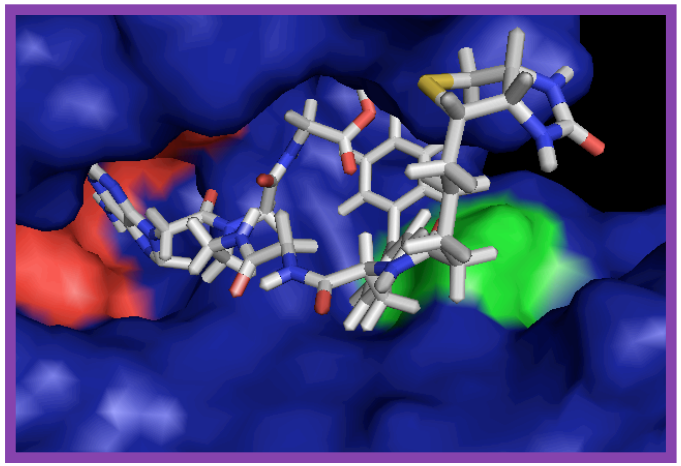
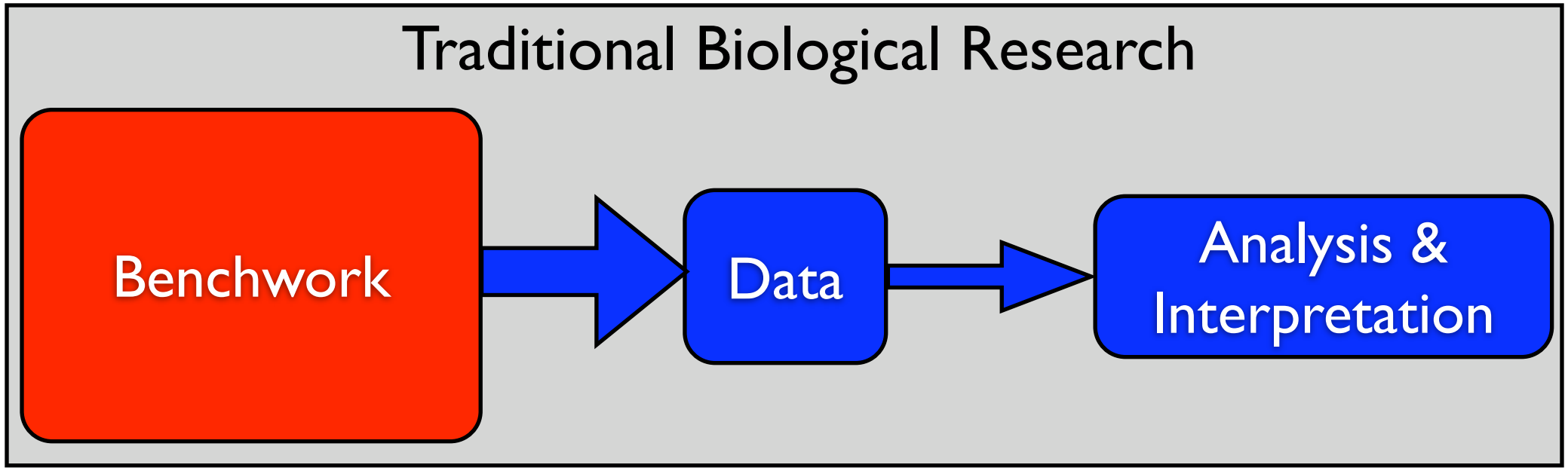
New Programs in Quantitative Biology:

