



Reproductive Pathology

What is new?

Rob Foster

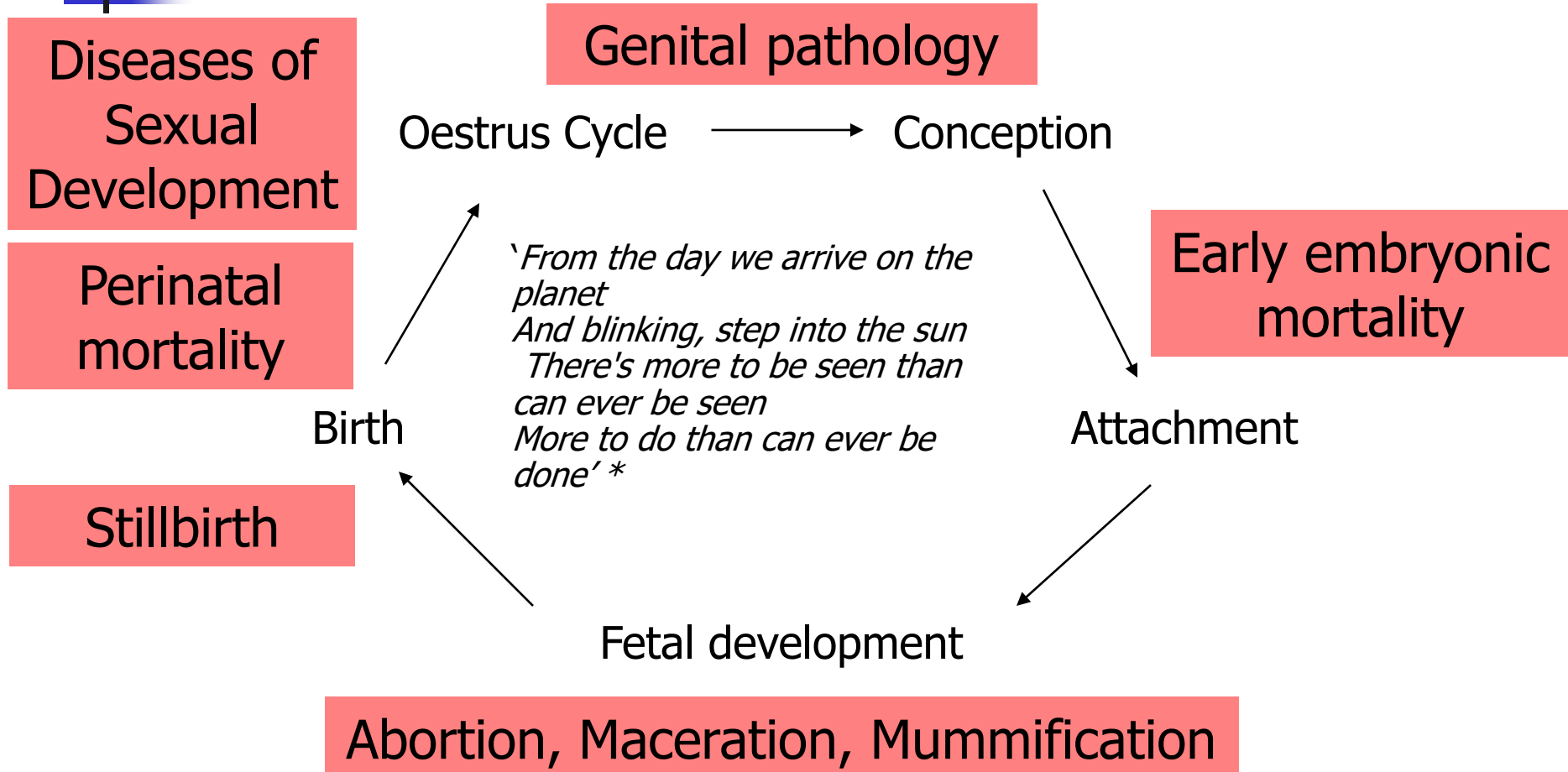
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The Circle of Life*



* "Circle of Life" Music by Elton John, lyrics by Tim Rice, Performed by Elton John



Day 2 – Companion animals

Horse

Dog

Cat



Failure of Pregnancy

Early embryonic mortality

Abortion

Stillbirth





Failure of Pregnancy

- Mother
- Foetus
- Placenta
- Infectious
- Noninfectious
- Unknown



Results of investigation of fetus and placenta (sporadic)

Species	No Dx (%)	Infection
Mare	16	34
Dog		
Cat		

Tubal transport and placental attachment



Horse 3-4 days, attach day 17-40

Dog 7-10 days, attach day 17



Persistent mating induced endometritis

- Mating induces endometritis
 - Rapid mechanical clearance
 - Inflammatory response
- Delayed uterine clearance
 - Myometrial activity is primary defect.
 - Vulvar angle and length
 - Parity
 - Condition
 - Genetics



Microbial environment

- Sterile environment
 - Ovaries
 - Uterine tubes
 - Uterus
 - Cervix
- Contamination
 - Vulva
 - Caudal vagina
 - Cranial vagina



Defences

- Innate

- Epithelium
- Cervical barrier
- Conformation
- Myometrial tone and contraction
- Secretions
- Neutrophils and macrophages
- Compliment
- Cytokines

- Adaptive

- Humoral
- Cell mediated



Endometrial biopsy

- Horse
 - Well established protocols
 - Kenny and Doig
- Dog
 - Being developed by Dr Don Schlafer, Cornell University



Equine endometrial biopsy

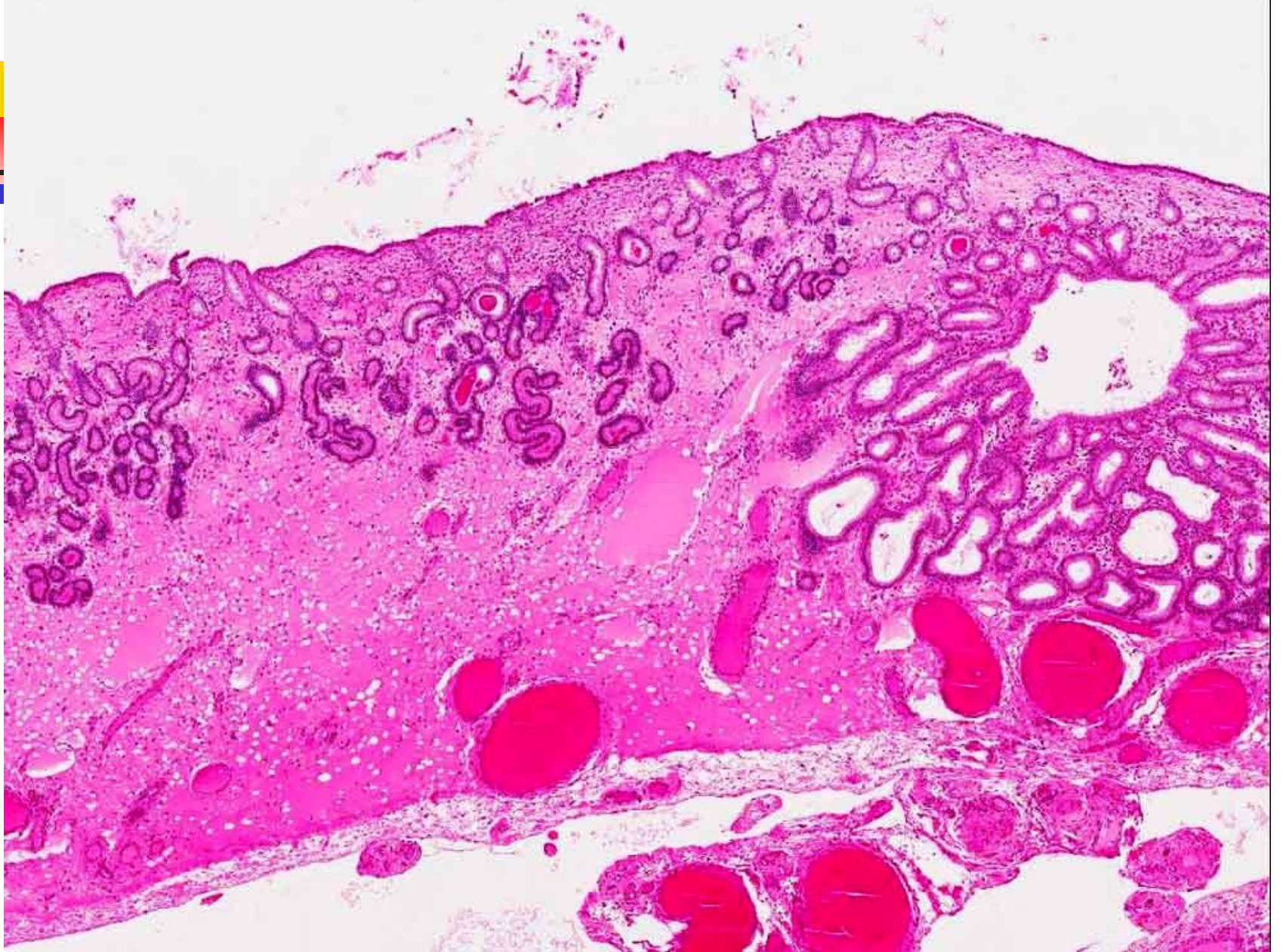
- Likelihood of live foaling
 - Grade 1 – 80+
 - Grade 2a – 50-80%
 - Grade 2b – 10-50%
 - Grade 3 - <10%
-
- Pathologists grade often different to Theriogenologists

