Mucky ears, swabs and smears: A guide to interpreting diagnostics for otitis externa

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IDEXX

Disclosure Ariane:
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Disclosure Marta:
Full-time Employee of IDEXX

The information contained herein is intended to provide general guidance only. As with any diagnosis or treatment you should use clinical discretion with each patient based on a complete evaluation of the patient, including history, physical exam and presentation, and laboratory data. With respect to any drug therapy or monitoring program, you should refer to a product insert, for complete description of dosage, indications, interactions, and cations, Diagnosis, treatment, and monitoring should be patient specific and is the responsibility of the veterinarian providing primary care.

ILOs

- **Review primary, secondary, predisposing and perpetuating factors**

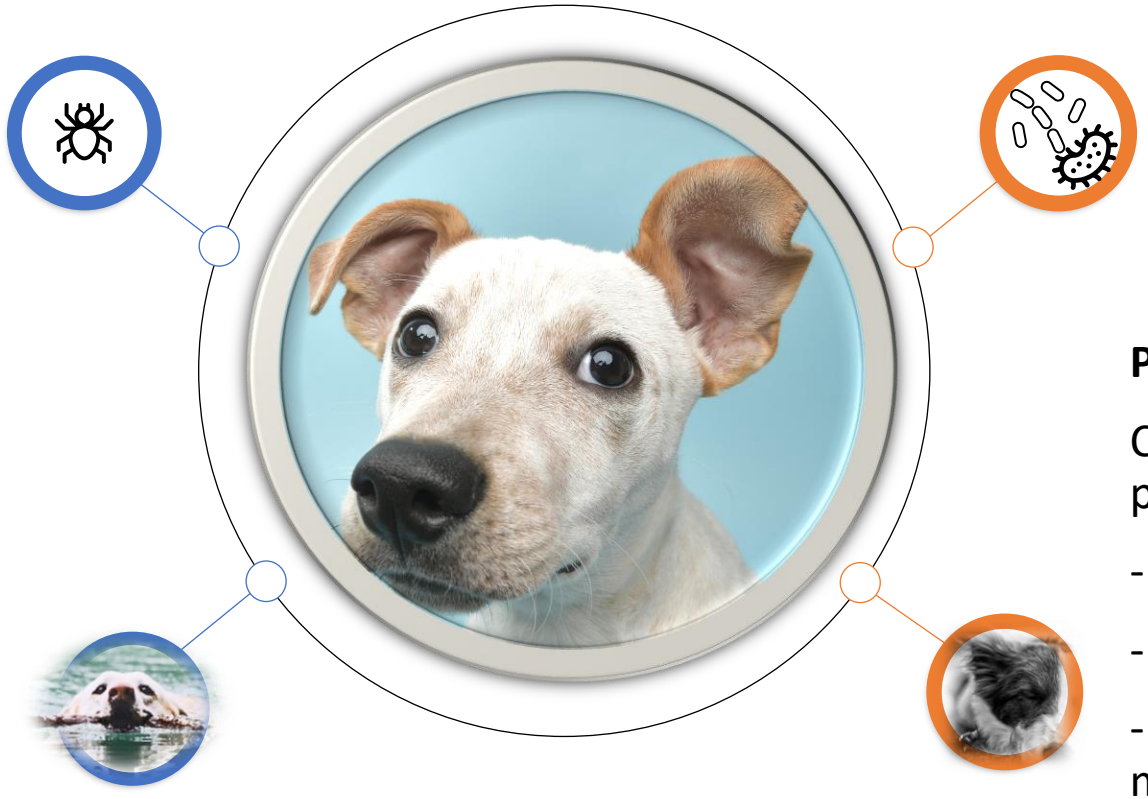
- **Develop an understanding of ear cytology, and the use of culture and microbiology results in otitis diagnosis**

- **Identify treatment strategies for chronic otitis**

Otitis externa is a multifactorial disease PSPP

Primary causes:

- Hypersensitivity *
- Parasitic *
- Space occupying lesions *
- Foreign bodies *
- Endocrinopathies
- Immune system pathology
- Congenital abnormalities



Secondary Causes:

Infections (bacterial and fungal) are secondary and represent ***DYSBIOSIS***

Perpetuating factors:

Chronic acquired changes that prevent resolution

- hyperplasia and thickening
- ear canal stenosis
- occlusion, fibrosis and mineralization
- otitis media
- cholesteatoma

Predisposing factors:

- Anatomy and conformation
- Life style and management

Otitis externa is a multifactorial disease PSPP

Primary causes:

- Hypersensitivity *
- Parasitic *
- Space occupying lesions *
- Foreign bodies *
- Endocrinopathies
- Immune system pathology
- Congenital abnormalities

Drive the inflammation

Allergies common!

Otitis can be ONLY clinical sign

Food relative common

Need to identify & address to avoid relapse

Further tests needed

Otitis externa is a multifactorial disease PSPP

Overgrowth only possible due to PPP

Often cocci (Staph pseudintermedius

+/- yeast (Malassezia spp)

Other also possible

Pseudomonas particularly difficult to manage

Identify by doing cytology

When rods seen → C&S

Biofilm!

Secondary Causes:

Infections (bacterial and fungal) are secondary and represent ***DYSBIOSIS***

Otitis externa is a multifactorial disease PSPP

Predisposing factors:

- Anatomy and conformation
- Life style and management

Present prior to onset of otitis

Most cannot be changed (conformation

Life-style changes (swimming) may be helpful

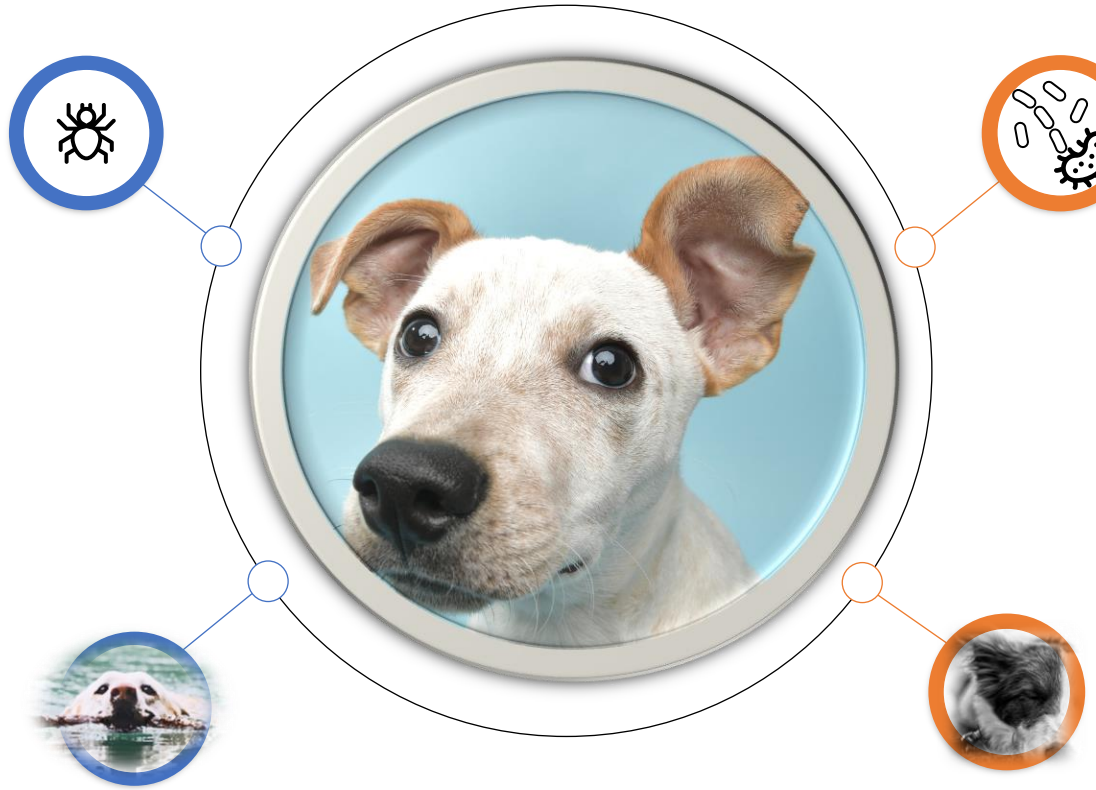
Otitis externa is a multifactorial disease PSPP

Caused by chronic otitis

Cause self perpetuation

Anti-inflammatory meds often needed

Imaging if OM suspected



Perpetuating factors:

Chronic acquired changes that prevent resolution

- hyperplasia and thickening
- ear canal stenosis
- occlusion, fibrosis and mineralization
- otitis media
- cholesteatoma


Are you looking at the ears?

Ear anatomy

- Explain to owners
- Epithelial migration → self cleaning process
  - Gets overwhelmed in a diseased ear

