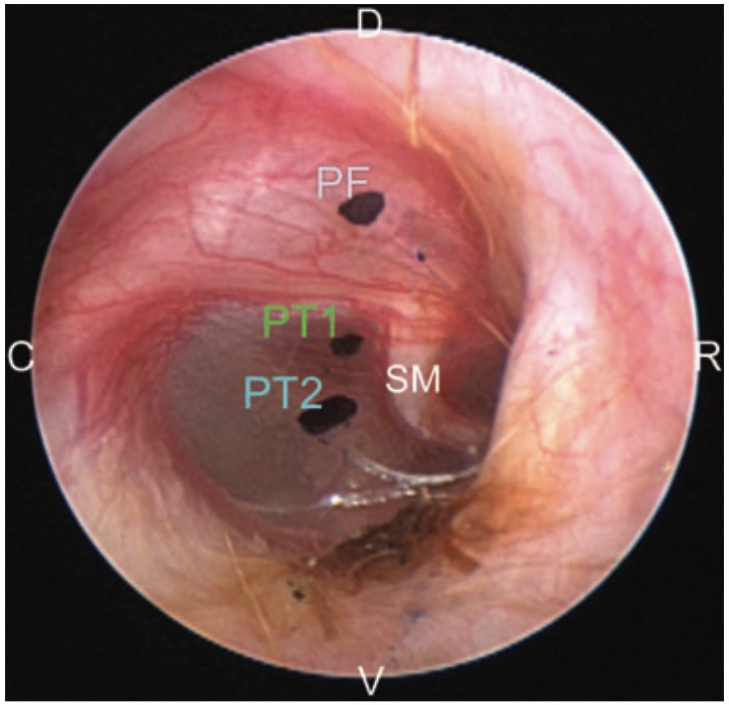


Figure 2. Locations for ink-drop placement. Right tympanic membrane of a dog. PT1, pars tensa 1; PT2, pars tensa 2; PF, pars flaccida; SM, stria mallearis; D, dorsal; V, ventral; C, caudal; and R, rostral.

Veterinary Dermatology

DOI: 10.1111/j.1365-3164.2011.00982.x

Epithelial migration on the canine tympanic membrane

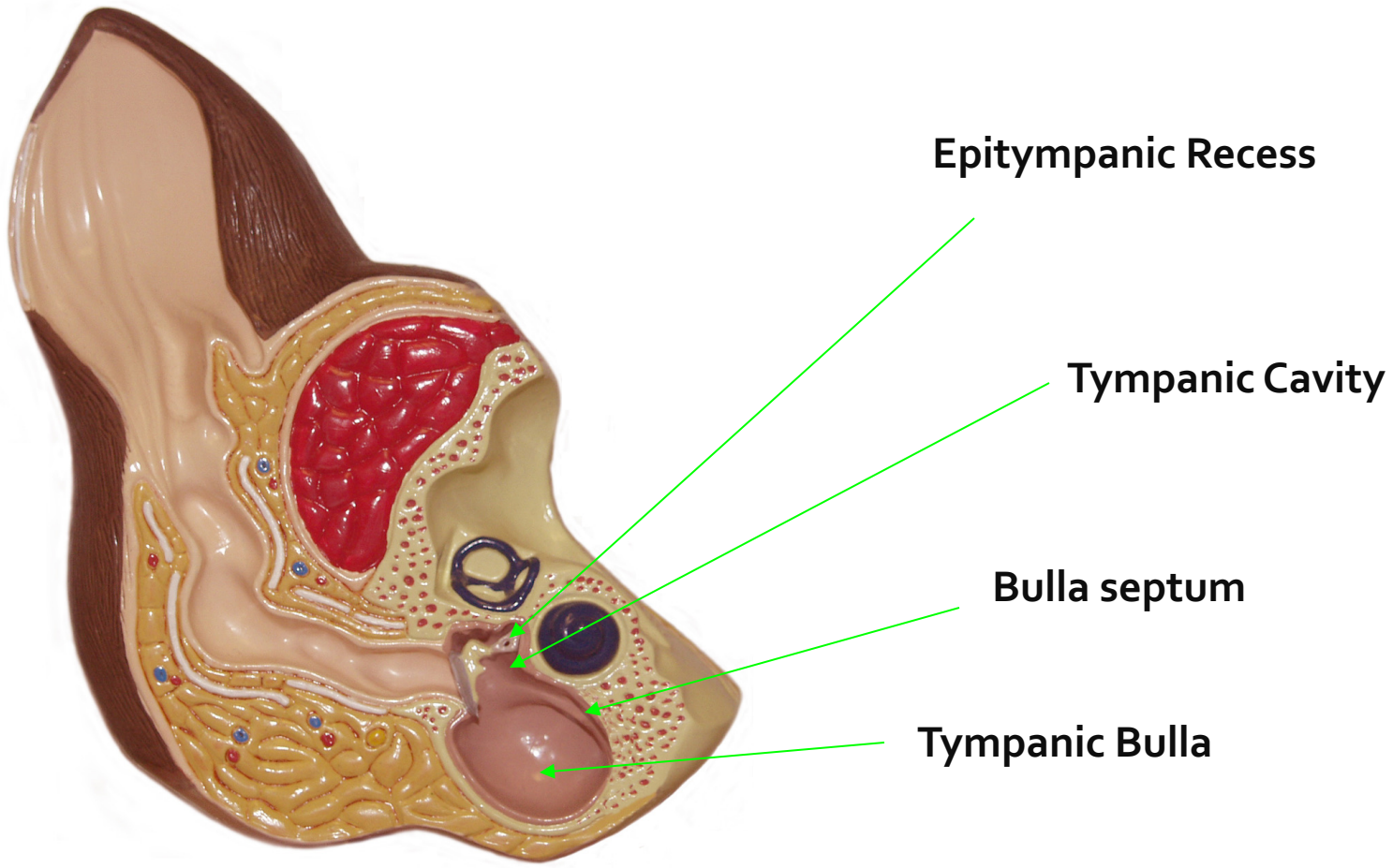
Natalie E. Tabacca*, Lynette K. Cole*, Andrew Hillier* and Päivi J. Rajala-Schultz†