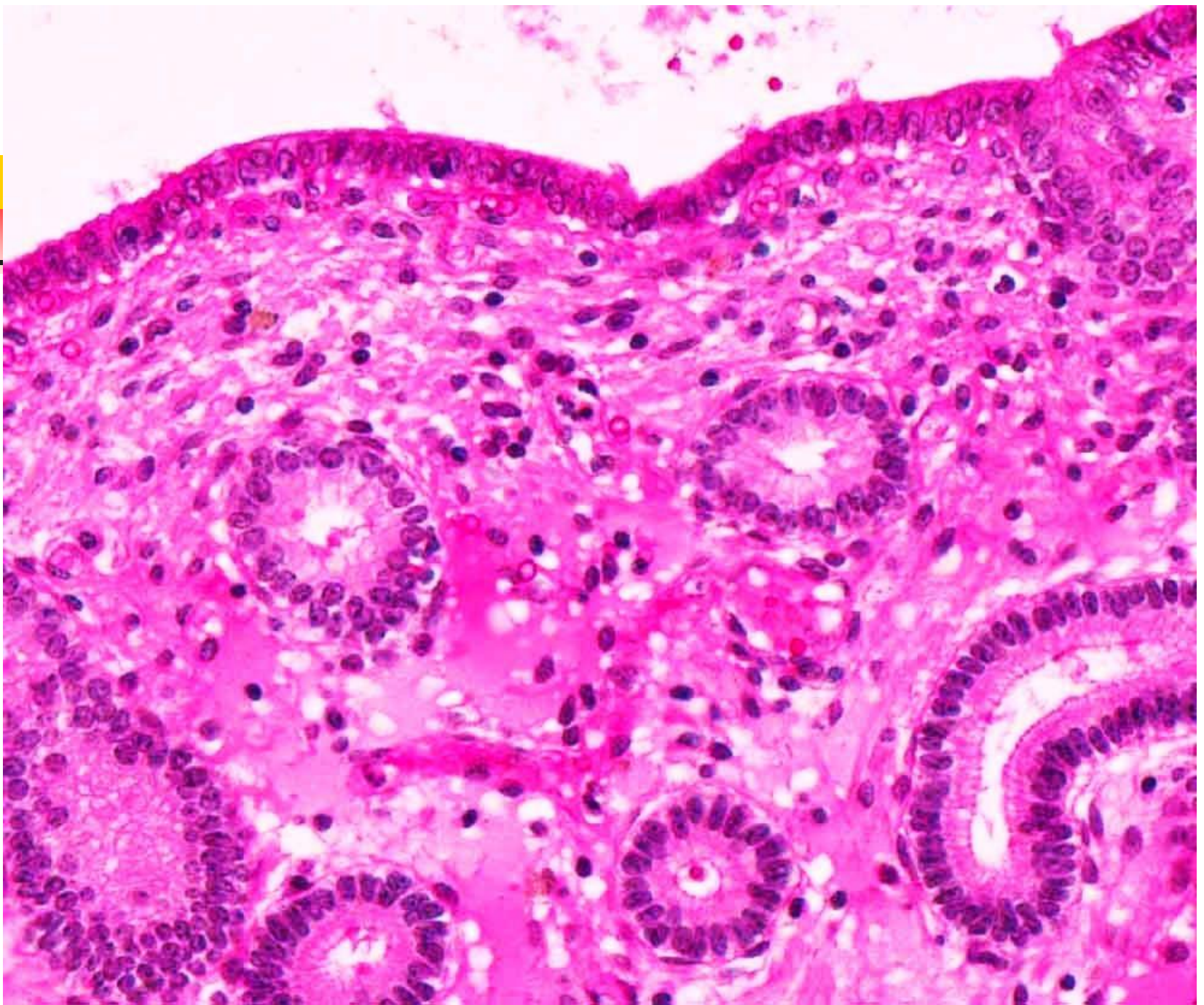


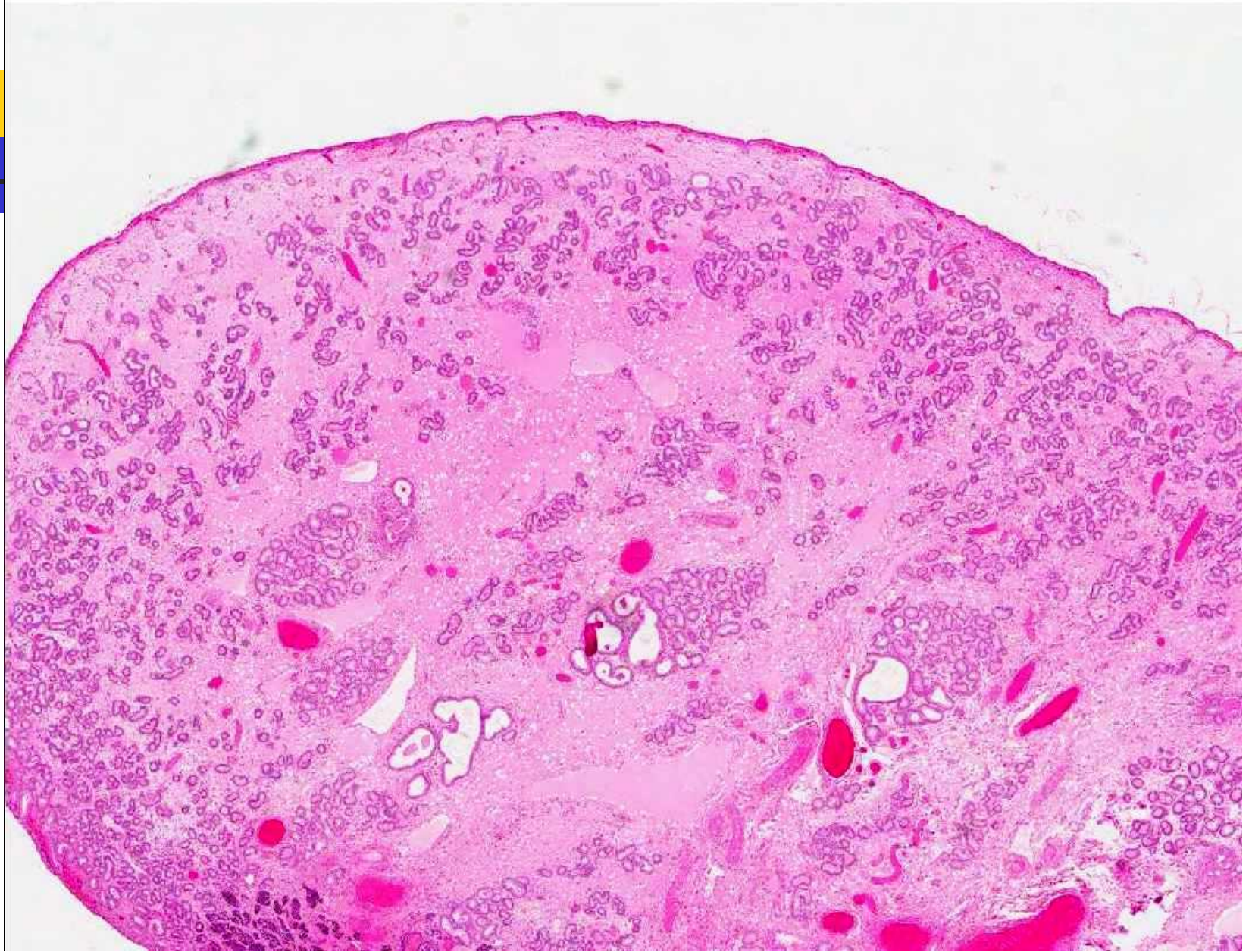
Evaluation of endometrial biopsy

- Use a 'synoptic report' approach
- Suitability of sample
- Stage of cycle
- Cells: neutrophils, lymphocytes, plasma cells, lymphoid follicles
- Fibrosis – nests
- Compartments: luminal, epithelium, Stratum compactum, stratum lucidum, glands, deeper structures, blood vessels











Placenta

- Protection, nutrition, respiration and endocrine control.
- Great immunological importance
 - transfer of antibodies
 - tolerance
 - regulation of foetal development
 - release of cytokines
 - many lymphocytes and immune cells



Maternal recognition of pregnancy

- Bovine

- IFN-t is anti PGF.
- Luteostasis inhibits oxytocin production by CL

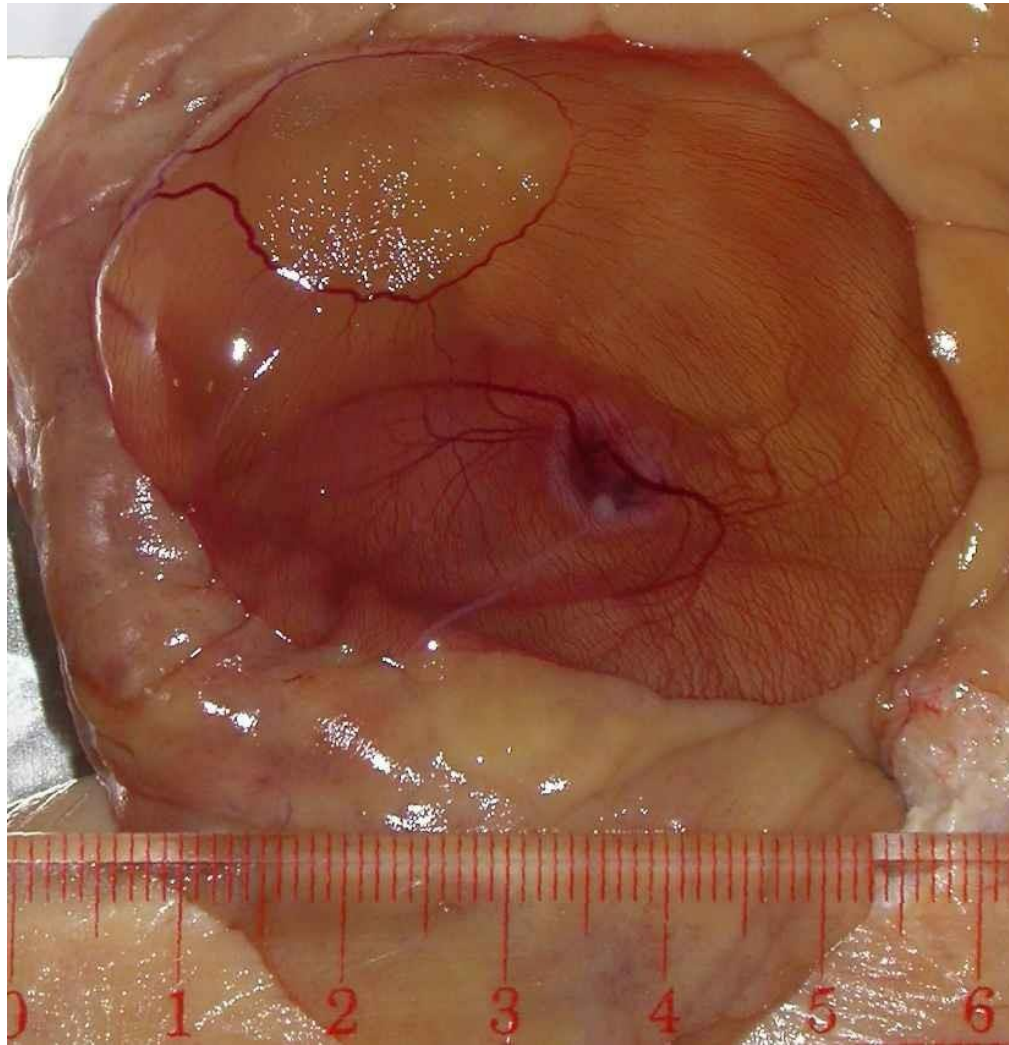
- Mare, Pig

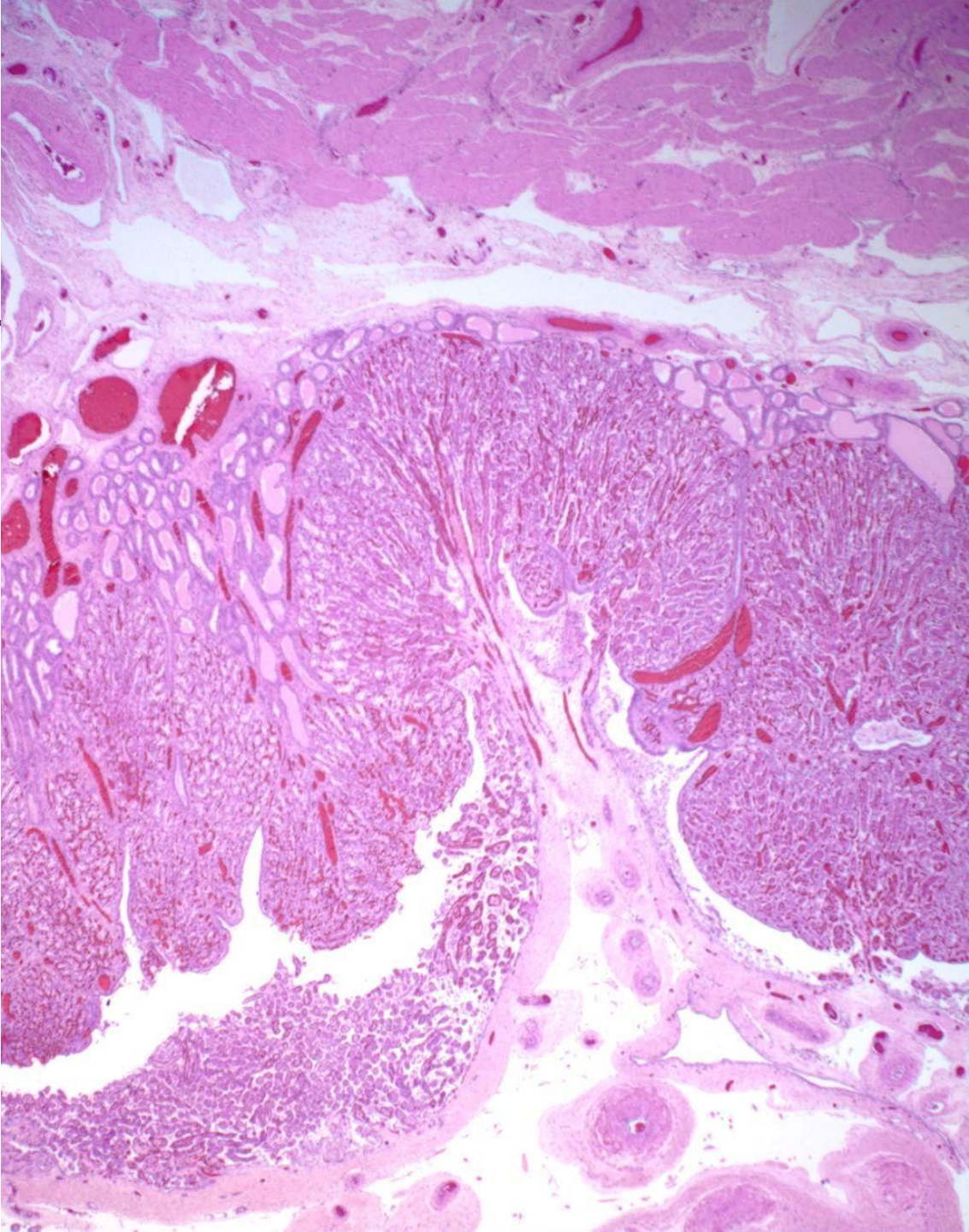
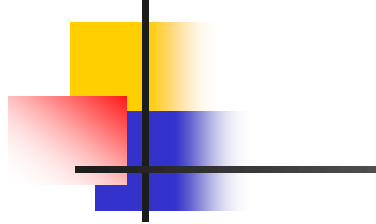
- ? Estrogens, PGF and PGE
- Oxytocin secreted by endometrium

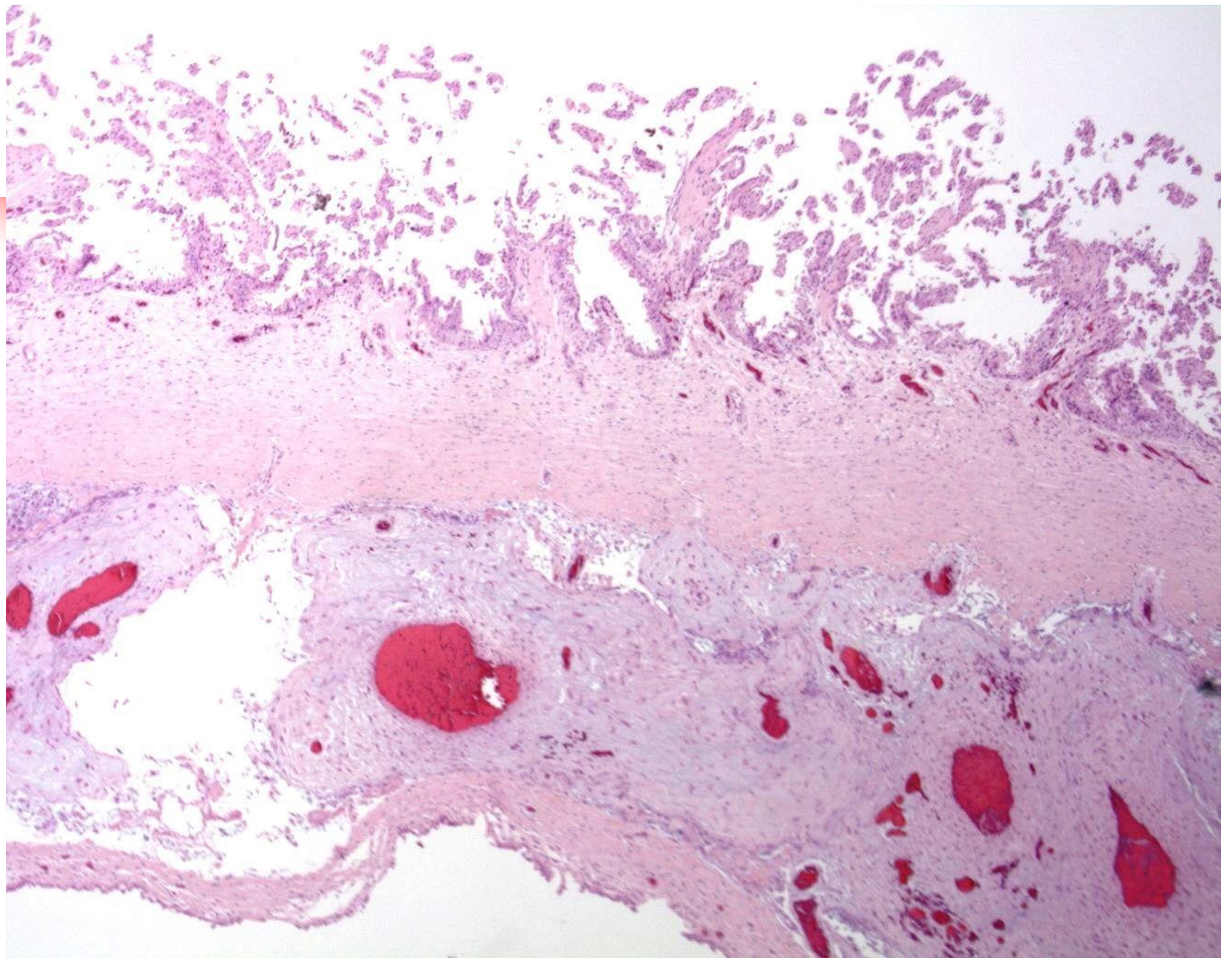


Photo complements of Dr Tony Hayes

Equine day 45









Equine placenta

- Twinning is common
- Live twins are rare!
- The equine placenta has no redundant capacity!

