Hardware

Project overview

- While we must understand the biology eventually, first we must understand what we have to do
- I don’t completely understand the project entails as of yet besides the parameters given, but will keep you guys up to date
- Drylab aspects
  - Controllable microfluidic device
  - “Chromastat” device
    - Maybe combine Chromastat and Controllable Microfluidic device
  - Filtration device

Controllable microfluidic device

- Parameters: x amount of inputs, mix to y amount of outputs, controllable using a raspberry pi

Hardware: Easy to purchase materials

http://2017.igem.org/Team:BostonU_HW/IntrouF

- Machining using Othermill (miniature mill)
- Mixing chemicals to create PDMS (similar to epoxy)
- Using epoxy, it seems
- Figure out interfacing with electronics/raspberry pi
- Fix problems

Software: Controlling in/out

http://2017.igem.org/Team:BostonU_HW/Model

- Feedback loop/rates for accurate dispensing (maybe interface with Chromastat!)
- Make software that simulates the system in a simple GUI rather than using the chip IRL

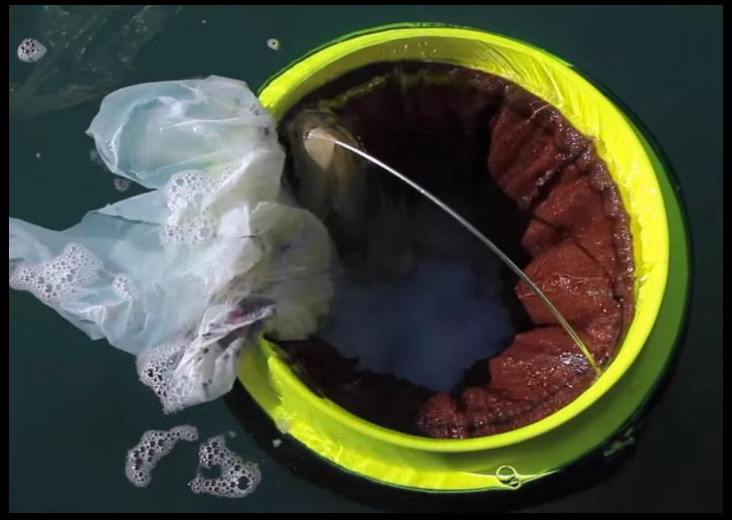
Chromastat

http://2017.igem.org/Team:Washington/Hardware

- Make it functional again, rework janky aspects
- What is it?
  - Culture chamber (test tube)
  - Able to detect and control concentration of culture based on color
  - Control conditions like heat, density, input and output chemicals (called inducers)
  - Bubble the mixture (aerates and stirs mixture)
  - Cheap, easy to use (plug and play)
  - Accurate (Syringe pumps)
  - Electronics upgrade

Filtration Device

- Parameters: Takes in water or something, churns it through a filtration system (full of bacteria?), gives back clean water
- No idea what this entails, more research needed, hardware and biology side.
- One suggestion was a floating robot that did this, or a floating filter.



Software Subteam

Our Goals

- Make the Chromastat automation functional
- Reconfigure the Chromastat for microfluidics
- Make our library more modular

Not your average Java project…

- More like Computer Engineering than Computer Science
- Interfacing with other hardware (sensors, motors, etc.)
- Still in Java, though!

Skills you will learn

- Computer Engineering & some EE
- Working with a larger codebase & with other contributors
- Software design practices (documentation, testing, spec, etc.)
- Linux, SSH, Git, Shell
- Multi-Threading (Concurrency)

