

# 20.180: Second Order Binding

## Second Order Binding (of two things)

Givens:

- A physical interaction between molecules **A** and **B**.
- A system that contains some initial concentration of molecules **A** and **B** ( $A_0$  and  $B_0$ , respectively).

Tasks:

- Compute the steady state concentrations of free **A**, free **B**, and the **A:B** complex.

Approach:

- Write differential equation for change in **A:B** over time.

$$\frac{d[A : B]}{dt} = +k_{on} * [A] * [B] - k_{off} * [A : B]$$

- Solve equation at steady state (that is, no change in concentration of the A:B complex).

$$0 = +k_{on} * [A] * [B] - k_{off} * [A : B]$$

- Solve for  $K_D$ , the dissociation constant.

Equation 1: 
$$K_D = k_{off}/k_{on} = \frac{[A][B]}{[A : B]}$$

- Note constraints on system due to conservation of mass.

Equation 2:  $[A_0] = [A] + [A : B]$

Equation 3:  $[B_0] = [B] + [A : B]$

- Note system of three unknowns with three equations (1-3 above)! Solve for unknowns **A**, **B**, and **A:B** (takes you through a quadratic).