Rhabdoviruses

Family: *Rhabdoviridae*

Genus	Type species
Vesiculovirus	Vesicular stomatitis virus Indiana
Lyssavirus	Rabies virus
Ephemerovirus	Bovine ephemeral fever virus
Novirhabdovirus	Infectious hematopoietic necrosis virus
Cytorhabdovirus	Lettuce necrotic yellows virus
Nucleorhabdovirus	Potato yellow dwarf virus

Among the 175 known rhabdoviruses are the causative agents of rabies, one of the oldest recognized infectious diseases, and economically important diseases of fish. The host range of these viruses is very broad: they infect many vertebrates, invertebrates, and plants. The genome of vesicular stomatitis virus has been a model for the replication and expression of viral genomes that consist of a single molecule of (–) strand RNA. The first RNA-dependent RNA polymerase discovered in a virus particle was that of vesicular stomatitis virus. The mapping of vesicular stomatitis virus gene order with ultraviolet light remains a classic study.

Figure 23 Structure and genomic organization of vesicular stomatitis virus. (A) The virion. (Left) Electron micrograph of negatively stained vesicular stomatitis virus. Courtesy of J. Rose, Yale University School of Medicine. (Right) Diagram of the virion, indicating the locations of the five virion proteins, the nonsegmented (–) strand genomic RNA, and the viral envelope. **(B) Genome organization.** Starting at the 3′ end, the (–) strand RNA genome encodes a small leader (l) RNA and the N, P, M, G, and L proteins. The (–) strand RNA is the template for synthesis of leader RNA and five monocistronic mRNAs (capped and polyadenylated) encoding the five viral proteins.

Figure 24 Single-cell reproductive cycle. The virion binds to a cellular receptor and enters the cell via receptor-mediated endocytosis **(1)**. The viral membrane fuses with the membrane of the endosome, releasing the helical viral nucleocapsid **(2)**. This structure comprises (–) strand RNA coated with nucleocapsid protein molecules and a small number of L and P protein molecules, which catalyze viral RNA synthesis. The (–) strand RNA is copied into five subgenomic mRNAs by the L and P proteins **(3)**. The N, P, M, and L mRNAs are translated by free cytoplasmic ribosomes **(4)**, while G mRNA is translated by ribosomes bound to the endoplasmic reticulum **(5)**. Newly synthesized N, P, and L proteins participate in viral RNA replication. This process begins with synthesis of a full-length (+) strand copy of genomic RNA, which is also in the form of a ribonucleoprotein containing the N, L, and P proteins **(6)**. This RNA in turn serves as a template for the synthesis of progeny (–) strand RNA in the form of nucleocapsids **(7)**. Some of these newly synthesized (–) strand RNA molecules enter the pathway for viral mRNA synthesis **(8)**. Upon translation of G mRNA, the G protein enters the secretory pathway **(9)**, in which it becomes glycosylated and travels to the plasma membrane **(10)**. Progeny nucleocapsids and the M protein are transported to the plasma membrane **(11** and **12)**, where association with regions containing the G protein initiates assembly and budding of progeny virions **(13)**.