1. *Circoviridae*
2. Chicken anaemia virus

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Circoviridae

- Virions—small, non-enveloped
- Spherical in outline, icosahedral symmetry
- Genomes circular, single-stranded DNA
- Virions very stable, resisting 60°C for 30 min. and pH 3–9
- Smallest known viral pathogens of animals
Transmission routes are fecal–oral

Viral replication is nuclear

Virus replication occurs in actively dividing cells in tissues of young animals

Cause persistent infections of their respective hosts

02 genera– Circovirus, Cyclovirus
**Genus Circovirus**

- **Members**
  - Beak and feather disease virus
  - Other avian circoviruses
  - Porcine circoviruses 1 and 2
  - Canine circovirus
- Type species: Porcine circovirus 1

**Genus Cyclovirus**

- Viruses isolated from chickens, goats, sheep and other farm animals
Beak and feather disease virus

- Causes debilitating, immunosuppressive disease

- Disease known as **Psittacine beak and feather disease**

- Disease in young psittacine birds, particularly cockatoos

- **Virus spreads through** –
  - virus shedding in feather dander
  - fecal shedding
  - feeding of chicks with regurgitated crop contents
Birds affected with Psittacine beak and feather disease

Image Source: Google
### Clinical Findings
- Feather loss, abnormal pin feathers & mature feathers and various beak abnormalities

### Diagnosis
- Presence of intracytoplasmic inclusion bodies in affected feather follicles
- By electron microscopy
- PCR assay

### Control
- Strict hygiene, screening and disposal of infected birds
Porcine circoviruses 1 and 2

PCV 1 – nonpathogenic

Porcine circovirus 2

- commonly in weanling piglets at 5–18 wks of age and sometimes adults
- Infections often subclinical or very mild
- Transmission occurs through direct contact and fomite
- virus shed in feces, respiratory secretions and urine
Porcine circovirus-associated disease (PCVAD)

Associated with several disease syndromes

- Post-weaning multi-systemic wasting syndrome
- Porcine dermatitis and nephropathy syndrome
- Porcine respiratory disease complex
- Reproductive failure
- Granulomatous enteritis
- Exudative epidermitis
- Necrotizing lymphadenitis
- Progressive wt. loss or decreased rate of wt. gain
Paleness or icterus and ill thrift

exacerbated by immuno-stimulation resulted from co-infecting pathogens

**Diagnosis and control**

- Immunohistochemistry

- “Botryoid” inclusion bodies in virus-infected macrophages in Postweaning multisystemic wasting syndrome

- PCR

- Good herd management practices, nutrition, hygiene and vaccination for disease control
Other avian circoviruses

- Occurs in pigeons, finches, canaries, geese, ducks, pheasants, gulls, ostriches etc.
- Mostly in young birds
- causing immuno-suppression, developmental abnormalities

Canine circovirus

- documented in dogs with vomiting and diarrhea
Family: *Anelloviridae*  Genus: *Gyrovirus*

Earlier genus *Gyrovirus* was included in family *Circoviridae*

Virions non-enveloped and icosahedral

Larger than circovirus virions

Have protruding pentagonal shaped units compared to flat pentameric units observed in circoviruses

Genome circular, single-stranded, ambisense or negative sense DNA
Transmission

- Infects only chickens, present in poultry flocks worldwide

- Both horizontal and vertical transmission occur

- Horizontal transmission—through inhalation or oral exposure

- Virus is shed in feces and feather dander

- Vertical transmission through egg occurs during viraemic period in infected laying hens for a period of 3–9 weeks
Pathogenesis and pathology

- Viraemia develops following infection of susceptible day old chicks

- Virus can be recovered from most organs and from faeces for about three or four weeks

- Principal target cells are precursor T cells in the thymus and haemocyto blasts in the bone marrow

- Destruction of these cells results in immunosuppression and anaemia
In chicks:
- chickens of 2–4 wks of age infected
- Severe disease in chicks co-infected with other viruses (avian reoviruses, avian adenoviruses, MD virus, IBD virus etc.)
- Affected birds depressed, anorexic, pale
- Subclinical infection in broilers affect weight gains
- Mortality rate– usually about 10%, may be up to 50%
- Slow recovery in birds surviving acute phase of disease
In adult chickens:

- Usually no illness or loss of egg production
- can become chronically or persistently infected

**Lesions**

- Atrophy of thymus tissues and bursa
- Pale bone marrow
- Haemorrhages under skin and in skeletal muscle
- Blood may be watery and clot slowly due to thrombocytopenia
Lesions

Subcutaneous haemorrhages on the wing

Subcutaneous haemorrhages

Pale carcass

Image source—Google
Diagnosis

- Based on history, clinical signs and pathologic findings
- Virus isolation in cell lines (in lymphoblastoid T cell, B cell lines), 1-day-old chicks or chick embryos
- Viral Ag in tissues by immuno-histochemistry
- ELISA, indirect immuno-fluorescence and virus neutralization
- PCR
Immunity, Prevention, and Control

- Maternal antibodies and controlled exposure are primary methods for control in broilers
- Good farm management and hygiene
- Control of other immunosuppressive viruses to prevent additive effects of disease
- Vaccination