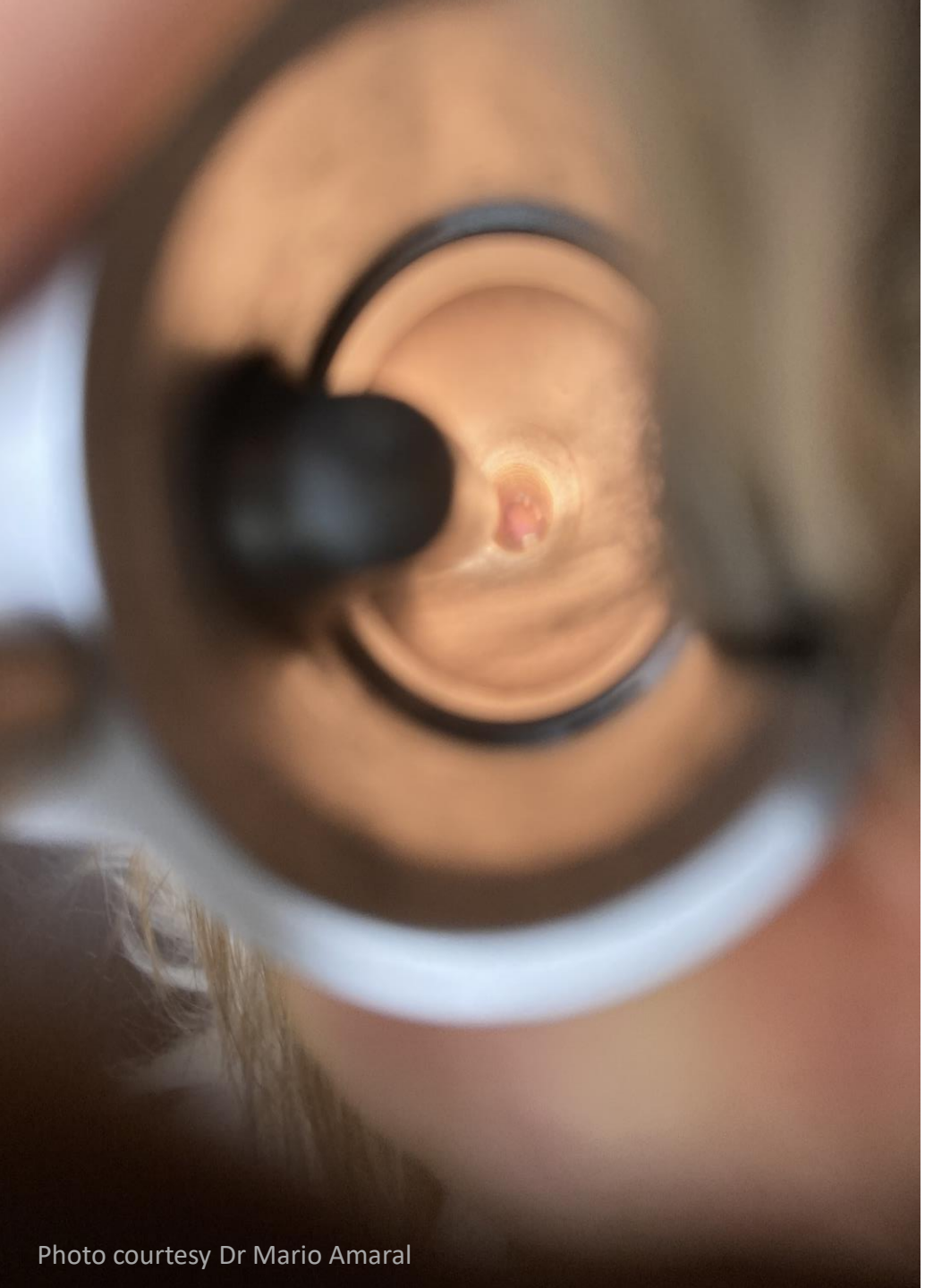


Photo courtesy Dr Mario Amaral

examination is essential in otitis externa

- Evaluate for primary, predisposing and perpetuating factors;
- Evaluate the amount and type of exudate in the ear canals;
- Estimate the amount inflammation;
- Identify hyperplasia, masses, and foreign bodies;
- Determine the status of the tympanic membrane
- Get clues for S

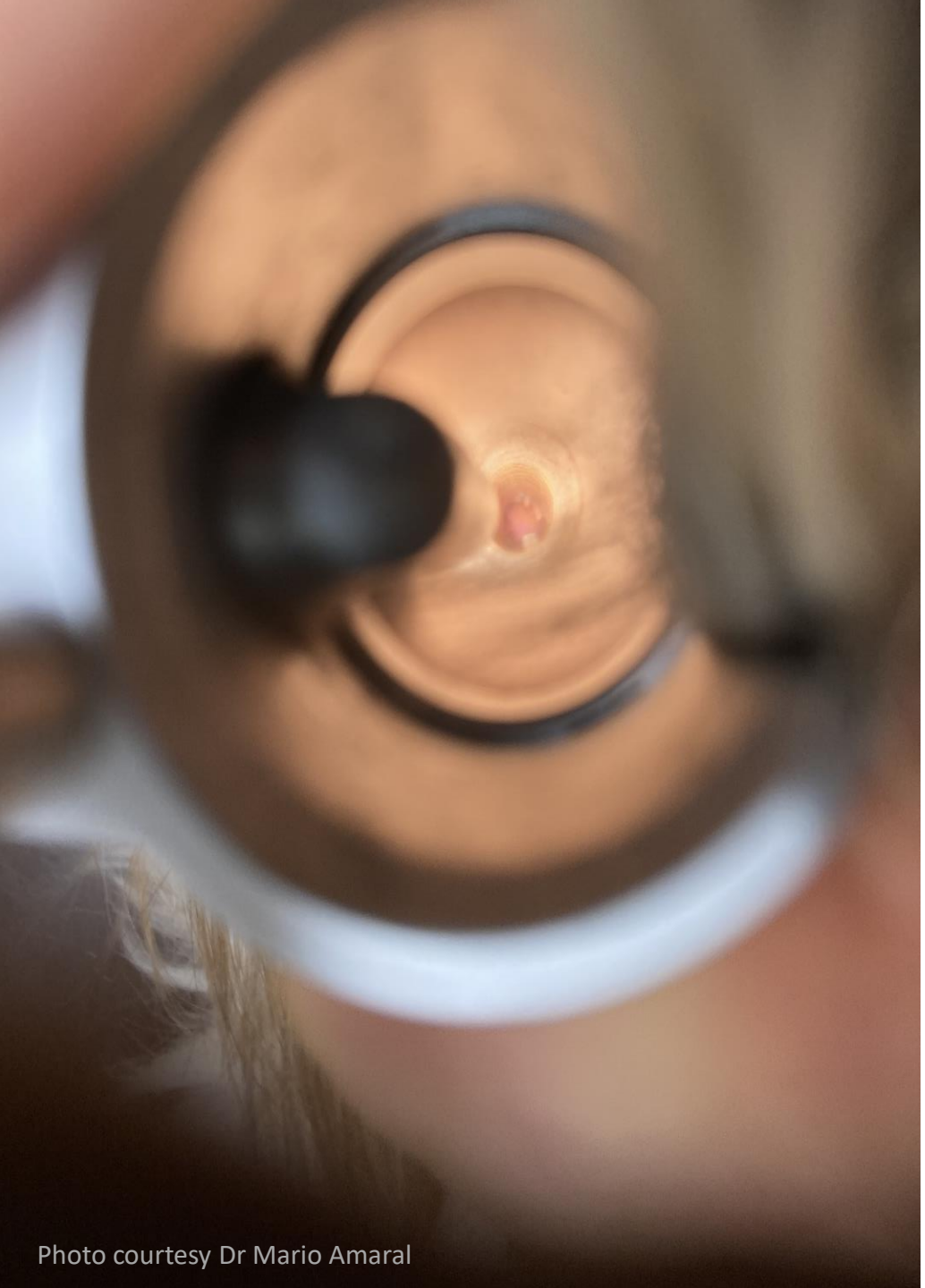


Photo courtesy Dr Mario Amaral

Ear exam: palpate, look, smell, look deeper…

- Evaluate for stenosis, hardening of ear canal
- Evaluate for other signs of generalized & dermatological disease
- Get clues for possible Ps
- Get help formulating therapy (nature of otic discharge, status of TM)

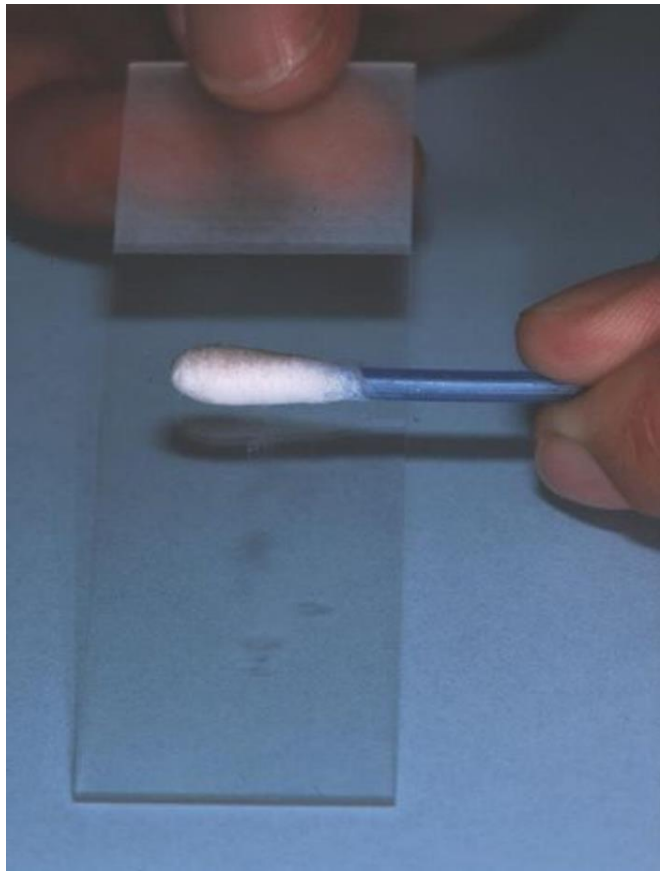
Ear cytology

- Provides information that can help guide treatment
- Most important test!
- Quick
- Inexpensive
- EVERY otitis patient & BOTH ears: initial consult & follow up
- Sometimes allows identification of primary causes (e.g. parasitic) or rule out ceruminous otitis only
- Most will have variable numbers of :
  - Keratinaceous material
  - Yeast or bacterial organisms
  - Variable inflammation
- Quantification and monitoring of response to treatment

How?

