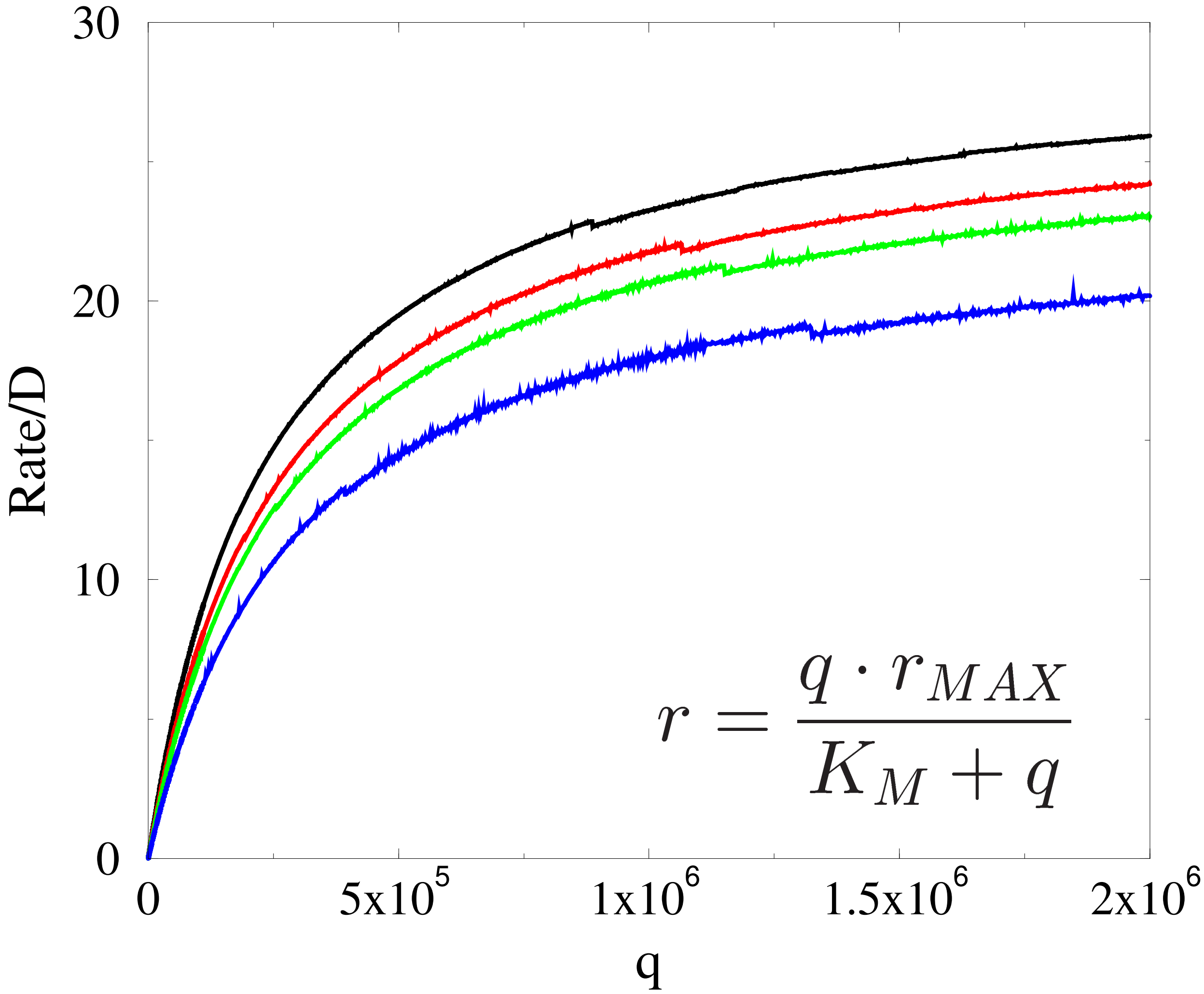
Results: rate of ATP consumption



$$q = \exp\left(\frac{\Delta\mu}{kT}\right) = \frac{[ATP]}{[ADP][P]}$$

Top to bottom curves: $F_{ext} = 0, -1, -3, -5$ in units of kT/p.