2011

Tympanic membrane- Rupture

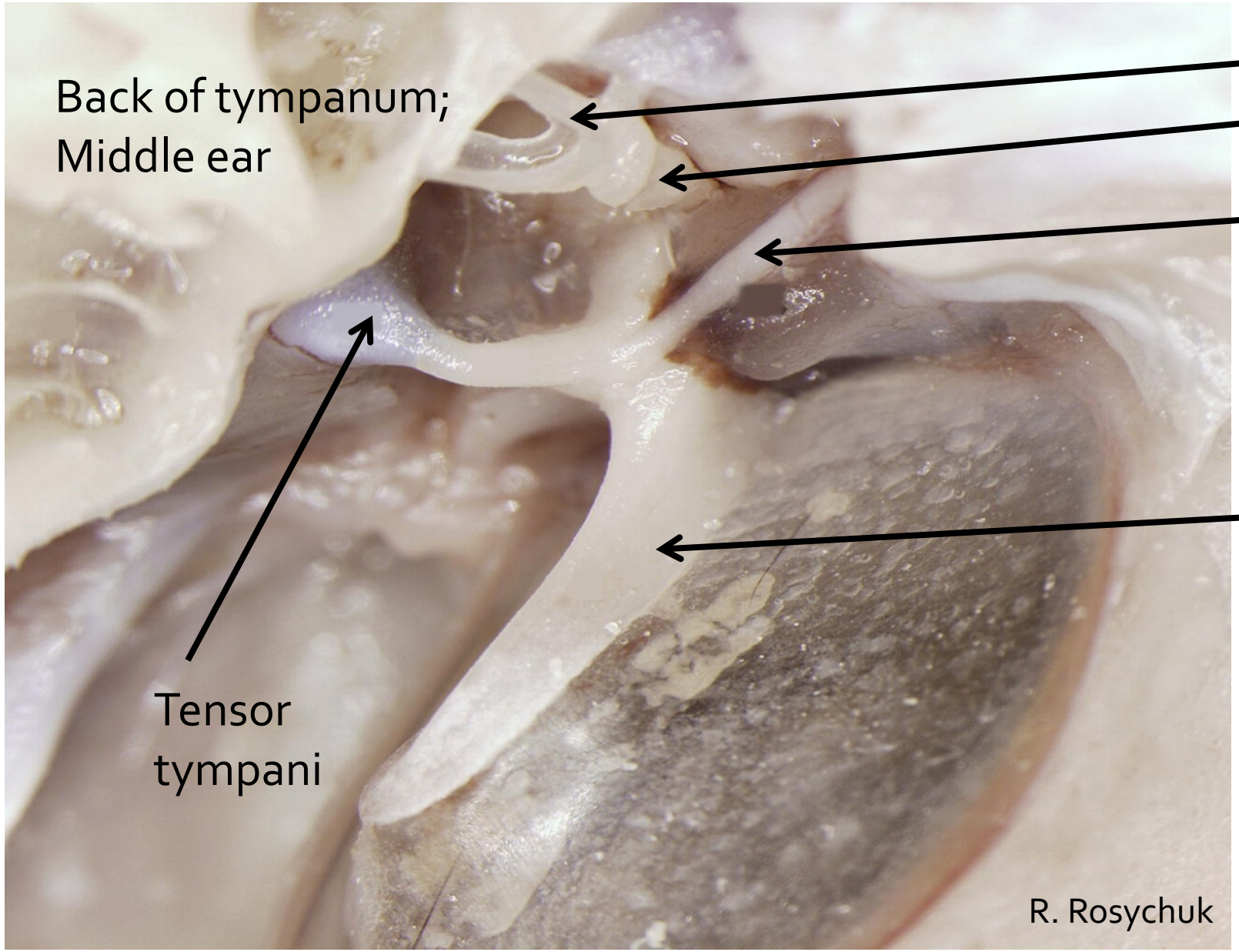
- Regenerate by day 14
- Complete healing between 21 and 35 days.
- Thicker than normal

But why… Ears?


Epitympanic Recess
Tympanic Cavity
Bulla septum
Tympanic Bulla

Tympanic cavity

- Air-filled tympanic cavity
- Lining
  - Simple squamous epithelium or simple cuboidal epithelium
  - On a thin layer of connective tissue

