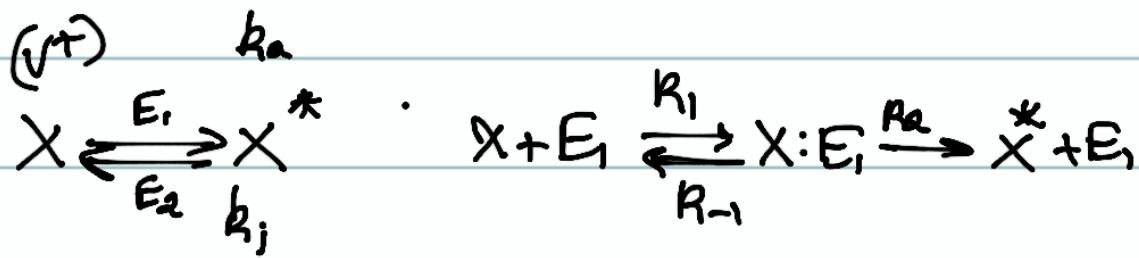


27th October, 2020

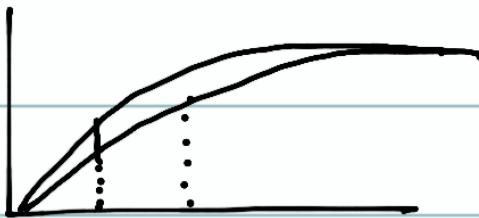


$$V^* = \frac{V_{max} X}{K_M + X}, \quad K_M = \frac{k_{-r} + k_2}{k_1}$$

If $K_2 = 0$,

$$K_M = \frac{k_{-r}}{k_1} \text{ is like } k_2 \text{ [Dissociation]}$$

(Affinity of X to E_1)

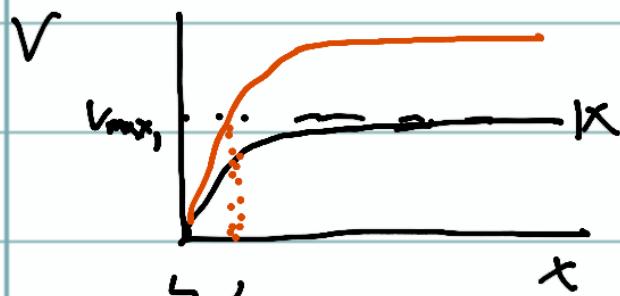


Bind with more efficiency \leftarrow Better \rightarrow Poor Affinity/Efficiency
 $k_{m1} < k_{m2}$
 \downarrow Bad

[Good substrate, reach max with lesser concentration] \rightarrow Reaches max with more concentration

Q) If conc. becomes $2x, 3x$. . then what's the change

→ Reaches max faster $\rightarrow V_{max}$ will increase



Same for first half

→ Affinity won't change as we only scale it up

$$\frac{dx^*}{dt} = k_a (x^T - x^*) - k_i x^*$$

$\underbrace{k_a}_{E_1 \text{ for bind}}$ $\underbrace{-k_i}_{E_2 \text{ for binding}}$

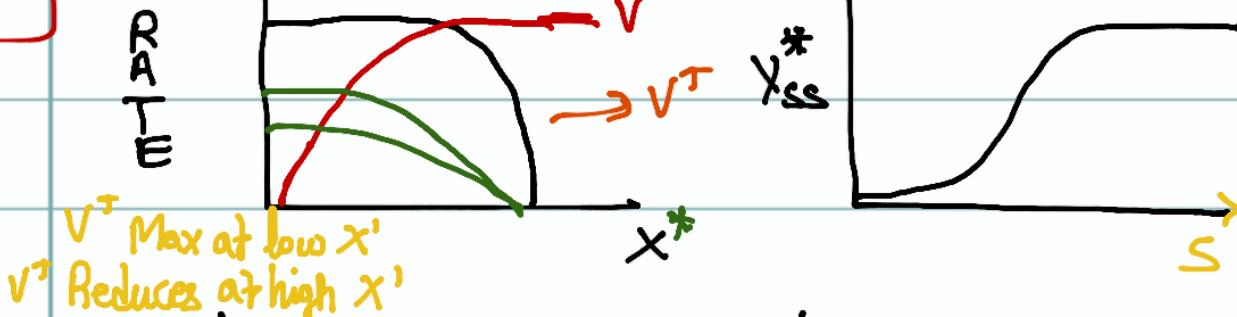
$$\frac{dx^*}{dt} = \frac{k_a (x^T - x^*)}{R_{m_1} + (x^L x^*)} - \frac{k_i x^*}{R_{m_2} + x^T}$$

