



Coronaviridae With Special Reference to Infectious Bronchitis

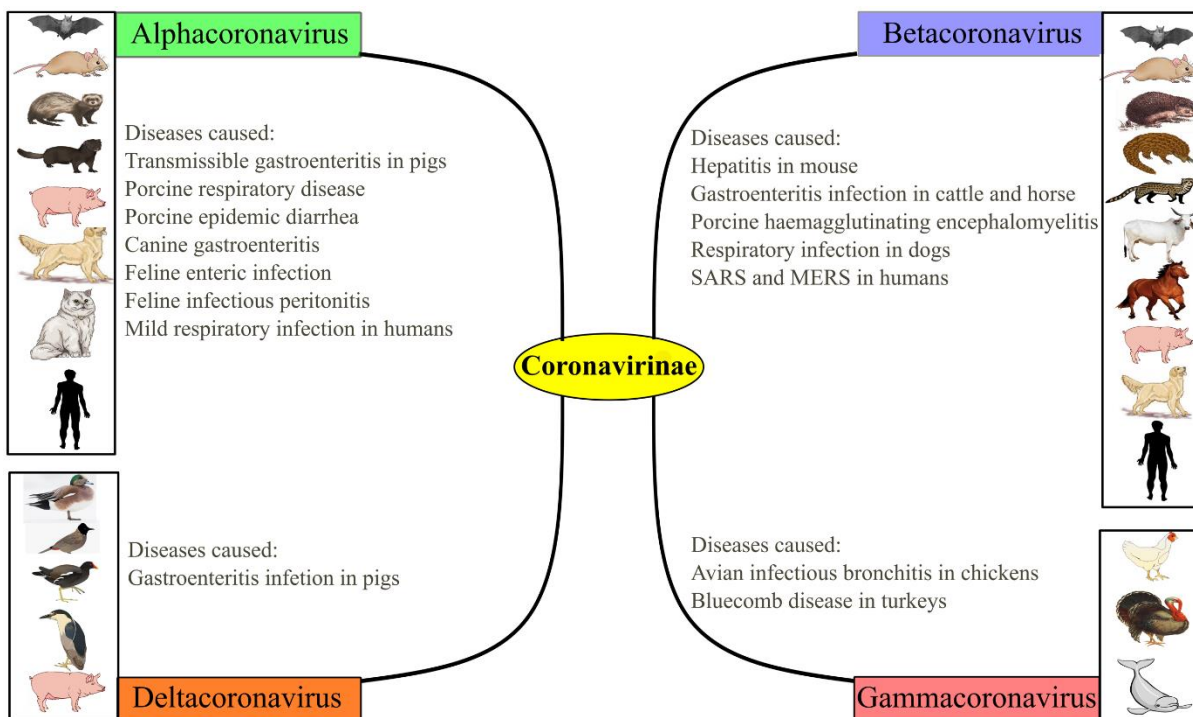
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<https://doi.org/10.5281/zenodo.7595735>

What is *Coronaviridae*?

Coronaviridae is a family of virus that consists of three sub-families namely *Letovirinae*, *Orthocoronavirinae* and *Pitovirinae*. Under the subfamily *Orthocoronavirinae*, four genera namely Alphacoronavirus, Betacoronavirus, Gammacoronavirus and Deltacoronavirus have been classified. The diseases caused by these genera of *Orthocoronavirinae* subfamily are illustrated pictorially in Figure – 1.



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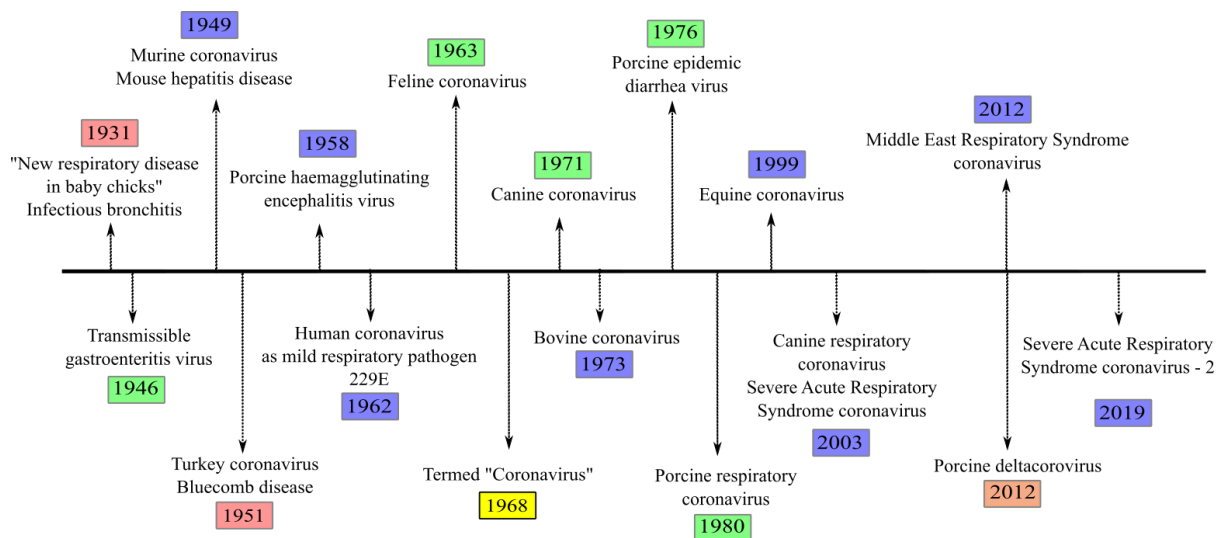


When was Coronavirus first identified?