Michaelis–Menten mechanism

$$M + ATP \overset{K_M}{\rightleftharpoons} M \cdot ADP \cdot P \overset{K_{cat}}{\rightarrow} M + ADP + P$$

$$K_M = \frac{[M][ATP]}{[M \cdot ADP \cdot P]}$$

$$r = K_{cat}[M \cdot ADP \cdot P]$$

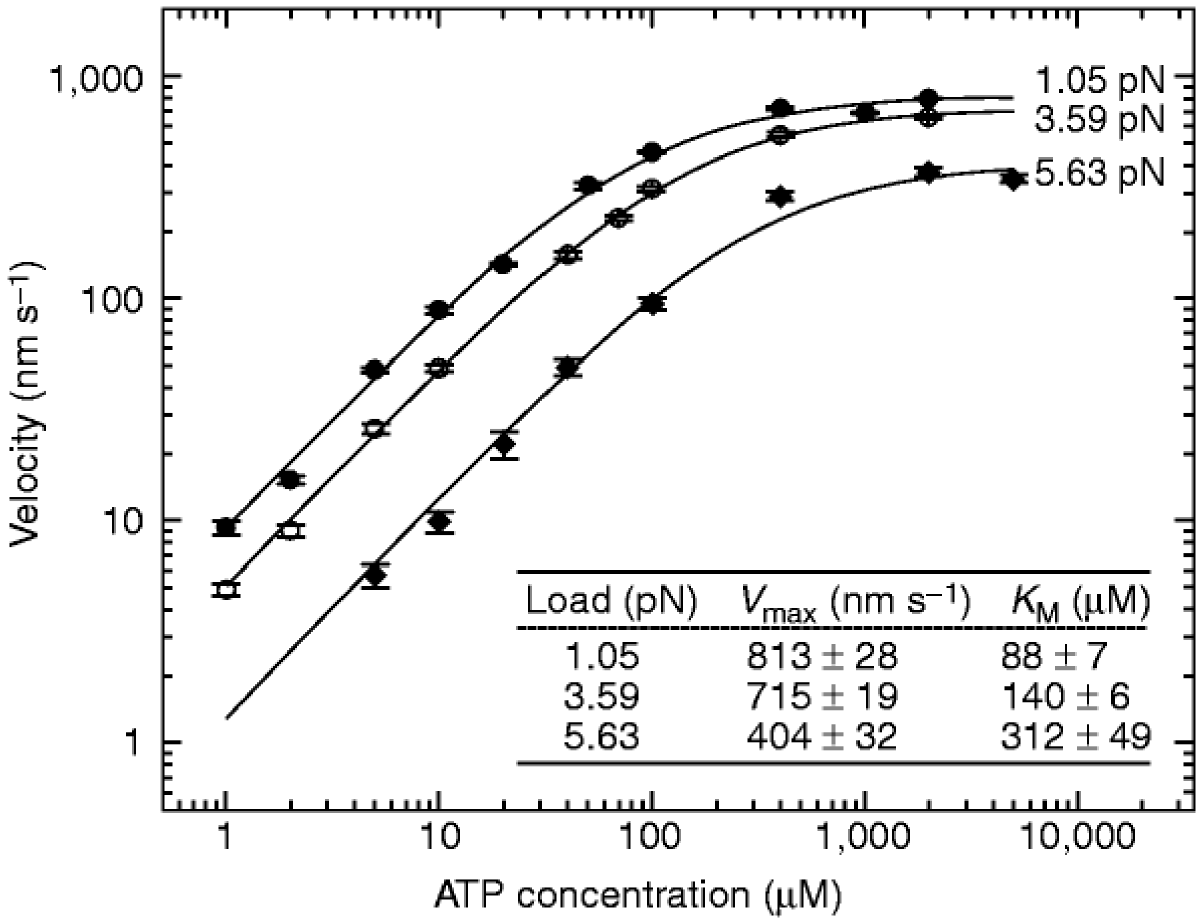
$$[M] = [M_0] - [M \cdot ADP \cdot P]$$

Michaelis law: $r = \dfrac{K_{cat}[M_0][ATP]}{K_M + [ATP]}$

Experimental results