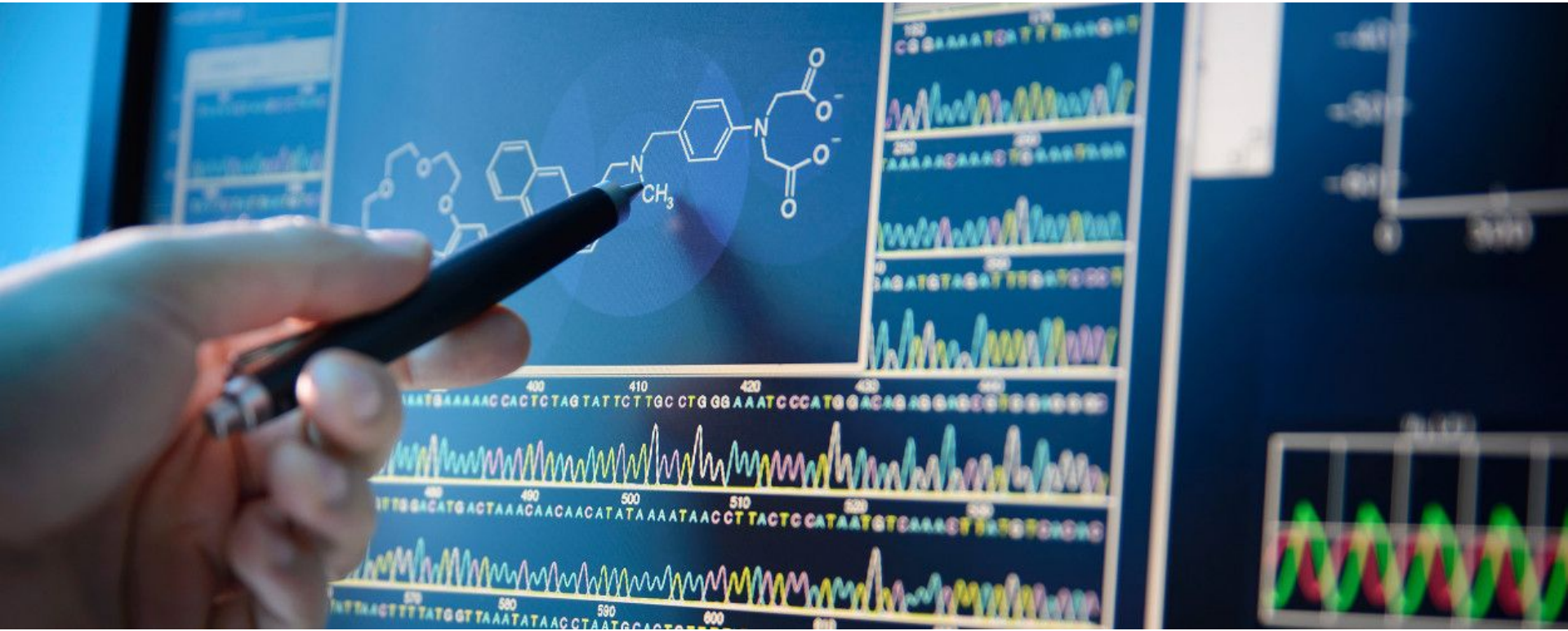
Where are these skills transferable?

- Embedded Systems
- Electrical Engineering
- Software development, in general (duh)

Requirements

- CSE 142 or equivalent (including self-taught)
- Willingness to ask questions
- Availability to physically come in to lab to work

Simulation Team


CH3
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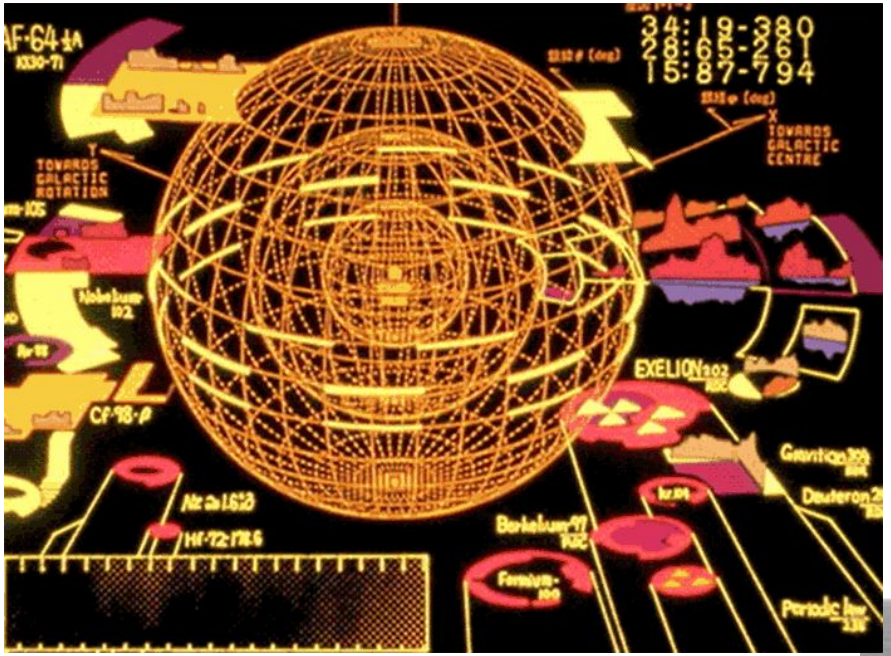
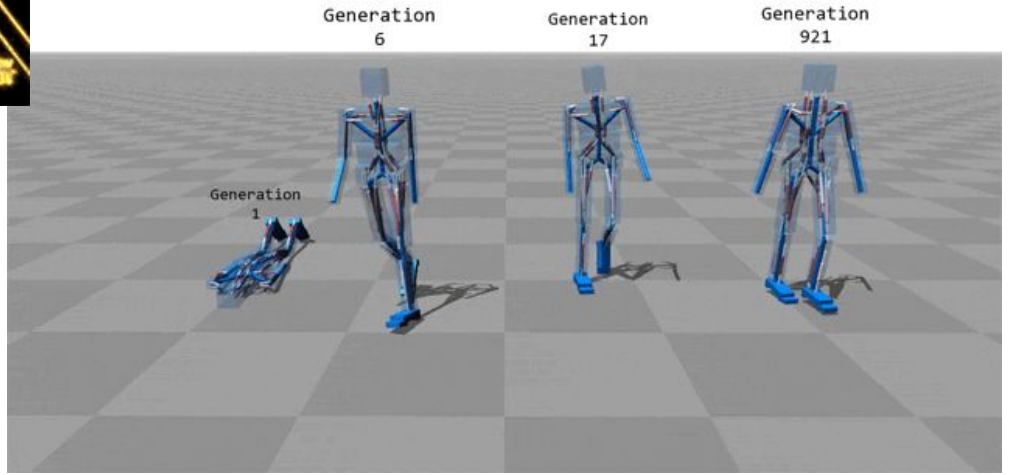
420
490
500
510
580
590
600