Cotton bud/gloves

Role out/dab on

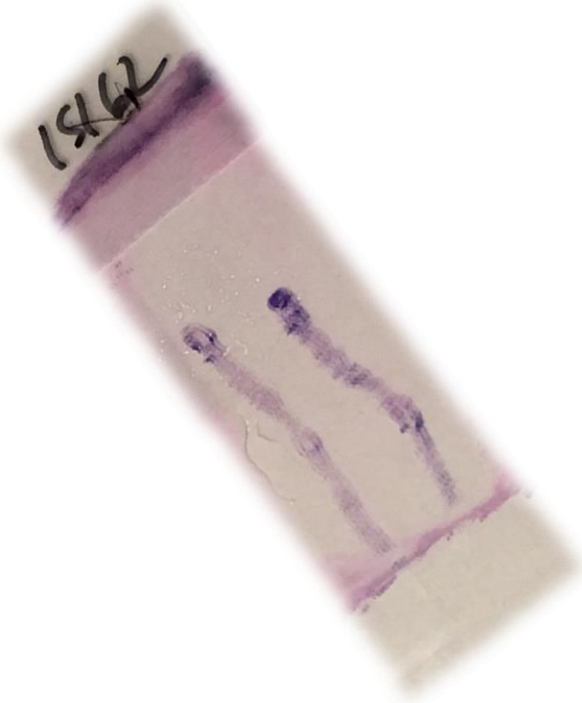


Sample processing

DiffQuick

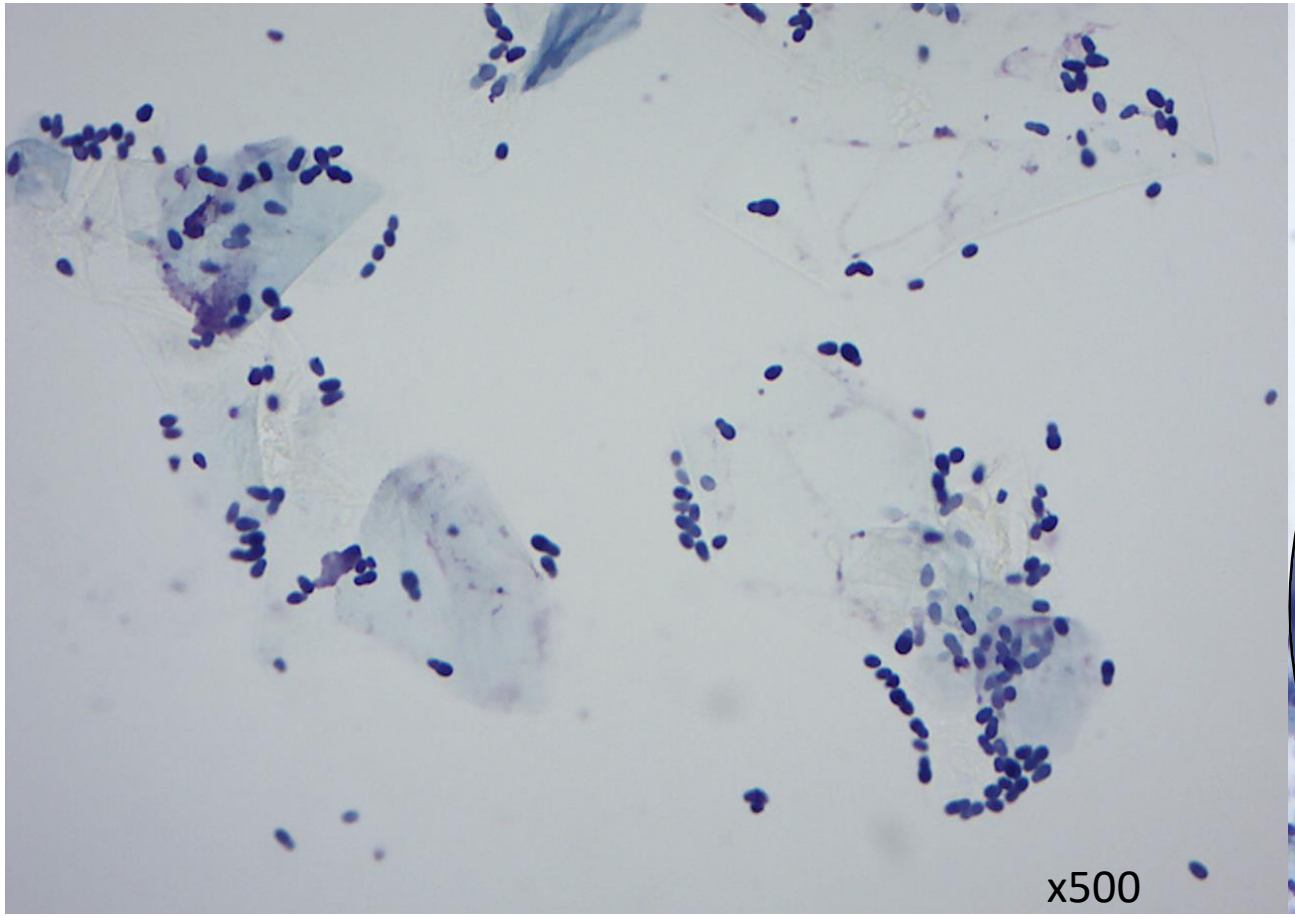
How to…

- Fixation: heat? Solution 1?
- Air dry
- Eosin red?
- Methylen blue!!!

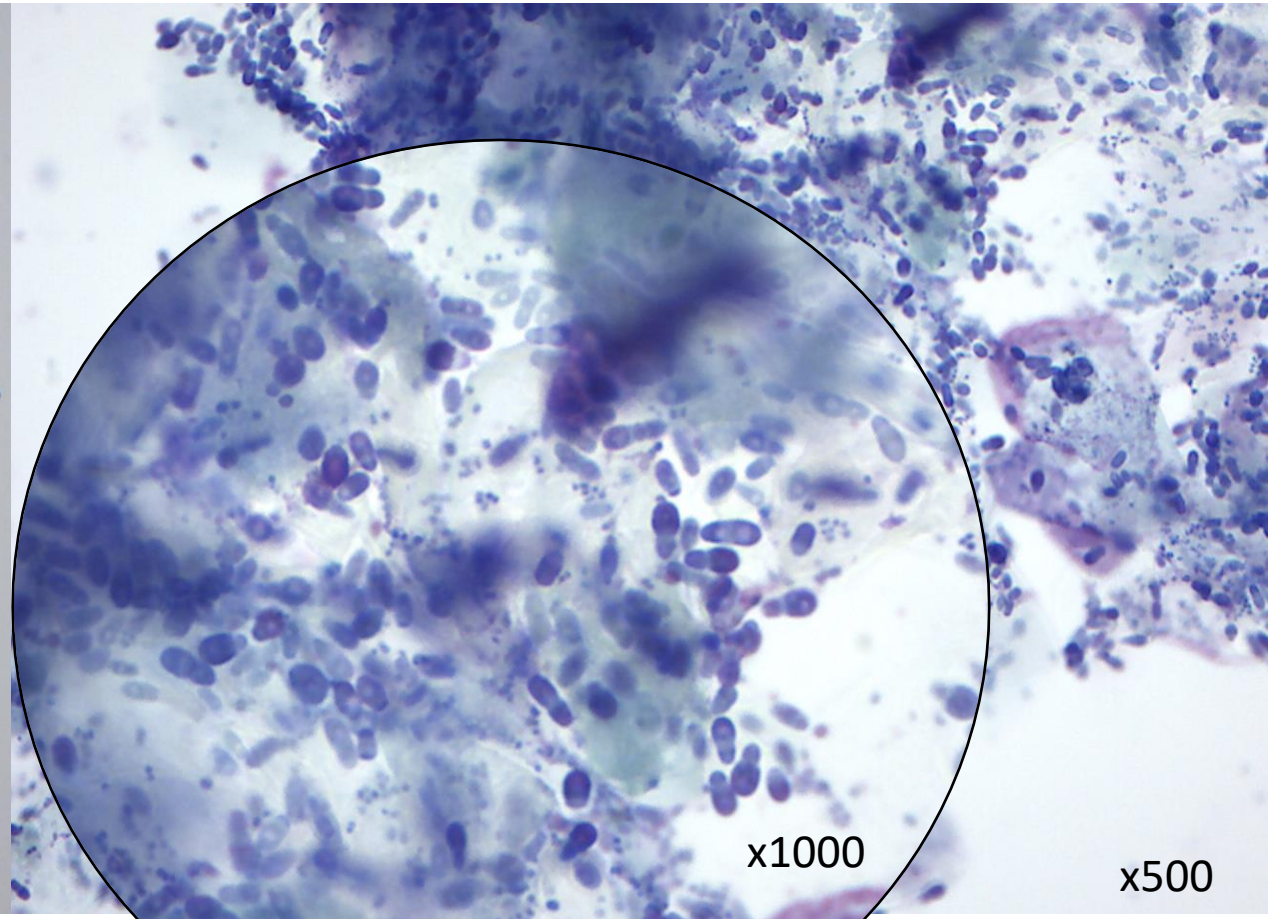


Different ears – different findings

Left ear – Malassezia only



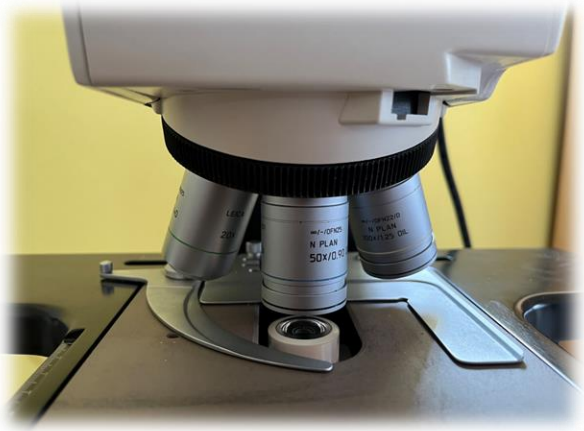
Right ear – Malassezia and cocci



Start ASAP and often
– it gets easier

Examining the smear

- Start with low power
- Examine the whole smear with a “battle ship movement”
- Choose the most cellular / well spread/ well preserved areas
- Increase to higher power field for identification and quantification of organisms:
- Look for organisms: cocci, rods, yeast
- Look for inflammatory cells

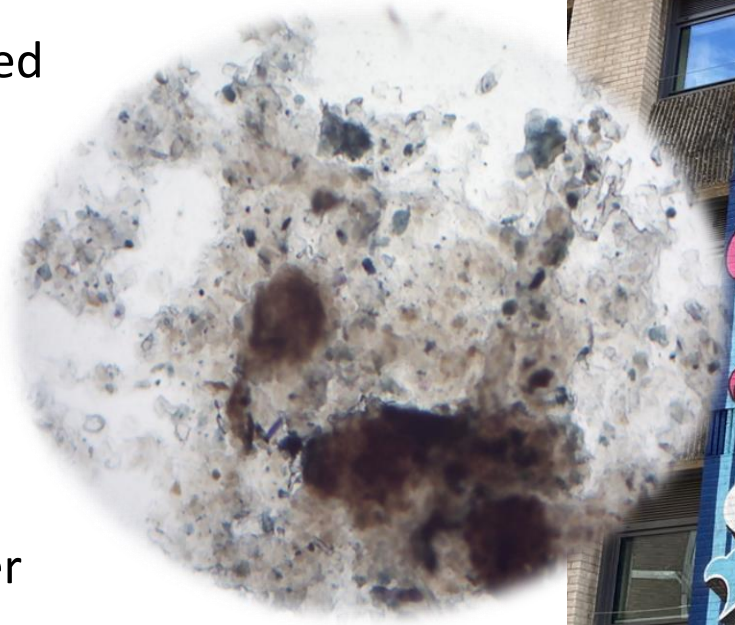


Ginel, P.J. et al (2002). A semiquantitative cytological evaluation of normal and pathological samples from the external ear canal of dogs and cats. Vet Dermatol 13: 151–156

