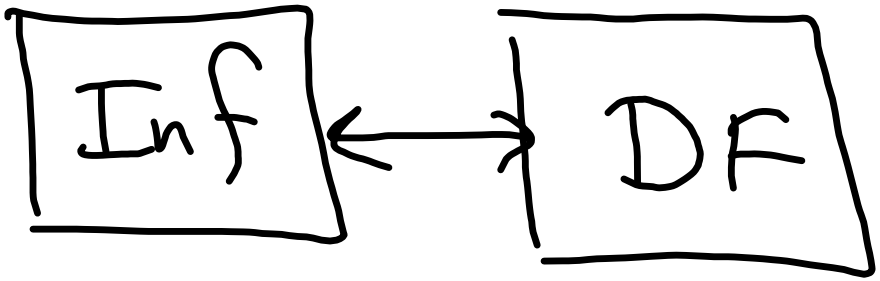
(1) Formulate Q

(2) Narrow Q

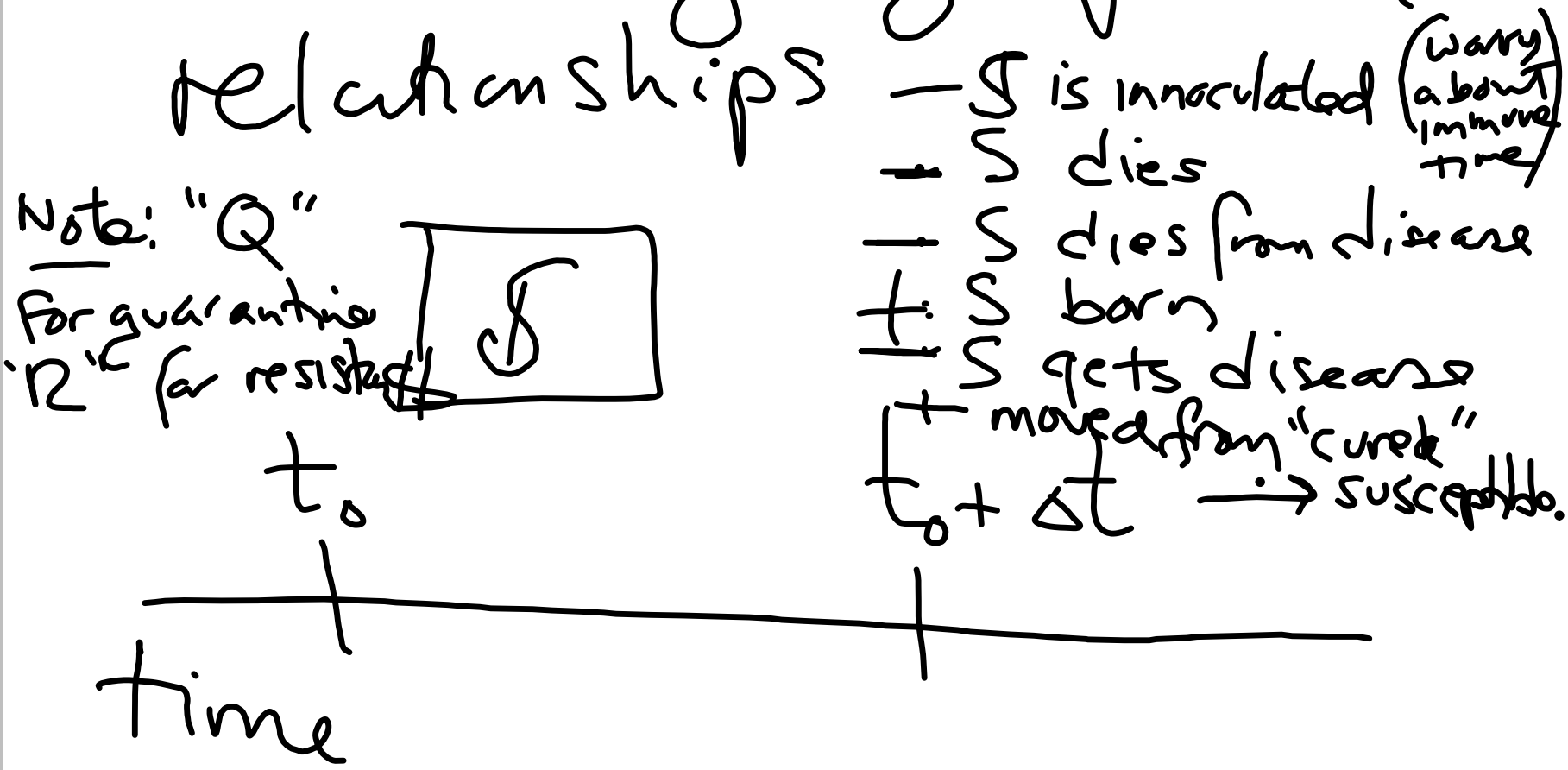
(3) Perform literature search
- → Be exhaustive
- → Track your search keys
- → Use multiple engines
- → Bookmark

