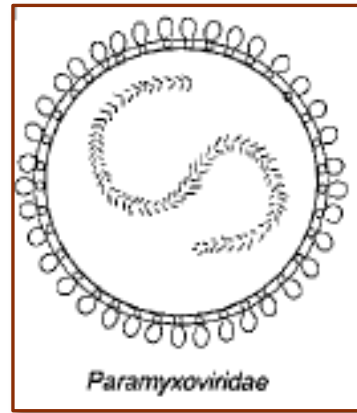


Paramyxoviridae



Faculty

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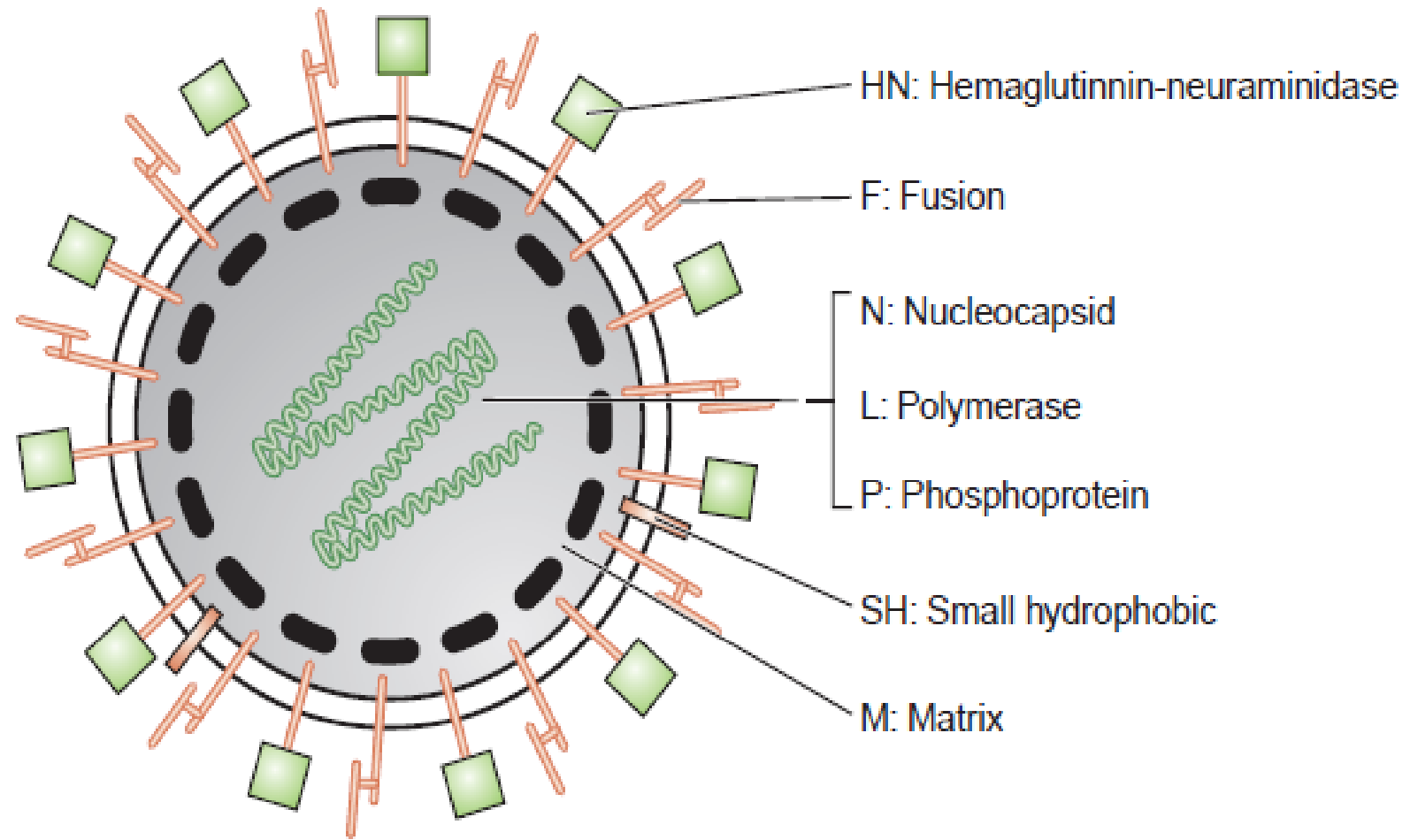
College of Veterinary Science and AH MHOW

Viral characteristics

- **Paramyxoviruses** and **Orthomyxoviruses** –formerly grouped together as the '**MYXOVIRUSES**' (Greek *myxa* means mucus) which describes their affinity for mucous membrane.
- *Paramyxoviridae* belongs the order **mononegavirales** means- single negative sense RNA
- Enveloped, "**HERRINGBONE SHAPED**" helically symmetrical nucleocapsid,
- 150-350nm in diameter

Cont....