Ceruminous Otitis

No/few microorganisms detected

- No parasites
- No/few bacteria
- No/few yeasts



Idiopathic seborrhoea and other keratinization disorders

The excess cerumen will predispose to bacterial and Malassezia overgrowth

Otodectes cynotis

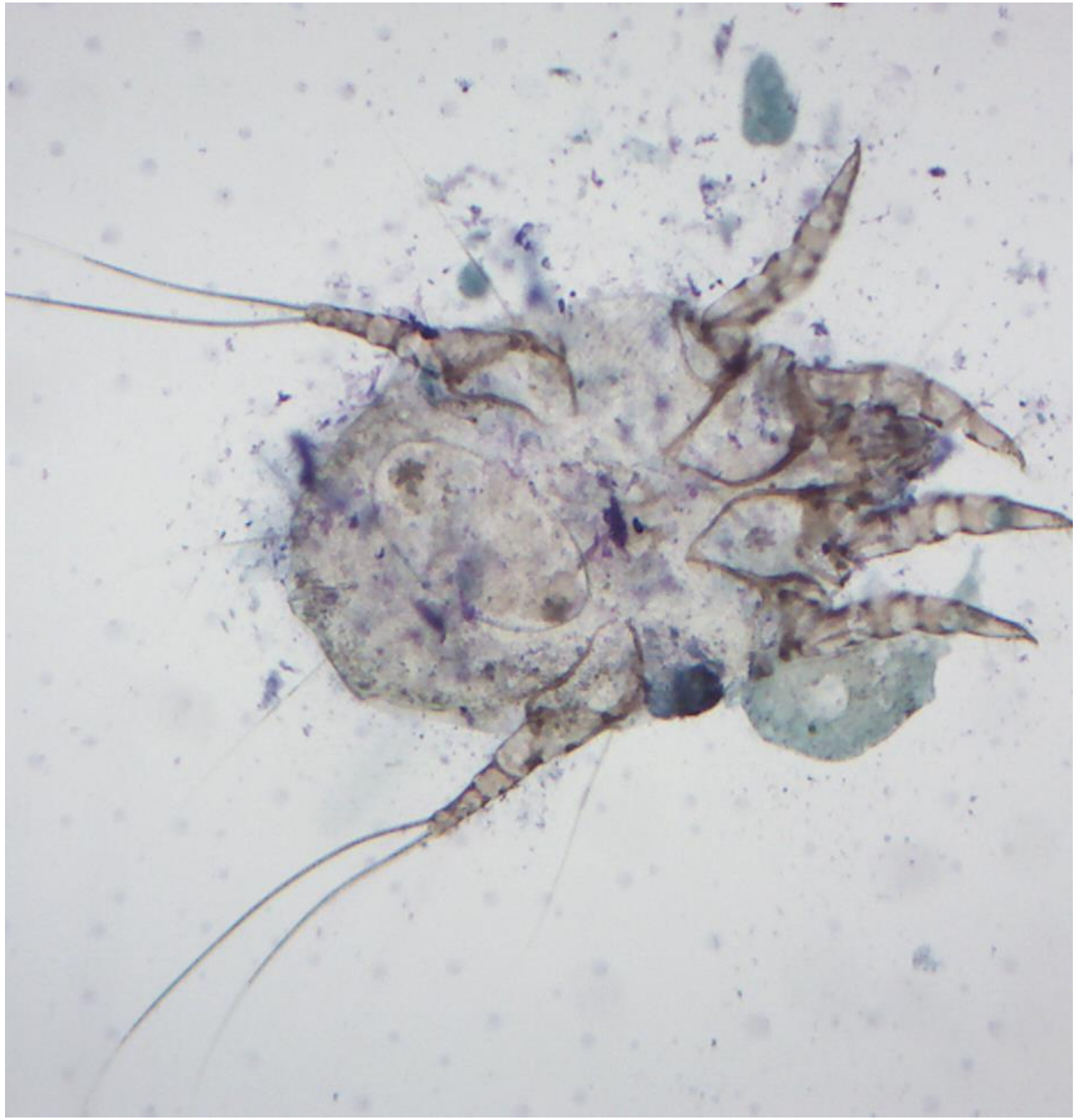
Parasites are primary cause of otitis

May have secondary bacterial overgrowth/infection

Best diagnosed in fresh smears

Up to 85% of feline otitis externa

Reinfestation can occur after treatment (specially from other pets)



Site: LEFT EAR :

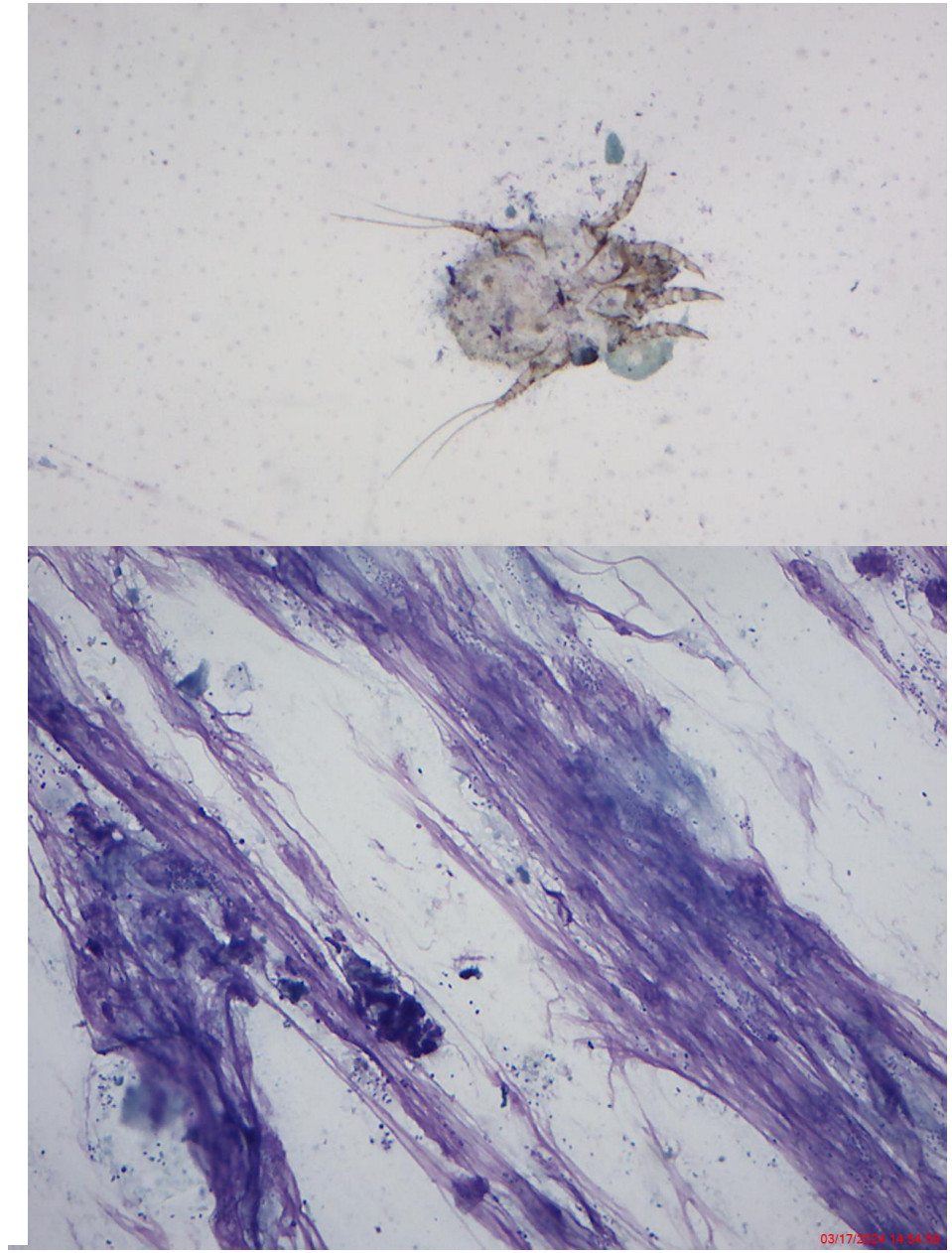
Aerobic Culture - Ear

Isolate 1 Profuse growth:Staphylococcus felis

Antibiotic	Result	MIC	Sensitivity Range		
Ampicillin (1)	Resistant				
Amoxicillin (1)	Resistant				
Amoxicillin-Clavulanic acid (1)	SENSITIVE				
Cloxacillin (1)	SENSITIVE				
Enrofloxacin (2)	SENSITIVE	<=0.5	0.5	Siir	4
Marbofloxacin (2)	SENSITIVE	<=0.5	0.5	Ssirr	8
Pradofloxacin (2)	SENSITIVE	<=0.12	0.12	Ssiirr	4
Neomycin (2)	SENSITIVE	<=2	2	Sssir	32
Chloramphenicol (1)	SENSITIVE	<=4	4	Ssirr	64
Ofloxacin (2)	SENSITIVE				
Fusidic acid (2)	SENSITIVE	<=0.5	0.5	Ssrrrrr	32
Minocycline (1)	SENSITIVE	<=0.5	0.5	Ssssir	16
Cephalexin (1)	SENSITIVE				
Gentamicin (2)	SENSITIVE	<=0.5	0.5	Ssssir	16
Ciprofloxacin (2)	SENSITIVE				
Florfenicol (1)	SENSITIVE	<=4	4	Ssrr	32

Organism identified by MALDI-TOF as Staphylococcus felis (coagulase-negative), which is regarded as a primary pathogen when recovered from urine. It is potentially pathogenic when recovered from skin, wounds, ears, abscess or conjunctiva.

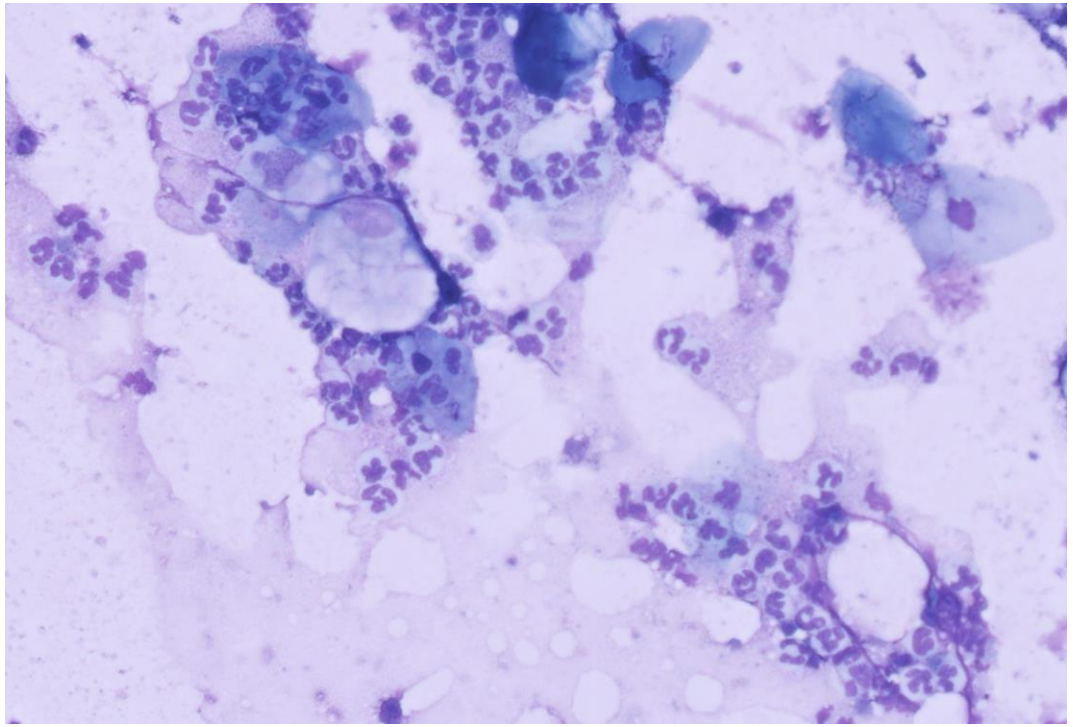
Note:
Standardised susceptibility tests do not reflect in vivo activity of topical antibiotics due to the high levels achieved in the target site with topical administration. Generic antibiotics quoted. The choice of antibiotic and knowledge of any contraindications is the Veterinary Surgeons responsibility. MIC units expressed in ug/ml. Antibiotics without a MIC have been predicted using international guidelines. For more information on interpretation of MICs visit idexx.co.uk/MIC



Neutrophils only

- Inflammation is not infection!

- Remember allergies and foreign bodies!



The ear is not sterile…

- Just because we see/grow bacteria does not implicate bacterial otitis

- Consider ***DYSBIOSIS***

- High numbers of organisms – overgrowth and/or infection

- Phagocytosis and intracellular bacteria – ongoing active infection

- If reporting number of organisms present:
    - average of 10 oil immersion (x1000) microscopy fields:

DEBATABLE!