K. Visscher, M.J. Schnitzer, S. Block, Nature 400, 8 July 1999, p. 184

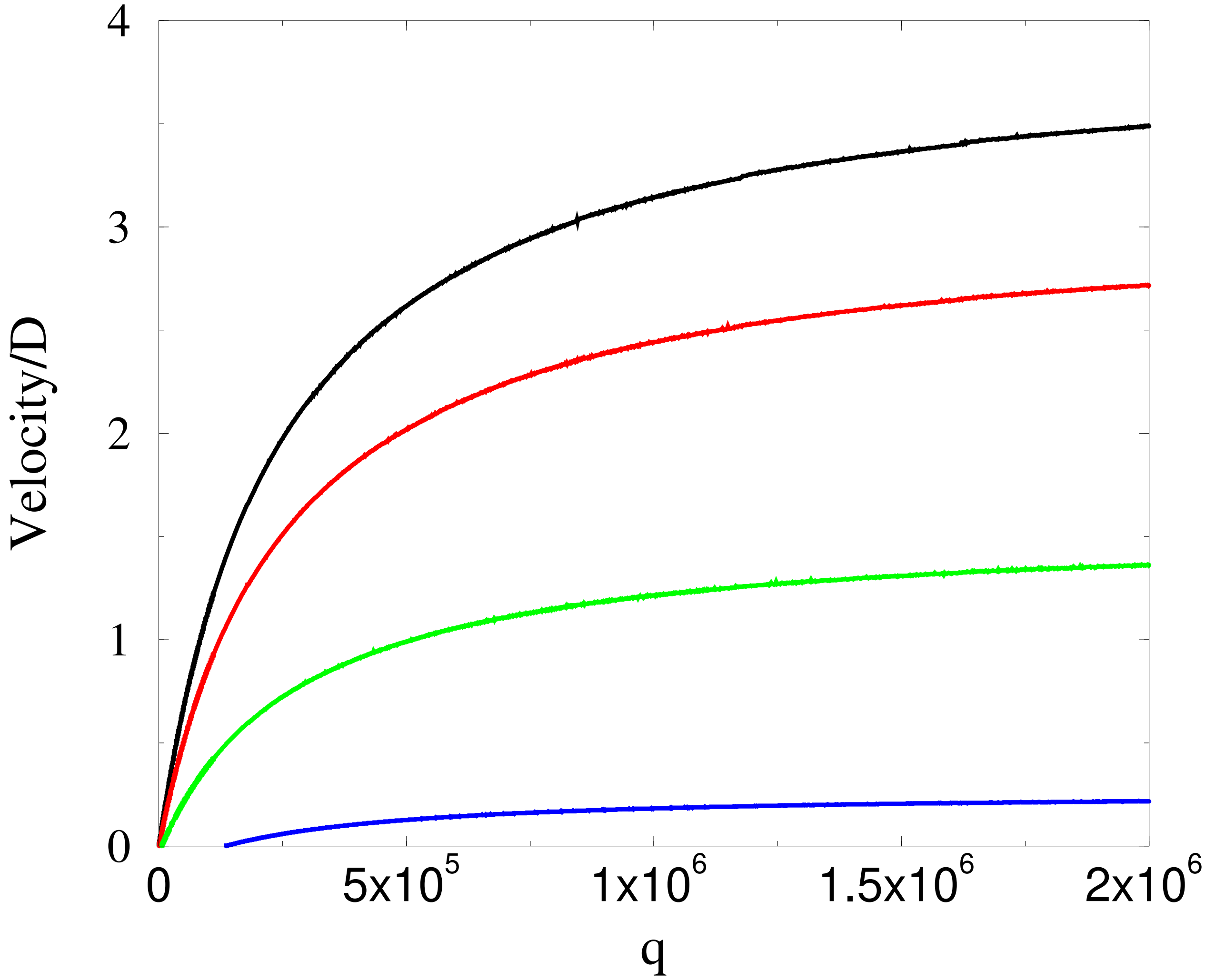
“a phenomenon that is inconsistent with either simple model”



$$v = \frac{v_{MAX}[ATP]}{K_M(F_{ext}) + [ATP]}$$

$$v_{MAX} = \epsilon(F_{ext})p \cdot K_{cat}$$

Results: velocity



$$v = \frac{\alpha \cdot (F_{ext}) r_{MAX} \cdot q}{K_M(F_{ext}) + q} + \beta(F_{ext})$$

Top to bottom curves: $F_{ext} = 0, -1, -3, -5$ in units of kT/p.