Funduscopic Interpretation
Understanding the Fundus: is that normal?

Gillian McLellan
BVMS PhD DVOpthal
DECVO DACVO MRCVS

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Fundus ≠ Retina

- working knowledge of fundus anatomy
- how to evaluate the fundus systematically
- normal fundus variants
- hallmarks of fundus pathology
Fundus anatomy

- Vitreous normally optically clear (almost)
- Only retinal vessels / pigmented RPE +/- inner choroid (tapetum) make a major contribution to the typical appearance of a normal fundus
Retinal Vascular Patterns

holangiotic
Retinal Vascular Patterns

Merangiotic

Paurangiotic

Anangiotic
Retinal anatomy

- Light traverses 8 retinal layers to reach photoreceptor O.S.
  - Photoreceptors largely responsible for translucent appearance of NSR
  - Cone density highest in area centralis or macula
- RPE = single cell layer
  - Pigmented / non-tapetal
  - Tapetal / non-pigmented
retinal anatomy
tapetum

- structure within the choroid
  - cellular in dog and cat
  - regular compacted collagen array in ruminants, horses
- visible due to absence of pigment in overlying RPE
  - seen ophthalmoscopically as a bright, shiny sweep of color (or not)
Tapetal development

- RPE completely pigments during fetal development
- Autophagy of melanin occurs in presumptive tapetal zone
  - RPE depigments
- Tapetal maturation is not complete until 12-14 weeks of age in dogs and cats
Connecting capillaries
In areas of thin tapetum choroidal vessels may segmentally shine through, in some cases the long posterior ciliary artery, or vortex veins may also be seen.
Tapetal variation in equine fundus
Feline tapetum – transient variant
Normal : Non-tapetal fundus

Varies in color depending on amount of melanin in RPE and choroid

RPE contains melanin, tapetum absent
Normal : Non-tapetal fundus

- non-tapetal fundus
- (optic disc)
- (retinal blood vessels)

RPE contains melanin, where the tapetum is absent.

Choroid darkly pigmented

Reflection from internal limiting membrane may be prominent here and this is also a good place to evaluate nerve fiber layer with a red free light.
Nerve fiber layer may be visible
The subalbinotic "tigroid" fundus
retinal vasculature and optic nerve head
hallmarks of retinal disease

- altered tapetal reflectivity
- changes in pigmentation
- vascular changes
- hemorrhage
- altered optic nerve head appearance
altered tapetal reflectivity

- normal reflectivity
- hyper-reflectivity
- hypo-reflectivity

Schematic diagram showing layers of the eye:
- retina
- tapetum
- RPE
- choroid
- sclera
increased tapetal reflectivity

- associated with retinal thinning
  - Degeneration
  - Detachment (giant tear)
increased tapetal reflectivity
reduced tapetal reflectivity

- associated with increased retinal thickness
  - folding
  - edema
  - cellular infiltration
  - subretinal effusion (incl. detachment)
- Associated with choroidal infiltrates /fibrosis
Reduced tapetal reflectivity
altered fundus pigmentation

- appearance of pigment in tapetal fundus
  - post-inflammatory
  - aberrant metabolites
  - Lipopigment (RPED)

- loss of pigment in non-tapetal fundus
  - post-inflammatory
  - degenerative retinal disease (PRA)
Equine pigmentary changes
retinal thickness and the non-tapetal fundus

- tapetum absent
- lesions associated with increased retinal thickness visible as gray areas
retinal vasculature

- attenuation
- sclerosis
- hemorrhage
- congestion
- increased tortuosity
- pallor
  - anemia
  - lipemia
Lipemia retinalis + anemia
optic nerve head changes

- reduction in size or enlargement
- inflammation
  - associated with hemorrhages, infiltrates
- depression / cupping / coloboma
- darkening
  - associated with loss of neural tissue (atrophy)?
  - Congestion?
- pallor
  - associated with loss of vasculature
  - Associated with gliosis
Movement cues
fundoscopy ≠ pathology ≠ etiology
Words of Advice

- Record your findings at the time!
- Take photos if possible – “Eye phone”?
- Try to explain in terms of underlying histopath
- Consider other funduscopic features, ocular or systemic findings that you might expect to find in conjunction with the presumed “abnormality”
- Re-evaluation – progressive disease?
...some useful phrases

● Describe location – transverse & axial
  ● Relative to landmarks
  ● Depth cues?

● Describe the lesion(s)
  ● Well-circumscribed
  ● ill-defined, indistinct
  ● Focal, multifocal or diffuse
  ● Elevated or depressed
  ● Color change e.g. (de)pigmentation, infiltrate, exudate
Still can’t decide?

- Use higher mag./change viewing angle?
- Red-green filter?
- Second opinion? Ask!
- Functional testing - electrophysiology
- Is there a genetic test?
- Consider other imaging techniques
  - Fluorescein angio, OCT, cSLO/autofluorescence imaging
Maybe we are not as invincible as we think we are?