# Biophysics 3G03 + LifeSci 3BP3
# Modelling Life
# Objects of the Course

1. Learn to build computational models to study phenomena in biology.
    - turn the biology into “rules” that the program uses
    - figure out what important things to keep and what to ignore or simplify

2. Learn to use the Netlogo agent based modelling system

3. Learn a bit of mathematics
    - differential equations
    - probability distributions

4. Learn a bit of biology
    - dynamics of transcription and translation
    - spread of infections
    - evolutionary game theory ..... etc

There will be some lectures where we do background and theory, but in most classes we will work on programs in the class.

You will be given a simple program for the start of each project. The worksheets ask you to add additional features and analyze the results.

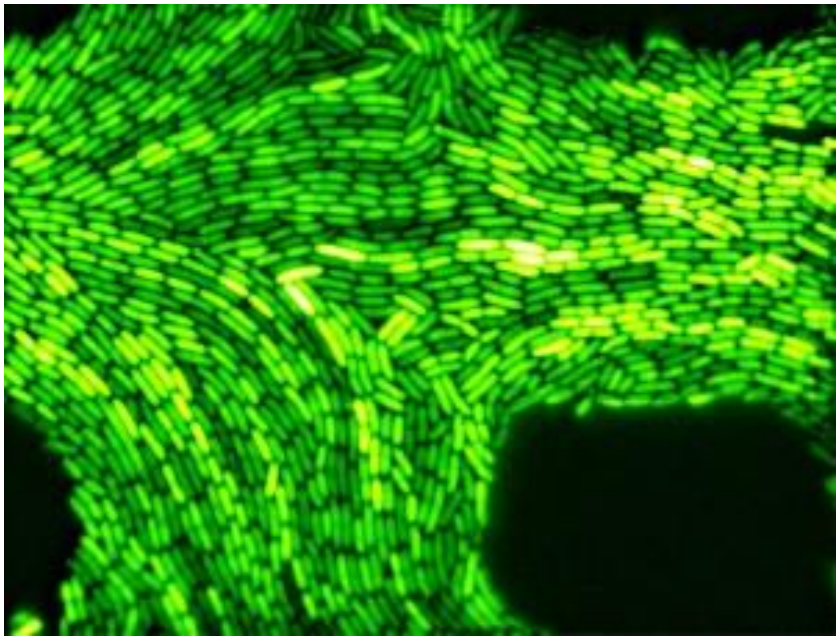
You need to hand in regular reports to show that you have completed the steps in the worksheets. There will be 6 projects on different biological topics taking 1 or 2 weeks each. The final few weeks will be a group project on a subject of your choice. Deadlines will be announced as we go along. You need to keep up with the exercises. There is no final exam.

Download and install Netlogo before Wednesday. See link on Avenue.

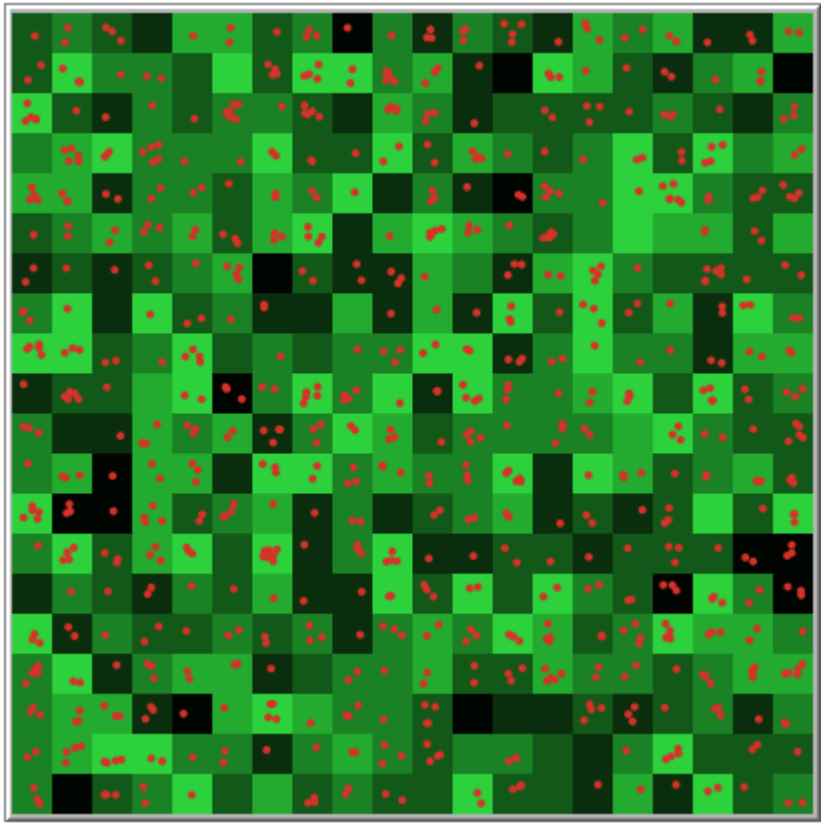
Sources of help for Netlogo:

The Manual, Tutorials, Dictionary, Models Library ---- Read These!

