Chem 431A-L18-F'07
admin: Online quiz deadline Chapt 4 Monday, Nov5
no exceptions. If your computer didn't work, tough!

Last lecture:

1) Chou-Fasman Rules for 2° prediction

2) motifs, domains, 4° structure
3) oxygen-binding proteins (chapter 4)

Today: Quiz #5

1) Saturation curves for Mb and Hb

2) Hill coefficient – what it means

3) Cooperativity and Allostery of Hb

Oxygen binding proteins: Chapter 5

Mb -function is to facilitate O_2 transport in the muscles.(rapidly respiring tissue need O_2 fast at certain times and diffusion isn't fast enough. Mb acts like a bucket brigade. Of course, aquatic animals use it too as O_2 storage. Spermwhale has 10x more mb than terrestial animals.

$Mb + O_2 <=> MbO_2$ $K= [MbO_2] / ([Mb][O_2])$
$(=> [MbO_2] =[Mb][O_2](K))$

K=affinity constant. saturation:
θ = sites occupied/total sites available = fraction oxygenated=oxygenated/total=$[MbO_2]/\{[Mb]+[MbO_2]\}$

$=> \theta = [Mb][O_2](K) / \{[Mb] + [Mb][O_2](K)\}$

$=> \theta = [O_2]/\{(1/K)+[O_2]\}$ (ranges 0 to 1)

or, $\theta = P_{O2} /\{(1/K)+ P_{O2}\}$
at θ=0.5, $.5 = P_{50}/(1/K + P_{50}) => 1/K = P_{50}$
It is often written as: $\theta = P_{O2} / \{P_{50}+P_{O2}\}$
Because, (1/K) must be the P_{O2} at which θ=50%

for Mb $P_{50} \approx$ 4mm Hg
Discuss: plot θ vs pO_2 - hyperbolic, show P_{50}.

this represents hyperbolic curve (describe hyperbola)

$P_{O2} \approx$ 30 mmHg for Hb in venules. so Mb nearly saturated! (Mb is strongly binding protein)

show weakly binding protein!

Hb changes from strong binding protein at high O_2 to weakly binding at low P_{O2}.
sigmoidal curve. cooperative mechanism.
Earliest attempts to explain were by Archibald Hill (1910): assumed 1 step:

$Hb + nO_2 -> Hb(O_2)_n$ (ie infinite cooperativity).

$=> \theta = (P_{O2})^n / \{(P_{50})^n +(P_{O2})^n\}$ known as Hill eqn.

can show by rearrangement:

$\theta/(1-\theta) = (P_{O2})^n /(P_{50})^n$

Hill plot based on taking logs of both sides:

$Log\{\theta/(1-\theta)\}= n\log P_{O2}- n\log P_{50}$.

plot y = mx + b => where slope is n (an integer representing the number of subunits).

actual graph is diff: sometimes 1 sometimes 3. for ideally cooperative Hb, n = 4. Note that n cannot exceed the number of monomer subunits but can be less than it.