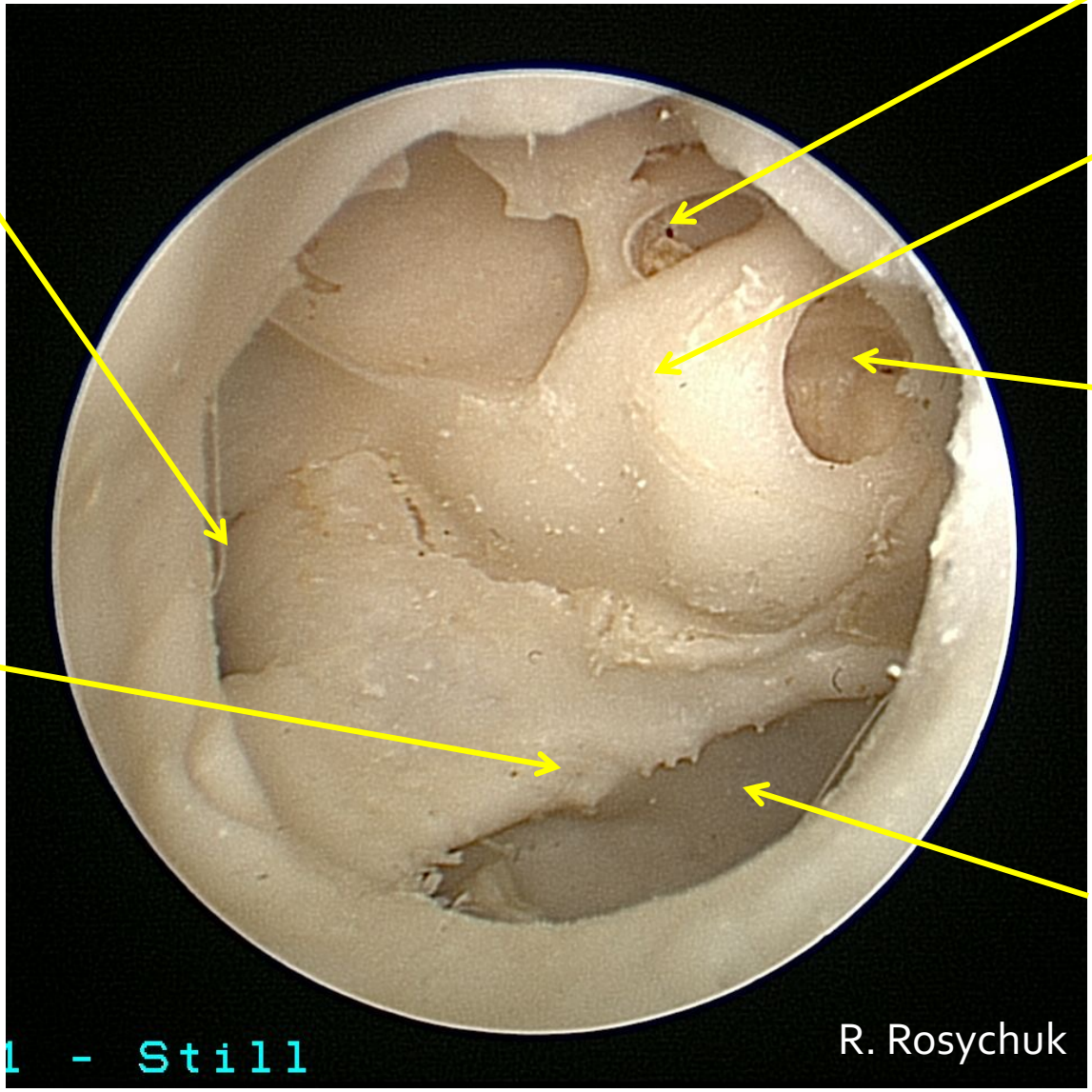

Back of tympanum;
Middle ear
Stapes
Incus
Corda tympani
Handle of
the Malleus
Tensor
tympani
R. Rosychuk

Three ossicles

Malleus
- attached to
  - Tympanic membrane
  - Petrous temporal bone
  - Incus

- Incus
  - Suspended between the malleus and stapes
- Stapes
- Base stapes is attached to the vestibular (oval) window
- Transmit/ amplify air vibrations from the tympanic membrane to the inner ear

Canine Middle Ear (left ear)



Auditory tube / canal
(Eustachian tube)

Oval window
(Vestibular window)

Cochlear
Prominence

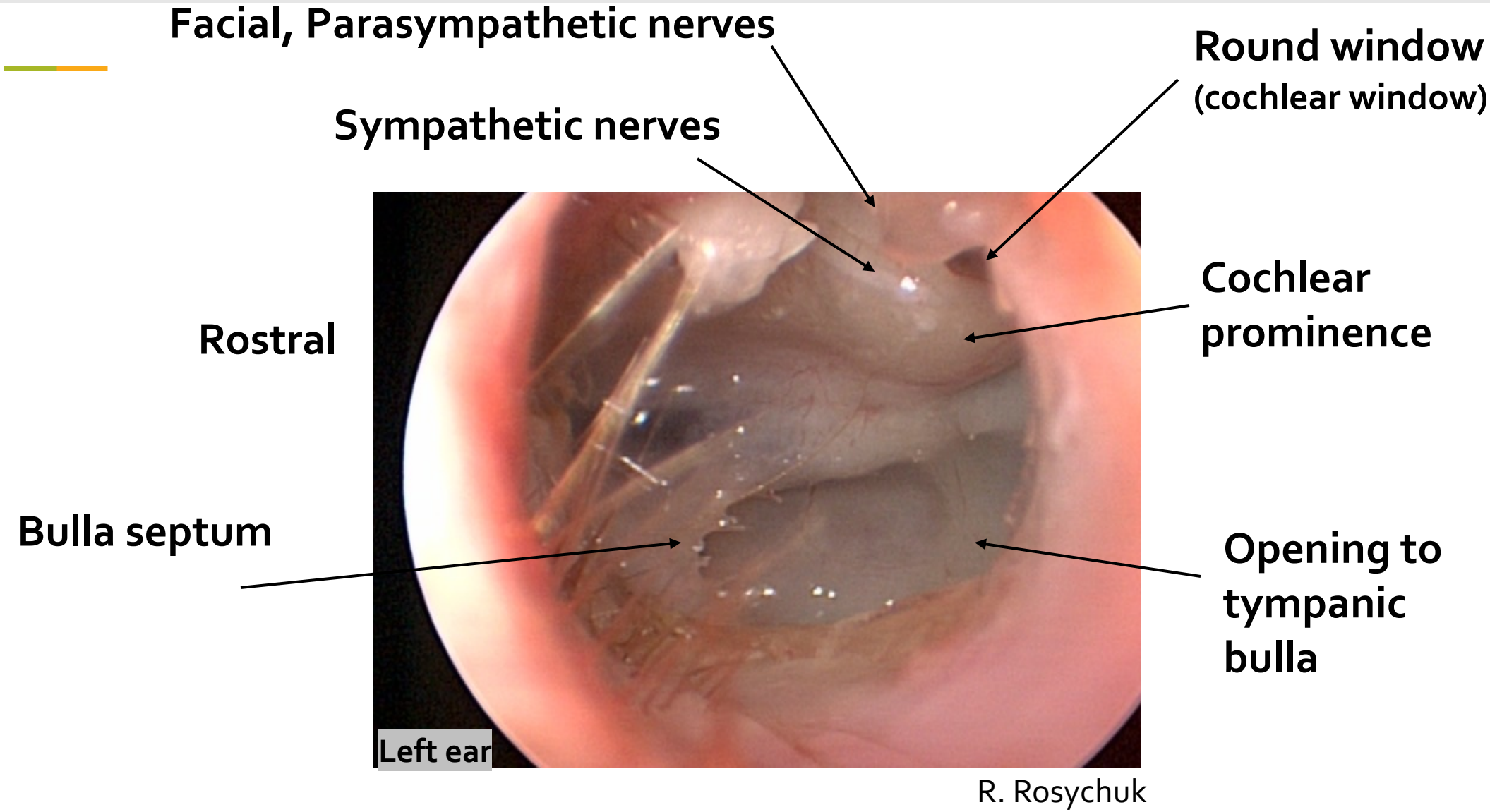
Round window
(cochlear window)

