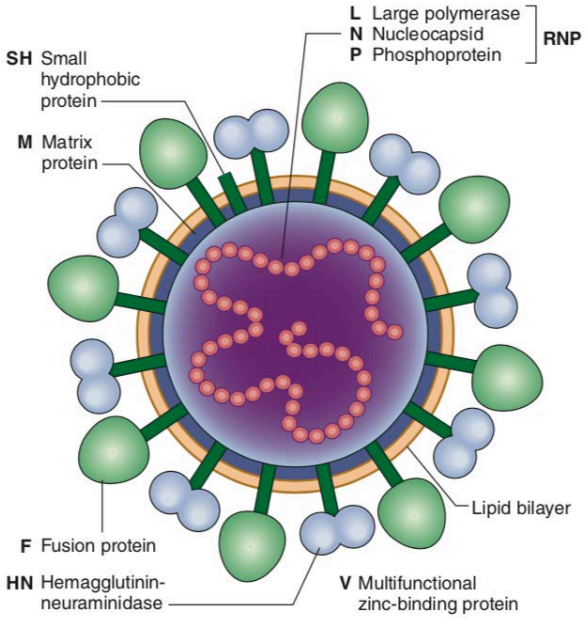
Property	Paramyxovirinae				Pneumovirinae	
	Respirovirus	*Rubulavirus*	*Morbillivirus*	*Henipavirus*[a]	*Pneumovirus*	*Metapneumovirus*
Human viruses	Parainfluenza 1, 3	Mumps, parainfluenza 2, 4a, 4b	Measles	Hendra, Nipah	Respiratory syncytial virus	Human metapneumovirus

Diagram of paramyxovirus



- Family: Paramyxoviridae
- Genus: *Morbillivirus*
- Enveloped, non-segmented, single stranded, negative-sense RNA virus.
- 100 to 250 nm.
- Inner nucleocapsid encodes at least eight structural proteins: F, C, H, L (large), M (matrix), N, P, and V.
- An envelope that include the hemagglutinin (H) and the fusion (F) proteins, M protein – inner lipid bilayer.
- H glycoprotein is involved in attachment of the virus to host cells via CD46 and is the antigen against which neutralizing antibody is formed.
- F glycoprotein is involved in spread of the virus from one cell to another.
- N, P, L are complexed with RNA.
- C and V play roles in the regulation of transcription and replication of the virus.
- Different genotypes: 8 clades, designated A, B, C, D, E, F, G, and H. Within these clades, there are 23 recognized genotypes ->important in epidemiology investigations
- **Only one serotype i.e.** *Life-long immunity occurs in individuals who have had the disease.*

Epidemiology

In the decade before 1963 when a vaccine became available, globally over 2 million deaths occurred annually; the majority in children <5 years of age. People born before 1966 were considered to be naturally immune as circulating virus was prevalent before this time, suggesting most persons would have acquired immunity from natural infection.

1975: Measles vaccine funded for all Australian infants at 12 months of age.

1989 -1998: MMR vaccine funded on the national schedule: starting to know that one vaccine dose only lasts for 5 years. Second dose was given at different age; from adolescents then age lowered to 4-5 years.

2013: Second dose moved forward to 18 months of age, given as MMRV

Measles notification rates in Australia have been progressively decreasing since 1994. In 2014, the WHO verified that Australia had achieved 'measles elimination' status, defined as the absence of endemic transmission in a defined geographical area for ≥ 12months. Although measles is no longer endemic here, Australia continues to have imported cases in overseas visitors and returning residents, with incidences of small to moderate-sized outbreaks.

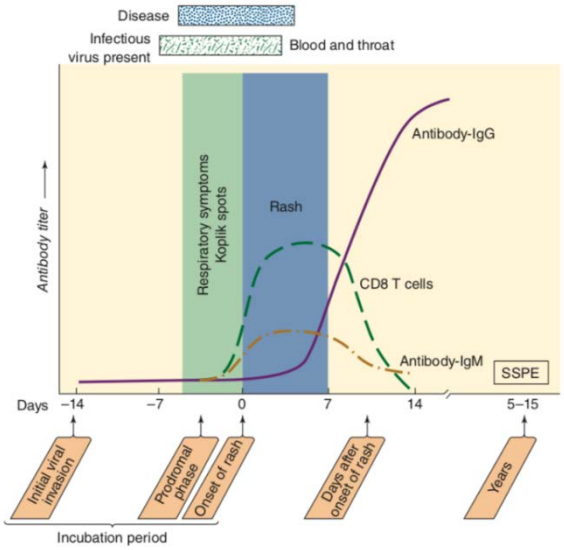
Spread of Infection

- Highly contagious, it is one of the most communicable infectious diseases.
- Remains infective in droplet forms in air for up to 2 hours.
- Spread by direct contact with droplets from respiratory secretions of infected persons and also by the airborne route.
- Most infectious during the late prodromal phase, when cough and coryza are at their peak; High infectivity 5 days before and up to 4 days after the exanthem.

