

# CSEP 527

# Computational Biology

Course Wrap Up

Please complete online course  
evaluation by Sunday

<https://uw.iasystem.org/survey/161047>

What is DNA? RNA?

How many Amino Acids are there?

Did human beings, as we know them, develop from earlier species of animals?

What are stem cells?

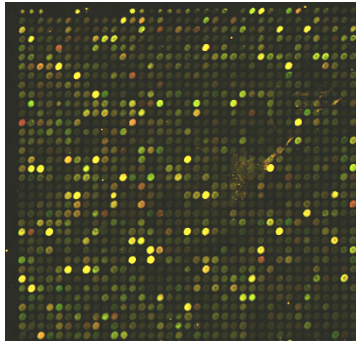
What did Viterbi invent?

What is dynamic programming?

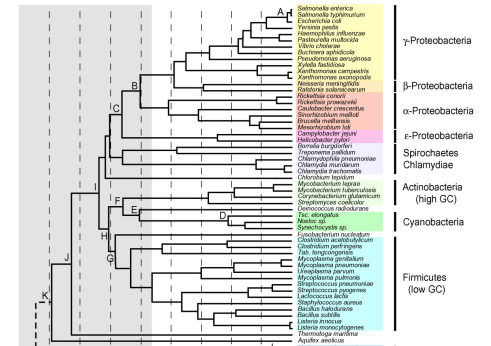
What is a likelihood ratio test?

What is the EM algorithm?

How would you find the maximum of  $f(x) = ax^3 + bx^2 + cx + d$  in the interval  $-10 < x < 25$ ?



# “High-Throughput BioTech”

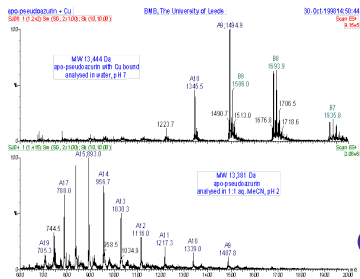
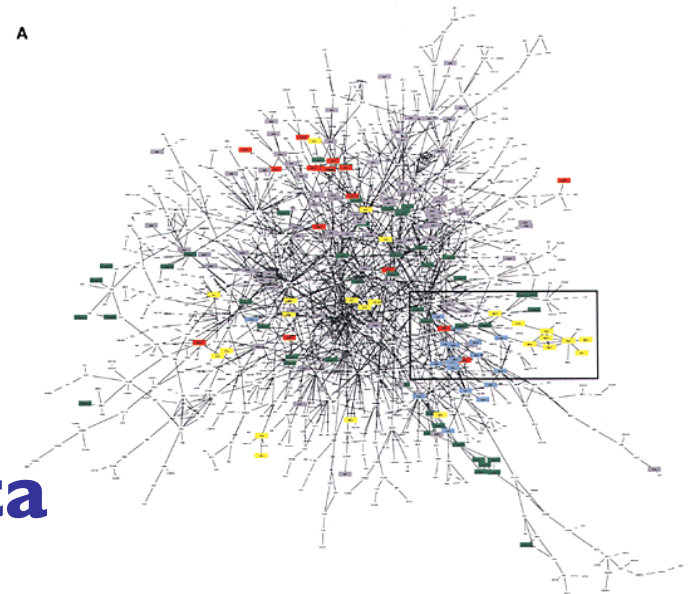
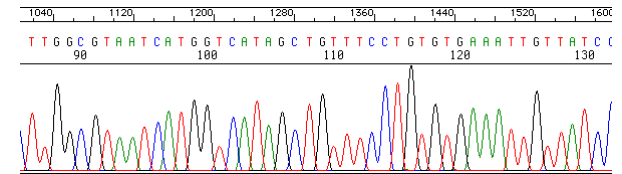
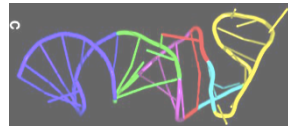


## Sensors

- DNA sequencing
- Microarrays/RNAseq/Gene expression
- Mass Spectrometry/Proteomics
- Protein/protein & DNA/protein interaction

## Controls

- Cloning
- Gene editing/knock out/knock in
- RNAi, CRISPR/CAS



**Floods of data**

**“Grand Challenge” problems**

# CS Points of Contact

## Scientific visualization

- Gene expression patterns

## Databases

- Integration of disparate, overlapping data sources

- Distributed genome annotation in face of shifting underlying coordinates

## AI/NLP/Text Mining

- Information extraction from journal texts with inconsistent nomenclature, indirect interactions, incomplete/inaccurate models,...

## Machine learning

- System level synthesis of cell behavior from low-level heterogeneous data (DNA sequence, gene expression, protein interaction, mass spec, ...)

## Algorithms

...

# Frontiers & Opportunities

## New data:

Proteomics, SNP, arrays, CGH, comparative sequence information, epigenomics, chromatin structure, ncRNA, interactome, single-cell everything

## New methods:

graphical models, rigorous filtering

## Data integration

many, complex, noisy sources

## Systems Biology

# Frontiers & Opportunities

## Open Problems:

splicing, alternative splicing

multiple sequence alignment

(genome scale, 100s-1000s of species, w/ RNA etc.)

protein & RNA structure

interaction modeling

regulation, at all levels

network models

RNA trafficking

ncRNA discovery

...

# Exciting Times

“Biology is to 21<sup>st</sup> Century  
as Physics was to 20<sup>th</sup>”

Lots to do

Highly multidisciplinary

You'll be hearing a lot more about it

I hope I've given you a taste of it



# Thanks!

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