



The free energy to *form* the complex is the opposite of the free energy to *break* the complex.

$$\Delta G_{associate} = -\Delta G_{dissociate} = -\left(\Delta G^{\circ'} + RT \ln \left(\frac{[Hb][O_2]}{[Hb \cdot O_2]}\right)\right)$$

The free energy to bind O_2 at the first site is:

$$\Delta G_{bind,1} = \Delta G_{T \rightarrow R} - \left(\Delta G^{\circ'} + RT \ln \left(\frac{[Hb][O_2]}{[Hb \cdot O_2]}\right)\right)$$

where $\Delta G_{T \rightarrow R} > 0$.

1. What happens to $\Delta G_{bind,1}$ as $[O_2]$ goes up? Why?
2. Write an expression for $\Delta G_{bind,2}$ (binding of the *second* O_2 molecule). Is it *easier* or *harder* to bind O_2 at the second site? Why?
3. What about binding at the third and fourth sites?
4. Can you justify the sigmoidal shape of the binding curve from these observations?