GUINEA PIGS

_Cavia porcellus_ – 64 chromosomes.

Hartley, Duncan, English shorthair – random, _outbred_, albino, most common.
Peruvian, Abyssinian – long-haired popular breeds.
strain 2, strain 13 – _inbred_, tricolor.

Hystricomorph (porcupine-like)

NORMATIVE BIOLOGY & ANATOMIC FEATURES

_Reproductive_ – long 59-72 day gestation period, hemochorial placentation (like mouse, rat, rabbit, human); large precocious offspring in litters of 2-5; dystocia particularly among females >6 month age with first litter; pubic symphysis under action of relaxin; weaned at 3 weeks but as early as 3-4 days; no estrous synchronization; intromittent sac that everts two keratinaceous styles during erection; vaginal closure membrane.

_Hematopoietic_ – heterophils, counterpart of neutrophils with distinct eosinophilic cytoplasmic granules; lymphocytes predominant peripheral circulating leukocyte; _Kurloff Cells_ – Foa Kurloff Cells, unique mononuclear leukocyte, lymphoid series, perhaps NK cell counterpart, present in sinusoids of spleen, stroma of bone marrow and thymus; Kurloff body, fine fibrillar to granular 1-8 µm structure within cytoplasmic vacuole causing displacement of nucleus, PAS-positive, Lendrum stain-positive for fibrinoid material; mucopolysaccharide released into trophoblast and fetal endothelium of placental labyrinth; rise in number with estrogen treatment or pregnancy, aggregates in placenta, perhaps fetal tolerance; modulates transplantable leukemia.

_Respiratory_ – thick media of pulmonary arteries and arterioles; larger airways surrounded by concentric bands of smooth muscle; perivascular lymphoid nodules in adventia of pulmonary vessels, alveolar septa thickened by lymphocytic infiltrates; osseous metaplasia; strain 13 and Hartley highly histamine sensitive & serve as models of respiratory anaphylaxis.

_Thymus_ – cervical thymus; degenerate thymocytes near Hassall’s corpuscles, common, incidental; located extra-thoracic in ventral neck.

_Heart_ – rhabdomyomatosis, vacuolated myofibers with fine granular glycogen infiltration, alcohol-fixed PAS-positive, incidental.

_Gastrointestinal_ – open-rooted check teeth; undivided glandular stomach; thin-walled cecum divided into pouches by bands of taenia coli smooth muscle; coprophagia, B-vitamins, protein recycling; requires _food_ intake at 0.06 gm/gm body wt, with exogenous vitamin C, <90 days from milling date; _water_ intake at 0.10 ml/gm body wt.

_Skeletal_ – unique, complete zygomatic arch.

_Mammary_ – one pair of inguinal mammary glands.

_Behavioral_ – family units, alpha male; nervous, freeze and stampede; refuse to eat or drink following significant changes.

VIRAL DISEASES

(Few recognized viral infectious diseases.)

DNA VIRUSES

_Adenoviral Pneumonitis_ – asymptomatic; low morbidity, high mortality in clinically affected animals; young; consolidation of cranial lobes, necrotizing bronchitis, bronchioalveolitis, 7-15 µm basophilic intranuclear inclusion.

_Cytomegalovirus_ – saliva, urine, transplacental transmissions; species-specific; large intranuclear inclusions with margination of chromatin in salivary gland epithelium; intracytoplasmic inclusions, persist, inapparent; rare clinically apparent disease; possible foci in salivary glands, kidney, liver, spleen, lung; common, incidental; experimental exposure results in mononucleosis-like lymphoid hyperplasia with lymphadenopathy.

_Herpesvirus_ – Caviid Herpesvirus 2, GPHLV, Guinea Pig Herpes-like Virus, nonpathogenic; Caviid Herpesvirus 3, GPXV Guinea Pig X Virus, unclear relevance as pathogen.

RNA VIRUSES

LYMPHOCYTIC CHORIOMENINGITIS

_Etiology:_ LCMV, Arenaviridae.
_Transmission:_ inhalation, ingestion, apparently through intact skin.
Clinical: rare natural infection.
Pathology: lymphocytic infiltration in meninges, choroid plexus, ependyma, liver, adrenal, lung.
Significance: polytropic, wide host range; zoonotic potential.

OTHER VIRUSES

PVM, Sendai, TMEV/GDVII, Reo-3 – occasionally seroconvert; attributable lesions not observed.

Cavian Leukemia Virus – rare, C-type, Retroviridae, oncovirus associated, lymphoblastic.