- use semiquantitative assessment

Common organisms found in normal ears and in otitis

Normal ears

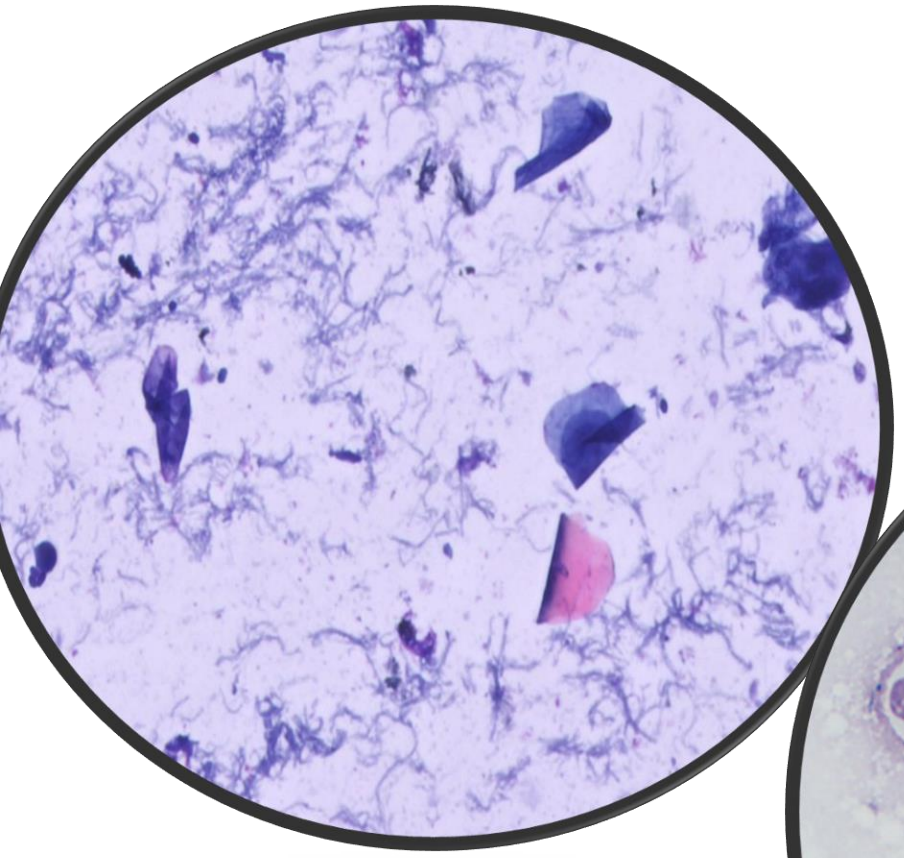
- *Malassezia pachydermatis* , other Malassezia spp. and other yeasts*
- *Staphylococcus pseudintermedius**
- *Staphylococcus schleiferi* subsp. *coagulans*
- Coagulase-negative staphylococci
- *Corynebacterium* spp. †
- *Streptococcus* spp.
- Other species
  - Actinobacteria, Proteobacteria, Firmicutes, and Bacteroidetes

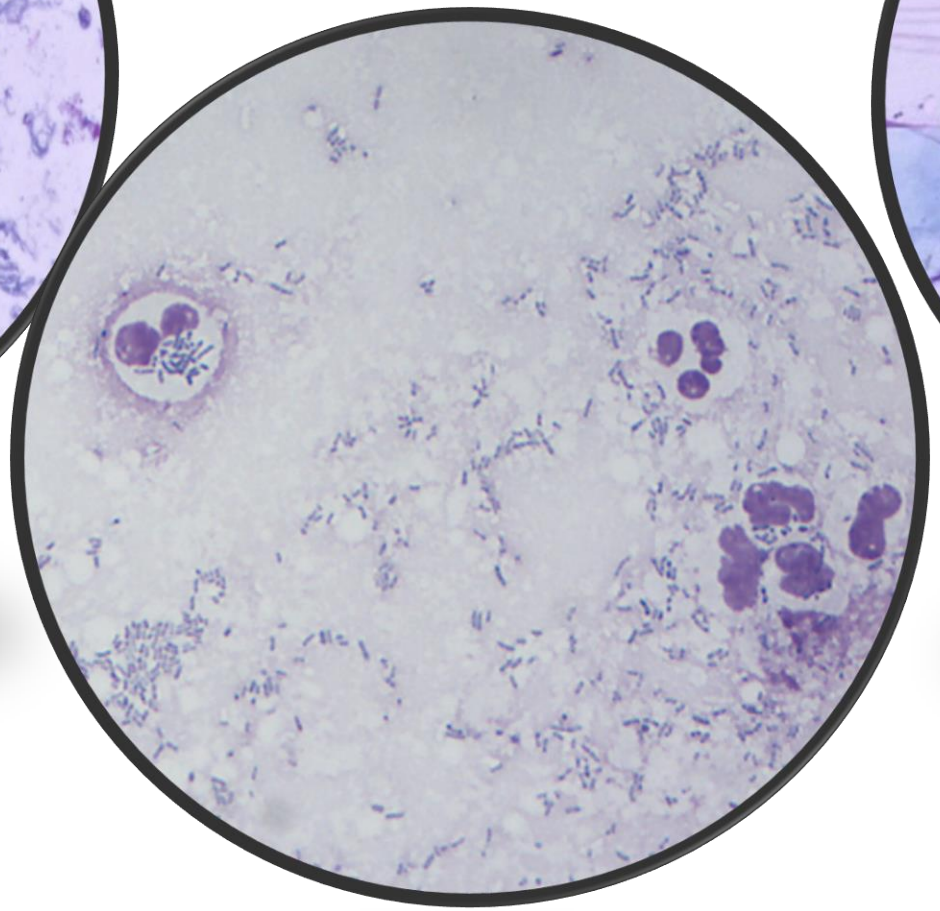
Ears with otitis externa

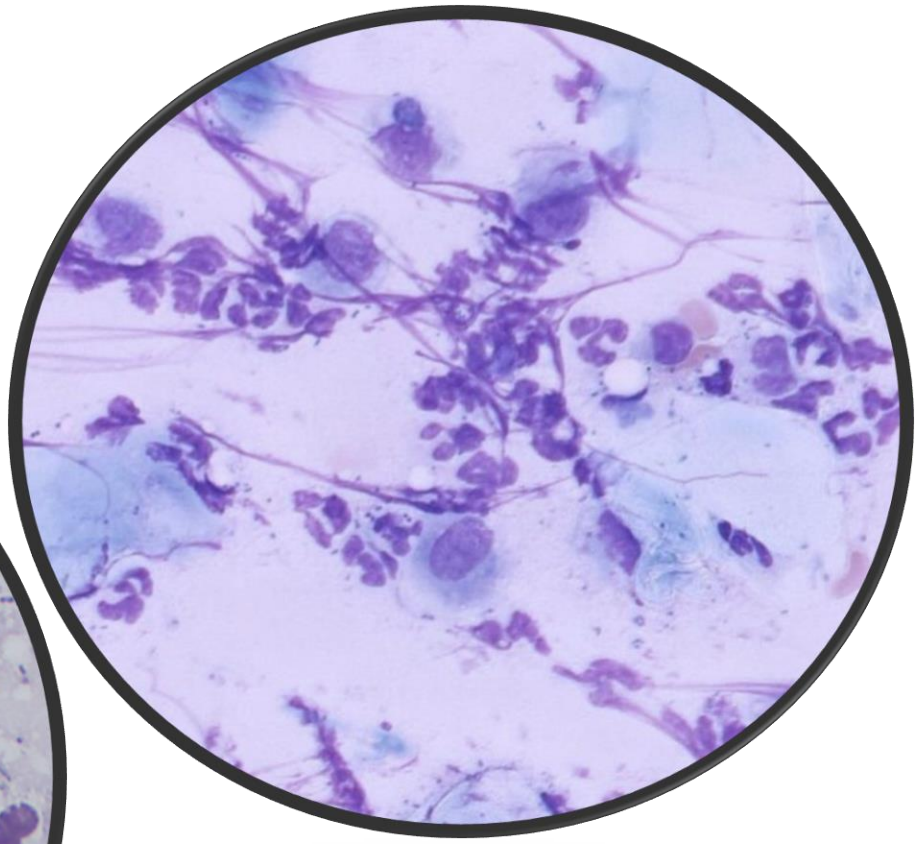
- Malassezia spp.*
- Staphylococcus pseudintermedius* and other staphylococci
- Pseudomonas aeruginosa*
- Proteus mirabilis*
- Beta-haemolytic streptococci (e.g. S. canis)
- Corynebacterium spp.
- Enterococcus spp.
- Escherichia coli

