Excerpt from: Flaviviruses

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It is important for man to understand the molecular properties of the flavivirus, since they dictate how the virus reproduces, grows, and infects. Once virologists understand the virus's molecular biology, they can develop new vaccines and medical treatments against this disease-causing agent. An overview of the molecular biology includes a description of the virus's physical structure, chemical nature, and infection mechanism.

Like all other viruses, the flavivirus is not a living organism, but a chemical particle made up of two main components: a protein coat and genetic material. The protein coat surrounds the genetic material of the virus and protects it from the environment; it also helps the virus bind to new cell hosts during the course of infection. The flavivirus takes the form of a spherical, enveloped particle made up of a layer of lipids (or fat molecules) surrounding a strand of RNA (the virus's genetic material) that is intertwined with multiple copies of a specific kind of protein, the capsid C protein. This protein is used as a structural component of the virus's interior body, the nucleocapsid. Mixed within the surrounding lipid layer are multiple copies of two other kinds of proteins, called the envelope E protein and the membrane M protein. While the capsid C protein serves a structural role, the envelope E and membrane M proteins play important parts in the reproduction of the virus and its binding to antibodies and surface cel1 receptors (proteins anchored in the cell membrane). Binding with surface cell receptors allows the virus to enter the cell and begin its parasitic activities; binding with antibodies causes the virus to be marked for destruction by the animal host's immune system. Both binding processes have important consequences for the virus; hence it is important that the nature of these viral proteins is understood in greater detail.

Because they are too small, flaviviruses cannot carry out the complex activities of growth and metabolism - hence, they must enter host cells and exploit their systems for growth and reproduction. These injurious effects of viral replication in cells are one of the basic causes of viral disease. Flaviviruses gain entry into cells through a process called receptor-mediated endocytosis. In the first step, the virus attaches itself to the receptor proteins on the surface of the cell's membrane with its envelope E proteins. This binding event sends a signal through the cell's receptor proteins, which act like antennae, and triggers a response by the cell to form a pit within its membrane. This pit will eventually engulf the virus and enclose it within a membrane-bound sack. The membrane-bound virus is then transported to an acidic compartment within the cell, called the endosome, where the acidic environment indirectly causes the release of the virus particle from its membrane coat. Once released, the virus disassembles and its RNA genetic material is freed into the cell's cytoplasm, where it is replicated into multiple copies of RNA. These newly synthesized strands of RNA then give rise to the structural protein components of the next generation of flaviviruses, which are assembled within the cell and are released into the environment by budding through the cell's membrane.