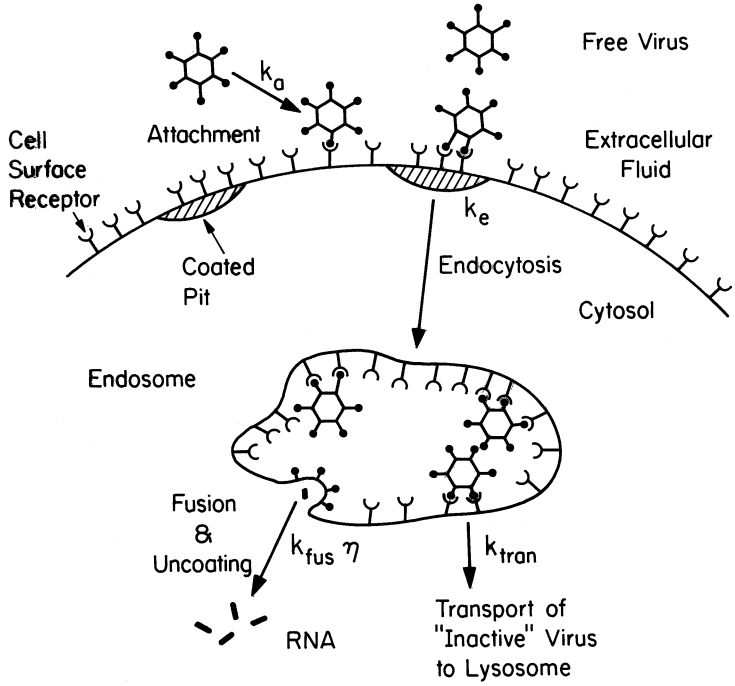

Figure 15.2. The trafficking of an enveloped RNA virus is depicted. A mathematical model of these processes is given in the text.

number of available receptors per cell. If the ratio of R to V_{ex} is large, R is approximately the total number of receptors.

Once the virus is attached, it randomly associates with "coated pits," which internalize the virus through the process of *endocytosis*. Endocytosis is a process of invagination of the plasma membrane to form a vesicle in which the receptors and anything attached to the receptors are captured within the vesicle. Such vesicles are known as *endosomes*. The rate of endocytosis is assumed to be:

$$dV_i/dt = k_e V_s \tag{15.3}$$

where V_i is the number per cell of internalized virus, V_s is the surface concentration of virus (number per cell), and k_e is the endocytosis rate constant.

The amount of surface virus can be determined from combining eqs. 15.1 and 15.3 to give:

$$dV_s/dt = k_a C V_{ex} - k_e V_s \tag{15.4}$$

Endosomes are intermediates in recycle of plasma membrane components and transport of internalized materials to lysosomes for degradation. For the virus to replicate successfully it must escape from the endosome before it is delivered to a lysosome. Endosomes undergo a biphasic pH change. In early endosomes pH drops from about 7.5 to 6.0 within 5 to 10 min. In the second phase pH drops slowly to about 5.2 in another 30 to 60 min. The pH drop is due to membrane proteins that pump hydrogen ions into the endosome.