BACTERIAL DISEASES

DYSBACTERIOSIS
Etiology: Penicillin, Bacitracin, Ampicillin administration with overgrowth of Clostridium difficile.
Transmission: iatrogenic.
Clinical: diarrhea, 50% mortality; 1-5 days following antibacterial treatment.
Pathology: gram-positive streptococci and lactobacilli intestinal flora lost, overgrowth of Eschericia coli or Clostridium difficile with enterotoxin (normally not isolatable) and resultant bacteremia; edematous and hemorrhagic cecal mucosa with sloughing of enterocytes; ileal mucosal hyperplasia, mononuclear cell infiltration.
Dx: assay for C. difficile toxin.

TYZZER’S DISEASE
Etiology: Clostridium piliforme, spore-forming, obligate intracellular, gram negative, filamentous bacterium; propagates only in embryonated eggs or cell culture.
Transmission: orofecal; intrauterine experimentally; fecal shed spores survive >1 year; contaminated food, bedding, environment; wide species range including rats, gerbils, hamsters, guinea pigs, rabbits.
Clinical: low morbidity, high mortality; sudden death and watery diarrhea; predisposing factors.
Pathology: miliary, 5 mm, pale hepatic foci of coagulative to caseous necrosis with polymorphonuclear infiltration, liver lesions most consistent finding in mice; segemental mucosal necrosis of terminal ileum and cecum frequently transmural; intracytoplasmic bundles of baccili adjacent to necrotic foci by Warthin-Starry, Giemsa, or PAS stains.
Significance: persistence of spores in environment; acute mortality; potential zoonosis for immunocompromised.

PROLIFERATIVE ILEITIS
Etiology: Lawsonia intracellularis; cannot be grown on artificial medium.
Transmission: rapidly spread among weanlings, 3-5 weeks of age, resistant after 12 weeks; wide host range of susceptibility.
Clinical: diarrhea.
Pathology: hyperplasia of duodenal, jejunum and ileal crypt and villous epithelium, elongation and fusion of villi, downward extension and penetration of crypts through lamina propria; crypt microabscesses; pyogranulomatous inflammation; fibrinous peritoneal adhesions; PAS or Steiner’s or Warthin-Starry silver stains show numerous small slightly-curved intracellular bacilli within apical cytoplasm of hyperplastic enterocytes, and macrophages with PAS-positive granules in lamina propria and submucosa.
Significance: sporadic.

SALMONELLOSIS
Etiology: Salmonella enteritidis, serotype enteritidis or typhimurium.
Transmission: orofecal; contaminated feed, bedding, intermittent shedding; weanlings more susceptible; incubation 3-6 days, fimbrial attachment to M-cells to GALT to mesenteric lymph nodes to disseminated; intracellular replication within macrophages avoid neutrophil attack.
Clinical: conjunctivitis, variable mortality; scanty fluid intestinal lumen contents.
Pathology: multifocal necrosis and venous thrombosis with leukocyte infiltration in liver, spleen, Peyer’s patches, mesenteric lymph nodes; multifocal granulomatous hepatitis, splenitis, lymphadenitis.
Significance: culling required; interspecies transmission, zoonotic.

BORDETELLA
Etiology: Bordetella bronchiseptica, small, gram-negative rod, affinity for ciliated respiratory epithelium.
Transmission: harbored in upper respiratory of many species including dog, cat, rabbit.
Clinical: airborne inhalation, inapparent carriers, nasal shedders, all ages susceptible; nasal exudate, dyspnea, vestibular signs, abortion.
**Pathology:** suppurative bronchopneumonia, pleuritis, otitis media; mucopurulent or catarrhal exudate in nasal, trachea, tympanic bullae, and upper airways; metritis.

**Ddx:** *Streptococcus pneumoniae, S. zooepidemicus, Staphylococcus, Klebsiella.*

**Significance:** important cause of mucopurulent respiratory disease in this species; exacerbations of subclinical infections; interspecies transmission.

**STAPHYLOCOCCUS**

**Etiology:** *Staphylococcus aureus,* coagulase-positive.

**Transmission:** contact; inapparent, persistent infection, high percentage of clinically normal animals.

**Clinical:** ulcerative pododermatitis, "bumblefoot", trauma, sanitation; isolated cases of pneumonia, mastitis, conjunctivitis.

**Pathology:** plantar surface of forefeet necrotizing, ulcerative pododermatitis; acute exfoliative hyperkeratotic and parakeratotic dermatitis of ventral abdomen in strain 13 animals that regresses in 2 weeks.

**Significance:** persistent inapparent infection; interspecies transmission.

**STREPTOCOCCUS**

**Etiology:** *Streptococcus zooepidemicus,* Lancefield group C, gram-positive coccus; "Cervical Lymphadenitis", chains of cocci.

**Transmission:** carried in nasopharynx and conjunctiva as inapparent infection; asymptomatic until abrasion, inhalation, farrowing.

**Clinical:** bilateral cervical lymph node enlargement.

**Pathology:** suppurative necrotizing lymphadenitis, retroorbital abscession, otitis media; acute sepsis in young with fibrinopurulent bronchopneumonia, pleuritis, pericarditis.