What are the important variables?

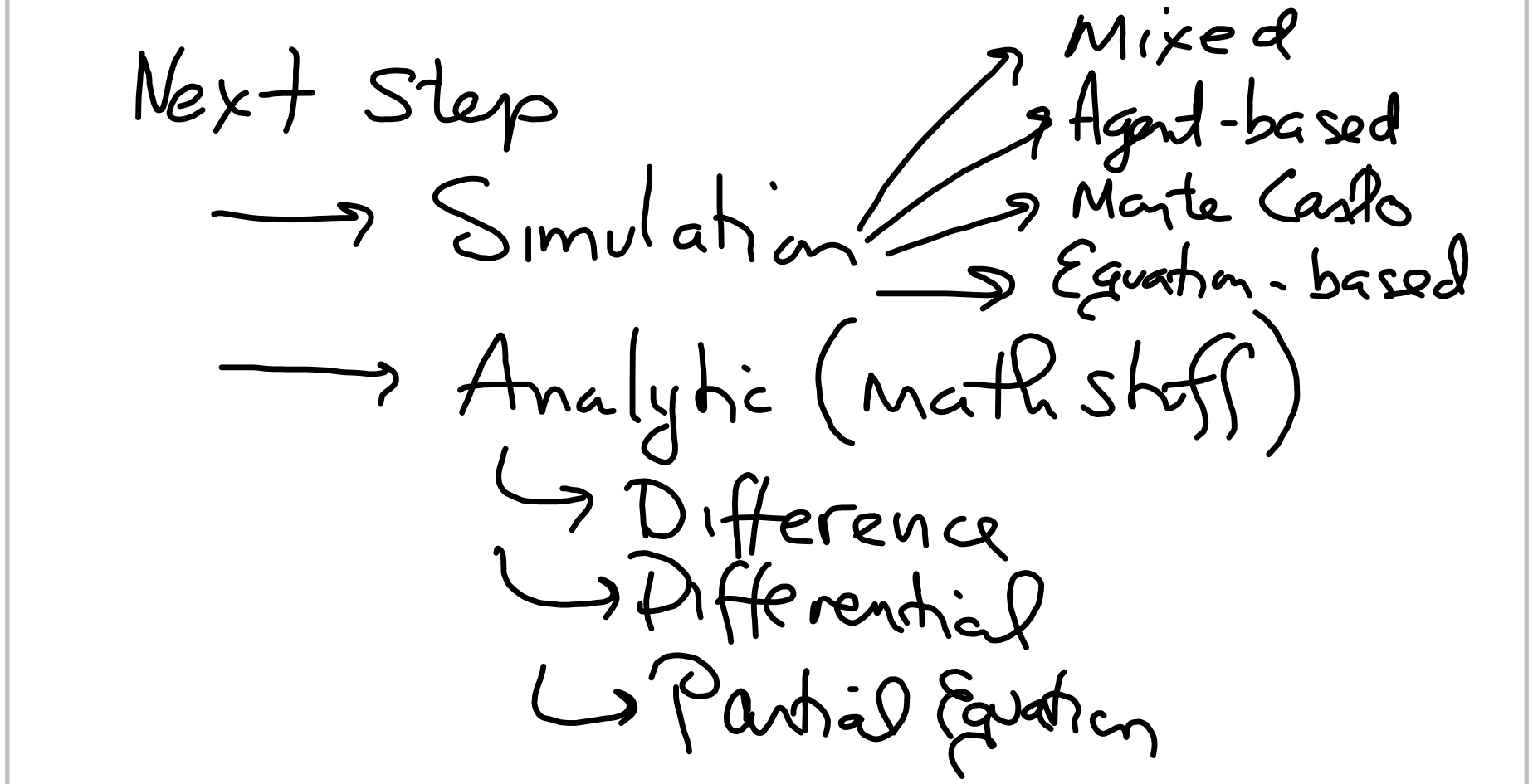
- How it spread?
- susceptibly
- incubation?
- transmission/contact rate



