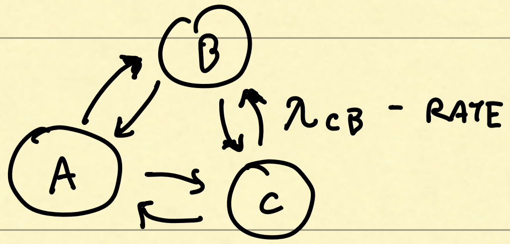
CONTINUOUS TIME MARKOV CHAINS

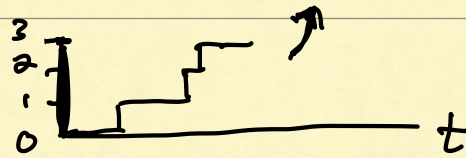


$$p_i(t) = \mathbb{P}(X(t) = i)$$

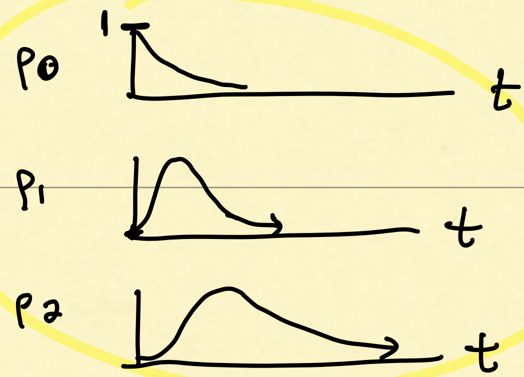
$$\frac{d}{dt}\begin{bmatrix} p_1 \\ \vdots \\ \\ p_N \end{bmatrix} = \begin{bmatrix} -\Sigma & \lambda_{21} & & \lambda_{N1} \\ \lambda_{12} & & & \\ & & & \\ \lambda_{1N} & & & \end{bmatrix} \begin{bmatrix} p_1 \\ \vdots \\ \\ p_N \end{bmatrix}$$

EX COUNTING POISSON EVENTS

$N(t) = \#$ EVENTS UP TO t



$$\begin{bmatrix} -\lambda & 0 & 0 & & \\ \lambda & -\lambda & 0 & & \\ 0 & \lambda & -\lambda & & \\ 0 & 0 & \lambda & & \\ 0 & 0 & 0 & \ddots & \\ 0 & 0 & 0 & & \ddots \end{bmatrix}$$



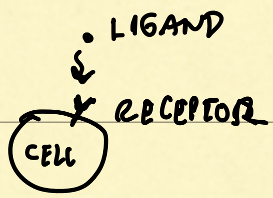
EX TWO MUTATIONS

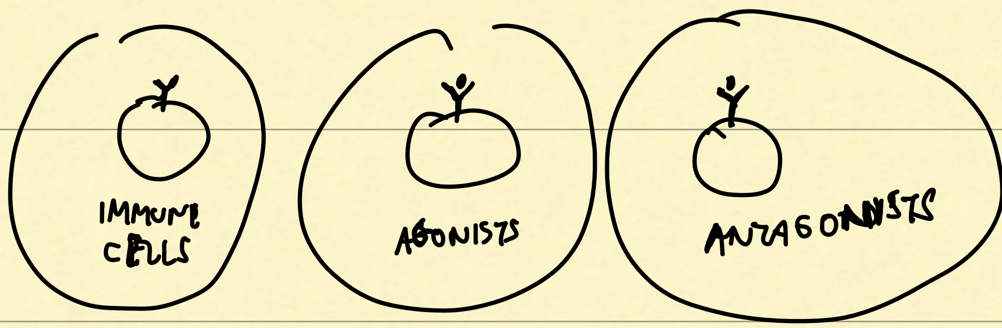
$$\begin{array}{l} uu \\ um \\ mu \\ mm \end{array} \begin{bmatrix} -2\lambda & & \\ \lambda & & \\ \lambda & & \\ 0 & & \end{bmatrix}$$

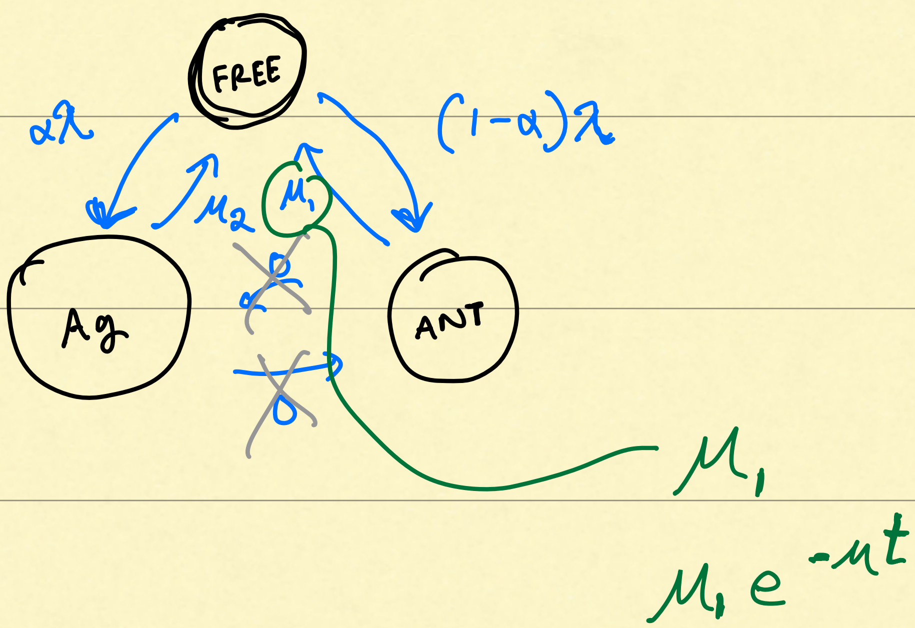
TO FIND THE STATIONARY DISTRIBUTION(S), SET

$$\frac{d}{dt}\begin{bmatrix}p_1\\ \vdots \\ p_N\end{bmatrix} = \begin{bmatrix}0\\ \vdots \\ 0\end{bmatrix}$$

PS **5**







FREE AGO ANT

$$\begin{array}{cc}
\begin{bmatrix} -\lambda & \mu_2 & \mu_1 \\ \alpha\lambda & -\mu_2 & 0 \\ \cancel{(1-\alpha\lambda)} & 0 & -\mu_1 \end{bmatrix} & \begin{array}{l} \text{FREE} \\ \text{AG} \\ \text{ANT} \end{array}
\end{array}$$

$(1-\alpha)\lambda$

$p_{FREE} =$

$p_{AG} =$

$p_{ANT} =$

CHECKS

$\alpha = 0, \quad p_{AG} = 0$

$\alpha = 1, \quad p_{ANT} = 0$

$\lambda = 0, \quad p_{FREE} = 1$

$p_{AG} = 0$

$p_{ANT} = 0$

$\mu_1 \to \infty, \quad p_{ANT} \to 0$

$\mu_1 \to 0$ AND $\mu_2 \neq 0, \quad p_{ANT} \to 1$

$\alpha \neq 1$