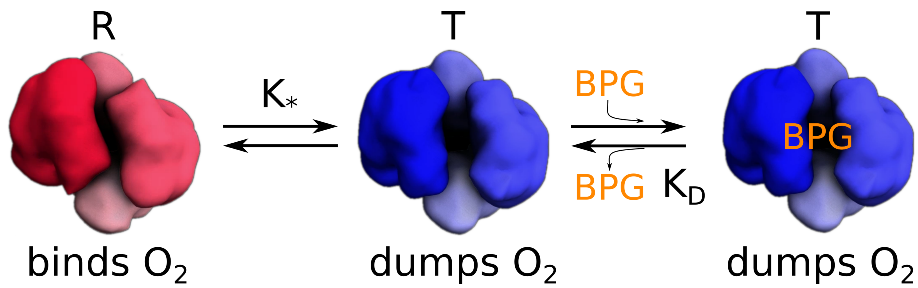

- The protein hemoglobin can be in either the **R** or **T** states.
- **R** binds O_2 tightly, **T** binds O_2 weakly.
- The molecule BPG can binds **T** (with affinity K_D) but not **R**.

1. The amount of O_2 you can transport from your lungs depends on $[R]$. Intuitively: if you increase the concentration of BPG, what happens to the concentration of $[R]$? Why?

   [R] WILL GO DOWN. AS YOU ADD BPG, THE $T \rightleftharpoons T{\cdot}BPG$ EQUILIBRIUM SHIFTS TOWARDS T·BPG. THIS DEPLETES T. BUT IF [T]↓, THIS PERTURBS $R \rightleftharpoons T$ EQUILIBRIUM. BY LE CHATELIER'S PRINCIPLE [R]↓ TO OFFSET [T]↓.

2. List the possible hemoglobin "species" below. (There are three).

   R T T·BPG

3. Write an equation for the fraction of molecules in the **R** state (θ_R) in terms of the concentrations of these species.

$$\theta_R = \frac{[R]}{[R]+[T]+[T{\cdot}BPG]}$$

4. Which terms in your equation depend on $[BPG]$?

   [T·BPG]

$$K_D = \frac{[T][BPG]}{[T{\cdot}BPG]}$$ (CALL BPG "B" TO SAVE SPACE).

$$K_D[T{\cdot}B] = [T][B]$$

$$[T{\cdot}B] = [T][B]/K_D$$

5. Can you justify your intuition from #1 mathematically?

   PUT INTO θ:

$$\theta = \frac{[R]}{[R]+[T]+\underset{\Uparrow}{[T][B]}/K_D}$$

AS B↑, θ_R↓ BECAUSE DENOMINATOR GETS HUGE.