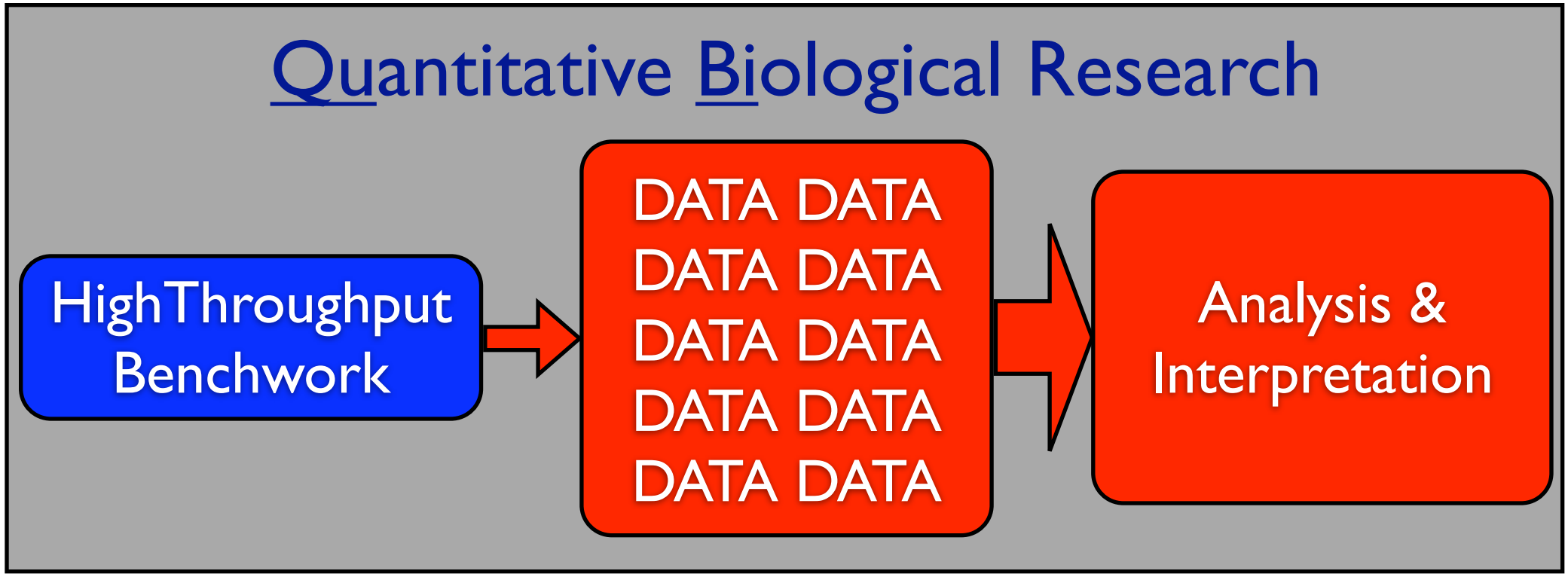
QuBi @ Hunter College



What is *QuBi*?

- Quantitative Biology
  - An initiative to join computational and quantitative disciplines to the analysis of biological data.
  - Bioinformatics, computational biology
  - Exciting, multidisciplinary field with many career options


Traditional Biological Research
Benchwork
Data
Analysis & Interpretation


Quantitative Biological Research
HighThroughput Benchwork
DATA DATA
DATA DATA
DATA DATA
DATA DATA
DATA DATA
Analysis & Interpretation

QuBi @ Hunter College

- Hunter has excellence in Quantitative Biology given existing departmental, faculty, and infrastructural strengths.
- We have revised our curriculum to have Quantitative Biology concentrations in 5 majors (Biology, Chemistry, Computer Science, Mathematics, Statistics)
- The National Institutes of Health (NIH) and Hunter College have recognized this excellence with grants and student scholarship support

Excellent Student Opportunities at Hunter!

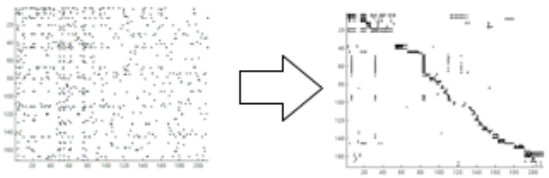
Student Support

- QuBi Scholarships
- MARC
- Harcourt Fellows

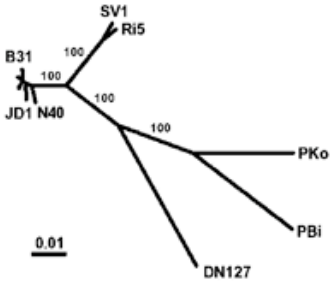
Research & Career Options

- Work with Hunter Faculty on Exciting Research Projects
- Prepare for Graduate Work or a Career in Fields including:
  - Computational Biology
  - Biostatistics
  - Protein Chemistry/Pharma
  - Biological Software Engineering