01100100
10100110
01101100


34:19-380
28:65-261
15:87-794
TOWARDS GALACTIC ROTATION
TOWARDS GALACTIC CENTRE
EXELION
Deuteron
Periodic law

What do we do?

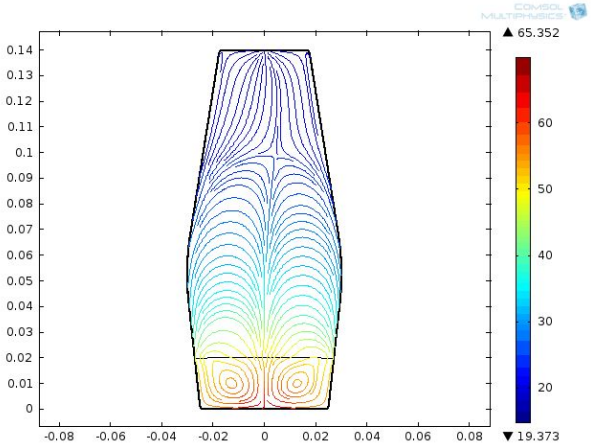

Generation 1
Generation 6
Generation 17
Generation 921

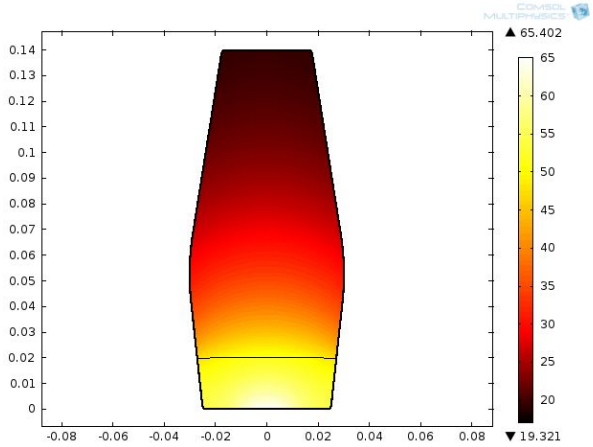
Computational Biology
(Gene Regulation* Modeling)

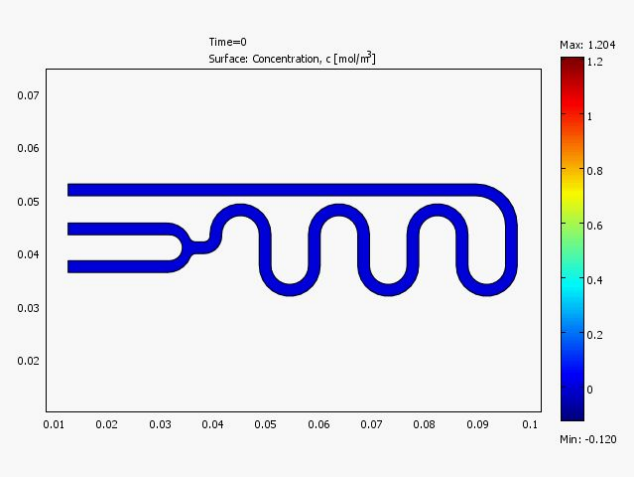
What do we do?

Multiphysics Analysis
(Mechanical Modeling)

