$$\begin{array}{c} E + S \underset{}{\overset{K'_m}{\rightleftharpoons}} ES \xrightarrow{k_2} E + P \\ + \\ I \\ \Big\Updownarrow K_1 \\ ESI \end{array} \tag{3.28}$$

With the definition of

$$K'_m = \frac{[E][S]}{[ES]}, \quad K_1 = \frac{[ES][I]}{[ESI]}$$
$$[E_0] = [E] + [ES] + [ESI] \text{ and } v = k_2[ES] \tag{3.29}$$

we can develop the following equation for the rate of reaction:

$$v = \frac{\dfrac{V_m}{\left(1 + \dfrac{[I]}{K_1}\right)}[S]}{\dfrac{K'_m}{\left(1 + \dfrac{[I]}{K_1}\right)} + [S]} \tag{3.30}$$

or

$$v = \frac{V_{m,\text{app}}[S]}{K'_{m,\text{app}} + [S]} \tag{3.31}$$

The net effect of uncompetitive inhibition is a reduction in both V_m and K'_m values. Reduction in V_m has a more pronounced effect than the reduction in K'_m, and the net result is a reduction in reaction rate. Uncompetitive inhibition is described in Fig. 3.10 in the form of a double-reciprocal plot.

High substrate concentrations may cause inhibition in some enzymatic reactions, known as *substrate inhibition*. Substrate inhibition is graphically described in Fig. 3.11.

The reaction scheme for uncompetitive substrate inhibition is

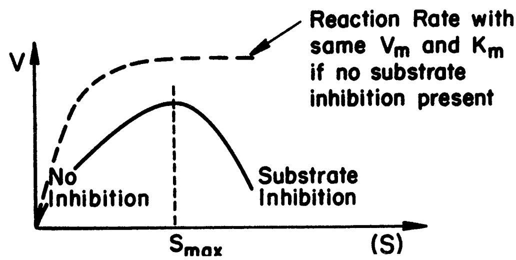

Figure 3.11. Comparison of substrate-inhibited and uninhibited enzymatic reactions.