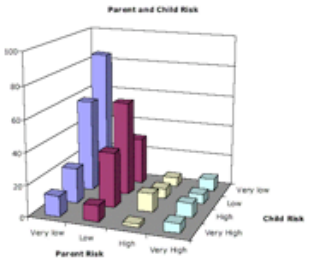
QuBi Faculty Research



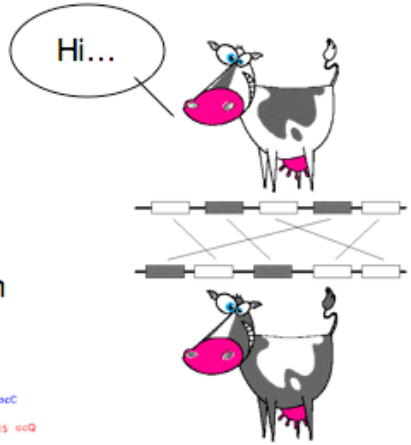
Clustering of motif expressions in genes



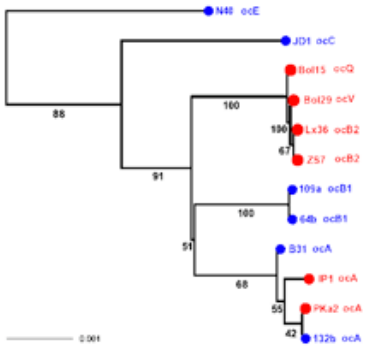
Building species phylogeny



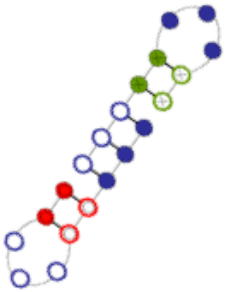
HIV risk in parents / children



Genome rearrangements



Predicting evolutionary distances



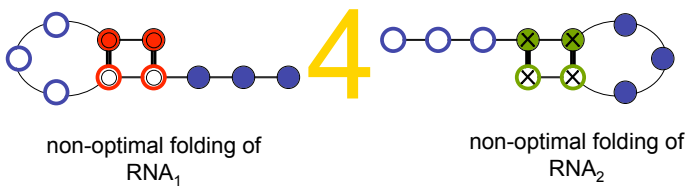
Structure prediction of RNA complexes

CS Research in QuBi

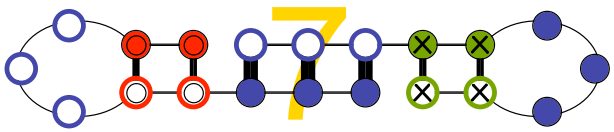
- Mneimneh: Computational approaches to study RNA-RNA Structure prediction

RNA folding and interaction (each one is optimal)

RNA folding and interaction (each one is non-optimal)



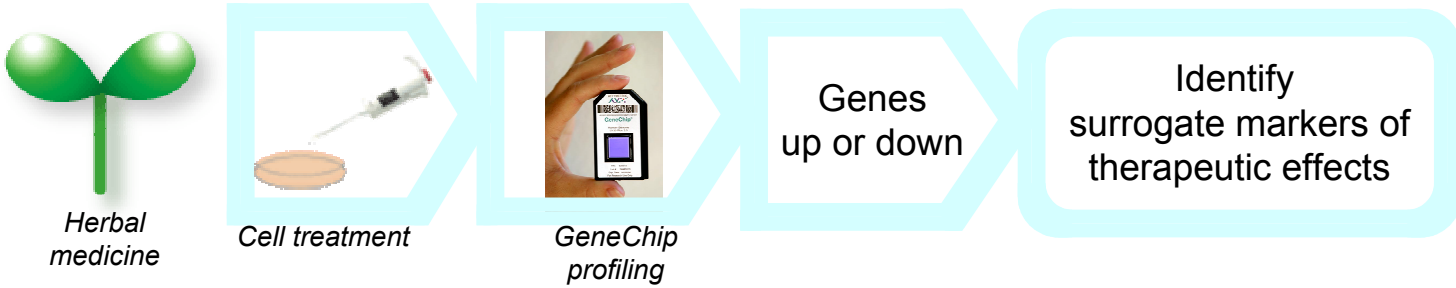
RNA folding and interaction (but better together)