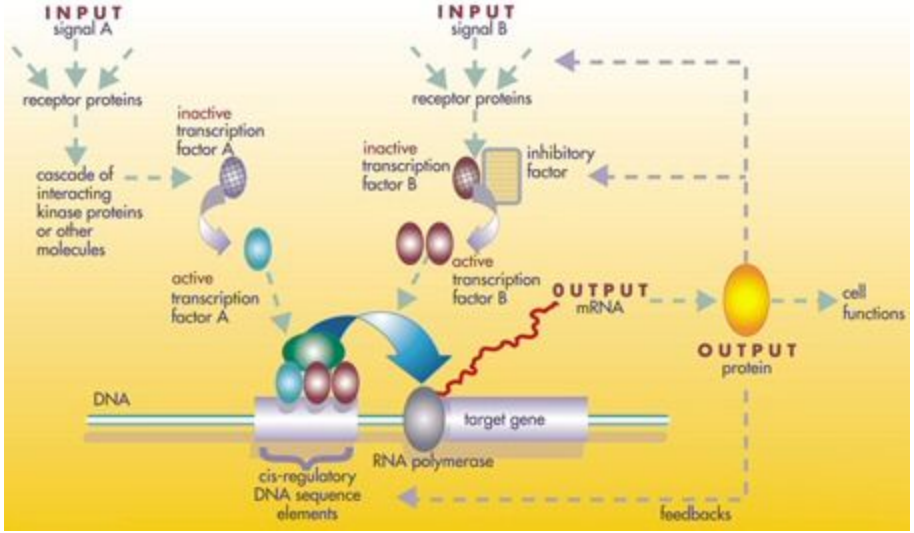
COMSOL

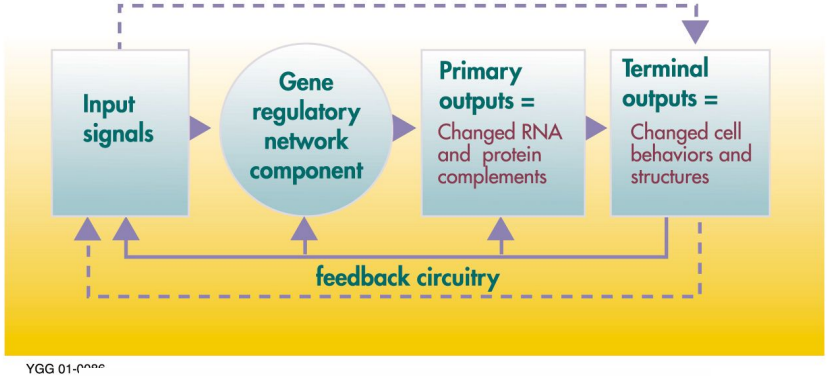


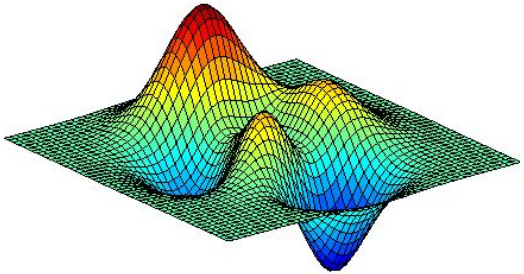


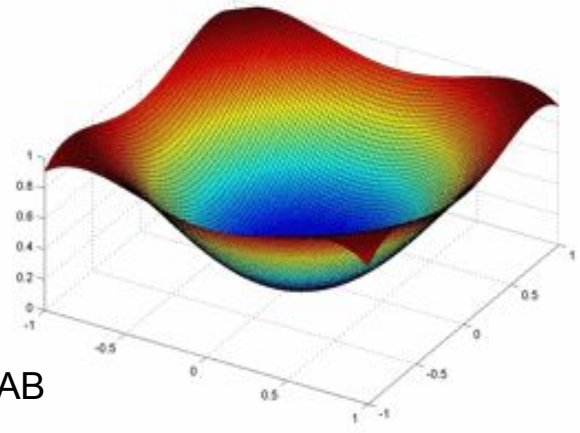


What do we do?









What do we do?

MATLAB

BIOINFORMATICIAN

What my friends think I do.