The first occurrence of Coronavirus (CoV) was avian infectious bronchitis virus that was reported in the year 1931 in chicks as “an apparently new respiratory disease”. The details of the first report of various CoV are depicted pictorially in Figure – 2.

How did Coronavirus get its name?

During the 1930s, it was not named as CoV. Later in the year 1964, three scientists from the Cambridge University, England studied the morphological features of c virus through electron microscope, and they reported that these viruses had projections called “spikes.” Subsequently, in the year 1967, two scientists from England, reported that the morphological features of human CoV isolated in the early 1960s was like that of the avian CoV reported in the year 1931. Hence, all these scientists proposed these viruses as “coronavirus” owing to the appearance of ‘solar corona.’ Prior to the electron microscopic examination, avian infectious bronchitis was observed under microscope and was reported as “doughnut” shaped virus, pear shaped virus with rod shaped spikes and as particles that appear in pairs or clumps.



Infectious bronchitis

Infectious bronchitis (IB) is a coronaviral disease that affects poultry. The causative of this disease is Avian coronavirus, under subgenus *Igacovirus*, genus *Gammacoronavirinae*, subfamily *Orthocoronavirinae* of family *Coronaviridae*. Avian coronavirus primarily affects respiratory system, and have also been reported to kidney, intestinal and neuromuscular system. It affects chickens primarily, and young chicks are more susceptible than adults. Symptoms of IB include gasping, coughing and nasal discharge with wet eyes, and swollen sinuses. In layers, it causes misshapen soft-shelled eggs, and causes cause teratological changes like stunted and curled embryos upon cultivation in embryonated chicken eggs. Some of the strains of IB include M5, M41, M151, Gray, Holt, Florida and B17, and some of the serotypes include Massachusetts, Arkansas and Connecticut.



How can the genome of Avian Coronavirus be described?

Avian Coronavirus genome can be described as a single stranded, positive sense, RNA genome of approximately 27.6 kb in size encoding four structural proteins namely spike (S), small envelope (E), integral membrane (M), and nucleocapsid (N). These structural genes are flanked on with polymerase on the 5' untranslated regions (UTRs) and with poly(A) tail on the 3' UTR, thereby arranging the genome in the order 5'-Pol-S-E-M-N-3'.

What are the functions of the different genes of Avian Coronavirus?

S gene is a glycoprotein that can be post transcriptionally cleaved into two subunits namely S1 and S2. S1 subunit forms the globular head of the spike protein and is regarded as the virus neutralizing and antigenic determinant. S1 plays a key role in host specificity, tissue tropism, viral attachment, and entry into host cell. S2 facilitates fusion of viral envelope to host cell membrane thereby enabling the entry of the virus into host. S gene serves as an important molecular determinant for identification of genotypes. E gene is a non-glycosylated protein involved in viral assembly and virus particle formation. M gene is a glycoprotein that maintains the structural integrity of Avian Coronavirus. It is also involved in virus assembly along with E gene and is involved in fusion along with S gene. N gene is involved in replication and transcription regulation, viral packaging and modulation of host cell processes upon interaction with host cell proteins.

What is the importance of N gene?

The 3' UTR of N gene has been reported to be conserved among different strains of avian coronavirus and hence has been designated as an important entity in molecular diagnosis of IB.

How Avian Coronavirus is being classified based on phylogeny?

Avian Coronavirus has been classified into 32 lineages categorized under six genotypes. Of these 32 lineages, 27 have been categorized under genotype I, and the remaining genotypes contain one lineage each. These lineages have been identified based phylogenetic analysis of S gene and based on geographical location. The different lineages include indigenous Asian, indigenous North American, North American and Asian, indigenous South American, European, indigenous African, European and African, indigenous Middle Eastern and indigenous Australian and New Zealand lineages.

How can Avian Coronavirus be cultivated in eggs?

Avian Coronavirus can be cultivated in amnio-allantoic fluid of 9 – 11 days old embryonated chicken eggs through intra-allantoic route, by incubating at 37°C for 72 hours. Field Avian Coronavirus might cause teratological changes like stunted and curled embryos.

What are the different vaccines available for prevention of IB in chicks?

Brand name	Serotype / Strain	Live / Inactivated	Manufacturer
Nobilis IB+ND*	M41	Inactivated	Nobilis
Avian Infectious Bronchitis Vaccine**	H120	Live, attenuated, freeze dried	Bio-Med



Globivac ND+IB	H120	Live, attenuated, freeze dried	Globion Pvt. Ltd.
Globivac IB H120	H120	Live, attenuated, freeze dried	Globion Pvt. Ltd.
Globivac IBK	Mass	Inactivated	Globion Pvt. Ltd.
Globivac ND+IBK	Mass	Inactivated	Globion Pvt. Ltd.
Inactivated IB, Inactivated IB+**	Mass	Inactivated	Hester Biosciences
Live H120	H120	Live	Hester Biosciences

*Combined vaccine; **Combined vaccine with ND is also available

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