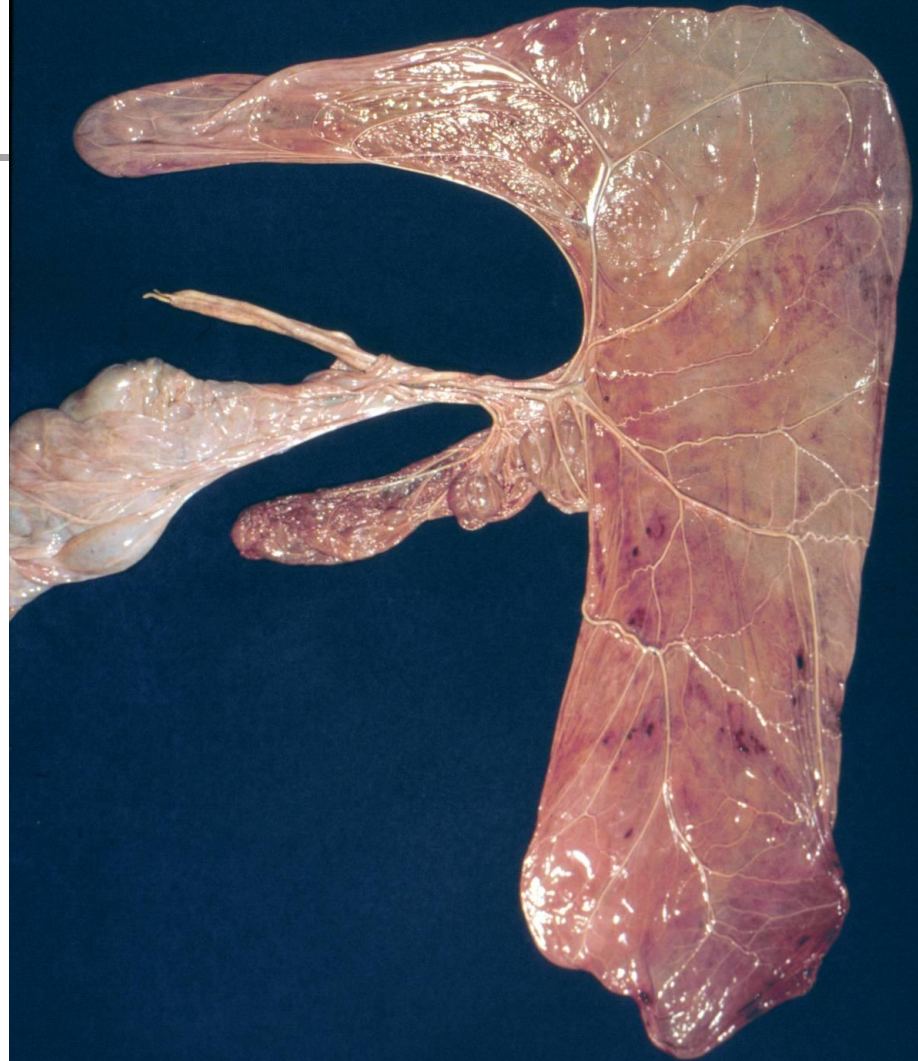




Equine placenta



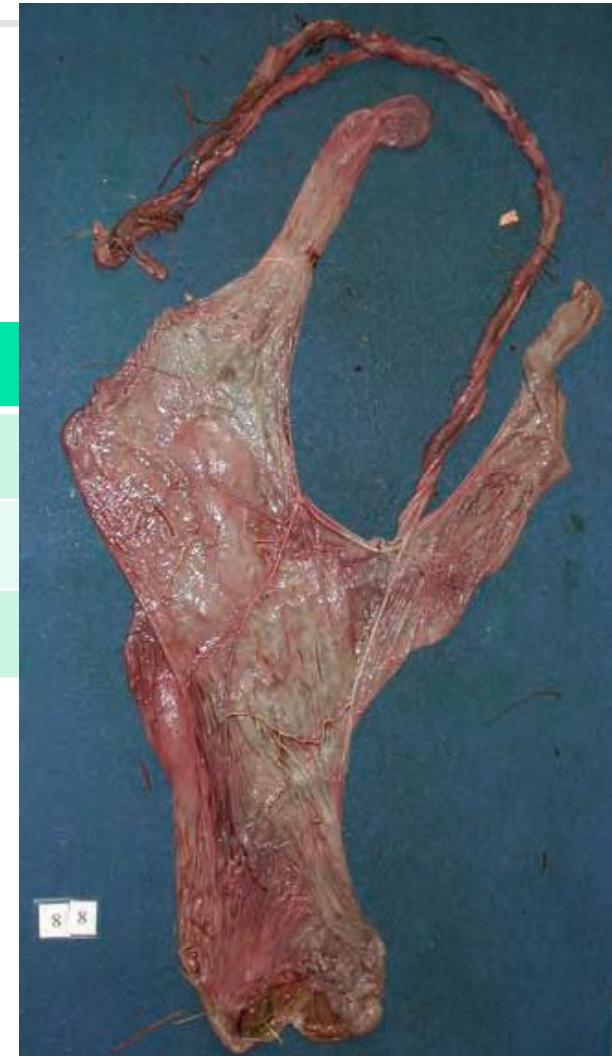
Allantoic surface



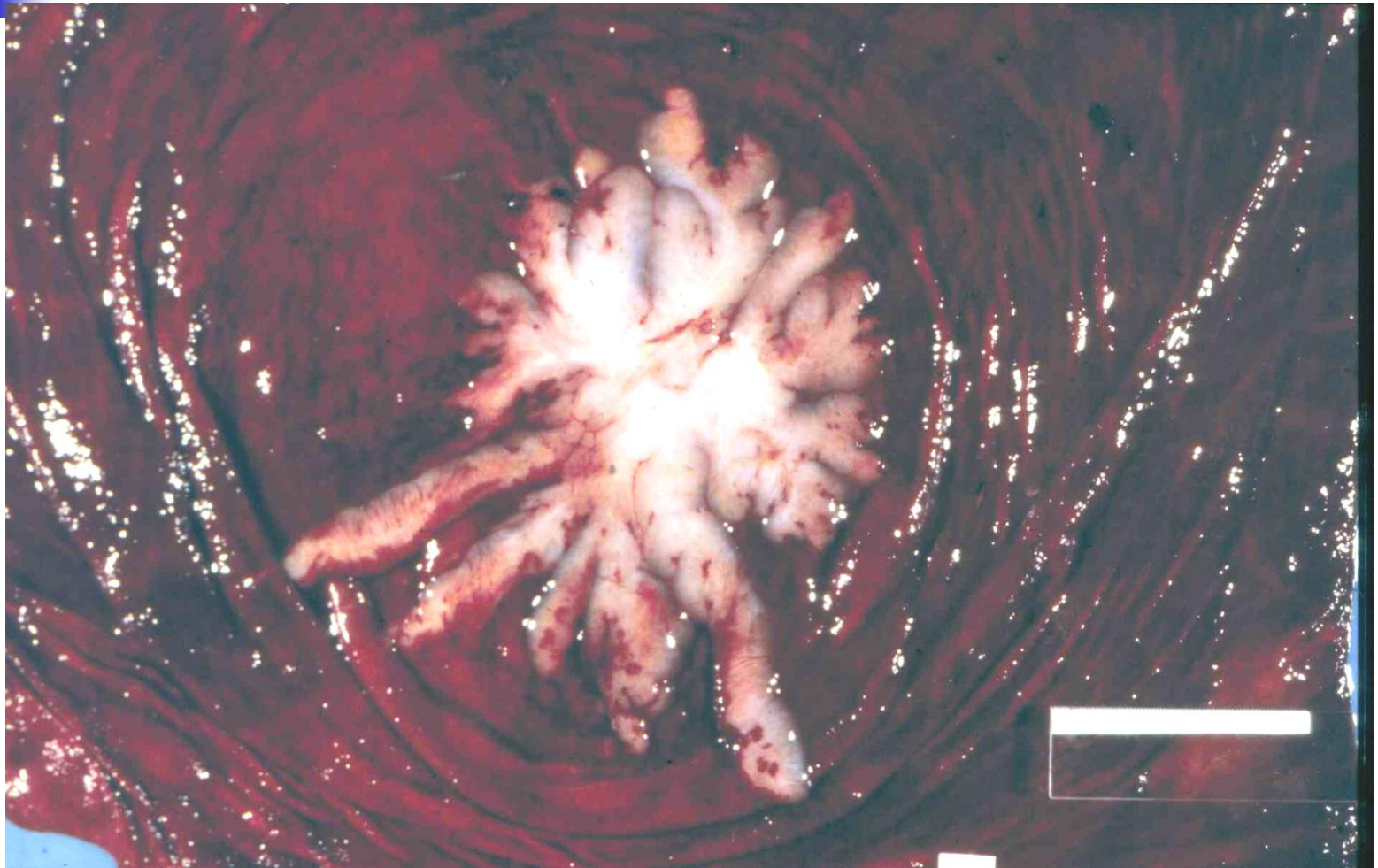
Pregnant horn, attachment

Pregnancy side at term

Attachment side	Left	Right
Left	25	16
Right	6	45

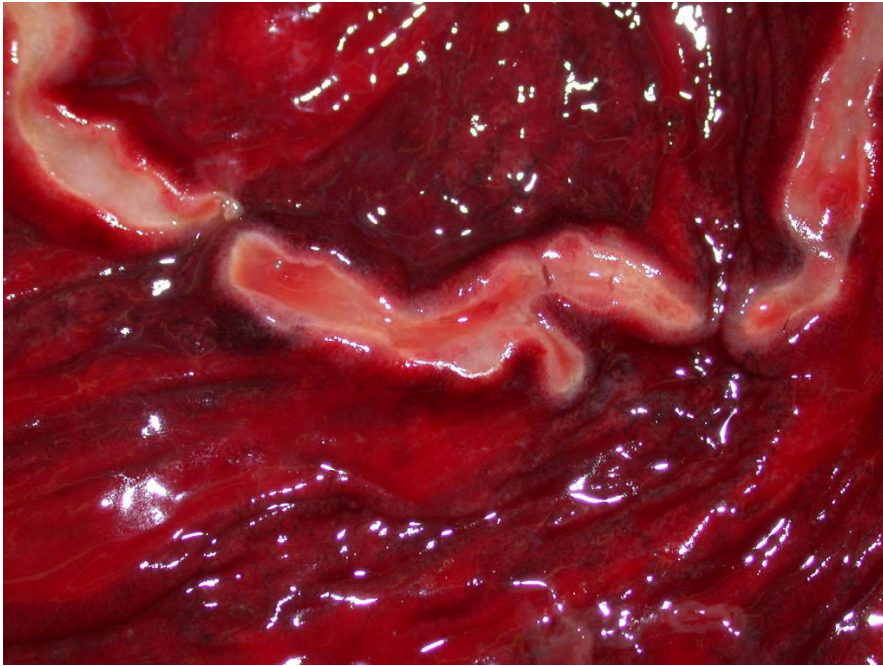


Cervical Star





Endometrial cups



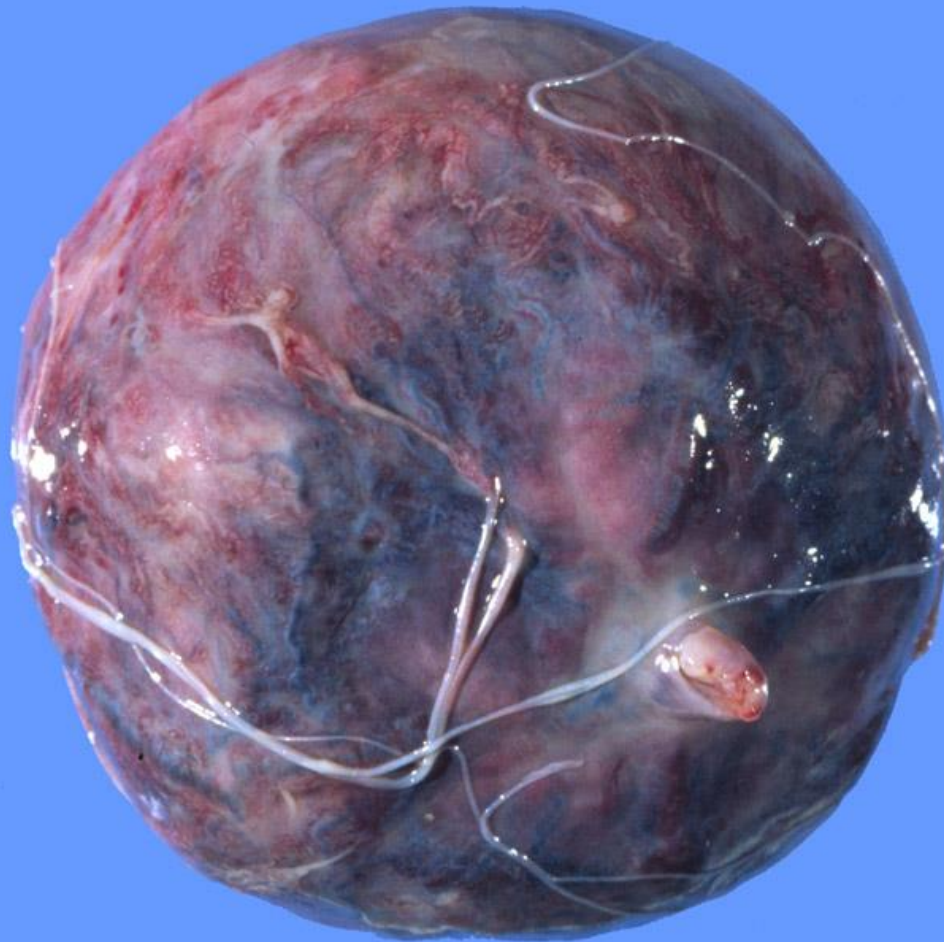
Attachment of cord



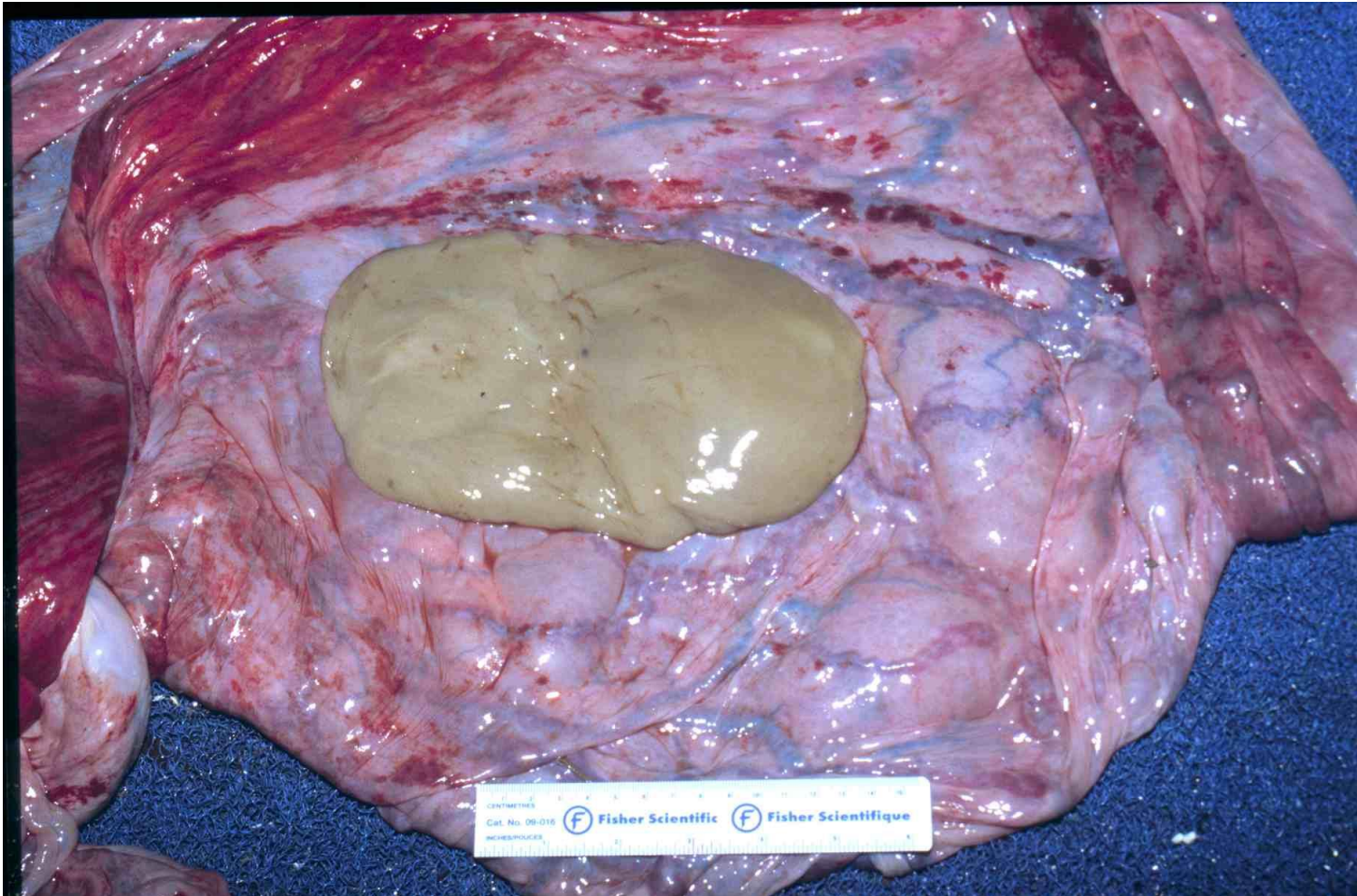
Allantoic pouch



Yolk sac remnant



Hippomane

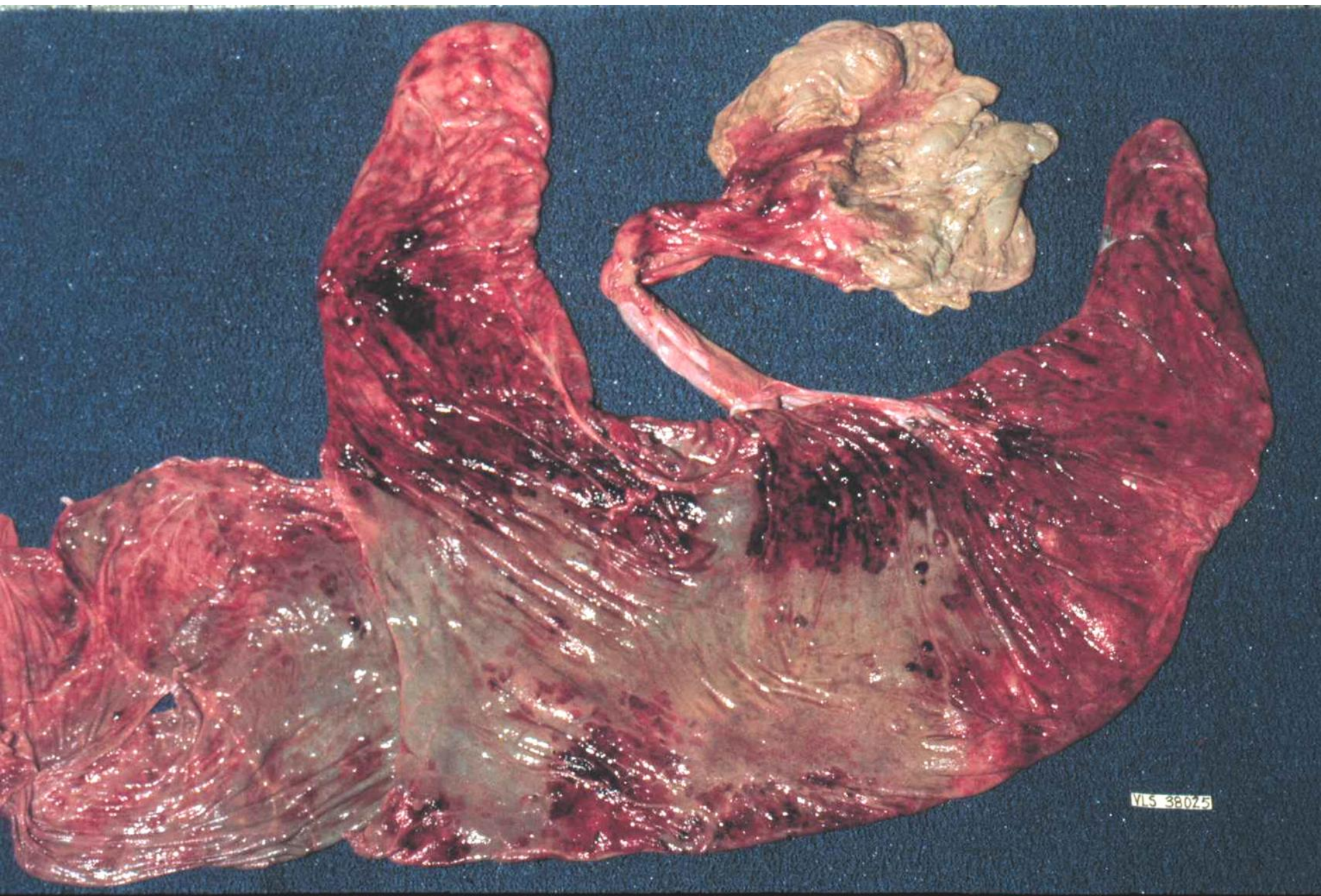