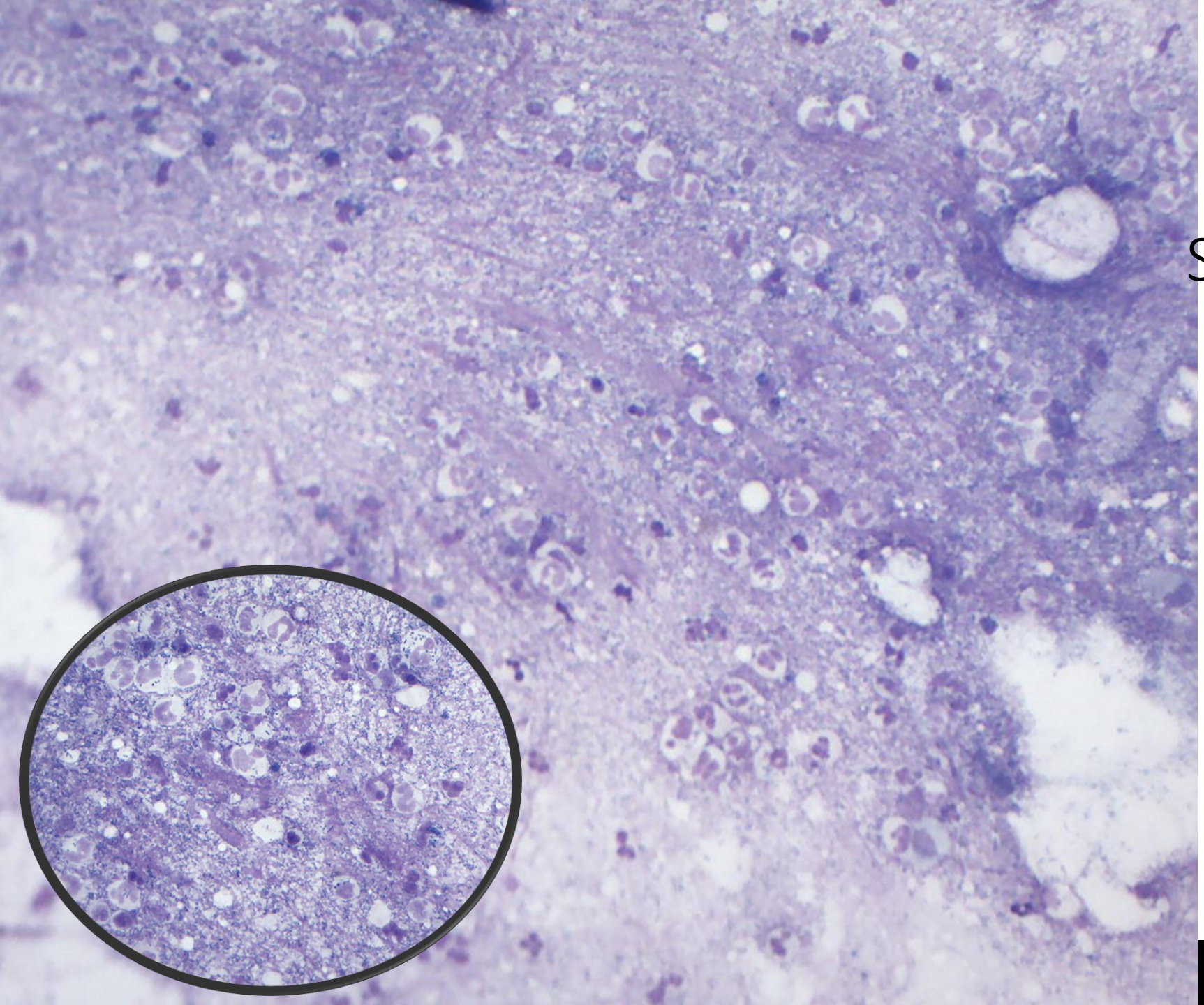
Otitis media: Also consider anaerobes

Bacterial Otitis









Septic Neutrophilic Inflammation
Bacterial Otitis

Biofilm can complicate the picture

Biofilm and Bacilli consider Pseudomonas

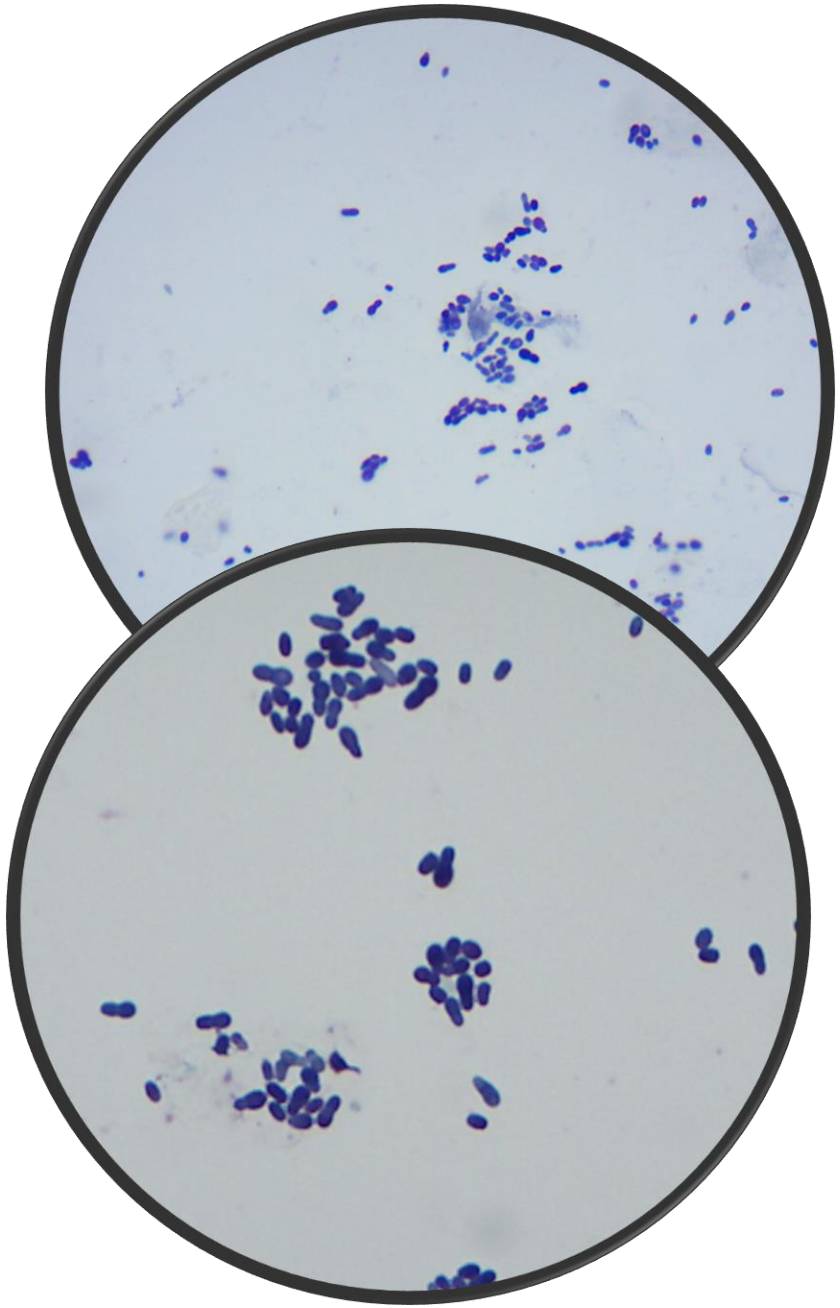
Isolate 1 Profuse growth:Pseudomonas aeruginosa

Antibiotic	Result	MIC	Sensitivity Range		
Ampicillin (1)	Resistant	N/A		(Intrinsic R)	
Amoxicillin-Clavulanic acid (1)	Resistant	N/A		(Intrinsic R)	
Enrofloxacin (2)	SENSITIVE	0.5	0.12	ssSiir	4
Gentamicin (2)	SENSITIVE	<=1	1	Sssir	16
Clindamycin (1)	Resistant	N/A		(Intrinsic R)	
Amikacin (2)	SENSITIVE	<=2	2	Ssssir	64
Tobramycin (2)	SENSITIVE				
Polymyxin B (3)	Intermediate	1	0.25	iilirrr	16
Cephalexin (1)	Resistant	N/A		(Intrinsic R)	
Marbofloxacin (2)	SENSITIVE	1	0.5	sSir	4
Cefovecin (2)	Resistant	N/A		(Intrinsic R)	

Pseudomonas aeruginosa may develop resistance during prolonged therapy with all antimicrobial agents. Therefore, isolates that are initially susceptible may become resistant within three or four days after initiation of therapy. Testing of repeat isolates may be warranted.

in mixed bacterial growth.

Note:
Standardised susceptibility tests do not reflect in vivo activity of topical antibiotics due to the high levels achieved in the target site with topical administration. Generic antibiotics quoted. The choice of antibiotic and knowledge of any contraindications is the Veterinary Surgeons responsibility. MIC units expressed in ug/ml. Antibiotics without a MIC have been predicted using international guidelines. For more information on interpretation of MICs visit idexx.co.uk/MIC



Malassezia Otitis

Semi quantitative assessment:

Varies with studies

- dry hpf (40x)
- mean *yeasts*/hpf ≥ 1 – 5 - 10 abnormal

However:

- overlap in yeast densities in skin samples from healthy and diseased dogs
- relatively small numbers of organisms may lead to skin disease in sensitised individuals

“Factors such as important variations in anatomical site, breed, sampling method and host immune status commonly thwart the interpretation of the clinical significance of an observed population (“XX yeasts in YY fields”); trial therapy is routinely required to establish this.”

Bond R, et al Biology, diagnosis and treatment of Malassezia dermatitis in dogs and cats: Clinical Consensus Guidelines of the World Association for Veterinary Dermatology. Vet Dermatol. 2020 Feb;31(1):75. doi: 10.1111/vde.12834. PMID: 31957203.

Is Culture Beneficial?

- May have limited benefit in otitis externa
- Allows to identify if only mixed flora
- Most cases of infection are due to :
  - *Malassezia* spp
  - *Staphylococus* spp (cocci)
  - *Pseudomonas* (bacilli)
- More useful in recurrent cases or with organisms with unusual morphology
  - e.g., coryneform, cocci-bacilli, filaments, yeasts, hyphae, etc
- Direct microscopy findings aid in the determination of clinical significance of isolates e.g., bacterial morphology associated with inflammation and phagocytosis.
  - **Always do Cytology before and when doing culture**

Is Culture Beneficial?

IDEXX SERVICES: **CANA, EARSW**
SAMPLES RECEIVED: **Pink cap e-swab**

MICROBIOLOGY

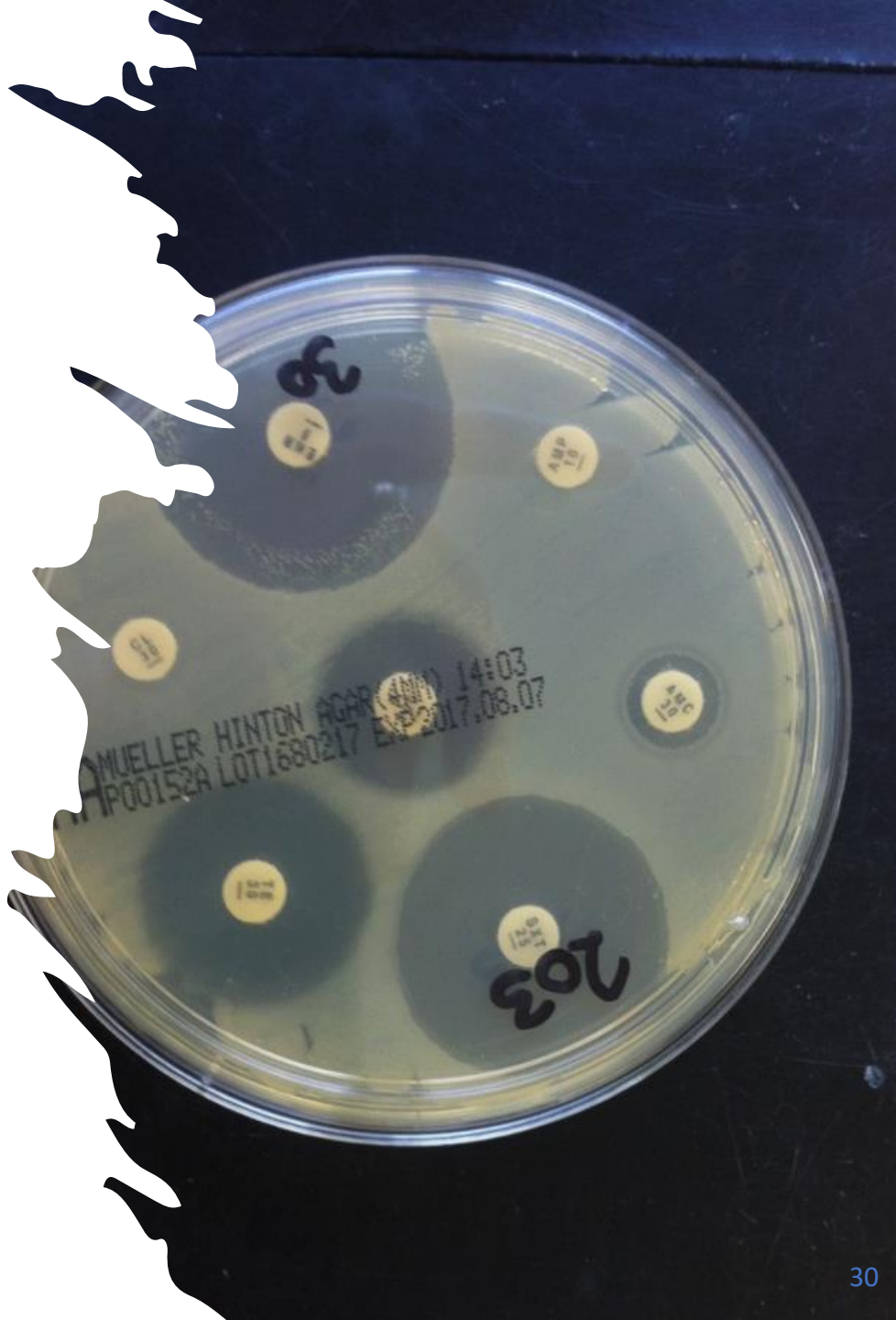
*Anaerobic Culture [a] — Moderate growth mixed anaerobes
*Site: — BOTH EARS :

Aerobic Culture - Ear

Isolate 1 — Profuse growth:Pseudomonas aeruginosa

Antibiotic	Result	MIC	Sensitivity Range		
*Amikacin	SENSITIVE	<=2	2	Ssssir	64
*Gentamicin	SENSITIVE	<=1	1	Sssir	16
*Ciprofloxacin	SENSITIVE	0.25	0.06	ssSssir	4
*Enrofloxacin	Intermediate	1	0.12	ssslir	4
*Marbofloxacin	SENSITIVE	<=0.5	0.5	Ssir	4
*Polymixin B	SENSITIVE	1	0.25	ssSsrrr	16
*Ofloxacin	SENSITIVE				

in mixed bacterial growth.

