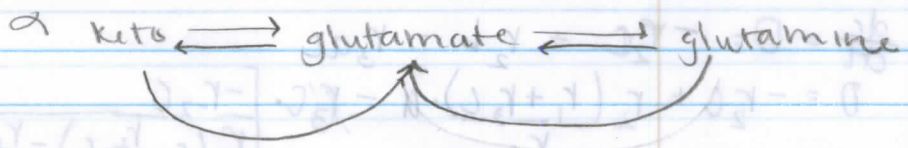
Library

6-7

MATLAB

N - Metabolism in Yeast

- Background : paper or how we derived de's
- Purpose: rate of Metabolism in yeast by looking @ 3
- Significance :



• = list & explain

- state variables: a, b, c a(t), b(t), c(t)
  → system of de's for model
  → explain/name all parameters + variables
- parameters : $r_1, r_{-1}, r_2, r_{-2}, r_3$

$$\frac{da}{dt} = -r_1 a + r_{-1} b - r_3 ac$$

$$\frac{db}{dt} = r_1 a - r_1 b + r_{-2} c - r_2 b + 2 r_3 ac$$

$$\frac{dc}{dt} = -r_{-2} c + r_2 b - r_3 ac$$

set equal to 0 & figure out them

$$\frac{da}{dt}\quad 0 = (-r_1 - r_3 c)a + r_{-1} b \qquad (r_1 + r_3 c)a + r_{-1} b$$

$$b = \frac{(r_1 + r_3 c)a}{r_{-1}}$$

$$\frac{db}{dt}\quad 0 = r_1 a - (r_1 + r_3 c)a + r_{-2} c - \frac{(r_1 + r_3 c) r_2 a}{r_{-1}} + 2 r_3 ac$$

$$r_1 a - r_1 a - r_3 ac + r_{-2} c - \frac{r_1 r_2 a}{r_{-1}} - \frac{r_2 r_3 ac}{r_{-1}} + r_3 ac$$

$$r_3 ac - \frac{r_1 r_2 a}{r_{-1}} - \frac{r_2 r_3 ac}{r_{-1}} + r_{-2} c = 0$$

$$r_3 a\left[c - \frac{r_2 c}{r_{-1}} - \frac{r_1 r_2}{r_{-1}}\right] + r_{-2} c = 0$$

$$r_3 a\left[\left(c-\frac{r_2}{r_{-1}}c\right)-\frac{r_1 r_2}{r_{-1}}\right]=-r_{-2}c$$

$$a=\frac{-r_{-2}\cdot c}{r_3\left[\left(c-\frac{r_2}{r_{-1}}c\right)-\frac{r_1 r_2}{r_{-1}}\right]}$$

$$\frac{dc}{dt}=0=-r_2 c+r_2 b-r_3 ac$$

$$0=-r_2 c+r_2\left(\frac{r_1}{r_{-1}}+\frac{r_3}{r_{-1}}c\right)\cdot a-r_3 c\cdot\left[\frac{-r_{-2}c}{r_3\left(c-\frac{r_2}{r_{-1}}c\right)-\frac{r_1 r_2}{r_{-1}}}\right]$$

$$=-r_2 c+\frac{r_2(r_1+r_3 c)}{r_{-1}}\cdot\left[\frac{-r_{-2}c}{r_3\left(c-\frac{r_2}{r_{-1}}c\right)-\frac{r_1 r_2}{r_{-1}}}\right]+\frac{r_3 r_{-2}c^2}{r_3\left(c-\frac{r_2}{r_{-1}}c\right)-\frac{r_1 r_2}{r_{-1}}}$$

$$=-r_2 c+\frac{r_3 r_{-2}c^2}{r_3\left(c-\frac{r_2}{r_{-1}}c\right)-\frac{r_1 r_2}{r_{-1}}}-\frac{r_2(r_1+r_3 c)r_{-2}c}{r_{-1}r_3\left(c-\frac{r_2}{r_{-1}}c\right)-r_1 r_2}=0$$

$$=\left[r_{-1}\cdot\left[r_3\left(c-\frac{r_2}{r_{-1}}c\right)-\frac{r_1 r_2}{r_1}\right]\cdot -r_2 c\right]+\left[r_{-1}\cdot r_3 r_{-2}c^2\right]-\left[r_2(r_1+r_3 c)r_{-2}c\right]=0$$

$$=-r_1 r_2 r_3 c^2+r_2^2 c^2+r_1 r_2^2 c+r_{-1}r_{-2}r_3 c^2-r_2 r_1 r_{-2}c-r_2 r_3 r_{-2}c^2=0$$

$$=c^2\left(r_{-1}r_{-2}r_3-r_1 r_2 r_3+r_2^2-r_2 r_3 r_{-2}\right)+c\left(r_1 r_2^2-r_2 r_1 r_{-2}\right)=0$$

$$c=\frac{-\left(r_1 r_2^2-r_2 r_1 r_{-2}\right)\pm\sqrt{\left(r_1 r_2^2-r_2 r_1 r_{-2}\right)^2-4\left(r_{-1}r_2 r_3-r_1 r_2 r_3+r_2^2-r_2 r_3 r_{-2}\right)0}}{2\left(r_{-1}r_{-2}r_3-r_1 r_2 r_3+r_2^2-r_2 r_3 r_{-2}\right)}$$

$$c=\frac{-\left(r_1 r_2^2-r_2 r_1 r_{-2}\right)\pm\left(r_1 r_2^2-r_2 r_1 r_{-2}\right)}{2\left(r_{-1}r_{-2}r_3-r_1 r_2 r_3+r_2^2-r_2 r_3 r_{-2}\right)};\quad c=0,\ \frac{r_1 r_2^2-r_2 r_1 r_{-2}}{\left(r_{-1}r_{-2}r_3-r_1 r_2 r_3+r_2^2-r_2 r_3 r_{-2}\right)}$$

or $c=0$

$c = 0$ $\qquad$ $c = \dfrac{r_1 r_2^2 - r_2 r_1 r_{-2}}{(r_1 r_{-2} r_3 - r_1 r_2 r_3 + r_2^2 - r_2 r_3 r_{-2})}$

$$a = \frac{-r_{-2} c}{r_3 \left[c - \frac{r_2}{r_{-1}} c\right) - \frac{r_1 r_2}{r_{-1}}}$$

$a = 0$

$$a = \frac{-r_{-2}\left(\frac{r_1 r_2^2 - r_2 r_1 r_{-2}}{r_{-1} r_{-2} r_3 - r_1 r_2 r_3 + r_2^2 - r_2 r_3 r_{-2}}\right)}{r_3 \left(\frac{r_1 r_2^2 - r_2 r_1 r_{-2}}{r_{-1} r_{-2} r_3 - r_1 r_2 r_3 + r_2^2 - r_2 r_3 r_{-2}} - \frac{r_2 \cdot [r_1 r_2^2 - r_2 r_1 r_{-2}]}{r_{-1}[r_1 r_{-2} r_3 - r_1 r_2 r_3 + r_2^2 - r_2 r_3 r_{-2}]}\right) - \frac{r_1 r_2}{r_{-1}}}$$

$$b = \frac{(r_1 + r_3 c)\, a}{r_{-1}}$$