Bulla septum

Tympanic Bulla

Rostral

Caudal


Facial, Parasympathetic nerves
Round window
(cochlear window)
Sympathetic nerves
Rostral
Cochlear prominence
Bulla septum
Opening to tympanic bulla
Left ear

R. Rosychuk

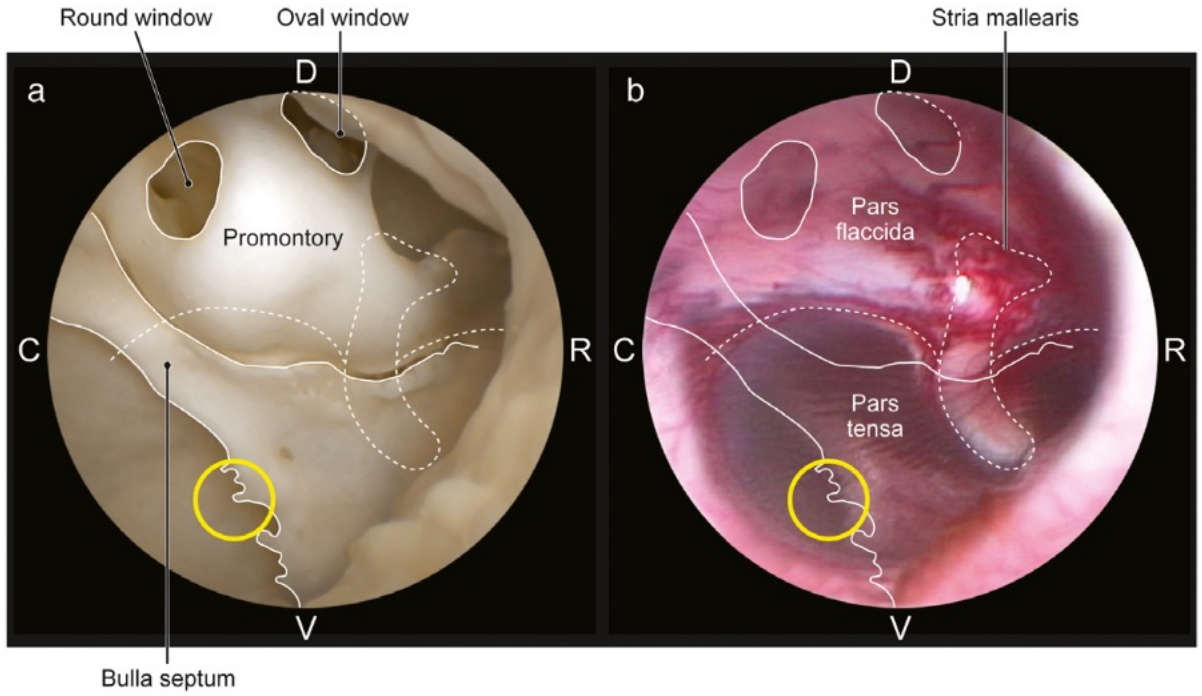
Myringotomy

Vet Dermatol 2021; **32**: 302–e82 DOI: 10.1111/vde.12966

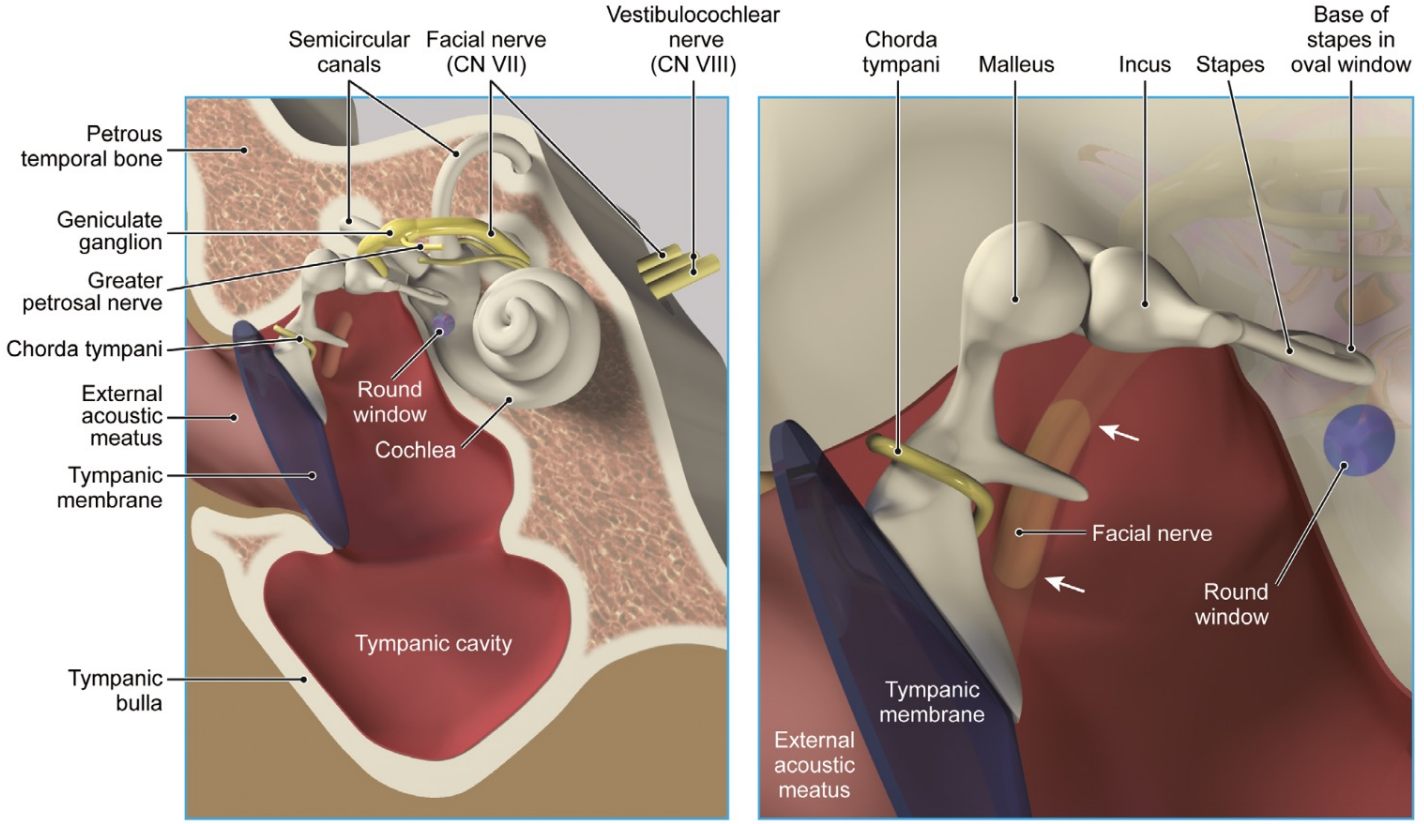
Clinical Techniques: When and how to do a myringotomy – a practical guide