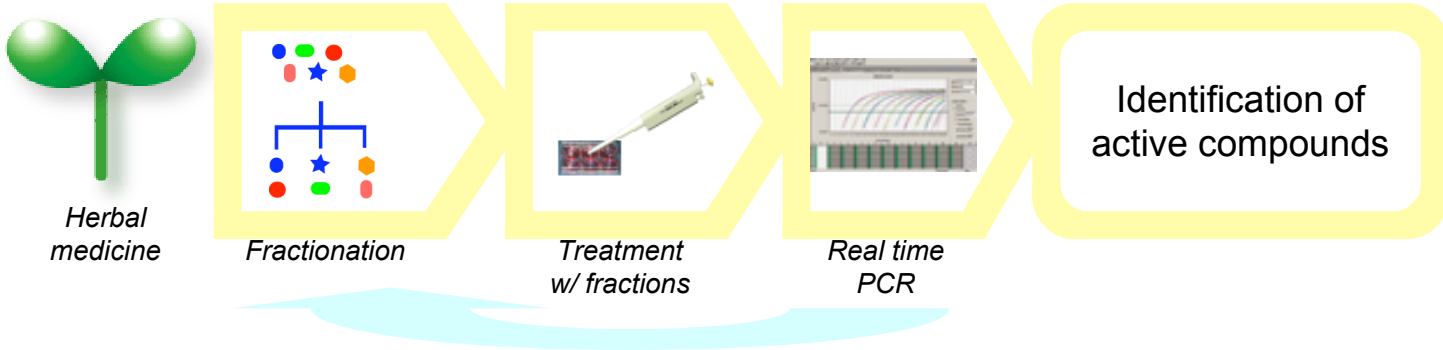
Optimal structure for RNA_1 and RNA_2

Chem Research in QuBi

- Kawamura: Genomic Screening using Microarray Data



2. Find the compounds that regulate the surrogate biomarkers

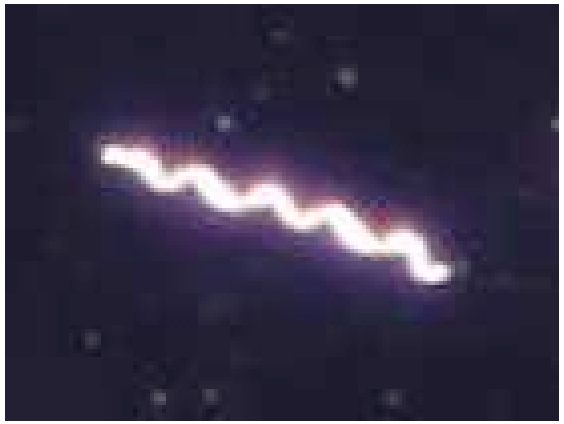


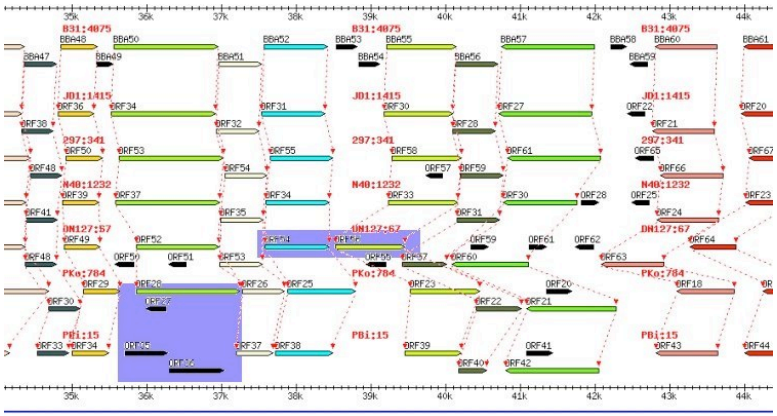
Kawamura, A. et al. *Bioorg. Med. Chem. Lett.*, **2006**, *16*, 2846.

Kawamura, A. et al. *Bioorg. Med. Chem. Lett.*, **2007**, *17*, 6879.