Amnion nodosum

- Don Schlaffer
- Horse mostly
- Mechanical abrasion
- Oligohydroamnion
- Allantoic epithelial cystic dysplasia





VLS 38025

Allantoic 'dysplasia'

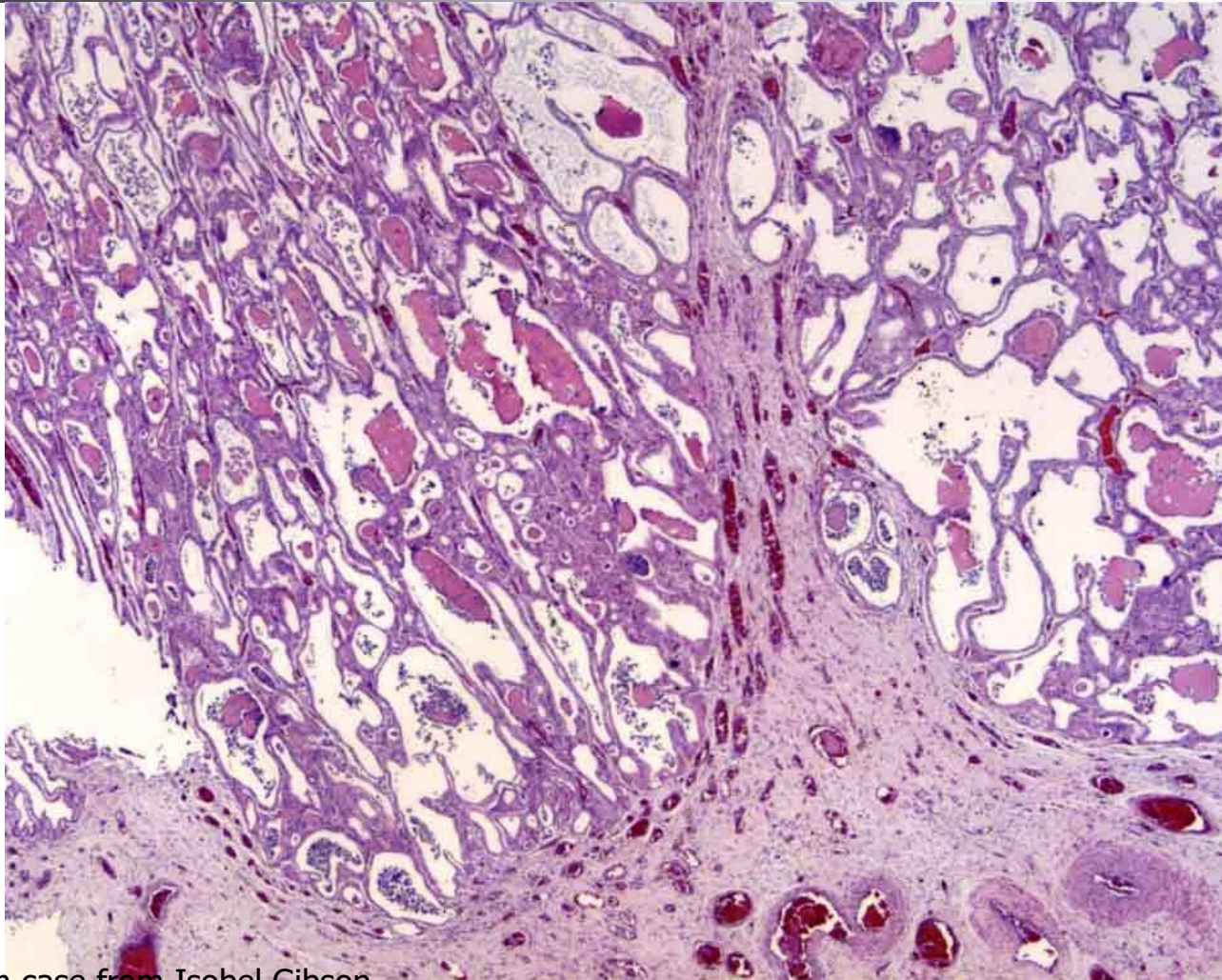


Photo from case from Isobel Gibson



Kentucky

■ No diagnosis	16	■ Infectious	37
■ Noninfectious	47	■ Bacteria	18
■ Dystocia/trauma	19	■ Placentitis	10
■ congenital defects	10	■ EHV	4
■ placental edema	7	■ Leptospirosis	2
■ twins	6	■ Fungal	2
■ cord abnormality	3	■ Nocardia	1
■ body pregnancy	2		