Lynette Cole* and **Tim Nuttall†**

Myringotomy



Myringotomy



Neurologic Signs of Otitis Media

Horner's Syndrome

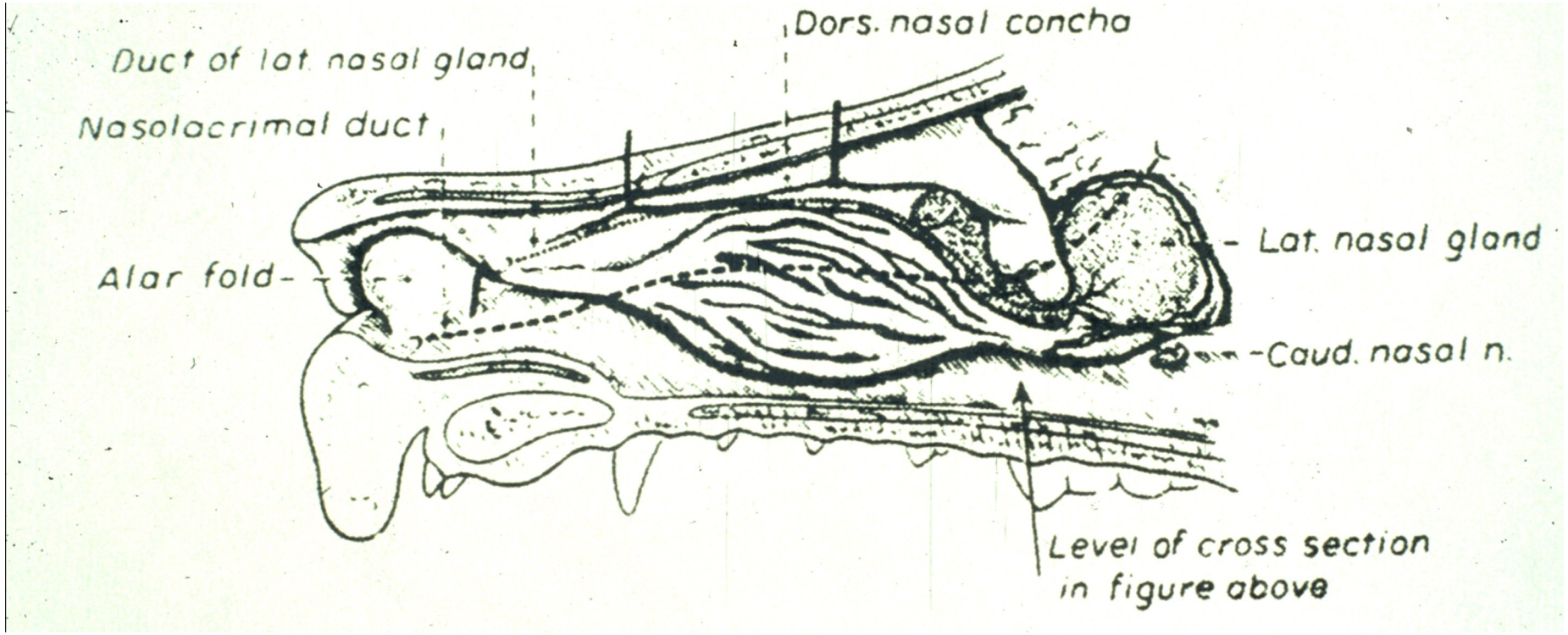
-Facial paresis, paralysis more common in dog