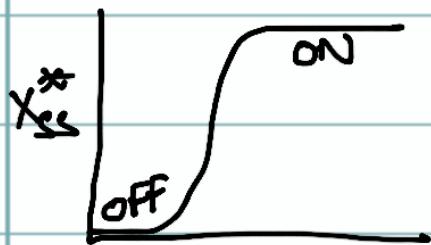
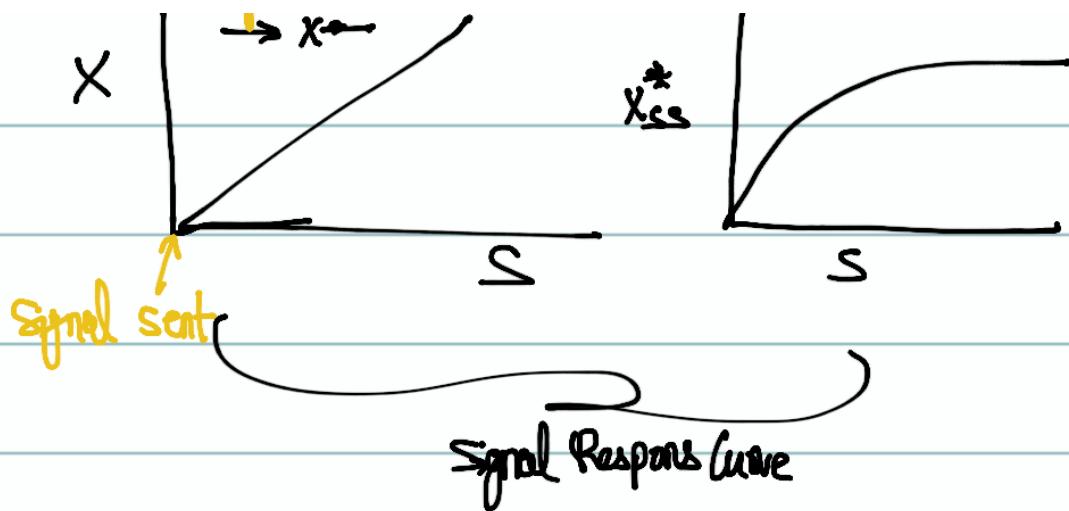
$\underbrace{k_a}_{V^+}$ $\underbrace{-k_i}_{V^-}$ $\rightarrow \text{Substs}$

$$x = x^T = x^*$$

More intersections at particular bond width

Sigmoidal response

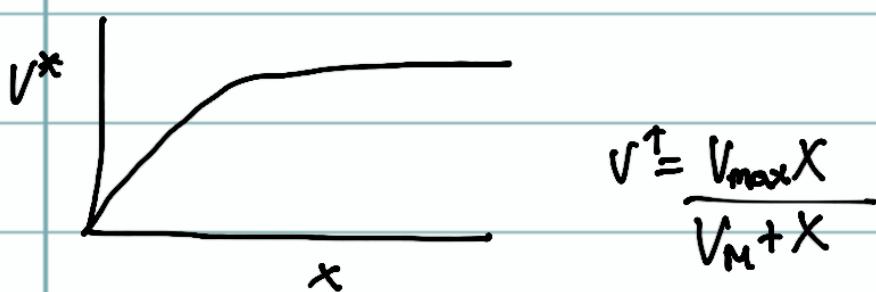




Ultra sensitive
switch type
characteristic

Has to be reversible
as in this context as

if it causes modification
then there won't be
any response for future
signals - i.e. reached
steady state



$$V^+ = \frac{V_{max}X}{V_m + X}$$

When X is very small,

$$V^+ \approx \frac{V_{max}X}{R_m} \quad \text{[First Order]}$$

When X is very large -

$$V^+ = V_{max} \quad \text{[Zero Order]}$$

Referred as ultra sensitivity

So if k_m is very low,

V^+ is almost like a zero-order. So curve is very step.