Giles *et al* 1993, Causes of abortion, stillbirth and perinatal death in horses. 3,527 cases. JAVMA 203: 1170-1175



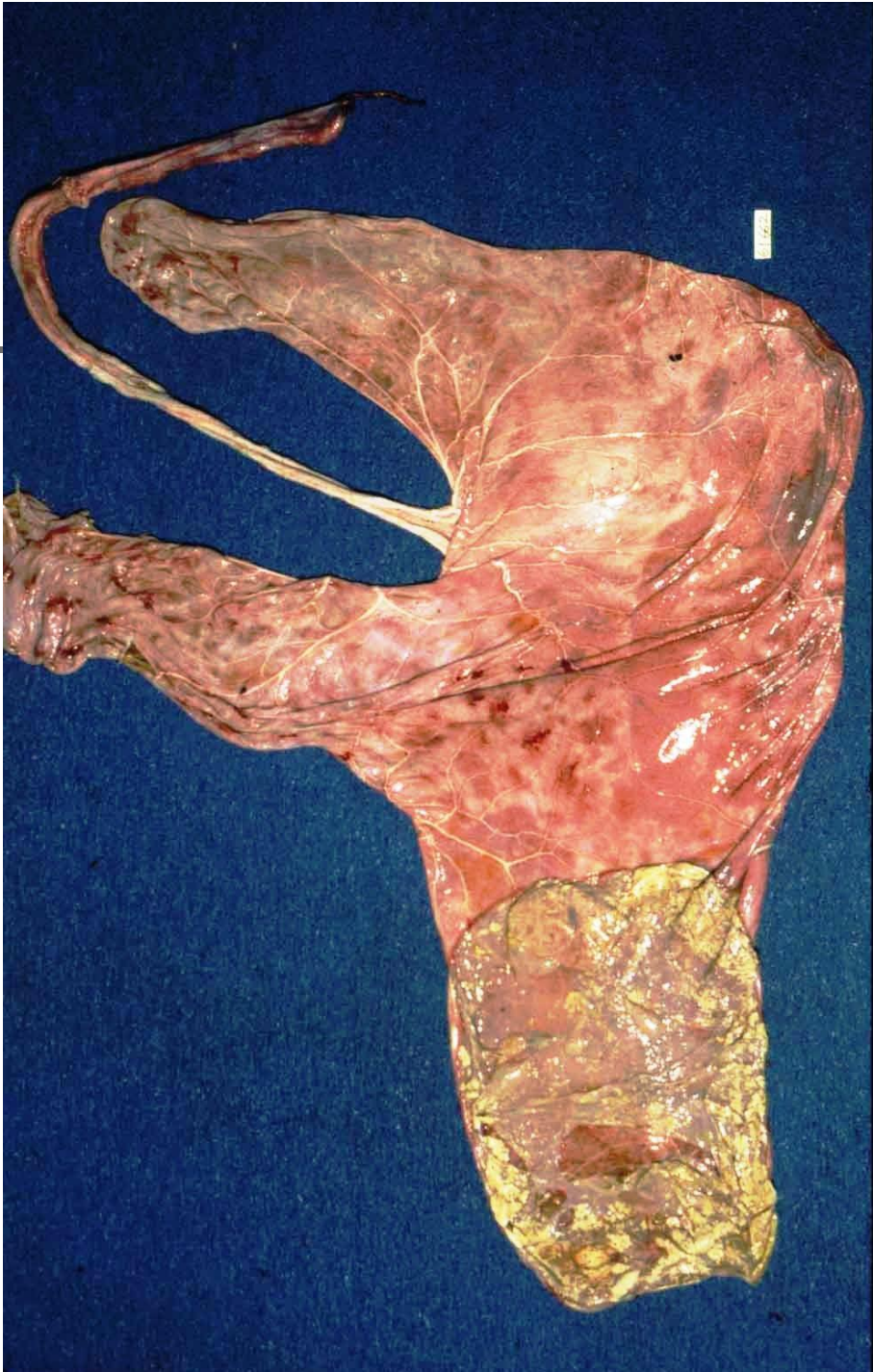
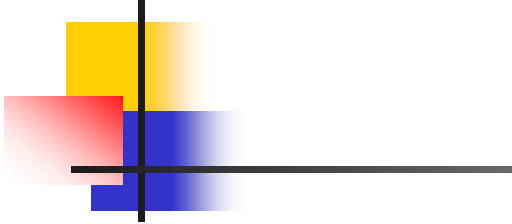
Maternal disease

- Systemic disease
 - Cytokine/inflammation
- Stress and luteolysis
- Ischemia/hypoxia
- Hyperthermia



Placental abnormalities







Cord Abnormalities

- too short <36 cm
- too long >83 cm
 - placental infarct
 - torsion
 - strangulation

Cord abnormalities - torsion



Twinning



Body pregnancy





Infectious Failure of Pregnancy

Infection

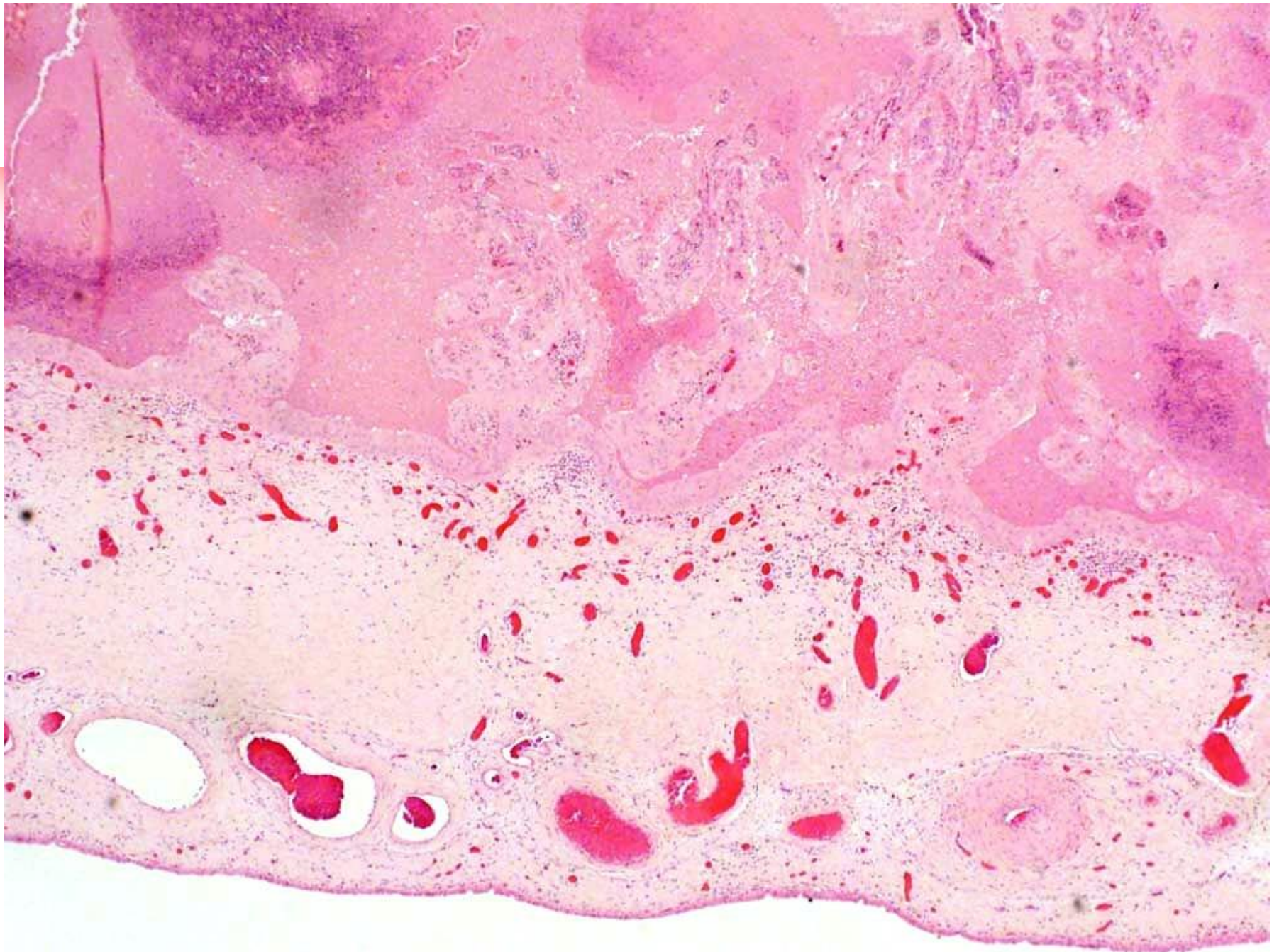
Not all agents are as 'pathogenic' as we might expect.

Inflammation

This is more important than we think!

Placentitis







Regionally important

- Fescue endophyte mycotoxicosis
 - *Neotyphodium coenophialum*
 - Ergot alkaloids
 - Hyperthermia
 - Placental edema and thickening
 - Dysmaturity
 - Prolonged gestation

Endophyte toxicosis





'Mare Reproductive Loss Syndrome'

- 2001 and 2002 foaling season
- Early fetal loss (>day 40) – about day 80
- Peak about May 7th
- Link to Eastern Tent Caterpillar (skin)
- Increased evidence of foetal sepsis.

- Hairs penetrate intestine – endotoxemia/bacteremia



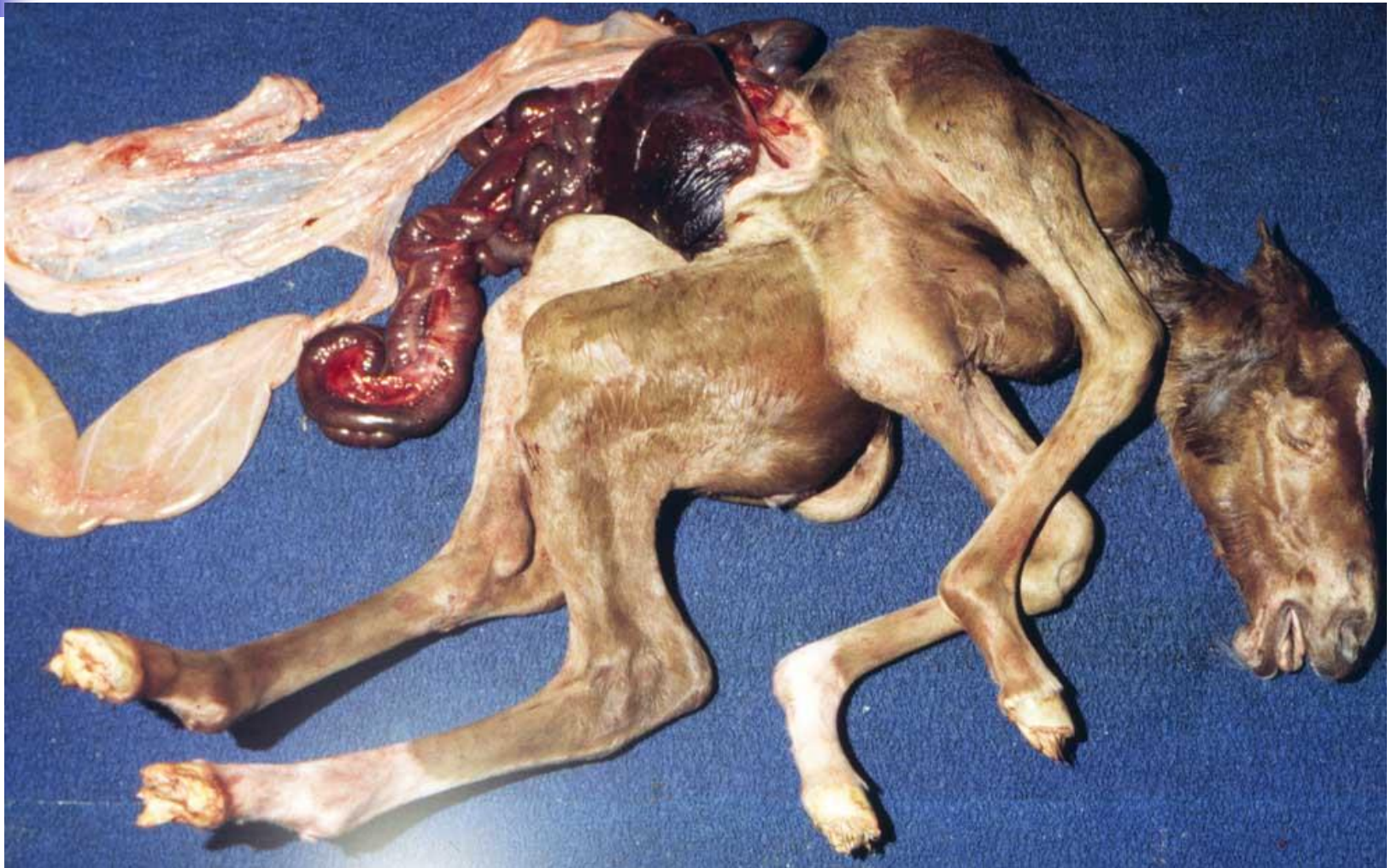
Equine amnionitis and foetal loss

“The most common combination of abnormalities in all cases was culture of an environmental coryneform from lung and stomach contents with no histopathologic change in the amnion, allantoic surface of the chorioallantois, umbilical cord and lung (18%); or positive culture of bacteria and acute to chronic amnionitis inflammation of the allantoic surface of the chorioallantois, and funisitis with or without fetal pneumonia (48%)”.