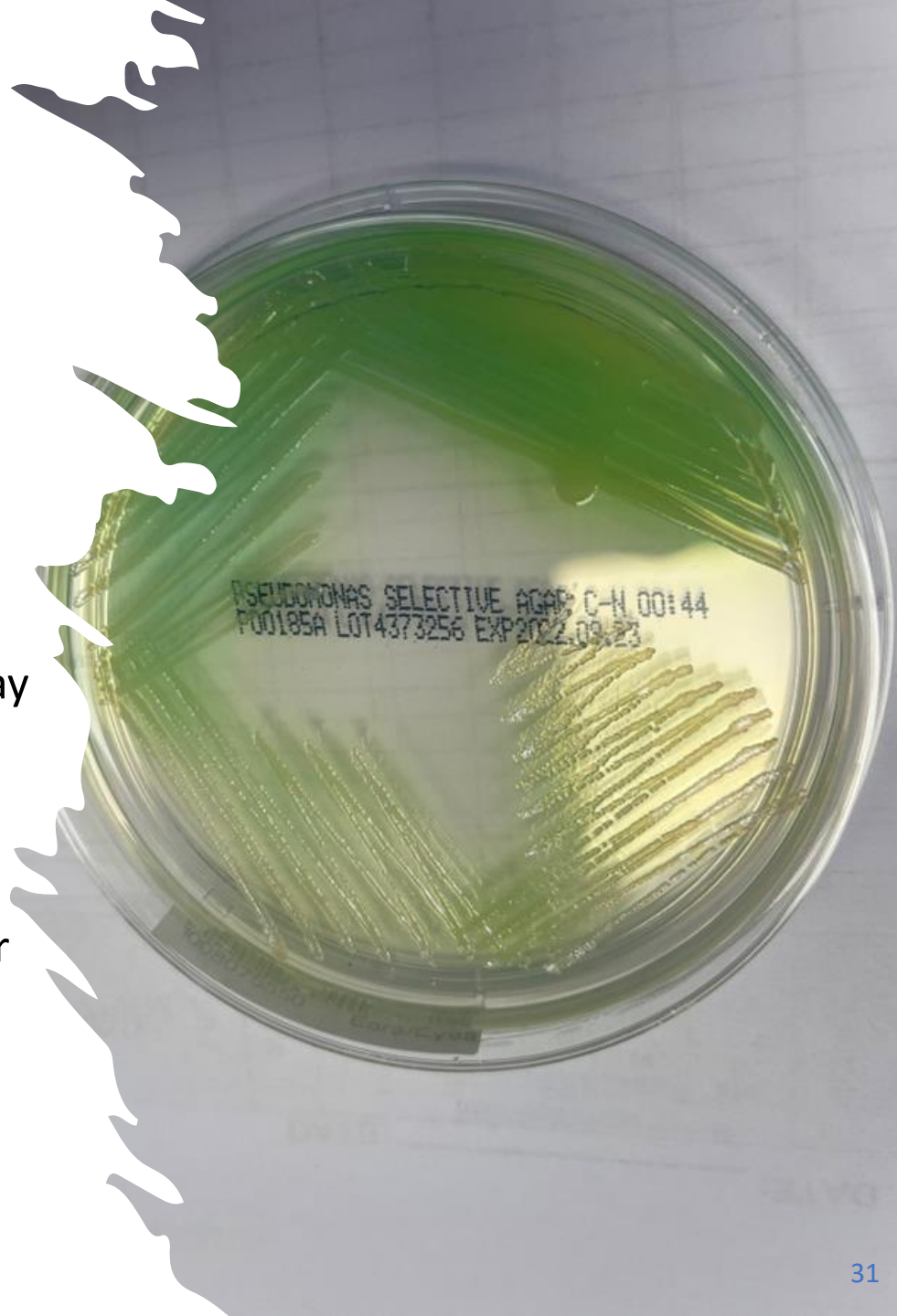


- ASTs are based on systemic breakpoints
- The results can be poorly predictive of the response to topical treatment.
  - If R on AST may respond in vivo due to high concentration that can be achieved on site
  - If S on AST may not respond in vivo due to local factors (e.g. inflammation, biofilm, ear stenosis, etc)
- May be useful with bacilli infection (e.g. Pseudomonas vs Enterobacterales vs Corynebacteria)

Is Culture Beneficial?

Typical indications for Culture include the following:

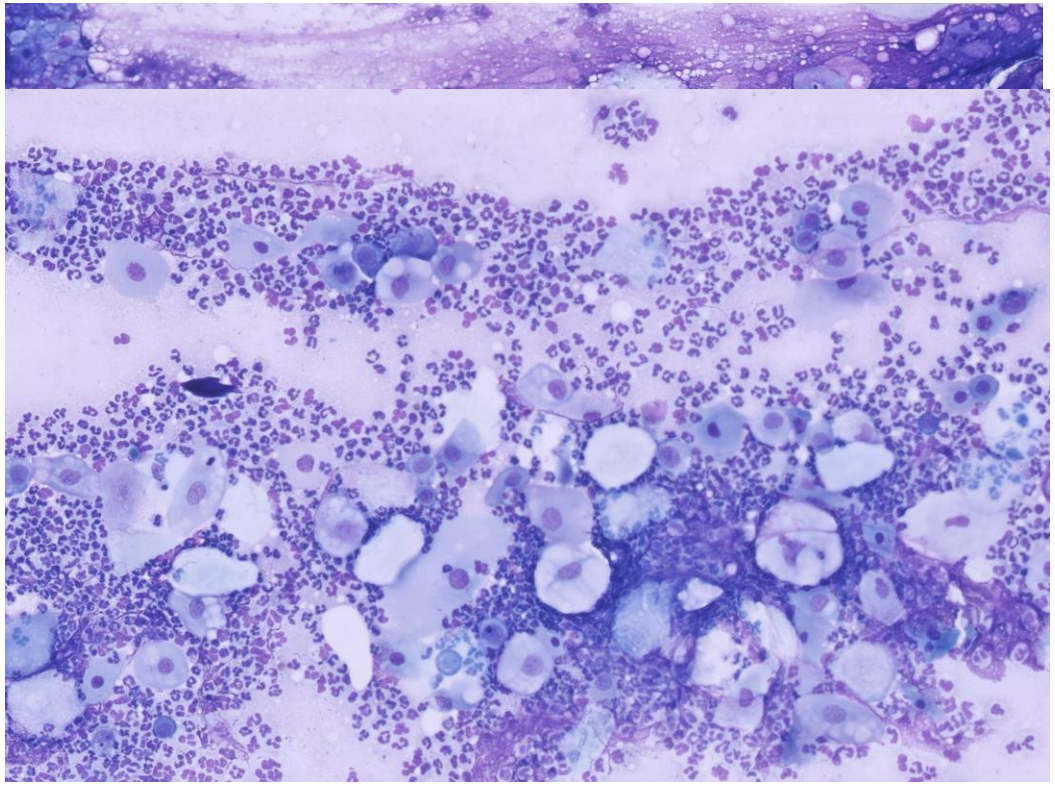
- Chronic otitis associated with bacteria (cocci and/or rods) seen on cytology
- Rods (bacilli) seen on cytology
- Organisms with unusual morphology
- Suspected or confirmed cases of otitis media (systemic therapy may be indicated)
- History of multidrug-resistant bacteria
- History of long-term oral or topical antibiotic therapy (including for other conditions
- Bacteria persisting on cytology despite apparently appropriate therapy



Is Culture Beneficial?

SPECIES	AGE		
Canine	9y 9m (03/06/2014)		
BREED	SEX	NEUTERED	ENTIRE
Basset Hound	F	X	

Please provide history to allow for interpretation (please indicate Differential Diagnosis / Disease Suspected / Specific questions you would like answered)
DOG HAS BEEN ON GENTAMICIN TOPICALLY FOR 4-6 WEEKS.



Ear Aerobic Culture

Isolate 1
Profuse growth:Pseudomonas aeruginosa

Antibiotic	Result	MIC	Sensitivity Range
Ampicillin (1)	Resistant	N/A	(Intrinsic R)
Amoxicillin-Clavulanic acid (1)	Resistant	N/A	(Intrinsic R)
Enrofloxacin (2)	Intermediate	1	0.12 sssIir 4
Gentamicin (2)	Resistant	>=16	1 sssiR 16
Clindamycin (1)	Resistant	N/A	(Intrinsic R)
Amikacin (2)	Resistant	>=64	2 ssssiR 64
Tobramycin (2)	Resistant		
Polymyxin B (3)	Intermediate	1	0.25 iiIirrr 16
Ofloxacin (2)	SENSITIVE		
Cephalexin (1)	Resistant	N/A	(Intrinsic R)
Marbofloxacin (2)	SENSITIVE	1	0.5 sSir 4
Cefovecin (2)	Resistant	N/A	(Intrinsic R)
Ciprofloxacin (2)	SENSITIVE	0.5	0.06 sssSirr 4

Pseudomonas aeruginosa may develop resistance during prolonged therapy with all antimicrobial agents. Therefore, isolates that are initially susceptible may become resistant within three or four days after initiation of therapy. Testing of repeat isolates may be warranted.

Standardised susceptibility tests do not reflect in vivo activity of topical antibiotics due to the high levels achieved in the target site with topical administration. Please note that topical treatment with the antimicrobials listed as intermediate (e.g. Polymyxin B) may be effective in this case given the high concentrations achieved at the site.