We will be more exact switch type 

[More 100% accurate]

Multi-Site Modification

Process



If it's rapid then we can think of them as independent process
Rapid means, reaches steady state quickly

$$X^* \cdot E_1 = E_2 \cdot X^{**} \quad \text{---(1)}$$

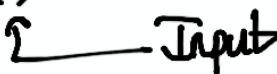
$$X^{**} = X^* \cdot \left(\frac{E_1}{E_2}\right) \quad \text{---(2)}$$

$$X^* E_2 = X E_1$$

$$X^* = X \left(\frac{E_1}{E_2}\right) \quad \text{---(3)}$$

From (2)/(3)

$$\therefore X^{**} = X \left(\frac{E_1}{E_2}\right)^2$$

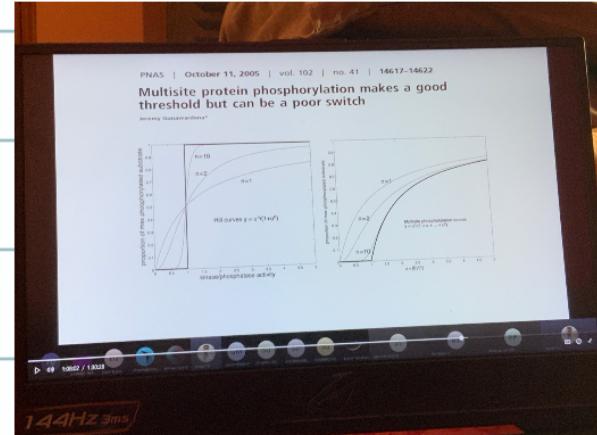
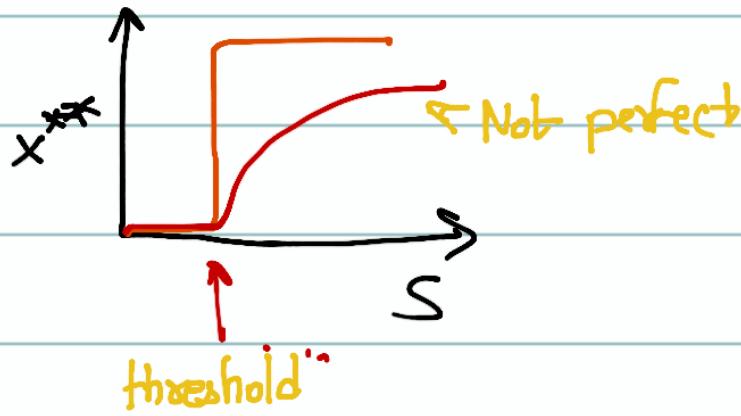
 Input

$$X_T = X + X^* + X^{**}$$

X-Total 

$$\chi = \frac{\chi_T}{1+s+s^2} \quad \text{where } s = \frac{E_1}{E_2}$$

$$\chi^{**} = \frac{\chi_T \cdot s}{1+s+s^2}$$



To get perfect switch along w/ multi-site

→ zero order kinetics
Cooperativity [Revise]

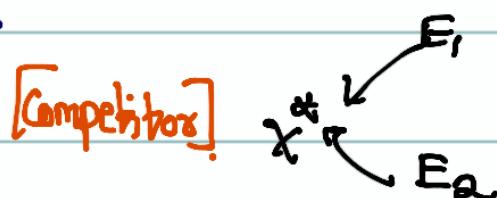
Something like if one modif. happens, it's going to promote next modification by cooperativity
↳ Becomes better substrate