Bio Research in QuBi

- Qiu: Comparative Genomics of Lyme Disease
- Identification of Virulence Genes and Vaccine Targets
- Development of Web-Tools for Visualizing Genome Differences
  - borreliagenome.org





The QuBi Curricula

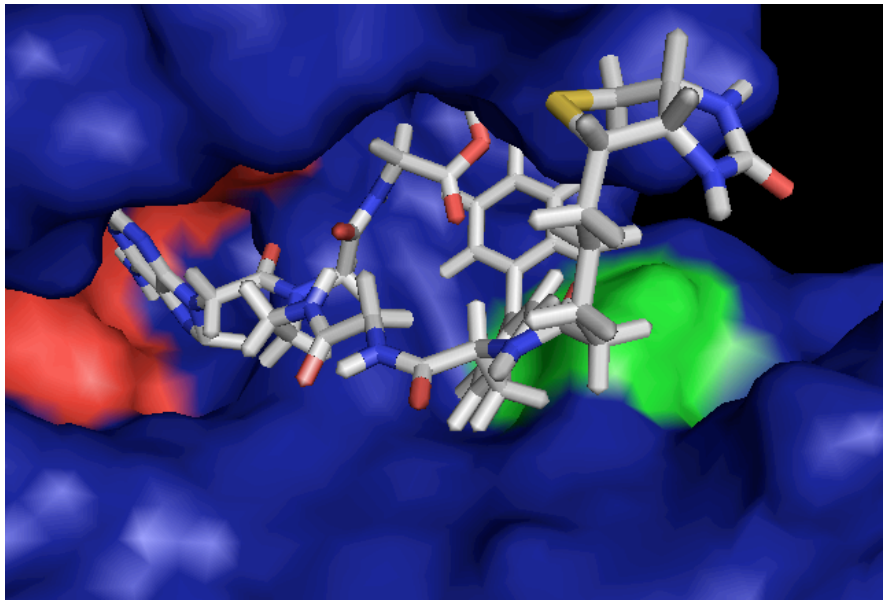
- Concentrations within the Biology, Chemistry, Computer Science, Mathematics, Statistics Majors
- Within each Major, these QuBi Concentrations are multidisciplinary, drawing on new and existing courses

Example QuBi Course
STAT319: Bayesian Inference in the Sciences

- Modeling Biological Variables:
  - Markov Chains: sequence of nucleotide base pairs in DNA
  - Hidden Markov chain Models: coding vs. non-coding regions in DNA
- Small class (12-15 students) allows for individualized attention and mentoring

Example QuBi Course
CHEM388: Chemical Genomics

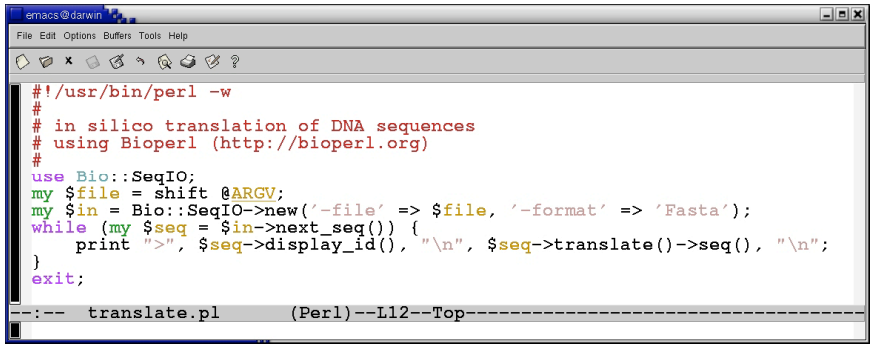
- Chemical and computational tools for genomics and proteomics research with two main themes:
  - Molecular visualization of three dimensional structures of macromolecules (proteins, DNA, etc.) as well as small molecules (drugs, etc.)
  - Chemical and computational tools for genomics and proteomics analysis.

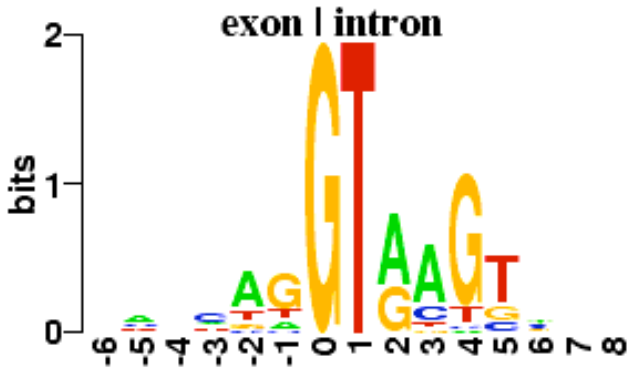


Example QuBi Course
BIOL425: Computational Molecular Biology

- QuBi Capstone Course
- Hands On Learning

- Bioinformatics Theory & Applications to:
  - Gene Prediction
  - Protein Structure Prediction
  - Molecular Phylogenetics
  - Gene Expression Analysis