Take Home MSG

- Physical exam and looking for primary causes essential

- Cytology will provide essential information on initial consult…
- …and at every subsequent visit until cure is achieved

- Recurrent cases need addressing underlying causes

- Culture may be useful in identifying which organisms are present
  - Overgrowth of normal flora
  - Dysbiosis
  - Infection

  - AST provides limited but valuable information

Traditional ear cytology can be challenging

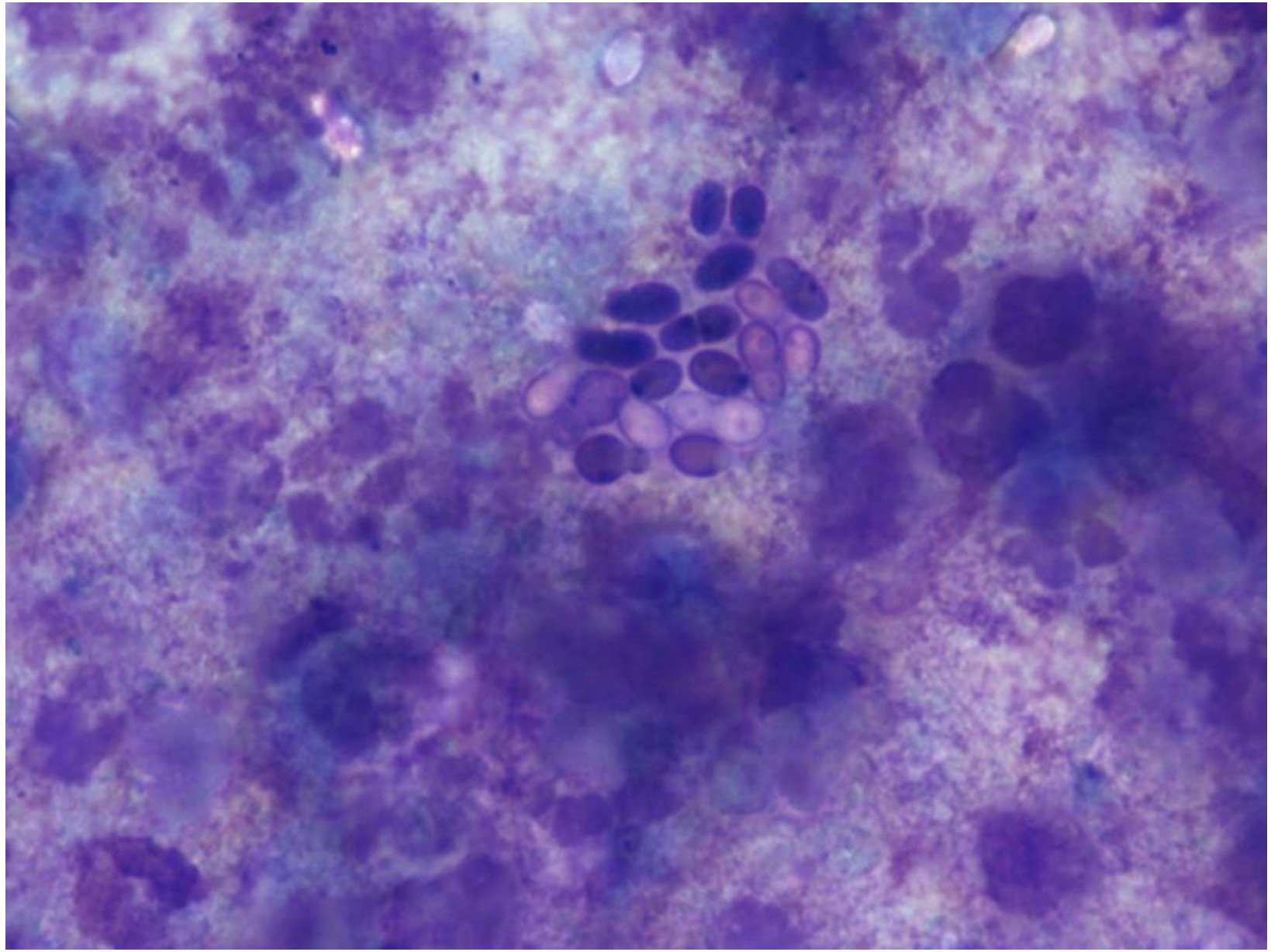
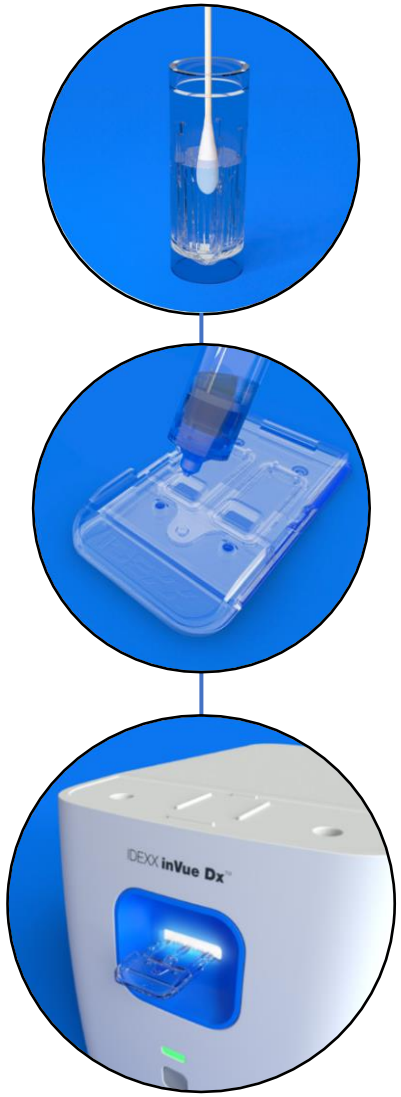


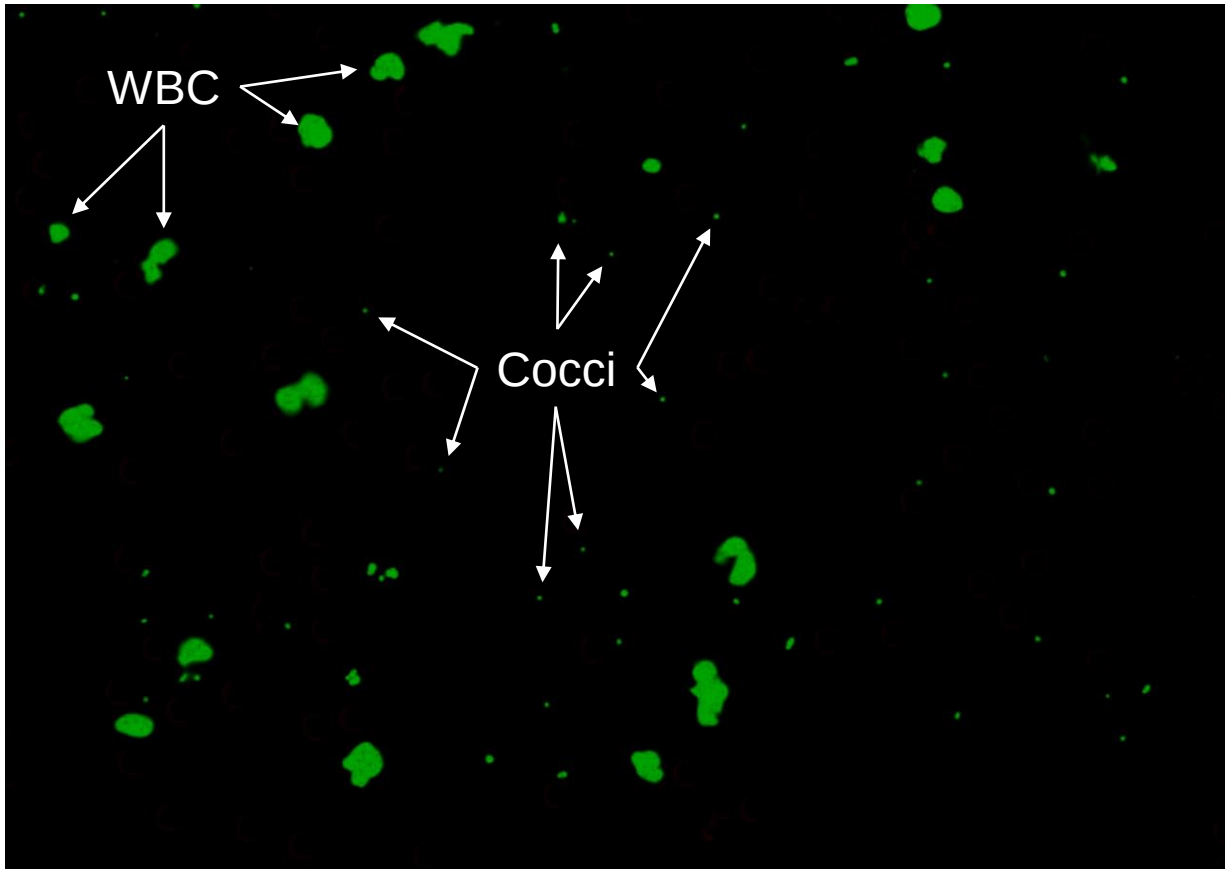
Photo courtesy of Dr. Elizabeth Layne

IDEXX inVue Dx™ analyzer: ear cytology workflow



1. **Put sample in the reagent.**
2. **Drop sample into cartridge.**
3. **Insert and press the Start button.**

IDEXX inVue Dx™ analyzer: Ear cytology



IDEXX VetLab Station 9:30 AM

SADIE 123456
Canine | Poodle | Female | 4 y | Profile

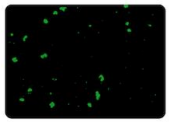
Back | Add Test

2024 | Jan 10

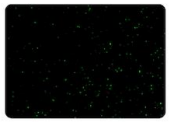
Result Details | Transfer Results

Cytology 1/10/24 8:02 AM

Left Ear

Bacteria, Cocci	**3-4+**	**Numerous coccoid-shaped bacteria present**
Bacteria, Rods	0-1+	Consistent with normal flora
Yeast	0-1+	Consistent with normal flora
WBC	**Present**	
Mites	Absent	
Diagnostic Considerations	Bacterial otitis with coccoid-shaped bacteria. The finding of numerous coccoid-shaped bacteria is 95% specific for the presence of bacterial otitis. Consider underlying causes of otitis externa, Typically these patients require longer duration of treatment or more intensive diagnostics/therapies (otic irrigation, advanced imaging to investigate potential for tumor or otitis media, foreign body presence).	
Images		

Right Ear

Bacteria, Cocci	**3-4+**	**Numerous coccoid-shaped bacteria present**
Bacteria, Rods	0-1+	Consistent with normal flora
Yeast	0-1+	Numerous yeast present
WBC	**Present**	
Mites	Absent	
Diagnostic Considerations	Bacterial otitis with coccoid-shaped bacteria. The finding of numerous coccoid-shaped bacteria is 95% specific for the presence of bacterial otitis. Consider underlying causes of otitis externa, Typically these patients require longer duration of treatment or more intensive diagnostics/therapies (otic irrigation, advanced imaging to investigate potential for tumor or otitis media, foreign body presence).	
Images		

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