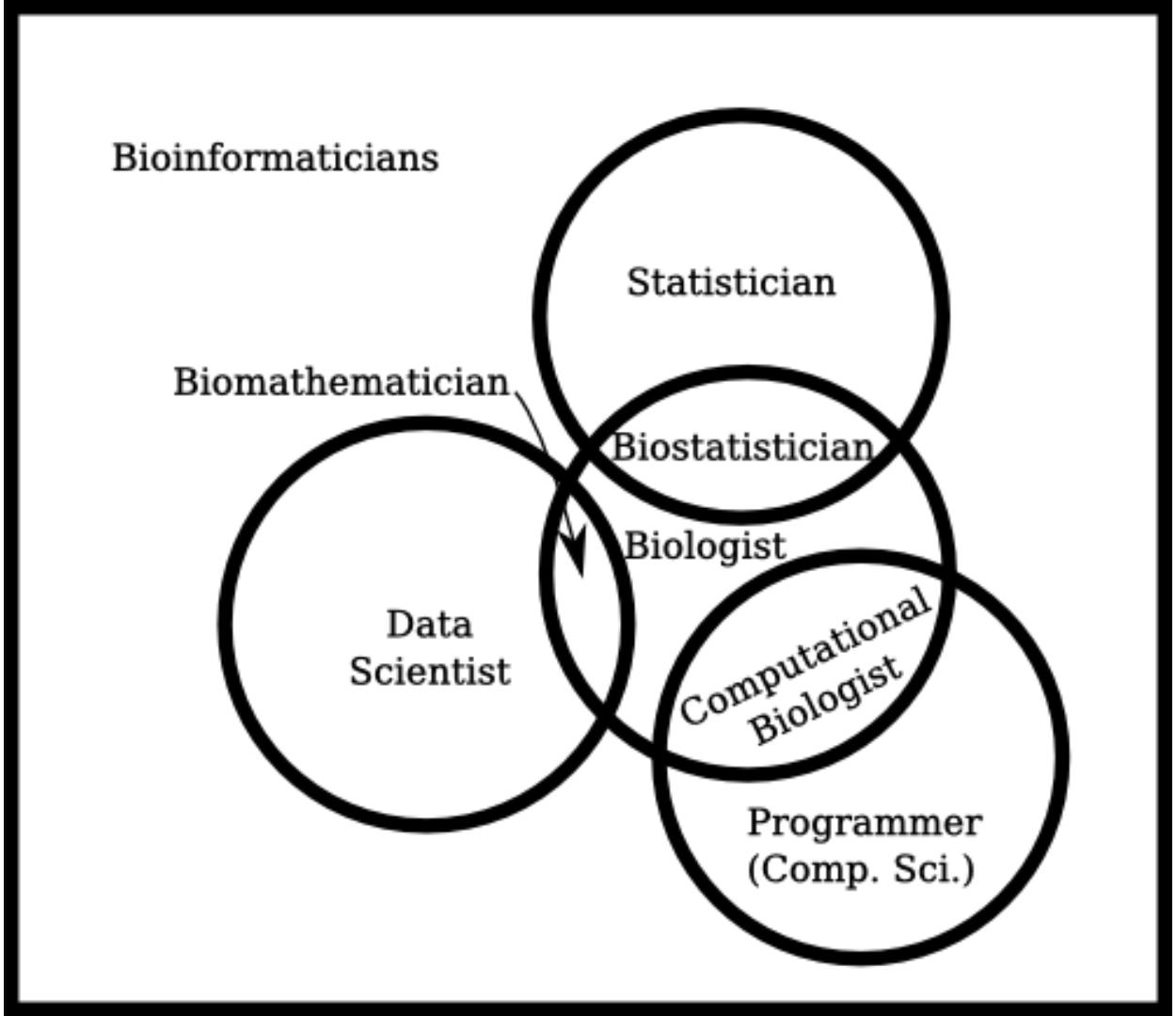
What my mom thinks I do.

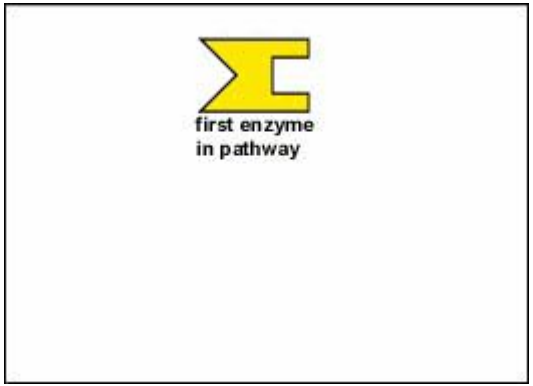
What engineers think I do.

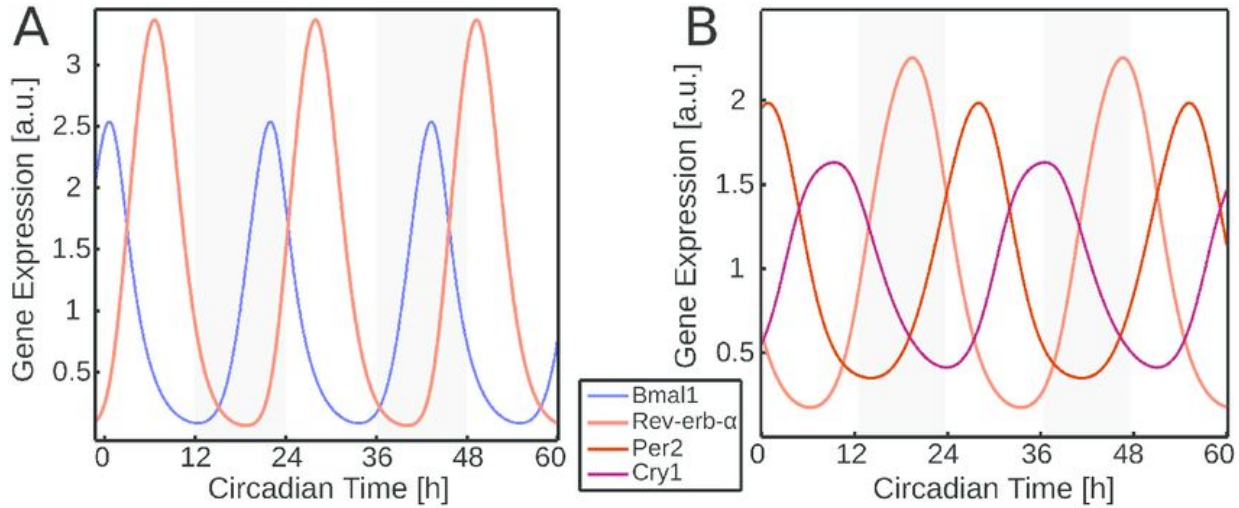
What biologists think I do.