# Stochasticity in gene expression

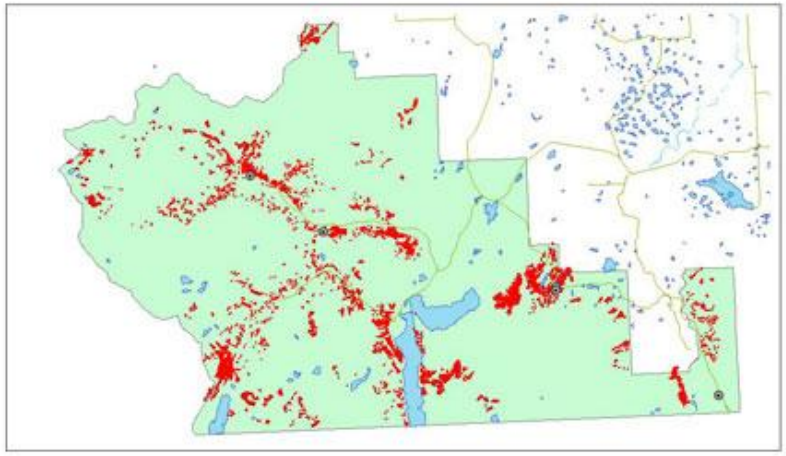


Observation:
Green fluorescent protein levels fluctuate between identical bacterial cells.

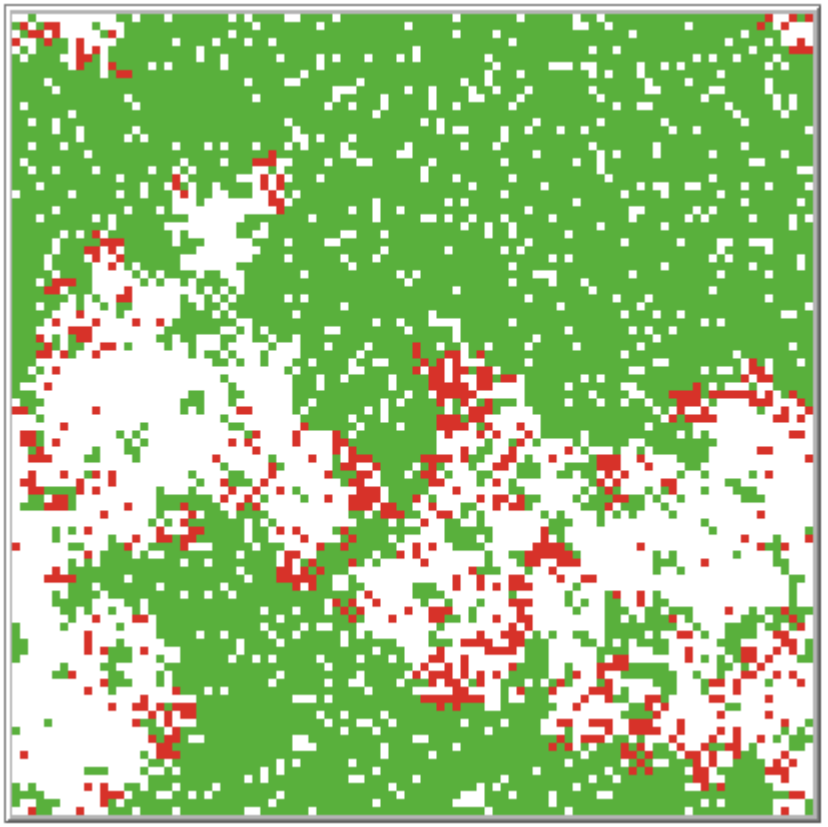


Model:
Follows numbers of mRNAs (red dots) and proteins (shown as a shade of green) in individual cells.

