

Free Energy Equation

$$\Delta G = \Delta G^{0'} + RT \ln \frac{[P]}{[R]}$$

@ equilibrium $\Delta G = 0$... thus rearranging $\Delta G^{0'} = -RT \ln \frac{[P]}{[R]}$

@ equilibrium $\frac{[P]}{[R]} = K_{eq}$

and @ 25°C ... $-RT \ln K_{eq} = -(2.0)(298)(2.303) \lg_{10} K_{eq} = -[1372] \lg_{10} K_{eq}$

thus..... $\Delta G^{0'} = -[1372] \lg_{10} K_{eq}$

The difference between ΔG and $\Delta G^{0'}$

$\Delta G^{0'}$ is a fixed value for a given reaction and indicates in which direction that reaction will proceed at standard conditions

standard condition **do not exist** within a cell, thus ΔG must be used to predict the direction of a reaction at a given time.

ΔG is determined by the concentrations present at that time & is a measure of how far a reaction is from equilibrium then.

Cell metabolism is essentially a non-equilibrium condition.

Metabolism works by changing the relative concentrations of reactants and products to favor the progress of unfavored reactions.

Relationship between K_{eq} and $DG^{0'}$

$$DG^{0'} = - [1372] \lg_{10} K_{eq}$$

<u>Products</u> <u>Reactants</u>	K_{eq}		\lg_{10}	$DG^{0'}$ cal/mole* [$\lg_{10} \times -1372$]	
1/1000	.001	10^{-3}	-3	+ 4116	[R] > [P]
1/100	.01	10^{-2}	-2	+ 2744	
1/10	.1	10^{-1}	-1	+ 1372	
1/1	1.0	0	0	0	
10/1	10	10^{+1}	+1	- 1372	[P] > [R]
100/1	100	10^{+2}	+2	- 2744	
1000/1	1000	10^{+3}	+3	- 4116	