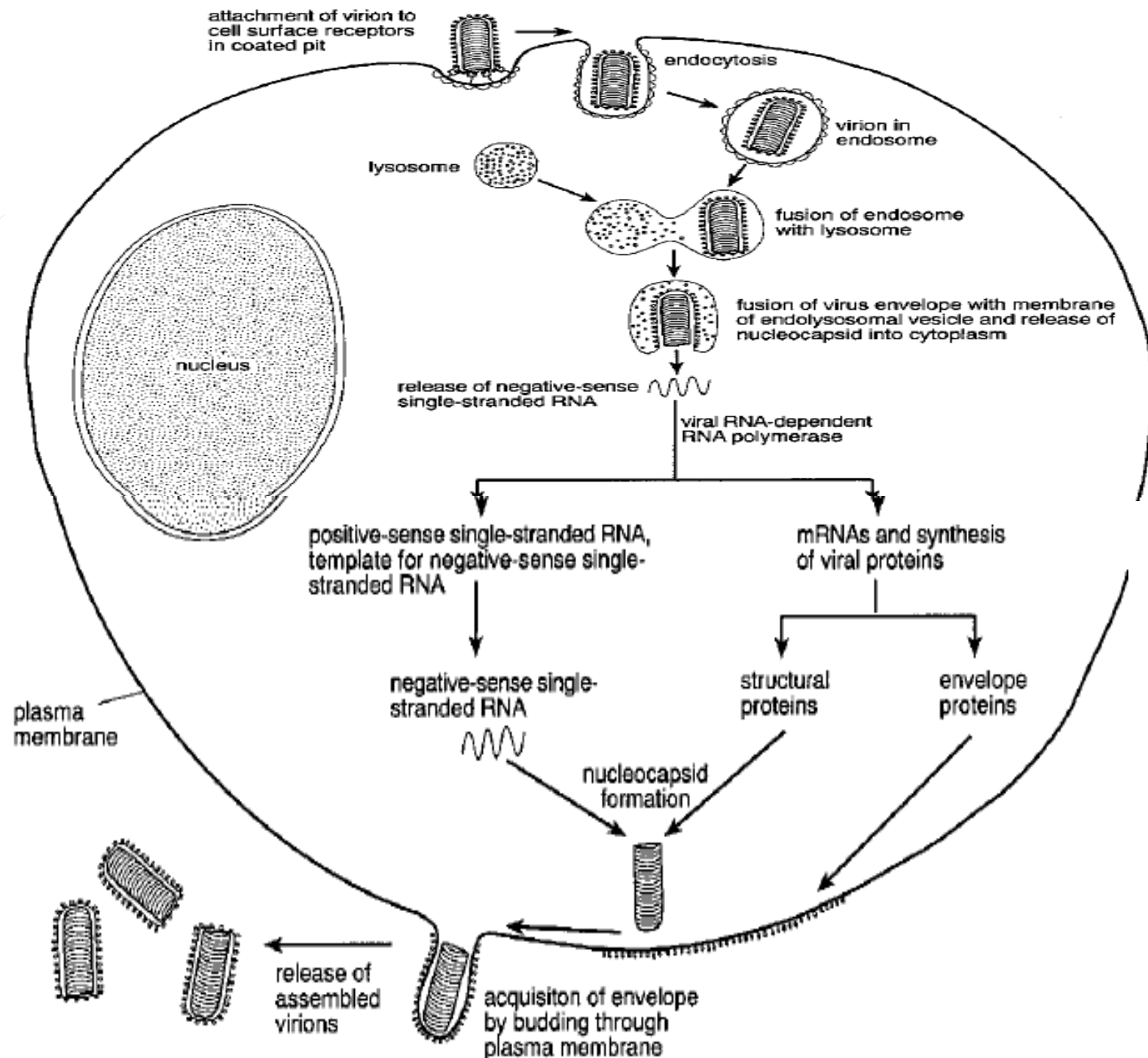
- Non-segmented, negative sense SS RNA (13-19kb in size)
- Two types of glycoprotein (spikes) project from the envelop, which can induce the production of virus neutralizing antibodies in infected host.
- The glycoprotein spikes are:
 - i. **Attachment protein**: The attachment protein may either be a haemagglutinin- neuraminidase protein (**HN**) or a protein without neuraminidase activity (**G**). The attachment proteins allow the virus to bind to cell surface receptors
 - ii. **Fusion protein (F)**: This causes the virus envelope to fuse with the host cell membrane
- Another protein associated with the matrix of virus known as **M-protein**





Cont....