R. Rosychuk

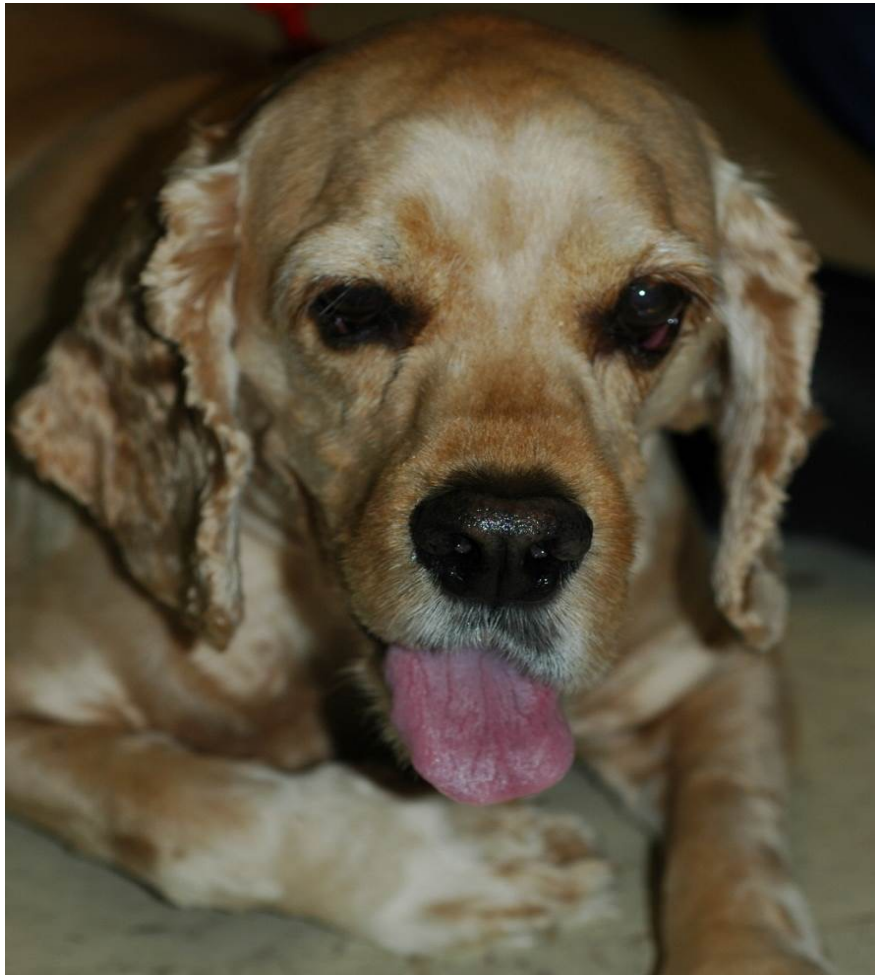
- Xeromycteria; chronic otitis media

Xeromycteria

Lack of lateral nasal gland secretions due to interrupted parasympathetic nerve input (nerve runs through middle ear)