# Spread of Infection

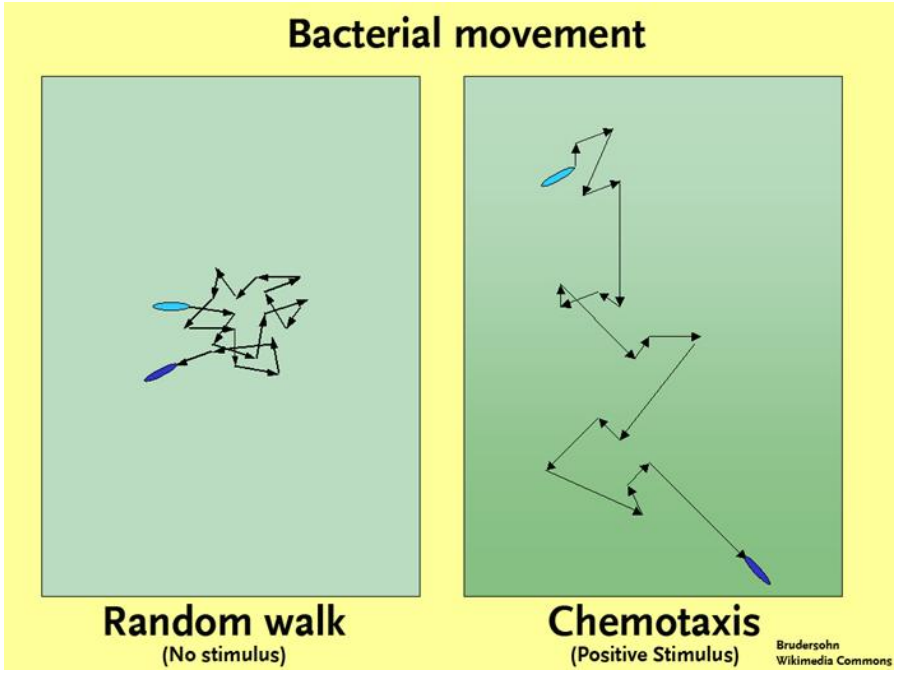


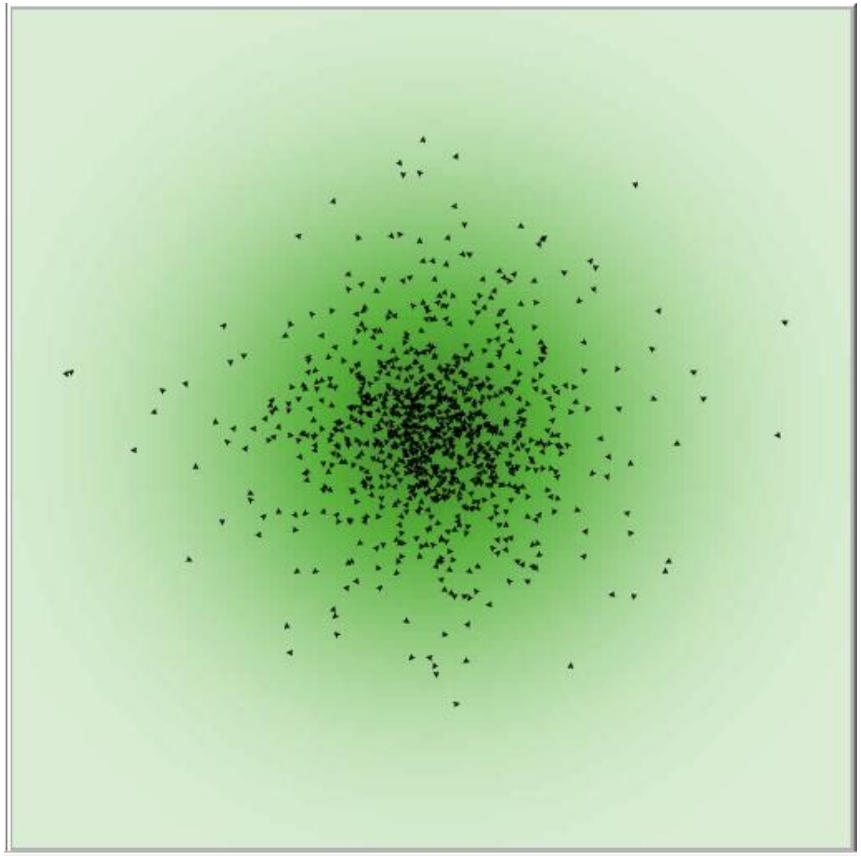
Observation:
Pine Beetle in Waterton Park



Model:
Green = healthy forest
Red = infected
Large white areas left behind where trees have died.