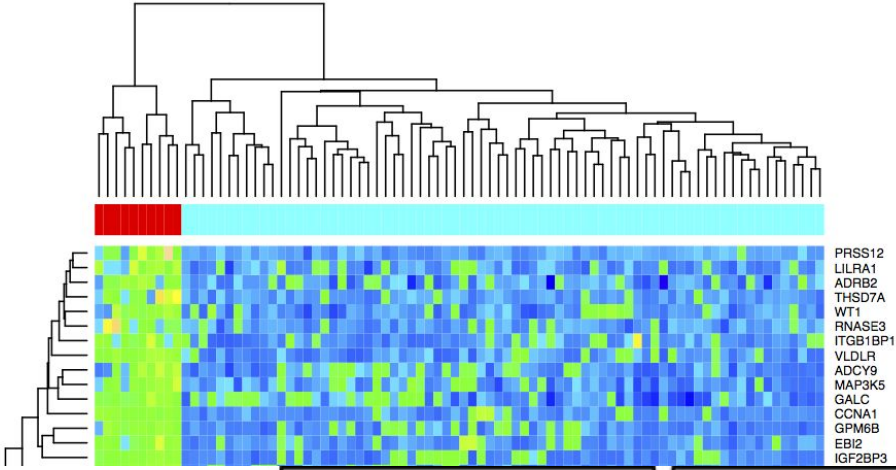
What I think I do.

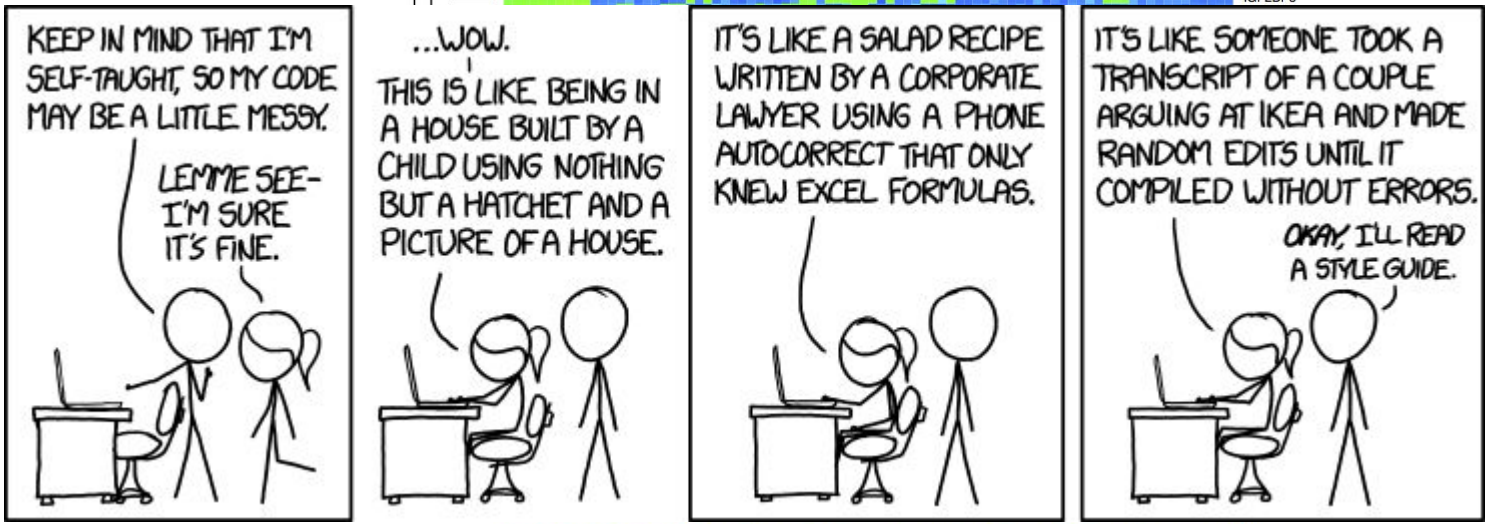
What I do.