Otitis media: Facial Nerve Paresis/Paralysis



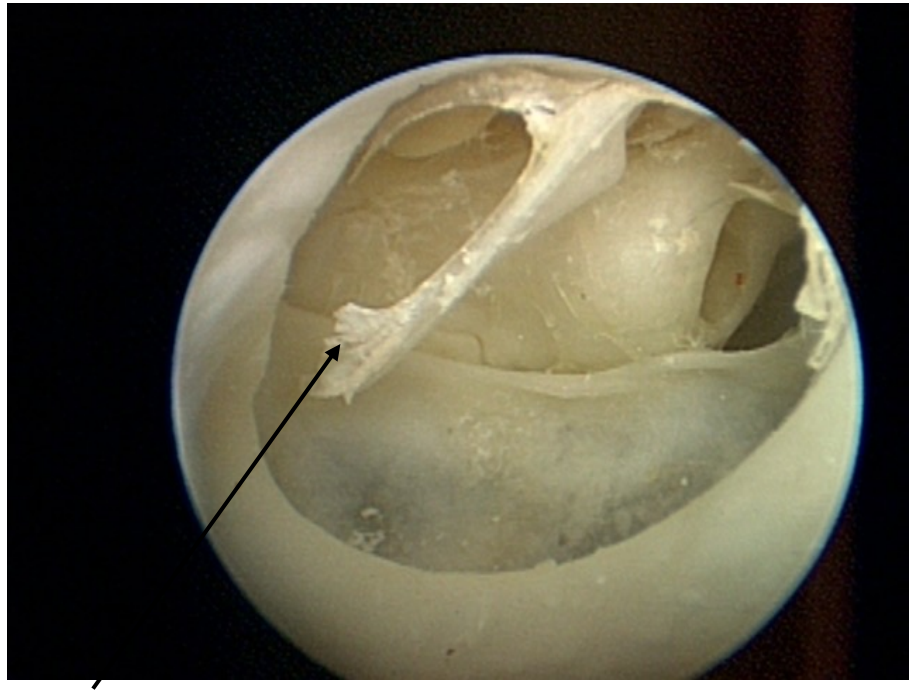
R. Rosychuk

Canine Middle Ear – Left ear

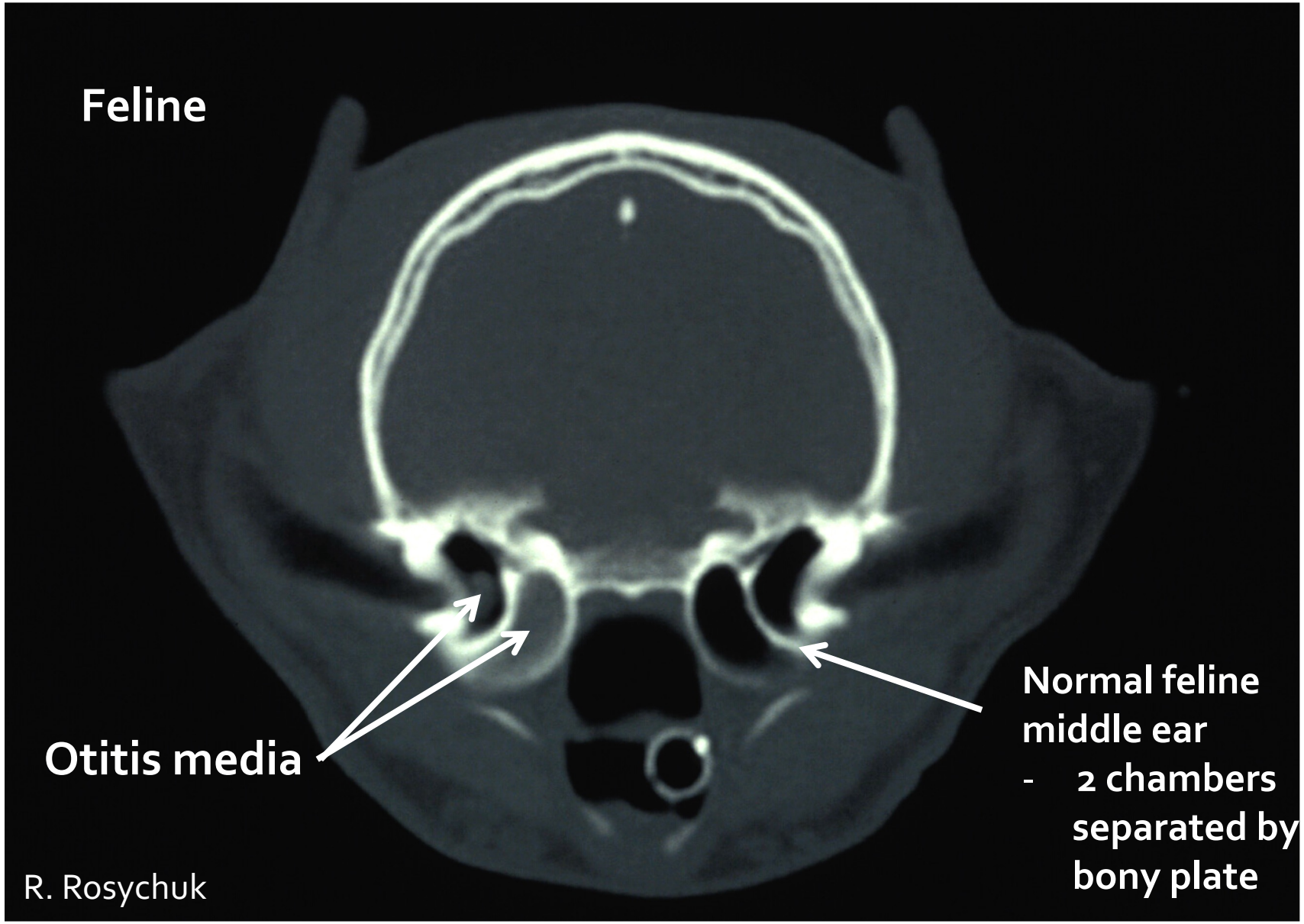
Rostral

Feline Middle Ear – Left ear

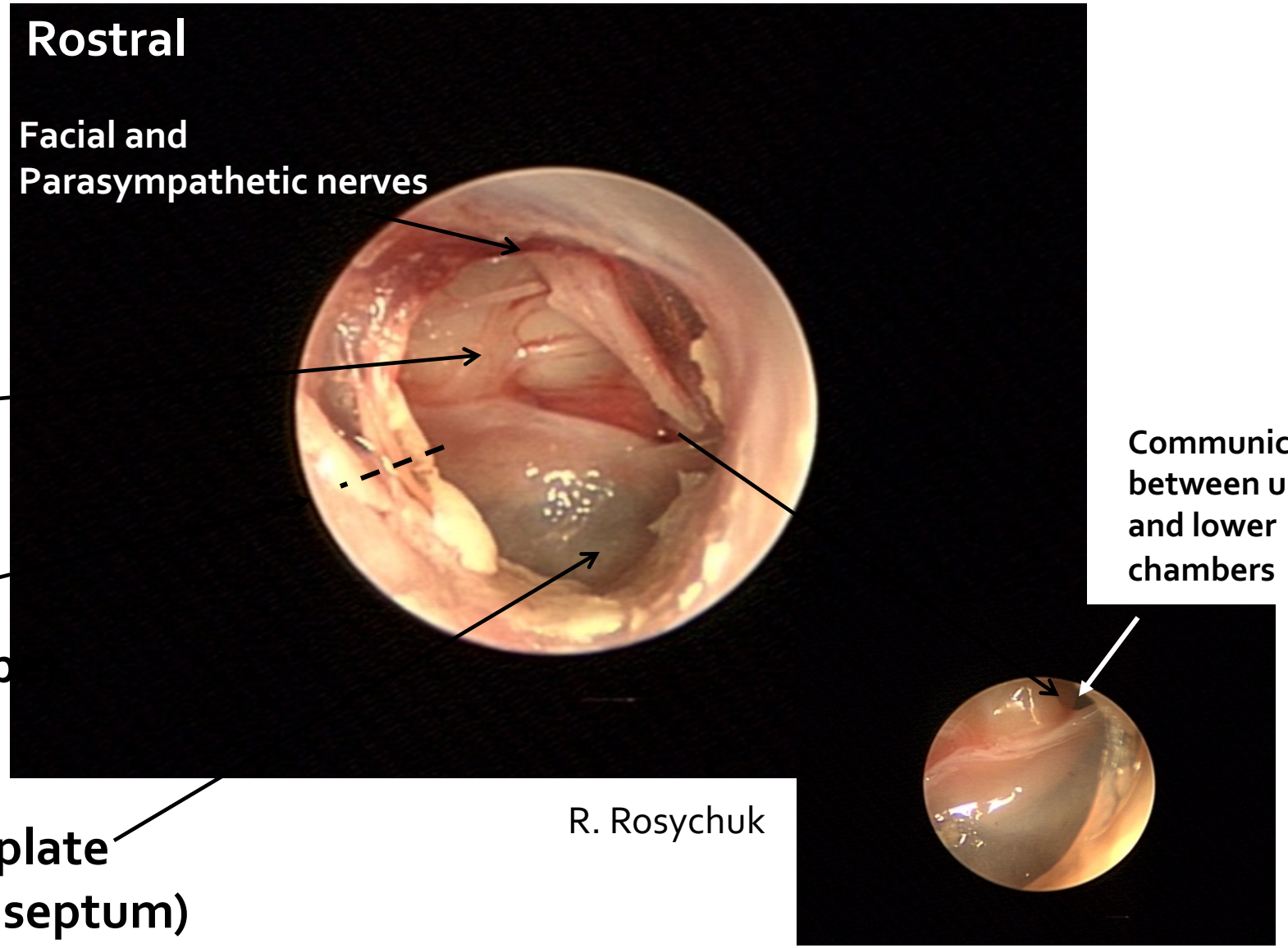
Rostral



(Almost) Complete
Bony plate


Feline
Otitis media
Normal feline middle ear
- 2 chambers separated by bony plate
R. Rosychuk

Feline Middle Ear – Left Ear



Questions…?

