THE INFAMOUS HYPERBOLIC EQUATION IN BIOCHEMISTRY

Hyperbolic equations appear in biochemistry in a number of forms.
Here are several forms commonly encountered:

Binding of O_2 to myoglobin:

$Mb + O_2 \rightleftharpoons MbO_2$

Proportion of myoglobin bound to O_2

$$Y = \frac{MbO_2}{\text{Total Mb}} = \frac{MbO_2}{MbO_2 + Mb}$$

Velocity of enzyme-catalyzed reaction:

$E + S \rightleftharpoons E@S \rightleftharpoons E + P$

$V_o \propto [E@S]$ at all E_o, S_o

$$Vo = \frac{V_{max} @ S_o}{K_m + S_o}$$

where ratio $\frac{S_o}{K_m + S_o} = \frac{[ES]}{[E_o]}$ is the proportion of E_o present as ES.

At low S_o, $[E@S] \propto [S_o]$ so $V_o \propto [S_o]$

At high S_o, $[E@S]$ is maximum, and $V_o = V_{max}$

Proportion of an ionizable functional group in the conjugate base or acid form:

$HA \rightleftharpoons A^- + H^+$

$[HA]_T = [HA] + [A^-]$

$$\text{Proportion [HA]} = \frac{[HA]}{[HA] + [A^-]}$$

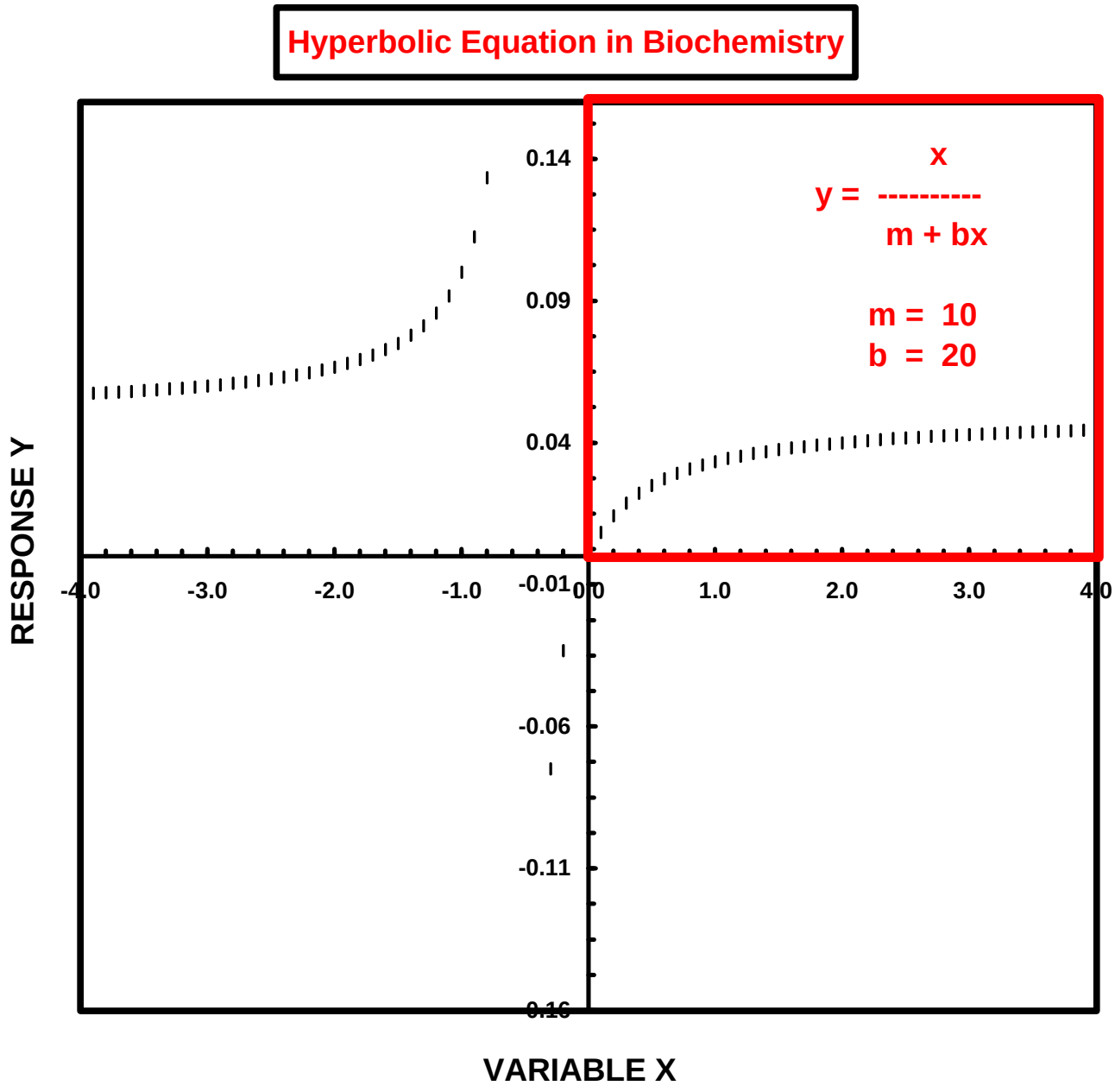
$$\text{Proportion } [A^-] = \frac{[A^-]}{[HA] + [A^-]}$$

$$\text{Proportion of HA} = \frac{[H^+]}{K_a + [H^+]}$$

$$\text{Proportion of } A^- = \frac{K_a}{K_a + [H^+]}$$

Proportion of free E (not total E_o) bound to an inhibitor

$$1/\alpha = \frac{K_I}{K_I + [I]}$$



Hyperbolic form of equation used in biochemistry (positive x and y quadrant) for analysis of enzyme kinetics, acid-base behavior, and absorption processes (e. g., binding of O_2 to myoglobin) .

The double reciprocal plot of data in the positive x and y quadrant, 1/y = m*1/x + b, is used to obtain values of m and b.