APPENDIX

In the DNA-binding step, helicase (H) can bind to DNA in either the free or the ATP-bound form:

$$nH + DNA \overset{K_1}{\Leftrightarrow} DNA\bullet H_n \qquad nH\bullet ATP + DNA \overset{K_2}{\Leftrightarrow} DNA\bullet (H\bullet ATP)_n$$

with $K_1 = \dfrac{[DNA][H]^n}{[DNA \bullet H_n]}$ **(4)** and $K_2 = \dfrac{[DNA][H \bullet ATP]^n}{[DNA \bullet (H \bullet ATP)_n]}$ **(5)**

The conservation relationship for DNA substrate can be written as:

$$[DNA]_{total} = [DNA] + [DNA \bullet H_n] + [DNA \bullet (H \bullet ATP)_n] \qquad \textbf{(6)}$$

ATP can bind to the DNA-free or the DNA-bound helicase:

$$H + ATP \overset{K_3}{\Leftrightarrow} H\bullet ATP \qquad DNA\bullet H_n + nATP \overset{K_4}{\Leftrightarrow} DNA\bullet (H\bullet ATP)_n$$

with $K_3 = \dfrac{[H][ATP]}{[H \bullet ATP]}$ **(7)** and $K_4 = \dfrac{[DNA \bullet H_n][ATP]^n}{[DNA \bullet (H \bullet ATP)_n]}$ **(8)**

Eq. 6 can be simplified, because [DNA] $\rightarrow \varepsilon$ under conditions compatible with cooperative DNA-binding (excess of helicase over DNA):

$$[DNA]_{total} = [DNA \bullet H_n] + [DNA \bullet (H \bullet ATP)_n] \qquad \textbf{(9)}$$

Eq. 8 and 9 can be rearranged as:

$$[DNA]_{total} = [DNA \bullet (H \bullet ATP)_n](1 + \frac{K_4}{[ATP]^n}) \qquad \textbf{(10)}$$

The initial rate of DNA unwinding (v) is then given by:

$$v = \frac{k[DNA]_{total}[ATP]^n}{K_4 + [ATP]^n} \qquad \textbf{(11)}$$

where k is the catalytic rate constant.