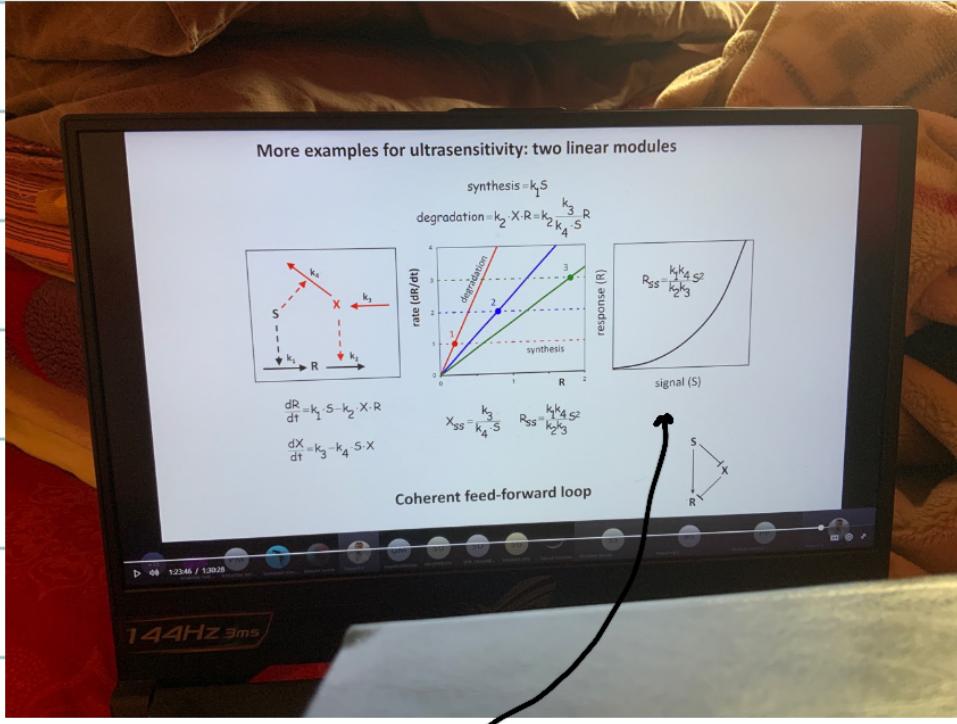
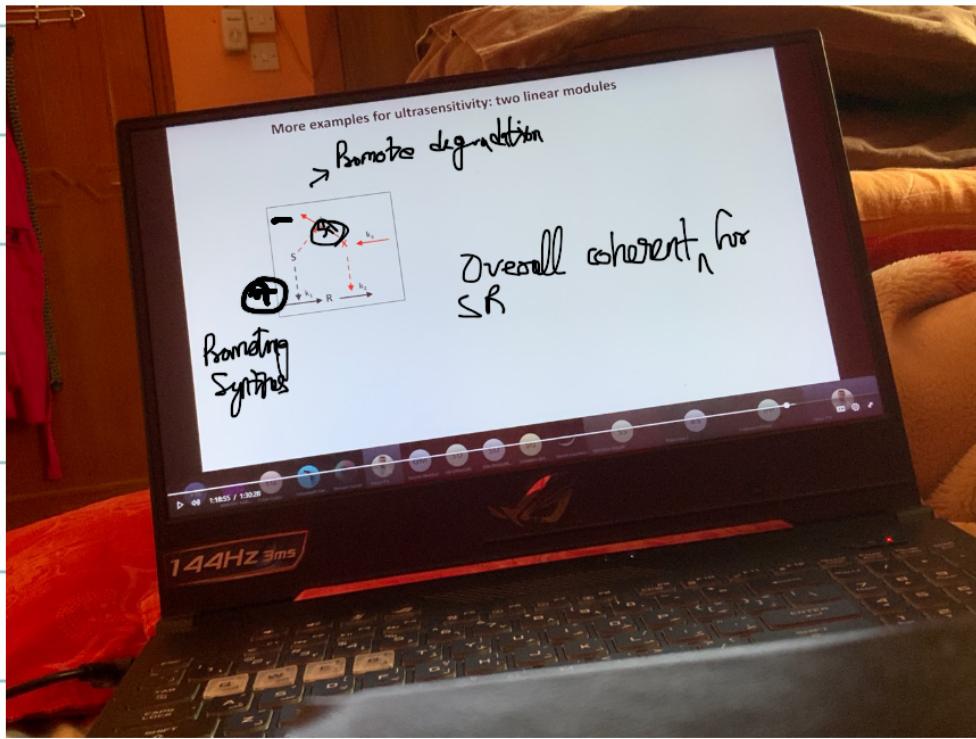
[Ordered]
&
Distributive