Foetal lesions

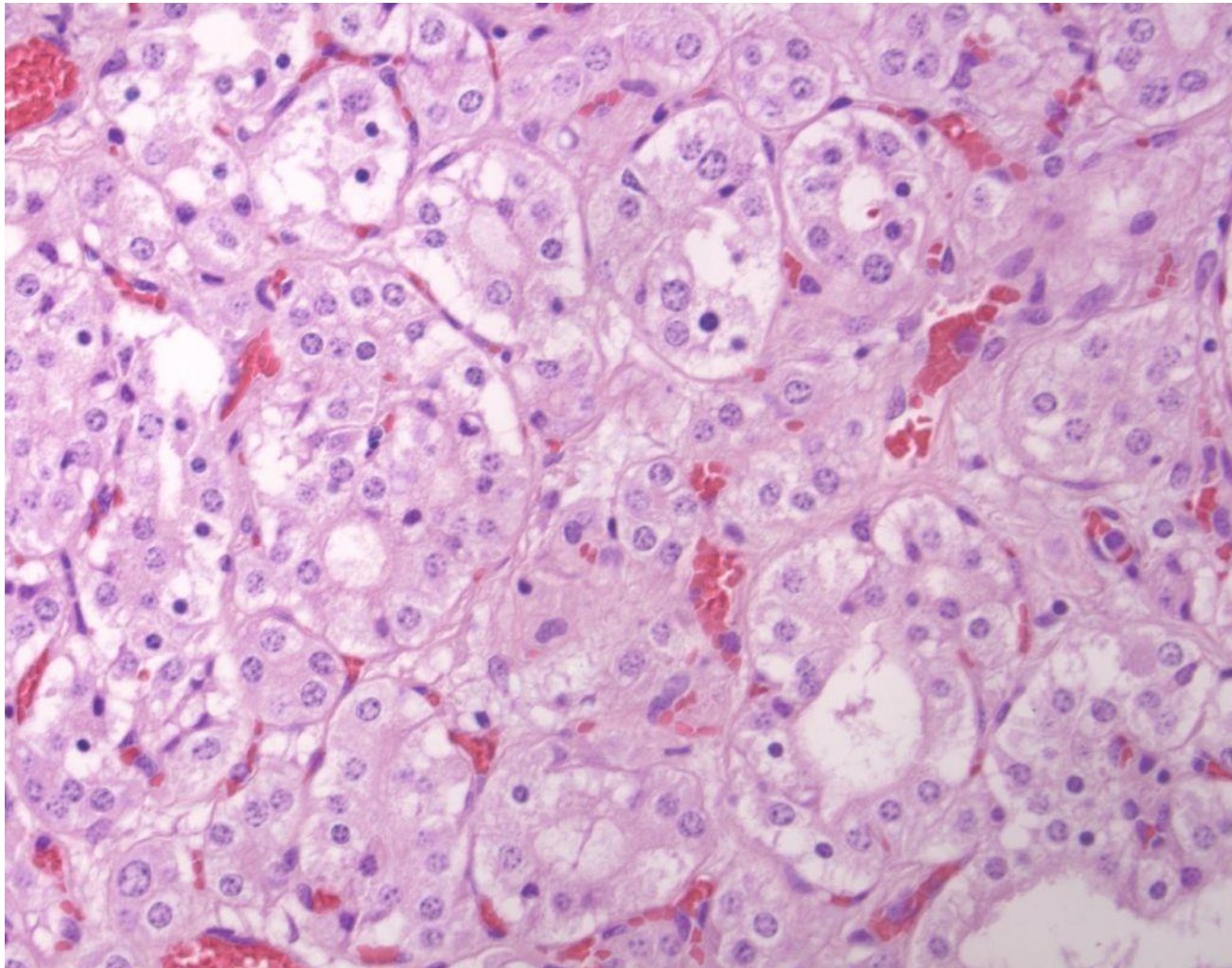
Schistosomus reflexus



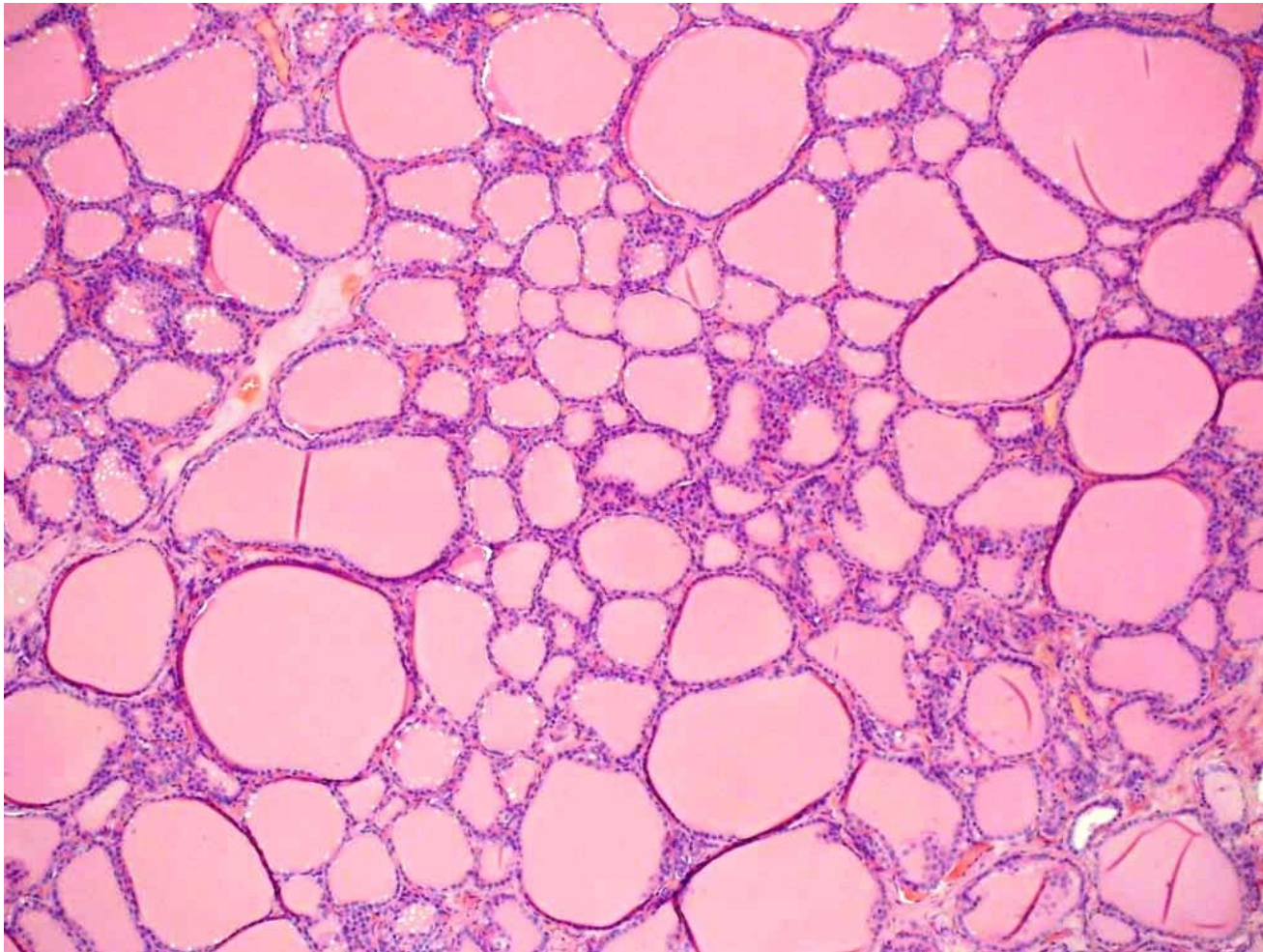
Osteopetrosis

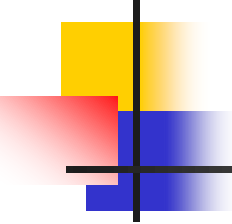


Thyroid hyperplasia



Normal foetal thyroid





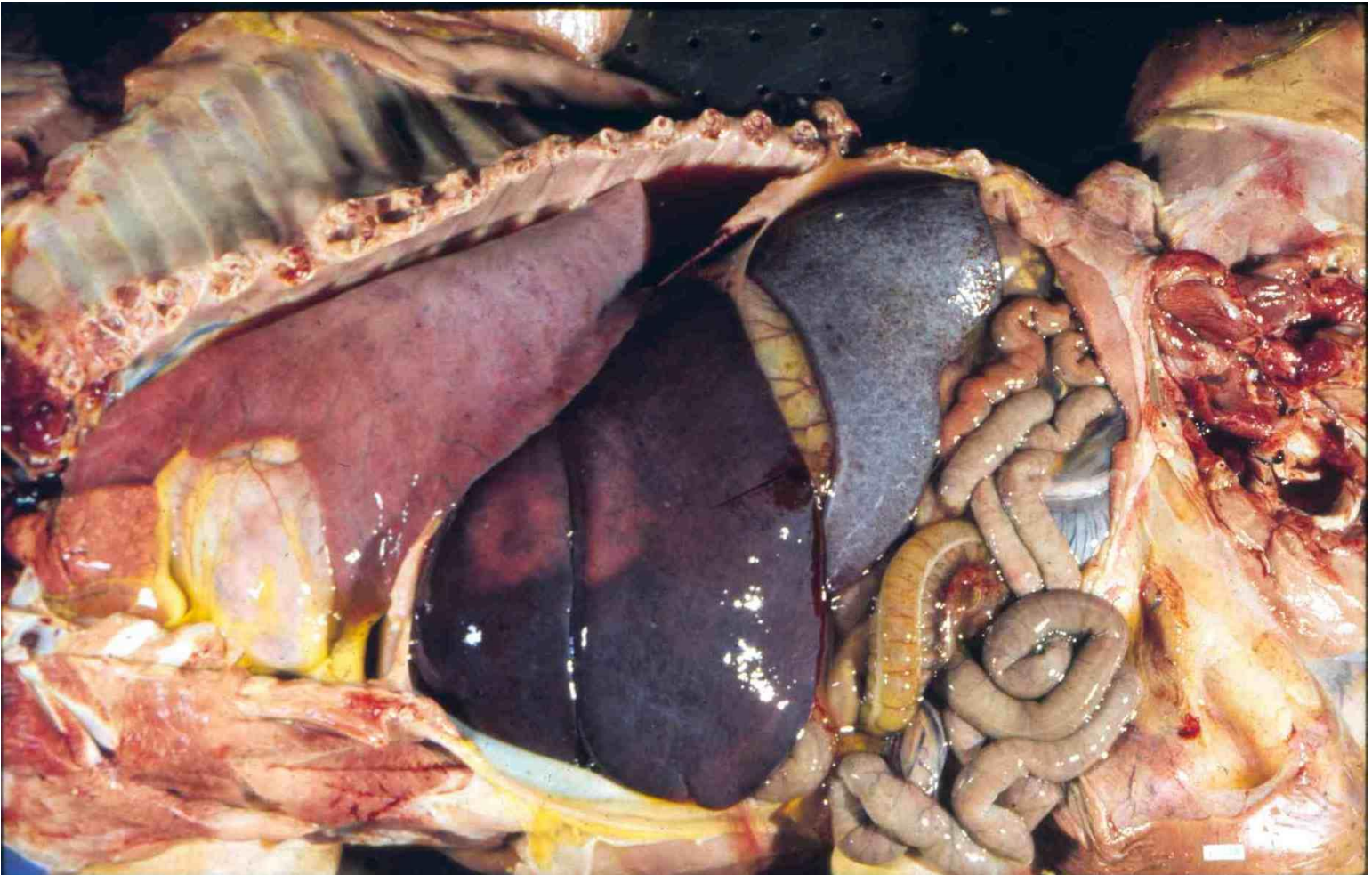
Musculoskeletal disease and thyroid hyperplasia

- Variety of skeletal abnormalities
 - Limb deformities
 - Arthrogryposis
 - Osteopetrosis
- Thyroids are macroscopically normal, but microscopic hyperplasia
- Vague increased mortality, poor doing, more perinatal mortality
- Poor feeds nitrite/nitrate