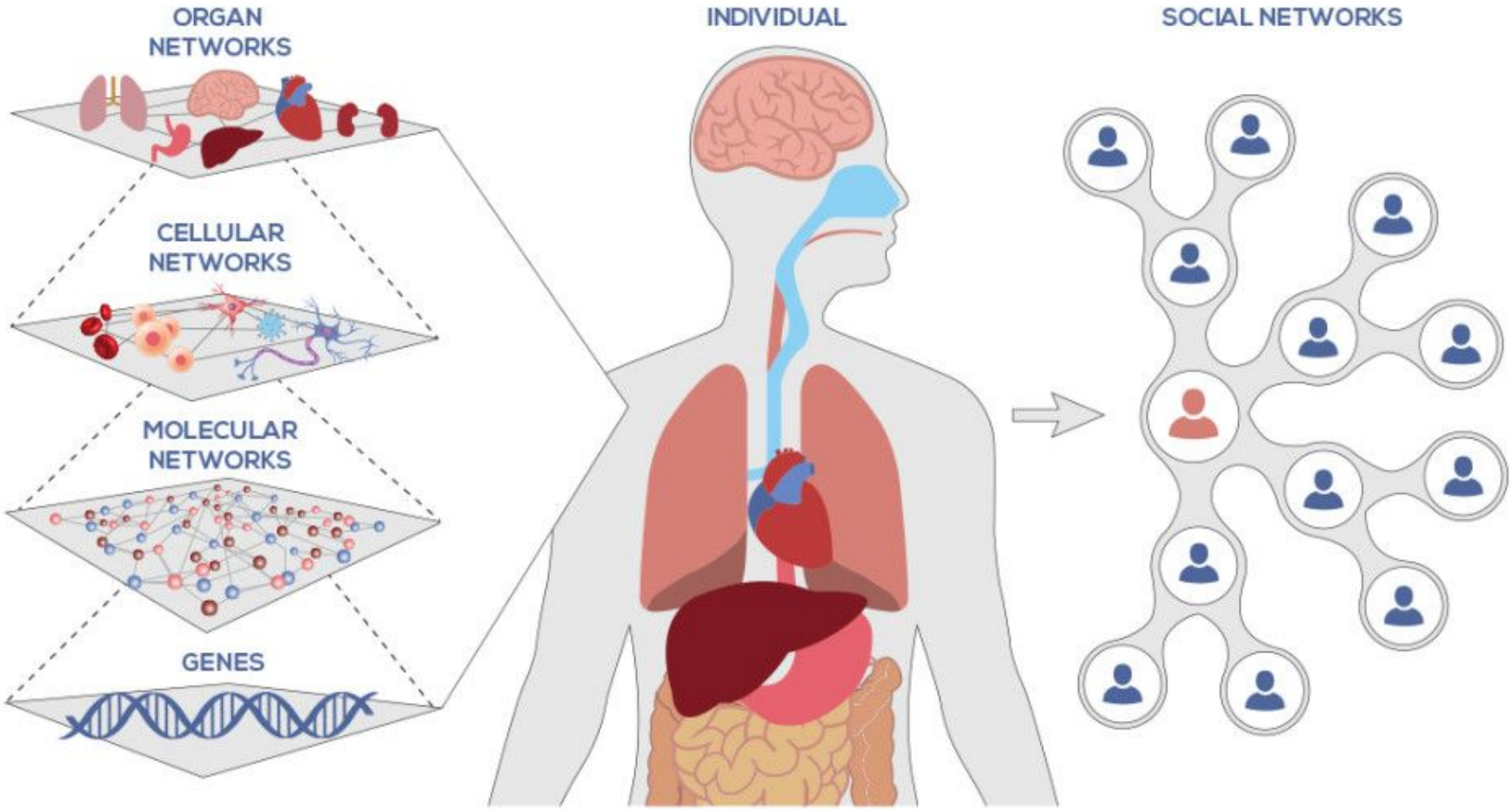

Bioinformaticians
Statistician
Biomathematician
Biostatistician
Biologist
Data
Scientist
Computational
Biologist
Programmer
(Comp. Sci.)


first enzyme
in pathway


A
Gene Expression [a.u.]
3
2.5
2
1.5
1
0.5
0
12
24
36
48
60
Circadian Time [h]
Bmal1
Rev-erb-α
Per2
Cry1
B
Gene Expression [a.u.]
2
1.5
1
0.5
0
12
24
36
48
60
Circadian Time [h]


PRSS12
LILRA1
ADRB2
THSD7A
WT1
RNASE3
ITGB1BP1
VLDLR
ADCY9
MAP3K5
GALC
CCNA1
GPM6B
EBI2
IGF2BP3


KEEP IN MIND THAT I'M SELF-TAUGHT, SO MY CODE MAY BE A LITTLE MESSY.
LEMME SEE- I'M SURE IT'S FINE.
...WOW. THIS IS LIKE BEING IN A HOUSE BUILT BY A CHILD USING NOTHING BUT A HATCHET AND A PICTURE OF A HOUSE.
IT'S LIKE A SALAD RECIPE WRITTEN BY A CORPORATE LAWYER USING A PHONE AUTOCORRECT THAT ONLY KNEW EXCEL FORMULAS.
IT'S LIKE SOMEONE TOOK A TRANSCRIPT OF A COUPLE ARGUING AT IKEA AND MADE RANDOM EDITS UNTIL IT COMPILED WITHOUT ERRORS.
OKAY, I'LL READ A STYLE GUIDE.