Auditory tube

- Short canal, extends from nasopharynx to rostral portion of tympanic cavity
- Sshort bony wall
  - rostrally formed by squamous part
  - ventrally floor is formed by the tympanic part of temporal bone.
  - This forms the musculotubal canal of the auditory tube which exits on the ventral aspect of the skull immediately rostral to the bulla and is guarded ventrally by the sharp pointed muscu- lar process of the temporal bone. The lateral wall is about 8 mm long and is nearly twice the length of the medial wall. The tube is oval in diameter and at its greatest diam- eter is 1.5 mm. The auditory tube is lined by pseudostrati- fied ciliated columnar epithelium containing goblet cells.1,2 It functions to equalize pressure on both sides of the tympanic membrane.46 The auditory tube is divided into three portions: cartilaginous (proximal and opens into the nasopharyx), junctional (part of the tube at which the cartilaginous and osseous portions connect) and the osseous portion (distal and opens into the anterior middle ear, Figure 5). The osseous portion of the auditory tube is
- patent at all times while the cartilaginous potion is closed at rest and opens during swallowing.47 It is opened by the contraction of the levator muscle and tensor palatini mus- cle. The entrance to the auditory tube is obscured behind the soft palate, midway between the caudal aspect of the nares and the caudal border of the soft palate.4 Based on contrast-enhanced computed tomographic imaging, the auditory tube originates from the rostral, dorsomedial aspect of the bulla and enters the dorsolateral aspect of the nasopharynx just caudal to the hamulus process of the pterygoid bone.48

- On the medial wall of the tympanic cavity there is a bony eminence, the promontory, which houses the cochlea and lies opposite to the tympanic membrane, medial to the epitympanic recesss.2 The cochlear (round) window is located in the caudolateral portion of the prom- ontory2,4 and is covered by a thin membrane that oscilli- ates to dissipate the vibratory energy of the perilymph in the scala tympani in the cochlea.2 The vestibular (oval) window is located on the dorsolateral surface of the promontory, medial to the pars flaccida.1,4 It is covered by a thin diaphragm over which the footplate of the stapes is attached

Sensory nerves

- Sensory innervation of the pinna is from four nerves; the trigeminal, facial, vagus, and second cervical.2,3,61 The mandibular branch of the trigeminal nerve is sensory to the skin of the head and the mucosa of the intraos- seous part of the external ear canal. The auriculotemporal nerve leaves the mandibular nerve at the oval foramen and emerges between the base of the auricular cartilage caudally and the masseter muscle cranially. It gives off the external acoustic meatus nerve, which is sensory to the external acoustic meatus near the tympanic mem- brane, and a ramus to the tympanic membrane. The auri- culotemporal nerve gives off rostral auricular nerves, which supply the skin over the lateral aspect of the tra-
- gus, a small portion of the rostroventral part of the pinna's concave surface, and the rostral border of the pinna.49
- The dorsal branch of the second cervical nerve gives off cutaneous branches to the rostrodorsal aspect of the convex surface of the pinna, including the apex of the pinna. Rostrally its cutaneous area extends around the cranial border of the pinna onto the medial aspect (con- cave surface) of the pinna, where it overlaps with the cra- nial border of the cutaneous area of the auricular branches of the facial nerve dorsally and of the auriculo- temporal branch of the mandibular branch of the trigemi- nal nerve ventrally. Caudally, the dorsal branch of the second cervical nerve overlaps dorsomedially with the cutaneous area of the dorsal cutaneous branch of the third cervical nerve and laterally with the cutaneous area of the greater auricular nerve from the ventral branch of the second cervical nerve on the convex surface of the pinna. The greater auricular nerve is the larger of the two terminal branches of the ventral branch of the second cer- vical nerve. It runs dorsocranially to the base of the pinna and divides into two branches which run toward the apex of the ear. The greater auricular nerve has a cutaneous area that covers the convex and concave surfaces of the pinna. It overlaps with the cutaneous areas of the greater occipital nerve dorsally on the convex surface of the pinna and the auricular branches of the seventh cranial nerve on the concave side of the pinna.66,67

Motor

- The facial nerve provides motor innervation for the superficial muscles of the head, face, external ear as well as the caudal belly of the digastricus, the stylohyoid, and the platysma of the neck. The facial nerve emerges from the ventral aspect of the medulla oblongata and exits ven- trolaterally through the trapezoid bodies. The facial nerve leaves the cranial cavity through the internal acoustic meatus accompanied by the vestibular and cochlear nerves. After a short distance in the internal acoustic meatus, the facial nerve enters the facial canal of the pet- rous temporal bone. The facial canal opens into the cavity of the middle ear near the vestibular (oval) window. The facial nerve gives off the stapedial nerve and the chorda tympani nerve. The chorda tympani continues into the middle ear cavity where the nerve crosses the medial sur- face of the handle of the malleus, passes across the med- ial surface of the tympanic membrane, and emerges through the petrotympanic fissure through a small canal in the rostrodorsal wall of the tympanic bulla, to join the lingual branch of the mandibular nerve.49
- The facial nerve exits the skull through the stylomastoid foramen. The fibres from the facial nerve are distributed to the external ear canal from the lateral internal auricular branches of the facial nerve. As the facial nerve emerges between muscles caudal to the base of the ear, it sends muscular branches to the caudal auricular muscles and the caudal auricular nerve. The facial nerve curves ventrally and rostrally around the annular cartilage and gives off a digastric branch. The next branch off the facial nerve, the caudal internal auricular nerve, is actually a sensory nerve and it supplies the caudal surface of the pinna. The facial nerve then gives off the middle internal auricular nerve, which supplies the skin of the rostral aspect of the concave portion of the pinna. Next off the facial nerve is the lateral internal auricular nerve, which

- supplies the nonosseous external ear canal. The facial nerve curves around the caudal border of the mandible on the surface of the masseter muscle and divides into the cervical, buccal, and auriculopalpebral branches. The auriculopalpebral nerve ascends from the base of the ear and divides into palpebral and rostral auricular branches. The palpebral branch forms a rostral auricular plexus between the eye and ear. The rostral auricular branch innervates the superficial and deep scutuloauricularis muscles.49,68

Add nerve blocks for procedures

- Sandra's abstract/ publication