- In general paramyxoviridae **epitheliotropic**
- Replication occur in cytoplasm, **intracytoplasmic inclusion bodies** forms
- Mature virions are released **by budding** from the plasma membrane at the sites containing virus envelope proteins.
- Infection of virus produce **effective immune response** and antibodies are neutralizing in nature
- Virions are very labile and sensitive to heat, desiccation, lipid solvents, non-ionic detergents and disinfectants.




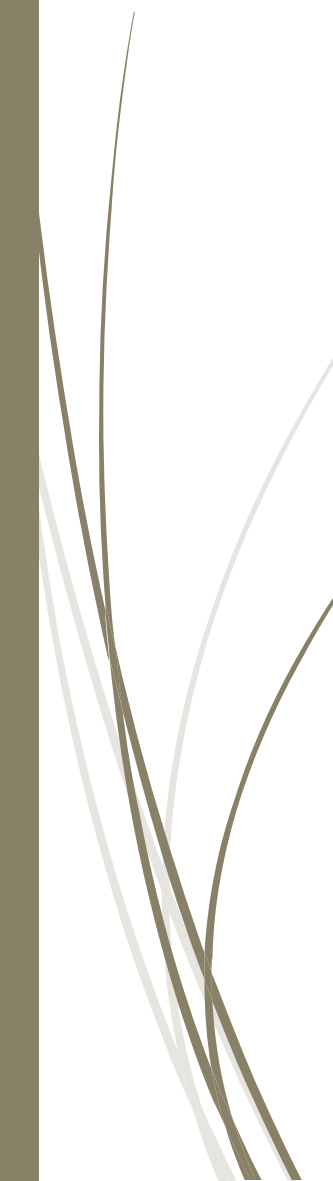
Classification

- **Order: Mononegavirale, Family: *Paramyxoviridae***
- **Subfamily: *Avulavirinae***
- Genus: orthoavulavirus
 - Species: Avian orthoavulavirus 1 – Newcastle disease
- **Subfamily: *Orthoparamyxovirinae***
- Genus: morbillivirus
 - Species: Canine morbilli virus – Canine Distemper
 - Species: Canine morbilli virus – Porcine Distemper
 - Species: Rinderpest morbilli virus – Rinderpest
 - Species: small ruminant morbilli virus – PPR
- Genus: Respirivirus
 - Species: Bovine respirovirus 3 – Bovine parainflueza
 - Species: Human respirovirus 3 – Human parainfluenza
- Genus: Henipa virus
 - Species Hendra henipa virus – Hendra virus
 - Species : Nipah henipa virus – Nipah virus
- **Sub family: *Meta paramyxovirinae***
- **Sub family: *Rubulaviridae***

Newcastle disease



- Synonyms: Ranikhet disease, Pseudofowl pest, Avian distemper, Avian pneumoencephalitis, Pseudopoultry plaque
- Etiology – Family *Paramyxoviridae*
- **Subfamily: *Avulavirinae***
- Genus: orthoavulavirus, Species: Avian orthoavulavirus 1 – APMV virus
- APMV-1 – cause Newcastle disease (NCD)
- Main Host – Poultry, duck, geeze but also infects Parrots, Ostrich and Migratory waterfowl

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- First described in 1936 in Indonesia in JAVA and subsequently Newcastle in England, hence named as Newcastle Disease (NCD)
 - In 1927 disease reported from Nanital region in Ranikhet area in India - named as Ranikhet disease
 - Virus has a property of haemagglutination of mammalian and avian RBCs
 - Virus easily inactivate at temp of 56°C in 3hrs. And at 60°C for 30 min.
 - Virus inactivated by acidic pH sensitive to ether, and organic solvents
 - Morbidity – 100%
 - Mortality – 90% depends on virulence of strain and vaccination history of flock



Transmission



- The virus is shed in all secretions and excretions of the affected host
- Direct contact
- Ingestion of and faecal material
- Inhalation of droplets
- Indirect through contaminated feed, water and clothing
- Although not vertically transmitted, chicks can be infected in hatcheries via contaminated egg shells.



Pathogenesis



- Initially the virus replicates in the mucosal epithelium of the upper respiratory and intestinal tracts
- After infection, virus spreads via the blood to the spleen and bone marrow, producing a secondary viremia.
- Leading to infection of other target organs: lung, intestine and central nervous system.
- Respiratory distress and dyspnea result from congestion of the lungs and damage to the respiratory center in the brain.
- Gross pathologic findings include ecchymotic hemorrhages in the larynx, trachea, esophagus, and throughout the intestine.