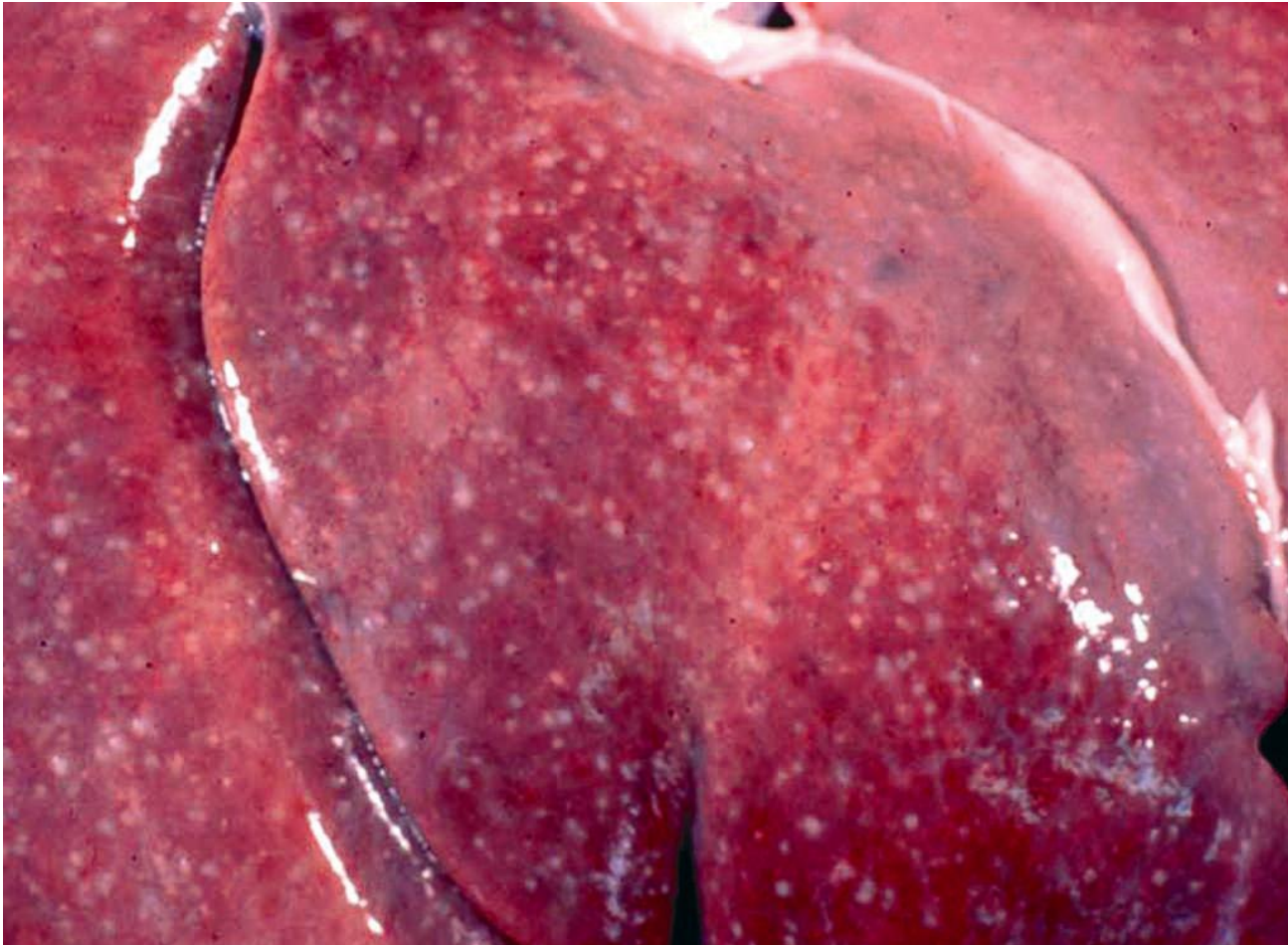
Fibrin cast of EHV1



Equine herpesvirus



Equine herpesvirus





Canine and Feline FOP

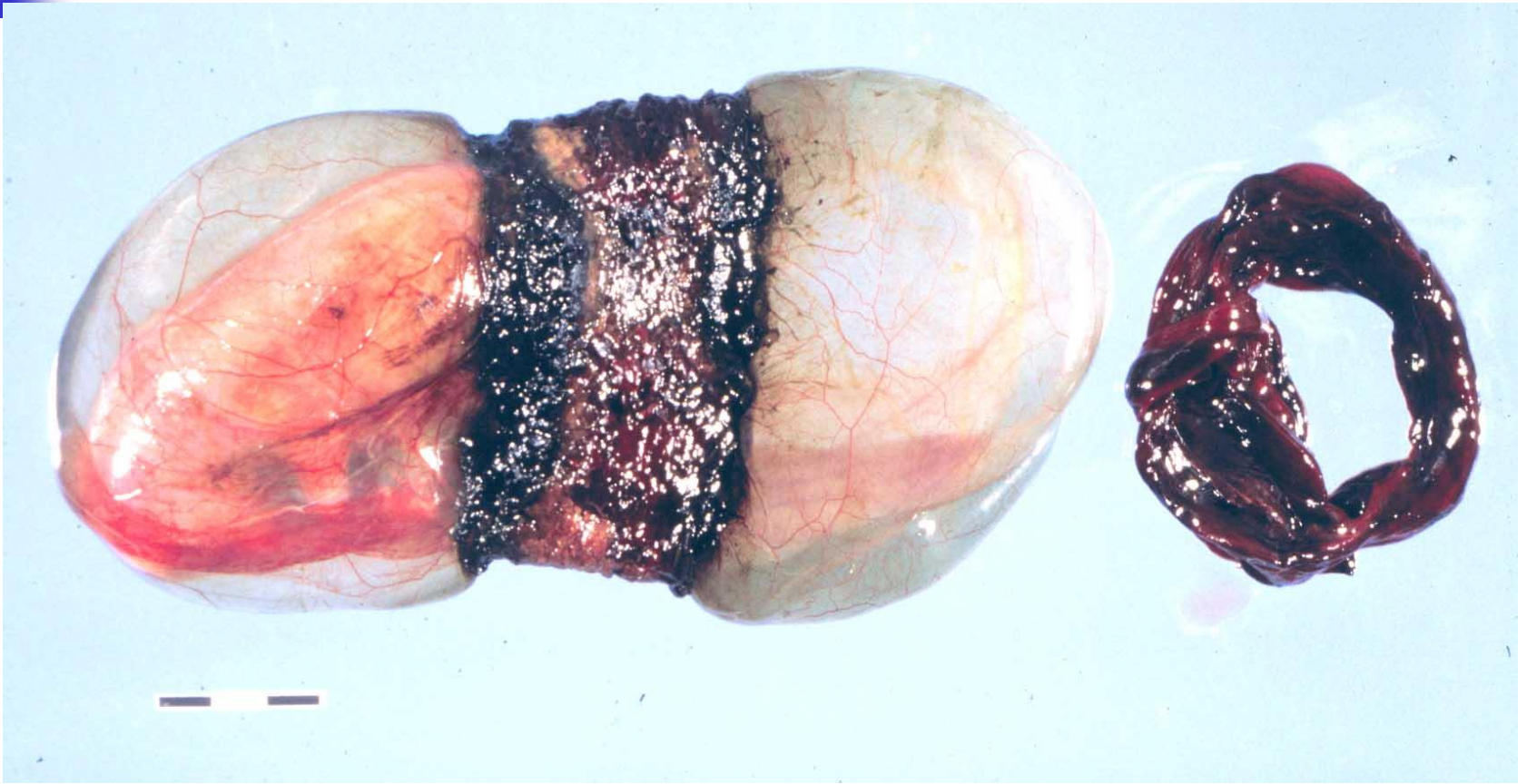
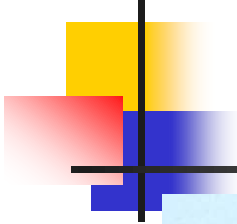
Typical aborted puppy – why?





Time of Death

- 12 hr cornea cloudy
 - 24 -36 hr fluid in cavities
 - 72 hr dehydration begins
 - 144 mummy
-
- Dogs have a long diestrous period – pregnancy is maintained despite fetal death





Failure of Pregnancy - Dogs

- Bacteria
 - *Streptococcus* spp
 - *Brucella canis*
 - *Salmonella*
 - *Campylobacter*
 - *Mycoplasma/Ureaplasma*
 - Other
- Viruses
 - Canine herpesvirus
 - Canine distemper/hepatitis
- Protozoa
 - Toxoplasma
 - Neospora
- **Endocrine**
 - Progesterone deficiency (hypoluteism)
 - Hypothyroidism



Failure of pregnancy - Cats

- Feline herpesvirus
- Feline calicivirus
- FIV, FeLV
- *Salmonella*



Stillbirth and perinatal mortality





Expectations

- Equine pregnancy rate
 - ~50%
- Canine
 - Up to 20% mortality
- Feline
 - Litter size 4.6
 - Birth weight 93.5g
 - Stillbirth 7.2%
 - Perinatal mortality 9.1% (to 8 weeks)



Perinatal mortality – dogs

- Expectations:
 - 2622 boxer puppies, 413 litters
 - 22% died before 7 weeks
 - Up to 30% attributable to infection
 - Up to 14% for white colour
 - Stillbirth the most common category.



Fetus *en utero*

- Receives nutrients, oxygen, protection
- Wastes are removed

- Moves
- Swallows
- Doesn't 'breath'

- Initiates parturition



Breathing

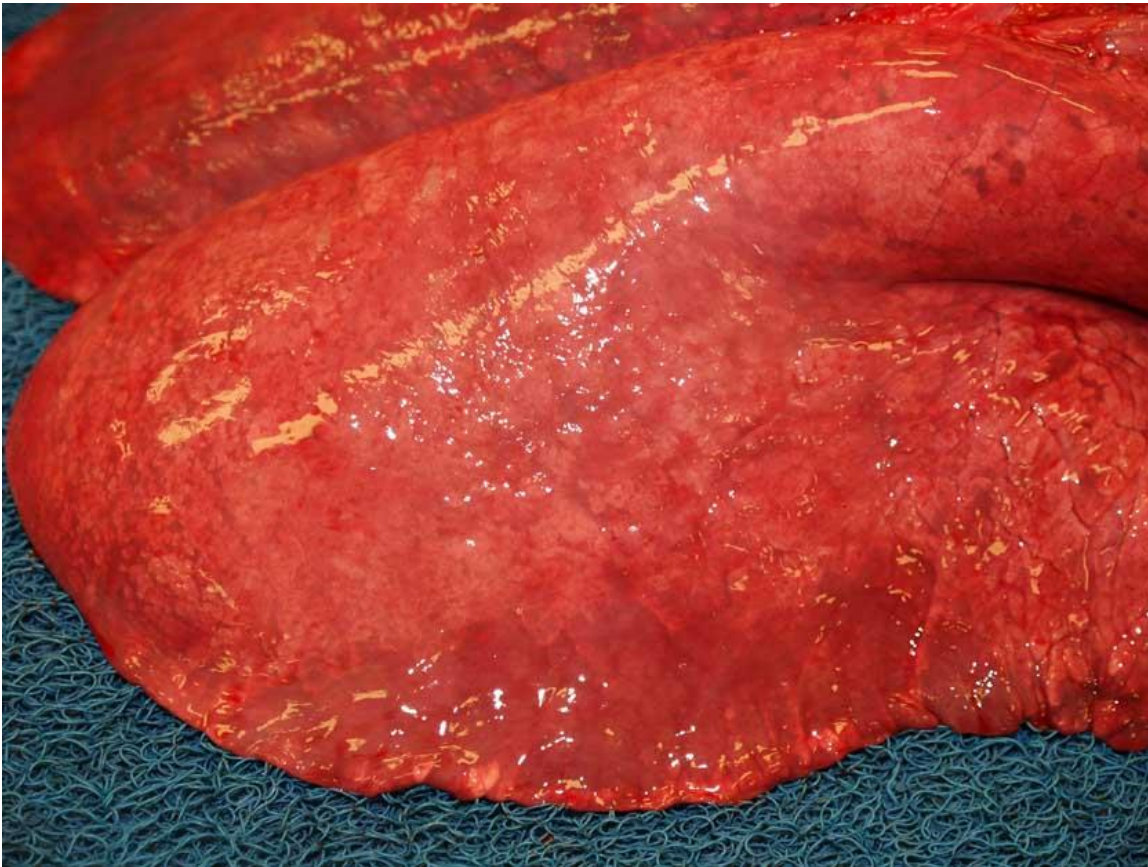
- Inhibited before birth
- Lungs atelectatic
- Begins immediately
- Hypoxia
 - Compression of umbilical cord
 - Premature separation of placenta
 - Excessive contraction of uterus (maternal supply)
 - Intracranial hemorrhage