Clinical Features

- Incubation period: 6-21 days (median 13 days)
- Prodromal phase: fever, **conjunctivitis** (causing photophobia), **coryza, cough.**
- Koplik's spot (bright red lesions with the white, central dot)

- **Maculopapular rashes**, *Progresses from face to body to extremities*
  - *Rash becomes confluent as it progresses*
  - *Rash affects palms and soles*



- **Other clinical variants of Measles:**
  - Modified measles: in partially immune persons, such as infants with residual maternal antibody. The incubation period is prolonged, prodromal symptoms are diminished, Koplik spots are usually absent, and the rash is mild.
  - Atypical measles has been described in persons who received killed measles vaccine followed by live vaccine, or received killed vaccine followed by exposure to wild-type measles virus. The disease tends to be severe with a more prolonged course with pneumonitis, hepatitis and atypical rash; therefore, the vaccine was withdrawn. The pathogenesis is believed to be hypersensitivity to measles virus in a partially immune host. Killed measles vaccine lacks the antigen that stimulates the immunity that prevents entry of measles virus into cells, thereby allowing measles infection to occur, despite the partial immunity derived from killed vaccine.

Complications

- Otitis media (9%); viral pneumonitis (6%), diarrhoea (8%)
- Secondary bacterial pneumonia (accounts for 60% of death).

- Neurological complications:
  - Encephalitis: 1 per 1000 cases
  - Post infectious encephalomyelitis (acute disseminated encephalomyelitis): an autoimmune disease associated with an immune response to myelin basic protein. The mortality rate in encephalitis associated with measles is about 10–20%. The majority of survivors have neurologic sequelae.
  - Subacute sclerosing panencephalitis (SSPE): 0.5 to 1 in 100,000 cases; occurring on average 7 years after infection. SSPE causes progressive brain damage and is always fatal.
- Rubeola during pregnancy, in contrast to German measles (rubella), is not known to cause congenital anomalies of the fetus but associated with increased risk of still birth, premature delivery and spontaneous abortion.

Laboratory diagnosis

Laboratory confirmation is not necessary for cases which meet the clinical case definition and have a clear epidemiological link to a laboratory-confirmed case but may still be sought. The results should be interpreted in the context of the clinical and epidemiological findings, and vaccination history.

- Measles virus nucleic acid testing (NAT) /PCR
  - Respiratory specimens such as nasopharyngeal aspirate or swab/ First catch urine or EDTA blood sample for NAT. (can be detected up to 3 weeks after onset of the rash)
- Serology testing
  - Measles-specific IgM is sensitive and specific for recent measles infection but can remain positive for 1 to 2 months following immunisation. IgM result can be negative early in the illness if taken less than 72 hours after the onset of the rash.
  - An IgM response will be present in approximately 75% of measles cases 3 days after rash onset, rising to approach 100% after 7 days.
  - A measles IgG antibody test should be performed together to interpret the result.
  - If no IgM or IgG is detected in a suspected case within 3 days onset of rash, repeat testing is recommended after 1 week.
- Viral culture
- Immunofluorescence
  - Antigen testing by immunofluorescence can be performed on respiratory or urine sample, however sensitivity and specificity are poor in comparison with other diagnostic methods.
- Genotyping
  - Assists in confirming the source of measles.

Therapy

- No specific antiviral treatment
- Measles virus is susceptible in vitro to inhibition by ribavirin, but clinical benefits have not been proved.
- Vitamin A once daily by mouth for 2 days found to reduce severity; some immunomodulation effect especially in vitamin A deficiency.

Isolation and restriction

- Suspected, probable and confirmed cases should be excluded from work, school, early childhood education and care services until 4 days after the onset of the rash.
- Hospitalised measles cases should be kept in respiratory isolation/airborne precautions until 4 days after the onset of the rash.

Prevention

- Active immunisation:
  - There are 2 types of live attenuated virus vaccines
    Combination measles-mumps-rubella (MMR) vaccine
    Combination measles-mumps-rubella-varicella (MMRV) vaccine
  - The 1st dose should be given at 12 months of age as MMR vaccine. MMRV vaccines are *not* recommended for use as the 1st dose of MMR-containing vaccine in children <4 years of age, due to a small but increased risk of fever and febrile seizures when used as 1st dose.
  - MMRV vaccine can be given at 18 months of age as the 2nd dose. If MMRV is not available, MMR can be given at the 4-year of age as the 2nd dose.

- Post-exposure prophylaxis
  - Susceptible contacts can be considered for MMR vaccine, even if the exposure is more than 72 hours.
  - Normal human globulin (NHIG) should usually be reserved for contacts at higher risk or severity of disease such as susceptible household contacts, immunocompromised individuals, pregnant women who cannot provide evidence of either immunisation or immunity, infants too young to be vaccinated and who are not likely to be protected by maternal antibodies.
  - Note: People who receive NHIG for measles post-exposure prophylaxis will not be able to receive an MMR (or varicella)-containing vaccine for at least 5 months (dependent on dose).

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