Some QuBi Facilities

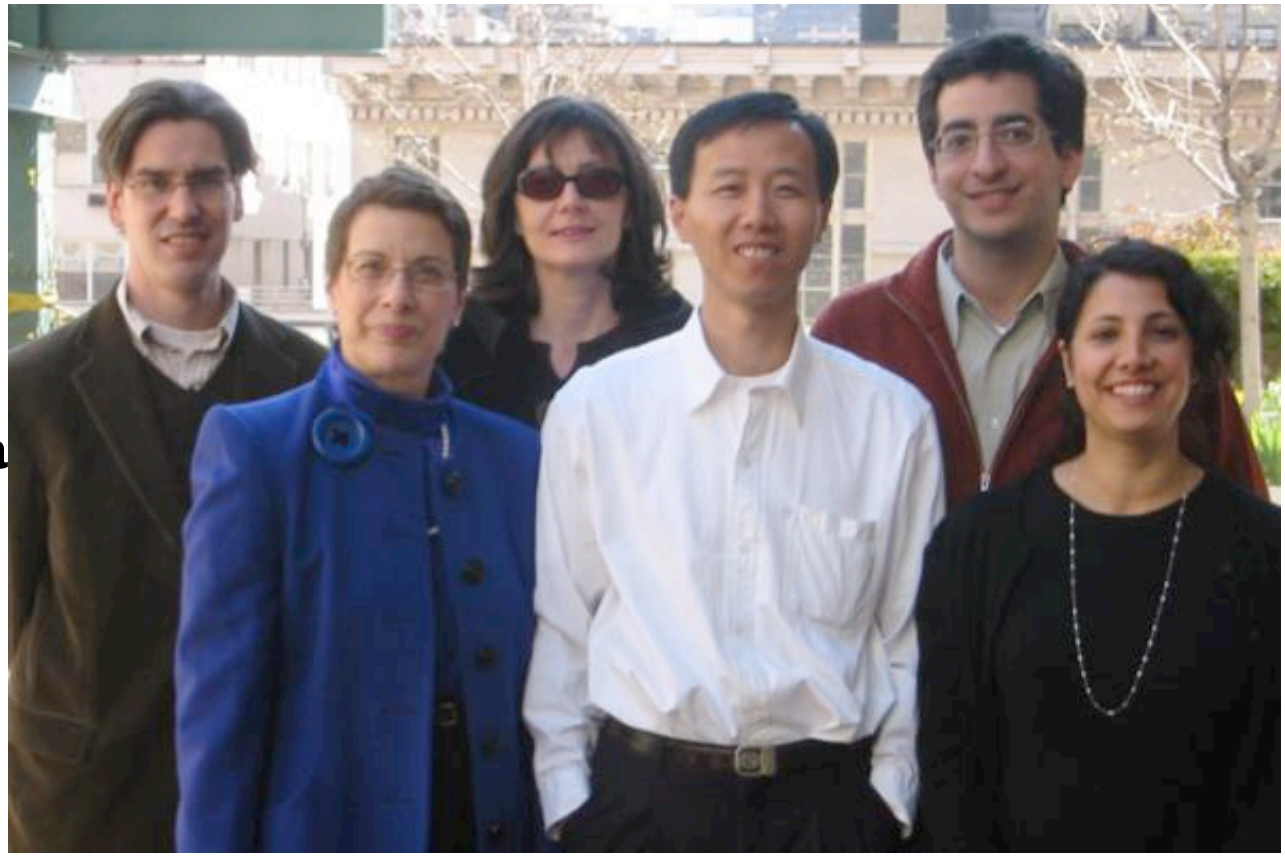
UNIX Lab

BioSAM Lab

BIOL100 Lab

QuBi Advisors

Kawamura
Chem



Mneimneh
CS

Steiper
Anthro

Teller
CS

Draghicescu
Math

Qiu
Bio

Talih
Stats

Alaie
Bio

Please go to the website to contact any of the faculty advisors or send email to Veronica Lichman, QuBi Grant Administrator at vlichman@hunter.cuny.edu