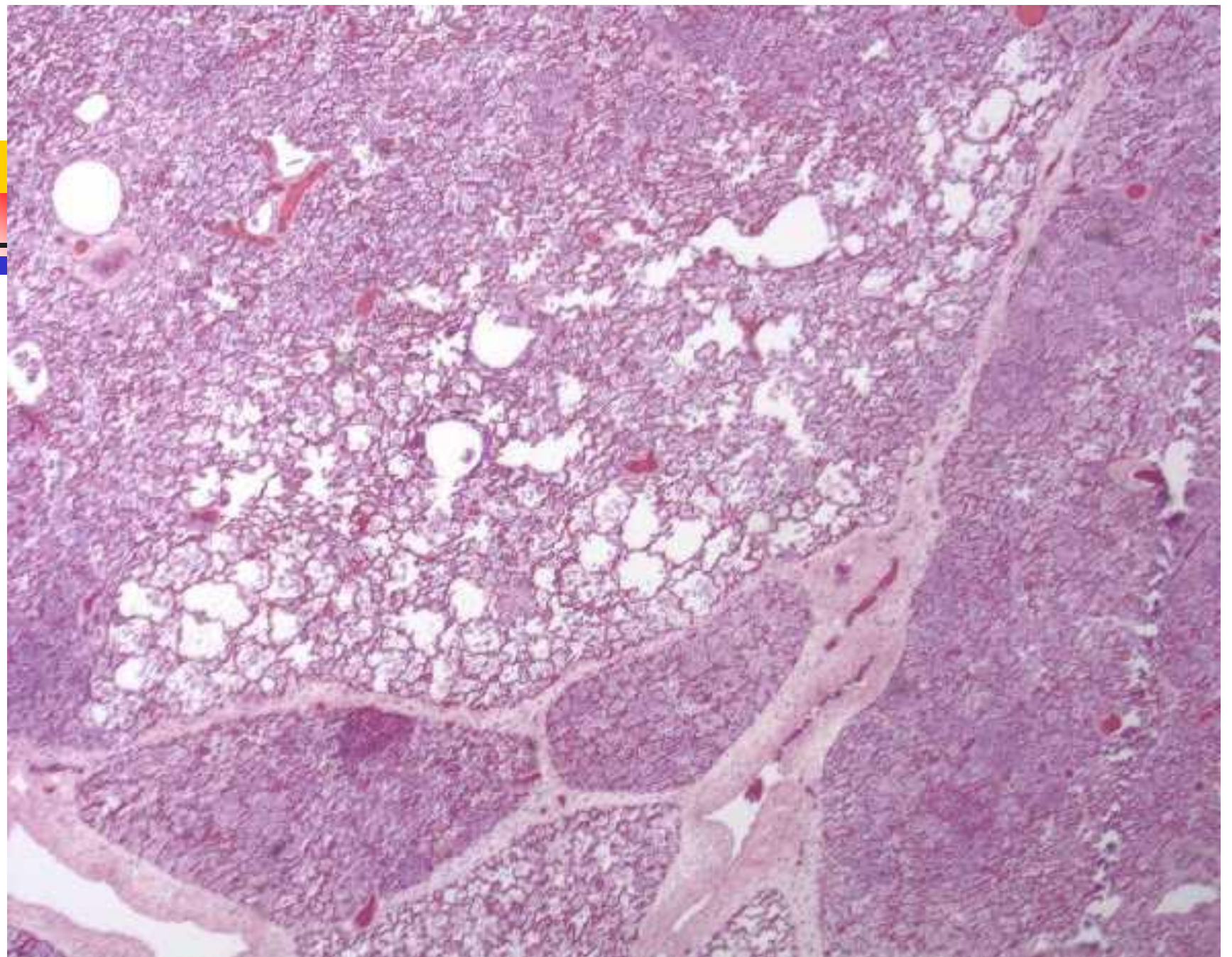


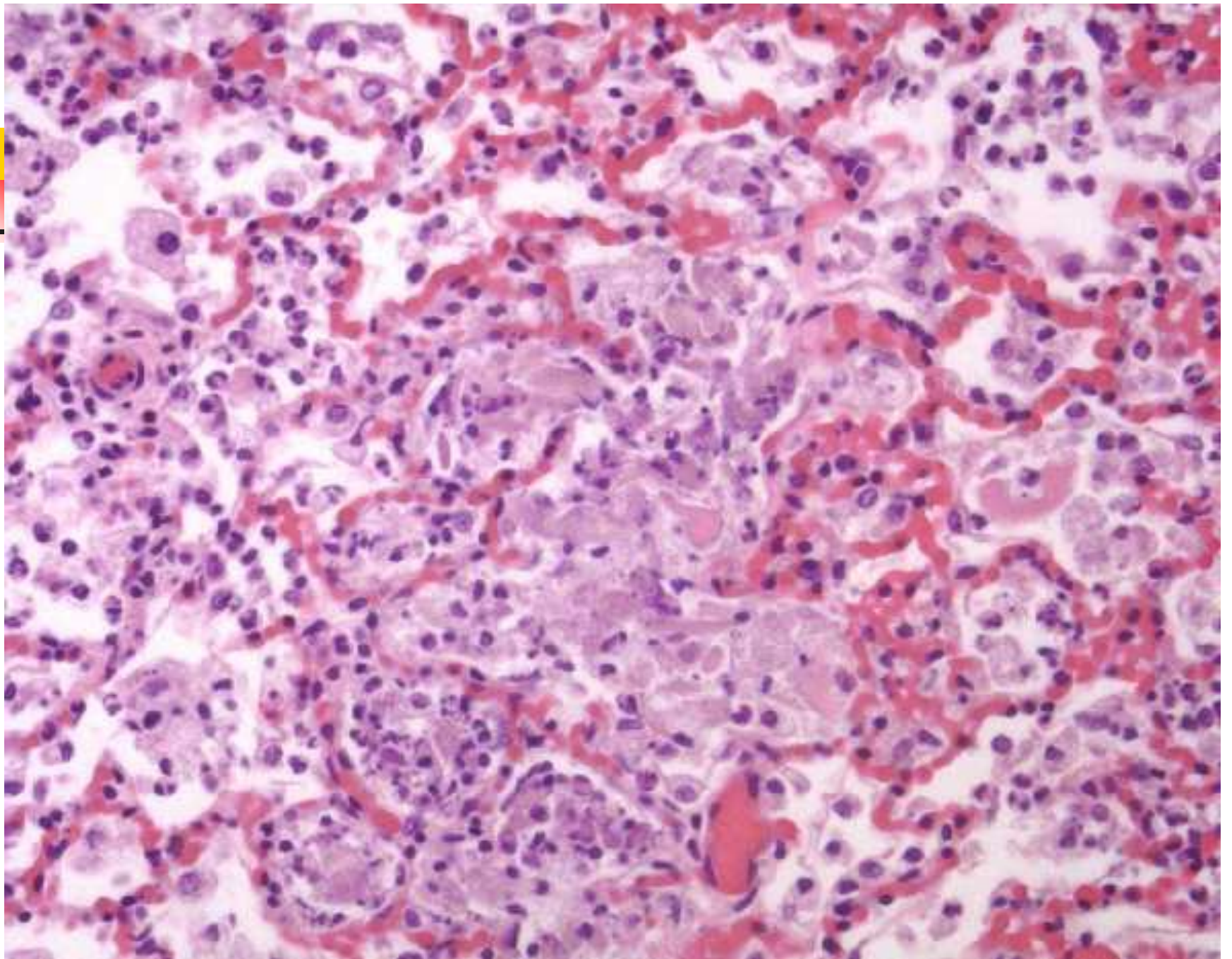
Congenital anomalies

- Obvious anomalies
- Less obvious anomalies
 - No look, no find
 - Cleft palate
 - Osteopetrosis
- Lethal defects with no lesions.

Aspiration of amniotic contents









Antibody transfer

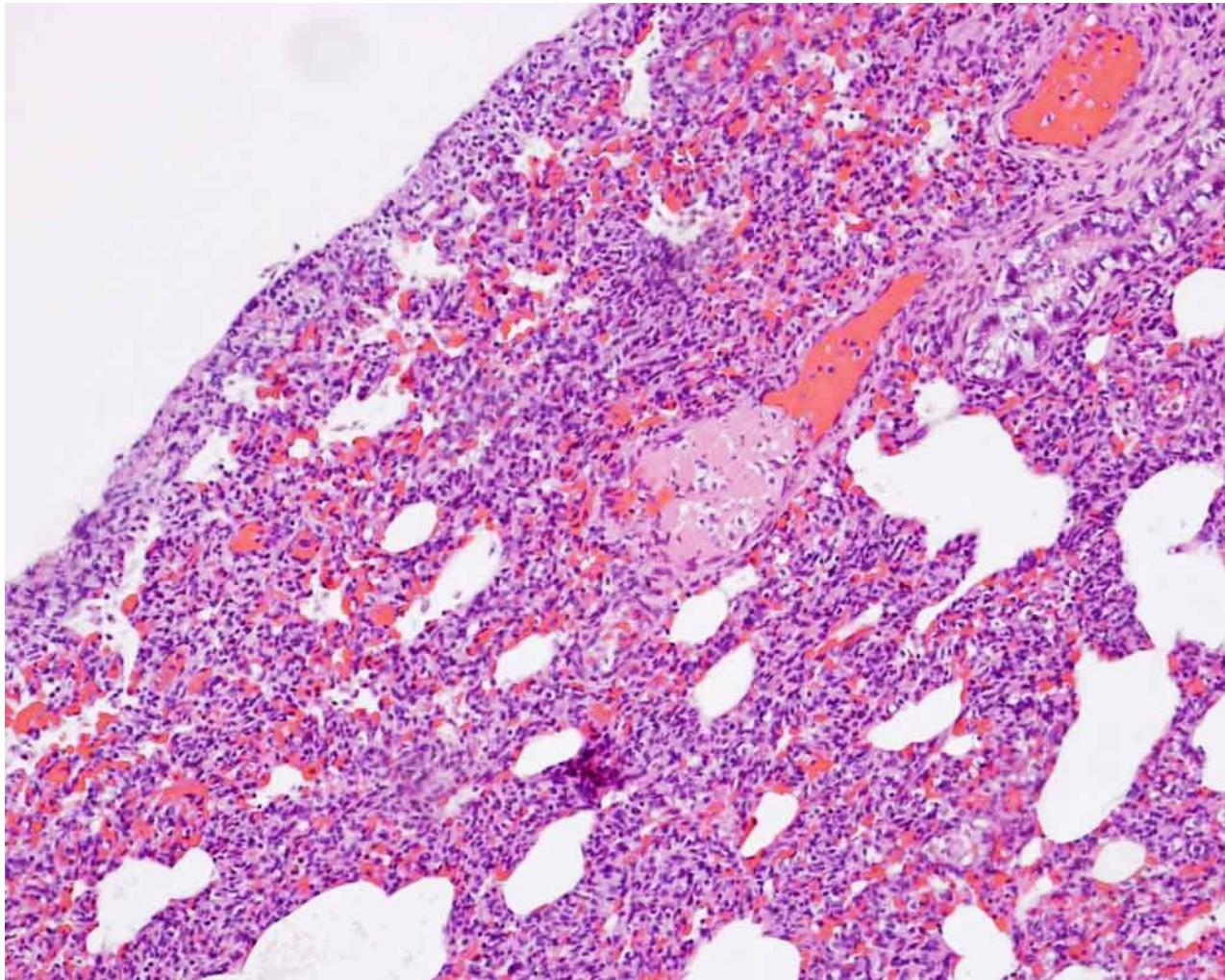
- Horse – 0
- Dog and cat – 5-15% of total, IgG
- Haemophagus organ - marginal haematomas.

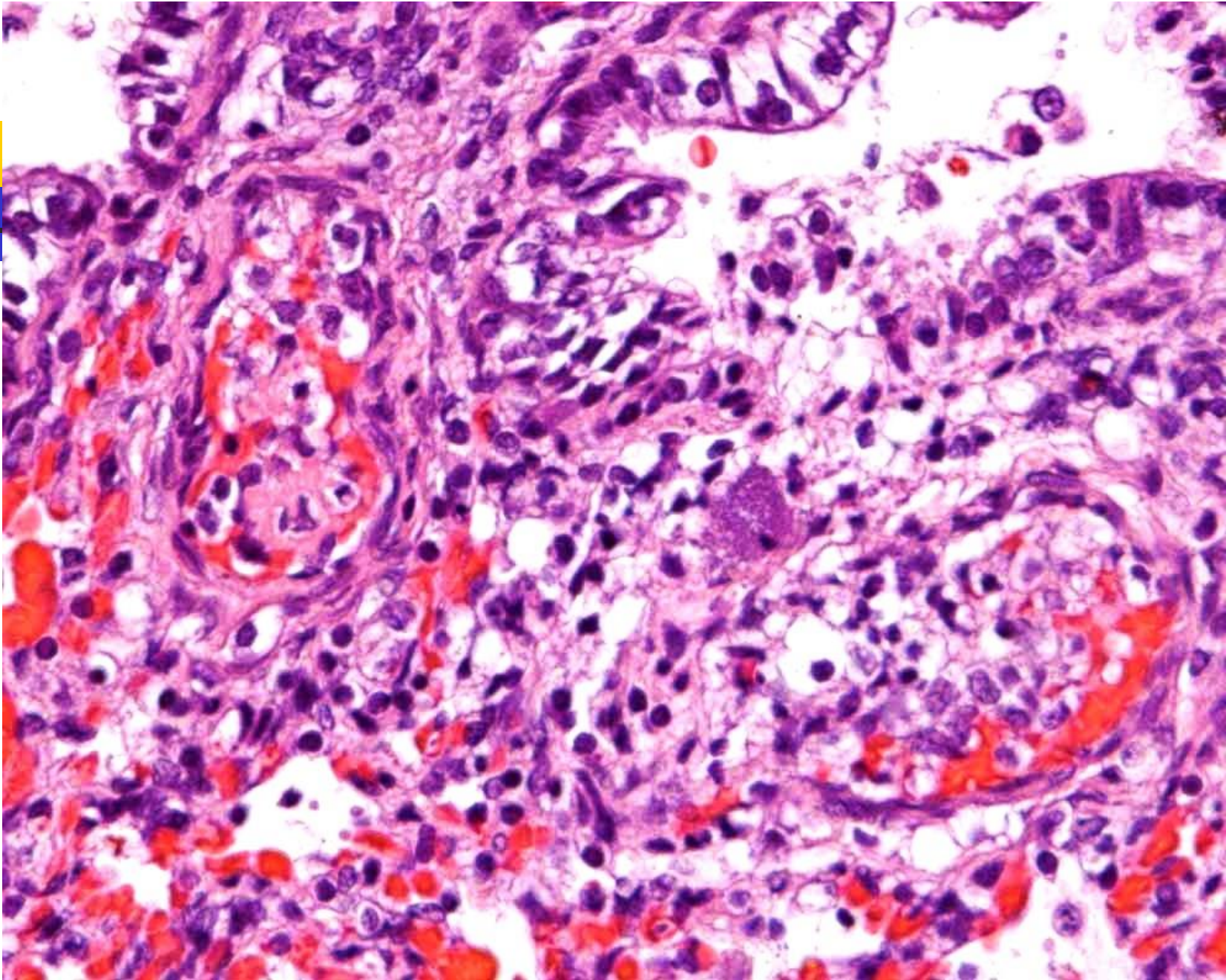


Neonatal sepsis

- Horse
 - Streptococcus zooepidemicus
 - Gram negatives
- Dog and Cat
 - Intestinal inhabitants
- Pulmonary lesions

Highland MA, Byrne BA, DebRoy C, Samitz EM, Peterson TS, Oslund KL. (2009)
Extraintestinal pathogenic Escherichia coli-induced pneumonia in three kittens and fecal prevalence in a clinically healthy cohort population. JVDI 2009 21: 609-615







Summary

- Expectation, expectation, expectation.
- Maternal, foetal, placental