Flow diagram for process & relationships



Note to self: spatial relations, homogeneity
classes of susceptibility


Next Step
Simulation
Mixed
Agent-based
Monte Carlo
Equation-based
Analytic (math stuff)
Difference
Differential
Partial Equation

Q: I wanna know if I can predict the # of cells on a culture if I know how many I started with

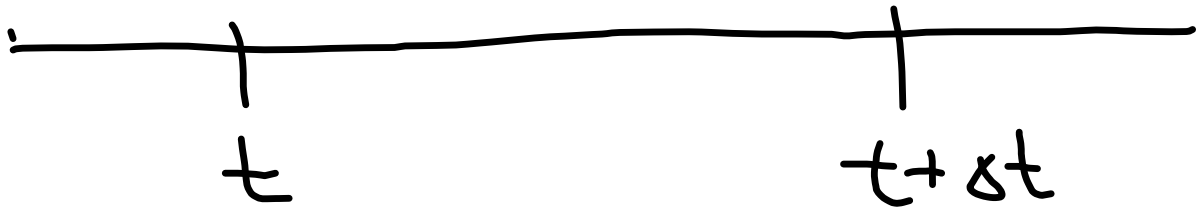
Literature:

- population model
  - human cell "hunh"
  - cell growth prediction
  - cell reproduction rates
  - cell density on cell growth
  - cell culture methods
  - models of cell growth
  - cell population models
  - cell models

V: Identify impact variables

- # of cells on plate at time "t"

R: Identify relationships/constants /parameters



- cells grow
- cell death
- cells divide

W: Ryte in Wurdz

Let $N(t)$ be the # of cells at time "t" and suppose we want to obtain

$N(t+\delta t)$

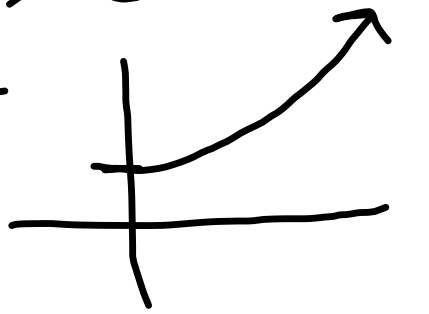
$$N(t+\delta t) = N(t) + \underset{(t,t+\delta t)}{\text{births in}} - \underset{(t,t+\delta t)}{\text{deaths in}}$$

$$N(t+\delta t) = N(t) + \underset{(t,t+\delta t)}{\text{births}} - \underset{(t,t+\delta t)}{\text{deaths}}$$

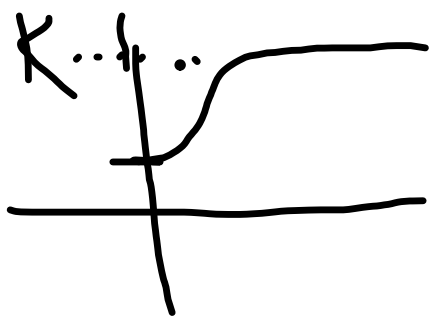
$$N(t+\delta t) = N(t) + \underset{\text{birth rate}}{\lambda(t)}\delta t N(t) - \mu(t)\delta t N(t)$$