↑
One complex itself

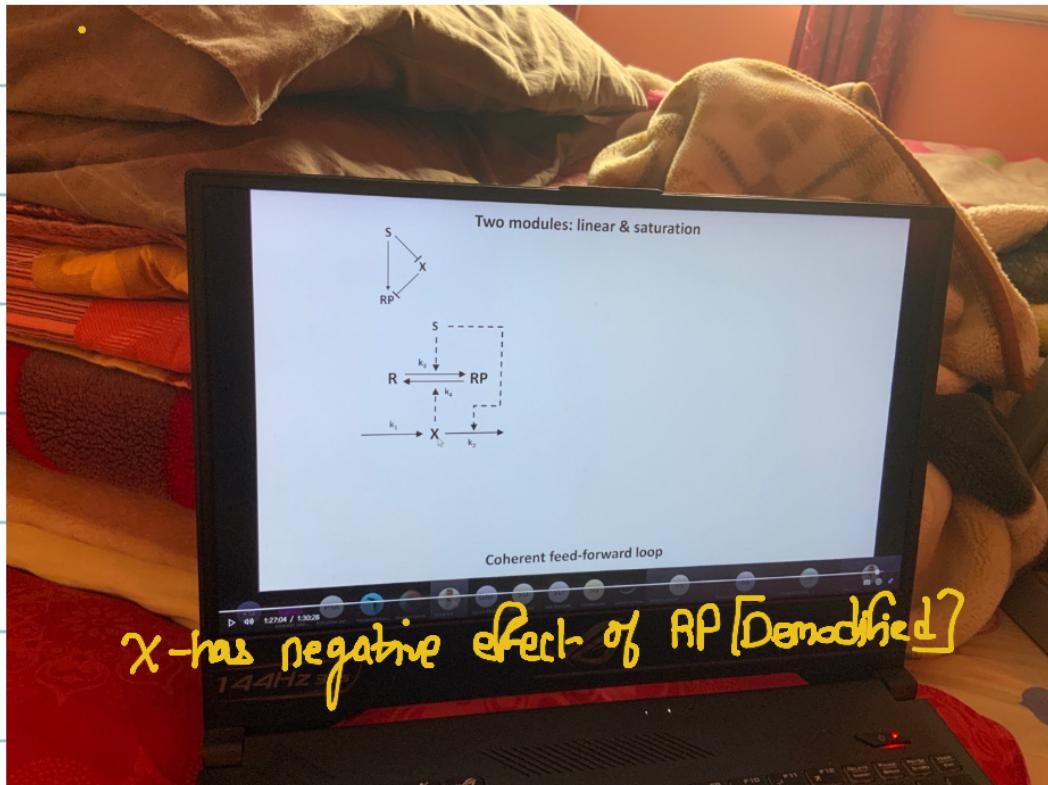


Did an example check 1:14p30

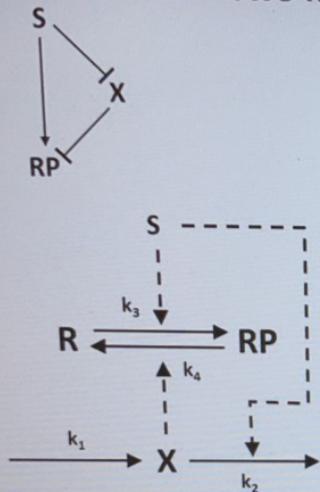


To make it saturated, protein activation/inactivation can give saturation

Perise

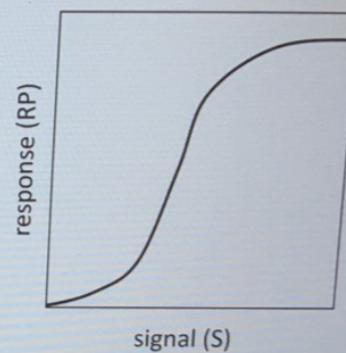
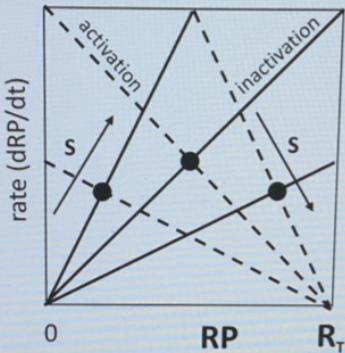


Two modules: linear & saturation



$$\text{Activation: } k_3 \cdot S \cdot (R_T - RP)$$

$$\text{Inactivation: } k_4 \cdot X \cdot RP = k_4 \frac{k_1}{k_2 \cdot S} RP$$



$$\frac{d RP}{dt} = k_3 \cdot S \cdot (R_T - RP) - k_4 \cdot X \cdot RP$$

$$X_{ss} = \frac{k_1}{k_2 \cdot S}$$

$$\frac{d X}{dt} = k_1 - k_2 \cdot S \cdot X$$

$$RP_{ss} = \frac{k_3 S^2 \cdot R_T}{k_3 \cdot S^2 + k_4 k_1 / k_2}$$

Coherent feed-forward loop



144Hz 3ms