ORGAN NETWORKS
CELLULAR NETWORKS
MOLECULAR NETWORKS
GENES
INDIVIDUAL
SOCIAL NETWORKS

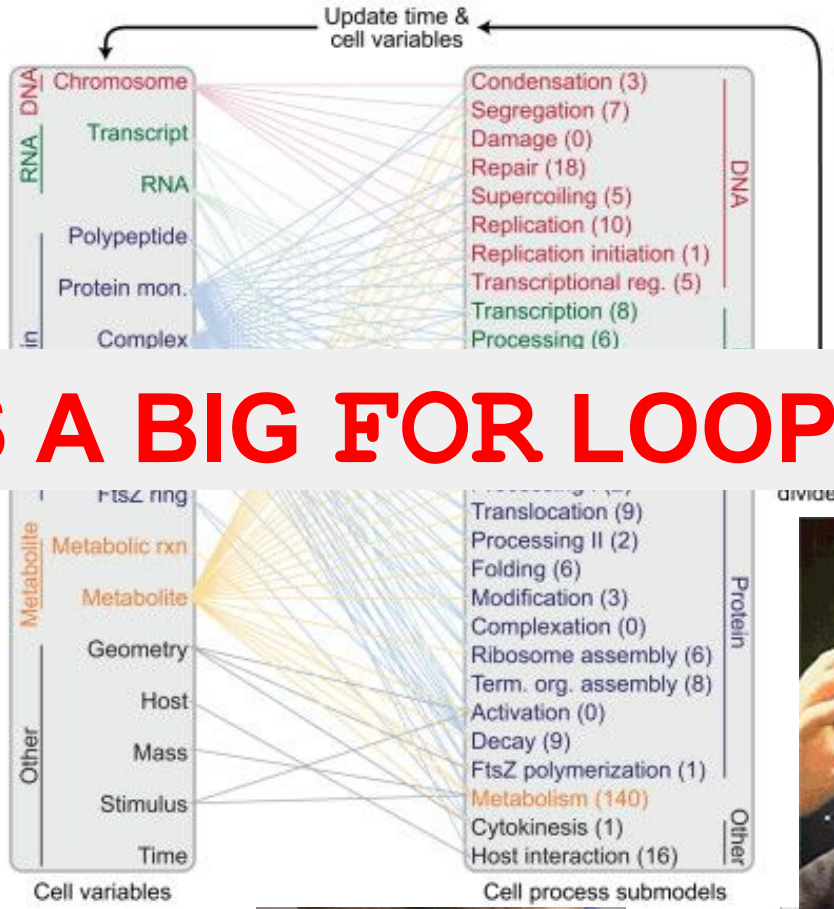
http://www.wholecellviz.org/viz.php#cellCycle

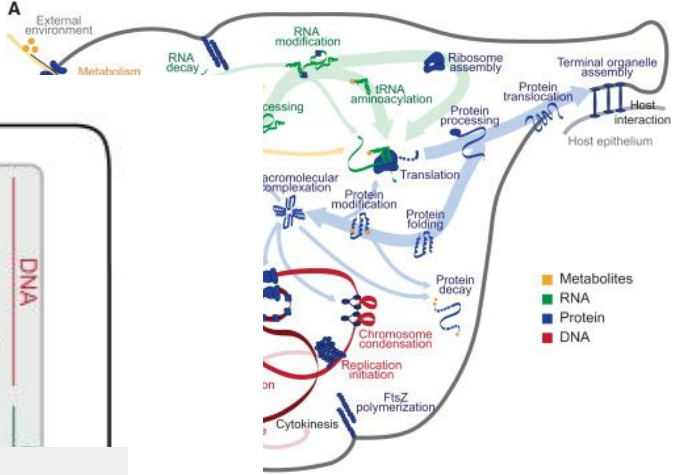
Theory

A Whole-Ce
Predicts Ph

Jonathan R. Karr,[1,4] Jayodita C
Benjamin Bolival, Jr.,[2] Nacyra
[1]Graduate Program in Biophysics
[2]Department of Bioenginee
Stanford University, Stanfo
[3]J. Craig Venter Institute, F
[4]These authors contributec
*Correspondence: mcovert
http://dx.doi.org/10.1016/j

IT'S A BIG FOR LOOP





Skills necessary

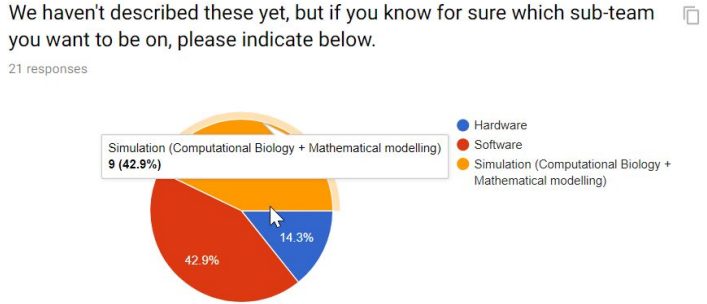
Gene Regulation Modeling:

- Barebones computer science (Think CSE 142)
- AMATH 301 (MATLAB)
- MATH 307 (ODE's fo lyfe)

Hardware Modeling

- COMSOL access
- "Tinkering" mindset
- At least 4GB of RAM

Matlab Memes for Science and Engineering Teens



I'm a
Bioinfomagician
I discover *de novo*
mutations using
simple workflows
Learn more
life
technologies