$$N(t+\delta t) = N(t) + (\lambda-\mu)N(t)\delta t$$

$$N(t+\delta t) - N(t) = (\lambda-\mu)N(t)\delta t$$



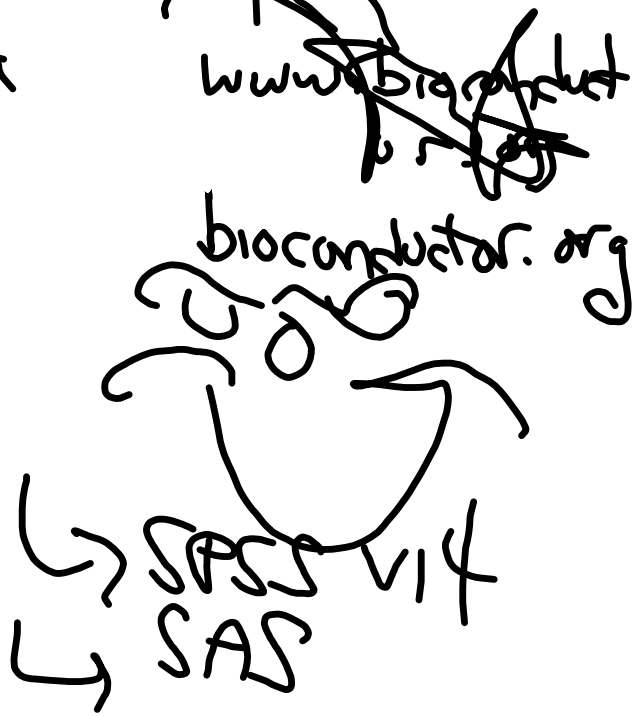
$$\frac{N(t+\delta t) - N(t)}{\delta t} = (\lambda-\mu)N(t)$$



$$\frac{dN}{dt} = (\lambda-\mu)N\left(1-\frac{N}{K}\right)$$

Analyze

→ Analytical/Software
- ↳ Maple
- ↳ Matlab
- ↳ Mathematica
- ↳ XPAUT
- ↳ S, S+
- ↳ R

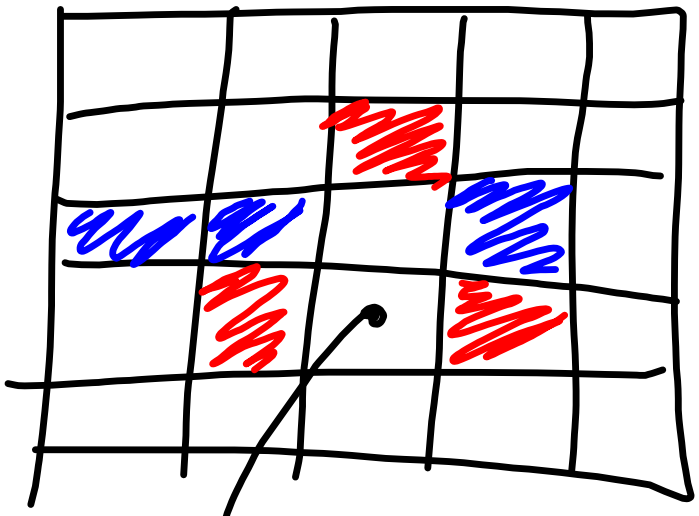


Simulate

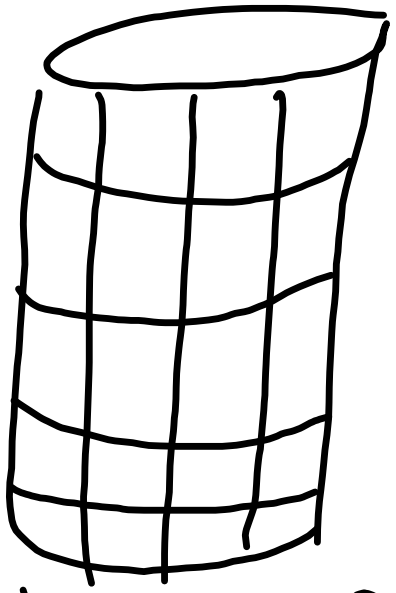
- numerical simulation
  - IMSL
  - NAG
- algorithmic simulation
  - Agents
    - automata
    - agents

SciVis

Viz



Cell



toroidal board

— states

J. Conway ⟷ Game of Life → rules

www.Swarm.org

ALIFE

Reynold's BOIDS

Analytical Methods:

↳ Symbolic programs
MAPLE ...