Pathotypes of NDV

Pathotypes of NDV based on virulence and tissue tropism:

- ▶ **Viscerotropic velogenic strain:**
 - ▶ causes severe fatal disease characterized by haemorrhagic intestinal lesions
- ▶ **Neurotropic velogenic:**
 - ▶ causes acute disease characterized by nervous (encephalitis) and respiratory signs with high mortality
- ▶ **Mesogenic strains:**
 - ▶ causes mild disease with mortality confined to young birds. This presents with respiratory signs, occasionally nervous signs but low mortality.
- ▶ **Lentogenic strains:**
 - ▶ causes mild or subclinical respiratory infection.
- ▶ **Asymptomatic enteric strains:**
 - ▶ a form that usually consists of a subclinical enteric infection.



Cont...

- Virulence of the strain tested by Mean Death Time (MDT) in embryonated egg.
 - Intra Cerebral Pathogenecity Index (ICBI) – To know the rapidity with which young chicks will be killed when virus inoculated Intra cerebrally
 - Plaque formation test in chick embryo cells
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Different forms of Disease

Different pathotypes responsible for the different forms of disease.

➤ Doyle's/ Asiatic forms of disease –

- caused by velogenic vescerotropic strain of virus responsible for acute form of disease which is highly fatal.
- Chickens are mainly affected and turkey less affected. Respiratory and intestinal tract affected, haemorrhagic lesions are seen. Mortality 90-100%.

➤ Beach's form/ pneumoencephalitis form –

- caused by velogenic neurotropic strain.
- Mostly neurological signs. Mortality 100%

➤ Beaudette form –

- caused by mesogenic strain.
- Respiratory signs occur occasionally nervous signs

➤ Hitcher's form –

- caused by lentogenic strains,
- Mild respiratory symptoms subclinical infection.
- Can effect all ages of birds but mortality is negligible.

Clinical signs


- Incubation period – 2-15 days
- Respiratory signs – Dyspnoea, Gasping, Nasal discharge, cyanosis of comb and wattles
- Intestinal signs - Crop dilatation, fibrinous exudate in pharynx, yellowish greenish diarrhoea
- Nervous signs – Muscle tremor, Drooping of neck Twisting of neck, Paralysis of Veins and nerves
- Oedema of head and neck
- In acute case sudden death
- Edema, hemorrhages, necrosis and ulceration of lymphoid tissue.
- Pathognomic lesion – pin point hemorrhages in proventriculus and gizzard.

Diagnosis

- ▶ Sample collection: trachea and cloacal swabs, nasal secretion and faeces
- ▶ Dead birds – oral nasal swab, lung tissue, kidney, spleen, brain, liver and heart.
- ▶ Isolation/ cultivation of Virus – in Embryonated chicken egg (9-12 days old) by allantoic route. Virus kills embryo within 24-72 hrs and shows hemorrhages and encephalitis
- ▶ After that allantoic fluid is tested for haemagglutination activity
- ▶ Virus can also be grown in chicken embryo fibroblast culture, BHK-21 cell lines
- ▶ Haemagglutination inhibition test using specific antiserum confirms the presence of NDV
- ▶ Immunofluorescent test for antigen detection
- ▶ ELISA
- ▶ RT-PCR



Prevention and control

- Locating poultry farms far apart
 - Preventing wild birds from having access to pens and feed-stores
 - Restricted human access to farm
 - Movement restriction between farms
 - Thorough cleaning and disinfection of vehicles and equipment
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Different strains used in live virus vaccines

Most common lentogenic strains of NDV

- Strain F – Strain isolated by Asplin (1952) and has lowest virulence among all lentogenic strains. least antigenicity
- Strain B-1 – isolated by Hitcher and Johnson (1948) and it is slightly more virulent and more immunogenic than F strain
- Lasota strain – isolated by Beaudatte (1949). This is more pathogenic than other two strains mentioned above.
- Strain CDF66 – this is another lentogenic strain of NDV isolated from respiratory tract of a pig in 1966 by Malik et al in India. It as good antigenecity

Mesogenic strain of NDV

- Mukteswar strain (R2B) – (Iyre and Hashmi, 1945)
- Komarov strain – less pathogenic than mukteswar strain
- Raokin strain - mostly used USA as a Vaccine strain



Vaccination

Vaccination: Lentogenic or mesogenic strains of NDV propagated in egg or tissue culture are used in live vaccines. They are administered as sprays, in drinking water or by Intranasal.

Live lentogenic vaccine – (Hitcher's B1 and Lasota strain) by intra ocular or intranasal or through spray.