**Ddx:** *Bordetella, S. pneumoniae.*

**Significance:** cull.

**PNEUMOCOCCUS**

**Etiology:** *Streptococcus pneumoniae,* lancet-shaped, gram-positive coccus, capsular polysaccharide type 19, (impairs phagocytosis, activates alternate complement pathway), pairs or short chains, diplococcus.

**Transmission:** aerosols; inapparent upper respiratory carriers up to 50% in some colonies.

**Clinical:** seldom occurs, epizootic in young during winter months, high mortality.

**Pathology:** fibrinopurulent pleuritis, pericarditis, peritonitis, bronchopneumonia, consolidation, thrombosis, alveolar flooding with heterophils.

**Ddx:** *Streptococcus zooepidemicus, Bordetella bronchiseptica.*

**Significance:** rare, but significant cause of mortality in enzootically infected colonies; serotype identical to human isolates; interspecies transmission.

**OTHER BACTERIAL INFECTIONS**

*Yersinia pseudotuberculosis* – rare, ileotyphilitis, miliary to caseous splenitis, hepatitis.

*Clostridium perfringens* – acute, fatal typhilitis; mucosal necrosis, enterocyte sloughing.

*Citrobacter freundii* – single reported epizootic, high mortality, pneumonia, pleuritis, enteritis.

*Klebsiella pneumoniae* – rare, acute speticemia, necrotizing bronchopneumonia.

*Pseudomonas aeruginosa* – single report, botryomycosis, sulfur granules in suppurative pulmonary lesions.

**MYCOTIC INFECTION**

**DERMATOPHYTOSIS**

**Etiology:** *Trichophyton mentagrophytes, Microsporum canis.*

**Transmission:** asymptomatic, possible epizootics with neonatal mortality.

**Clinical:** nasal "ringworm", head, sides, back.

**Pathology:** circumscribed, scaly, pruritic lesions with raised erythematous border and localized alopecia; arthrospores in hair follicle with PAS or methenamine sliver stains.

**Dx:** hyphae, arthrospores in wet mount of hair shafts cleared with 10% KOH, culture Sabouraud’s dextrose.

**Significance:** zoonotic.
RICKETTSIAL INFECTION

CHLAMYDIA
Etiology: *Chlamydia psittaci*, (GPIC) Guinea Pig Inclusion Conjunctivitis.
Transmission: direct contact; widespread, asymptomatic, 4-8 week age affected.
Clinical: erythemic conjunctiva, rhinitis, genital tract infections, abortion; possible lower respiratory signs with concurrent *Streptococcus* or *Bordetella* infection.
Pathology: conjunctivitis, intracytoplasmic organisms in sloughed epithelial cells, heterophil and lymphocyte infiltration.
Dx: Giemsa-stained conjunctival smears.
Significance: usually self-limiting; recover with no residual damage.

PARASITIC DISEASES

ECTOPARASITE INFESTATIONS

TRIXACARUS
Etiology: *Trixacarus caviae*, sarcoptic mite.
Transmission: widespread, burrows in the stratum corneum.
Clinical: scaling, crusting, alopecia, pruritis of neck, shoulder, inner thighs, abdomen.
Pathology: epidermal hyperplasia with orthokeratotic, parakeratotic hyperkeratosis; spongiosis, dermal infiltrate.
Dx: skin scrapings cleared with 10% KOH.
Significance: important cause of dermatitis in this species; zoonotic.

*Gliricola porcelli* – common, slender, thin head; *Gyropus ovalis* – uncommon, oval, wide head, large biting lice, pruritis, rough hair coat, alopecia.

*Chirodiscoides caviae* – nonburrowing mite; easily overlooked, lumbar, lateral hindquarters, few lesions, even heavy infestations may only evoke minimal signs with alopecia and pruritis.

*Demodex caviae* – one report, unknown incidence or significance.

ENDOPARASITE INFESTATIONS

PROTOZOAL INFECTIONS

CRYPTOSPORIDIUM
Etiology: *Cryptosporidium wrairi*, protozoan.
Transmission: juvenile animals, 30-40% infection rate.
Clinical: diarrhea, mortality possible.
Pathology: jejunum, ileum, cecum, crypt hyperplasia, villus atrophy, sloughing enterocytes, dilated lacteals, numerous miliary organisms on brush border along apices of enterocytes.
Dx: mucosal scrapings, phase contrast, often concurrent *E. coli*.
Significance: recognized pathogen, cause of enteritis in this species.

COCCIDIOSIS
Etiology: *Eimeria caviae*.
Transmission: ingestion sporulated oocytes.
Clinical: sporozoites penetrate crypt cells of anterior colon, diarrhea, weanlings.
Pathology: large intestine, petechiae, hyperplasia and sloughing of enterocytes, PMN infiltration.
Ddx: *Cryptosporidium wrairi*, *Clostridium*, dysbacteriosis.
Significance: common, moderately pathogenic.

