Diseases of Non-Human Primates

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Outline

• Taxonomy
• Systemic Diseases
• Organ-specific Diseases

Non-Human Primates

• >300 species of primates
  — Apes
    • Great apes
    • Lesser apes
  — Monkeys
    • Old World
    • New World
  — Prosimians ("premonkeys")
    • Most primitive NHPs

Apes

- Africa and Asia
- Larger, heavier than monkeys
- Longer lifespan
- More upright posture
- Often can walk on 2 legs
- No tail
- Broad chest
- Short, broad nose
- Rely on vision
- Large brain:body size
- Create tools, problem solve
- Great apes = orangutan, chimp, gorilla, bonobo
- Lesser apes = gibbon, siamang

OWM

- Catarrhine – narrow nose with thin septum, down-facing nostrils
- Africa and Asia – varied habitats from rainforest to desert
- Larger than NWM
- Longer hindlimbs than forelimbs
- Tails but lack prehensility
- Ischial callosities
- Prominent sexual skin around the anus and vagina in females
- Mandibular premolar specialized for sharpening upper canine
- Many have opposable thumbs
- Fingernails and toenails on all digits
- 2 subfamilies
  — Cercopithecinae (cheek pouches) = baboon, macaques, guenons, mandrill, drills, proboscis monkey, sooty mangabey, patas
  — Colobinae (leaf eating) = colobus monkeys, langurs
    • 3-4 chambered stomachs for fermentation of leaves, seeds
NWM

• Platyrrhine – broad nose with wide septum, outwardly directed nostrils
• Central and South America – arboreal habitats only
• Small to medium sized
• Long tails, sometimes prehensile
• Scent glands (territory marking)
• Thumb in line with other digits (spider monkeys have no thumbs)
• Not as much manual dexterity as OWM
• No ischiatic pads
• No cheek pouches
• (ex) tamarin, marmoset, capuchin, owl monkey, titi monkey, saki monkey, spider monkey, howler monkey, wooly monkey, squirrel monkey, uakari

Prosimians

• Lemurs, lorises, tarsiers
• Only live in Old World, tropical woodlands
• Mostly nocturnal
  – Large eyes with sensitive nocturnal vision
  – Large, independently movable ears
• Developed hand with good control
• Well-developed sense of smell, prominent snout

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Systemic Diseases To Cover

- Viruses
- Bacteria
- Nutritional
- Other

Alpha-Herpesviruses

- **Genus: Simplexvirus**
  - Macaque herpesvirus 1 [Herpesvirus simiae, Cercopithecin herpesvirus 1, Herpes B]
  - Papion herpesvirus 2 [Herpesvirus papio-2, Cercopithecin herpesvirus 16]
  - Saimirine herpesvirus 1 [Herpesvirus tamarinus, Herpes T]
  - Human herpesvirus 1 [Herpesvirus hominis 1, Herpesvirus simplex type 1]
  - Human herpesvirus 2 [Herpesvirus hominis 2, Herpesvirus simplex type 2]
  - Cercopithecin herpesvirus 2 [Simian agent 8]

- **Genus: Varicellovirus**
  - Cercopithecin herpesvirus 9 [Simian varicella virus]
  - Chimpanzee varicella virus
  - Human herpesvirus 3 [Varicella-zoster virus]
Beta-Herpesviruses

• **Genus: Cytomegalovirus (CMV)**
  - Host-specific, endemic viruses
  - Latency in salivary epithelium and kidney
  - Induce cytomegaly
  - Necrotizing lesions when clinical
  - Examples
    • *Rhesus cytomegalovirus* ([Macacine herpesvirus 3, Cercopithecine herpesvirus 8]
    • *Cercopithecine herpesvirus 5* (African Green monkey cytomegalovirus)
    • *Human herpesvirus 5* ([Human cytomegalovirus]
    • *Panine herpesvirus 2* ([Pongine herpesvirus 4, chimpanzee cytomegalovirus]
    • *Aotine herpesvirus 1, 3* ([Herpesvirus aotus types 1, 3])
Gamma-Herpesviruses

- **Genus: Rhadinovirus**
  - Macacine herpesvirus 5 (Macaca rhadinovirus, Cercopithecine herpesvirus 17)
  - Ateline herpesvirus 2 (Herpesvirus ateline strain 810)
  - Ateline herpesvirus 3 (Herpesvirus ateline strain 73)
  - Human herpesvirus 8 (Kaposi’s sarcoma-associated herpesvirus)

- **Genus: Lymphocryptovirus (EBV-like herpesviruses)**
  - Callitrichine herpesvirus 3 (Marmoset lymphocryptovirus)
  - Cercopithecine herpesvirus 14 (African Green monkey EBV-like virus)
  - Gorilline herpesvirus 1 (Gorilla herpesvirus)
  - Human herpesvirus 4 (Epstein Barr)
  - Macacine herpesvirus 6 (Cercopithecine herpesvirus 18, rhesus lymphocryptovirus)
  - Panine herpesvirus 2 (Herpesvirus pan, Pongine herpesvirus 1)
  - Papiine herpesvirus 2 (Herpesvirus papio, Cercopithecine herpesvirus 12)
  - Pongine herpesvirus 2 (Orangutan herpesvirus)
Retroviruses

- **Simian Retrovirus, type D**
  - Five serotypes: SRV-1, SRV-2 and SRV-5 historically of most clinical significance
  - SRV-4 recently associated with severe thrombocytopenia in Japanese macaques
  - Infects B and T lymphocytes, macrophages and epithelial cells
  - Lymphoid hyperplasia → atrophy, retroperitoneal or SQ fibromatosis, NOMA, lymphoma, OIs

- **Simian Immunodeficiency Virus (SIV)**
  - Lentivirus similar to HIV
  - Generally nonpathogenic in endemic hosts (African monkeys)
  - Progressive immune suppression and disease in aberrant hosts (macaques)
  - Lymphoid hyperplasia in lymph nodes and spleen → lymphoid depletion
  - Right atrial and pulmonary thrombosis, arteriopathy, maculopapular rash, giant cell pneumonia, giant cell encephalitis, lymphoma, OIs.

- **Simian T-Lymphotropic Virus, type 1 (STLV-I)**
  - Delta retrovirus
  - CD4+ T-cells infected in macaques, CD8+ T-cells in African monkeys
  - Lymphocytosis, lymphoma, leukemia
Other Systemic Viruses

- Measles
Bacteria

- *Mycobacterium tuberculosis*
- *Mycobacterium avium-intracellularare* complex (MAIC)
- *Streptococcus pneumoniae*
- *Klebsiella pneumoniae*
- *Shigella spp*
- *Yersinia spp*
- *Francisella tularensis*
- *Staphylococcus spp*
Rhesus

Baboon

Rhesus

Baboon

Rhesus

Baboon
Nutritional

- Fatal fasting syndrome of obese macaques
- Simian Bone Disease
- Scurvy
- Rickets
- White monkey syndrome in infant baboons
Other Systemic Diseases

- *Entamoeba histolytica* (Amoebiasis)
- Amyloidosis
Cardiovascular
New World monkey

Hematopoietic
Liver and Gall Bladder
Neuro

Rhesus

Orangutan
Rhesus

Urinary
Baboon

Rhesus

Black Lemur
References