# Chemotaxis in Bacteria

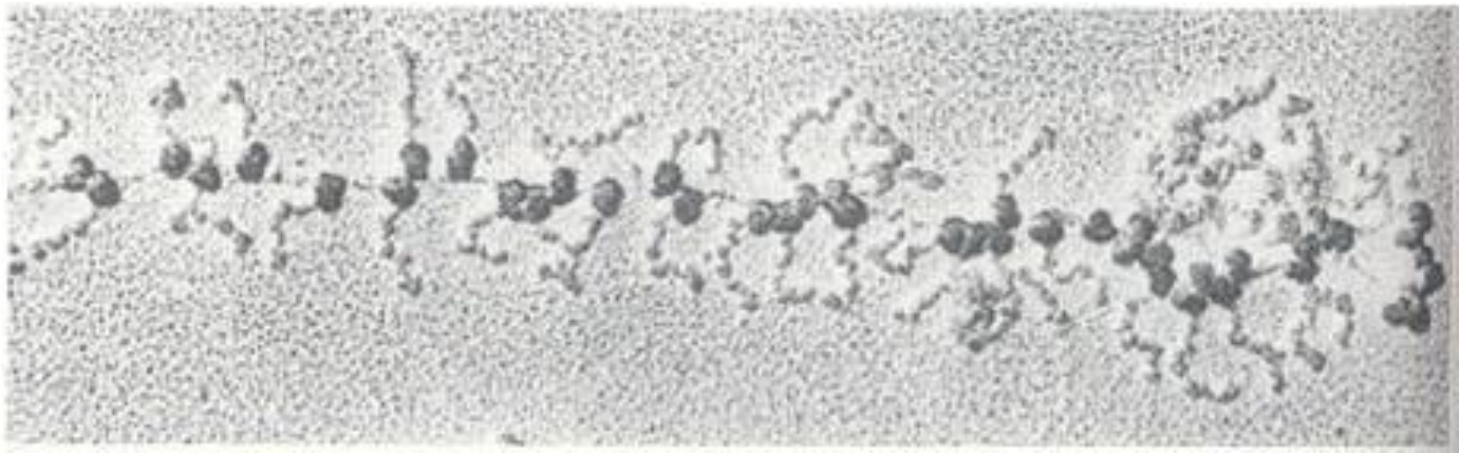


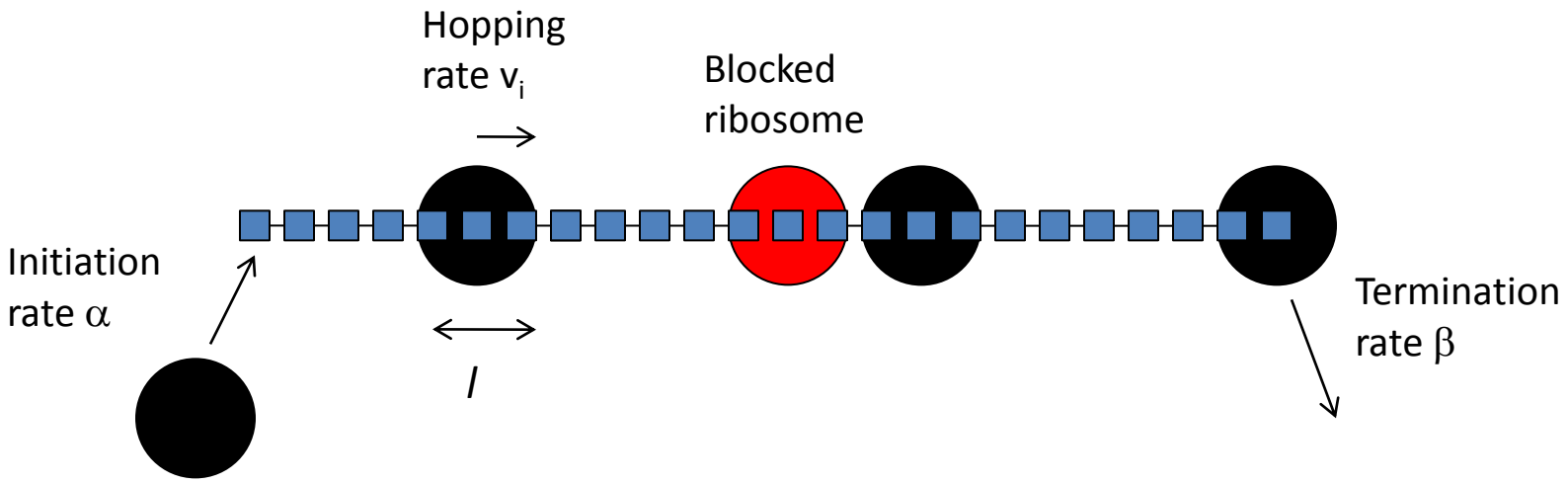
Observation:
Running / Tumbling behaviour of bacteria allows them to respond to concentration gradient of nutrient

Model:
Tumble probability depends on whether concentration is inceasing or decreasing.
Bacteria swim towards high concentration.

# Dynamics of Ribosomes on an mRNA



Observation - Polysomes – Many ribosomes move along the same mRNA




Model - Ribosomal traffic jams