*Klossiella cobayae* – rare, renal coccidiosis, penetrate intestinal mucosa, enter adjacent capillaries, schizogony in glomerular endothelial cells; gametogony in Henle’s loop, sporulated sporocysts released in urine; no clinical signs.

*Encephalitozoon cuniculi* – sporadic cases, multifocal granulomatous encephalitis, interstitial nephritis, gram-positive.
**Toxoplasma gondii** – rare, asymptomatic, multifocal hepatitis, pneumonitis, cysts in myocardium and CNS, gram-negative, ingestion of cysts from cats; differentiate from *E. cuniculi*.

**Balantidium caviae** – large ciliated organism with large ovoid to ellipsoid macronucleus, nonpathogenic or perhaps secondary invader.

**Entamoeba caviae** – nonpathogenic naturally; experimentally model with transmural enteric ulceration and hepatic abscessation.

**Tritrichomonas** – incidental.

**HELMINTH INFESTATION**

**BAYLISASCARIS**

**Etiology:** *Baylisascaris procyonis*

**Transmission:** wood shaving bedding contaminated with raccoon feces; larval migrans.

**Clinical:** stupor, hyperexcitability, opisthotonos.

**Pathology:** eosinophilic granulomatous inflammation associated with larval migrans in brain and lung; multifocal malacia.

**Significance:** rare.

**Paraspidodera uncinata** – small cecal, colonic worms, direct life cycle, mucosa, asymptomatic.

**OTHER DISORDERS**

**Scurvy**

**Etiology:** hypovitaminosis C; deficient in enzyme L-gulonolactone oxidase for synthesizing ascorbic acid by the glucuronic pathway; simian and human primates, guinea pigs, cetaceans, Indian fruit bats, channel catfish, some birds require supplemental vitamin C.

**Clinical:** ascorbic acid is essential in the hydroxylase reactions for the formation of hydroxyproline and hydroxylysine in the collagen molecule; deficient and defective production of interstitial osseous matrix; vitamin C also necessary for catabolism of cholesterol to bile acids.

**Pathology:** calcified cartilage scaffolding susceptible to microfractures, increased capillary fragility, increased prothrombin time, increased susceptibility to *Streptococcus pneumoniae*, enlargement of costochondral junctions, periarticular hemorrhages, ecchymoses, marked proliferation of poorly differentiated fusiform mesenchymal cells in periosteal region and medullary cavity.

**Significance:** skeletal, locomotor, cholesterol metabolism, resistance to bacterial infections, prolonged clotting times, feed within 3 months of milling date.

**Nutritional Muscular Dystrophy** – vitamin E/selenium deficiency, elevated serum creatine phophokinase, marked pallor of affected muscles, coagulative necrosis and hyalinization of myofibers, fragmentation of sarcoplasm; responds to alpha tocopherol therapy.

**Myocardial & Skeletal Muscle Degeneration with Mineralization** – multifocal muscular degeneration and mineralization, unresolved.

“**Metastatic Calcification**” – low dietary magnesium, high dietary phosphorus; high calcium and phosphorus diets interfere with magnesium absorption and metabolism, linear chalky deposits on serosal surfaces.

**Pregnancy Toxemia** – two patterns, 1. metabolic/nutritional, obese, advanced pregnancy, precipitated by reduced carbohydrate intake and mobilization of fat reserves, fatty infiltration of liver, kidney, adrenals, vessels; 2. circulatory “preeclampsia”, uteroplacental ischemia, compression of aorta by gravid uterus, placental necrosis, hemorrhage, multifocal hepatic necrosis, nephrosis, adrenocortical hemorrhage; thrombocytopenia, ketosis.

**Malocclusion** – open-rooted cheek teeth, maxillary molars and premolars overgrow labially, mandibular teeth overgrow medially.

**Segmental Nephrosclerosis** – unresolved pathogenesis, aging associated, interstitial fibrosis, poorly differentiated and dilated tubules, normal glomeruli, minimal infiltrate.
Cystic Rete Ovarii – ovarian cysts, frequently present, clear serous fluid, lined by ciliated cuboidal epithelium.

**NEOPLASMS**

(Rare neoplasms, possibly due to serum asparaginase, or large numbers of Foa-Kurloff cells, unresolved.)

**Reproductive** – 25% of spontaneous tumors, ovarian teratomas, uterine fibromas, leiomyomas; mammary adenocarcinomas; **Pulmonary** – 35% of spontaneous tumors, benign bronchial papillary adenomas, rare malignant; Leukemia – rare, C-type retrovirus associated, lymphoblastic; Skin – trichoepithelioma most common of cutaneous tumors.