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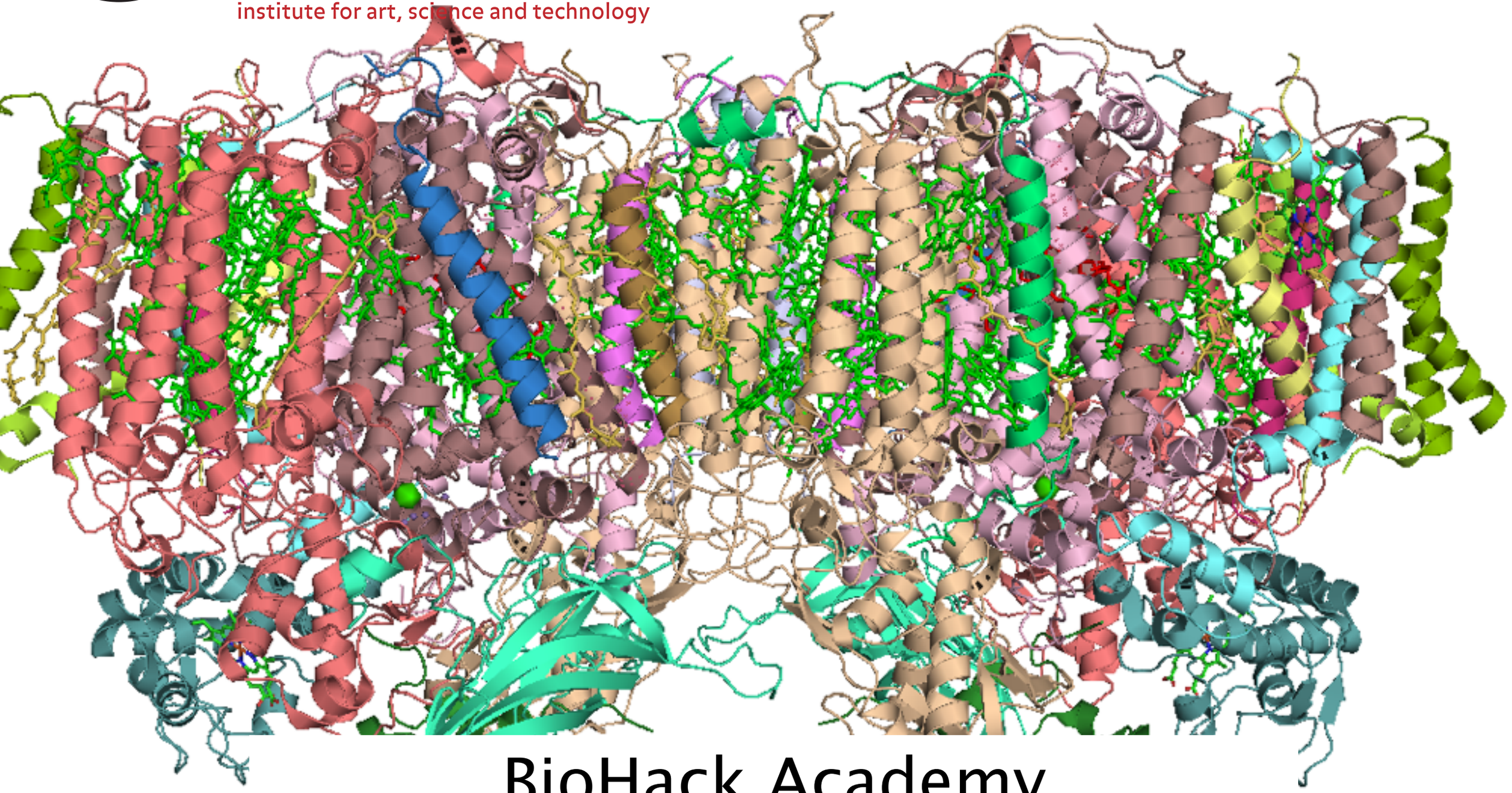


# BioHack Academy
# Bio Informatics

# The “Omics”

- “Genomics” DNA sequence analysis
- “Transcriptomics” DNA expression analysis
- “Proteomics” Protein (structure) prediction / analysis
- “Interactomics” Protein – Protein, DNA – Protein interaction
- “Metabolomics” Metabolism modeling

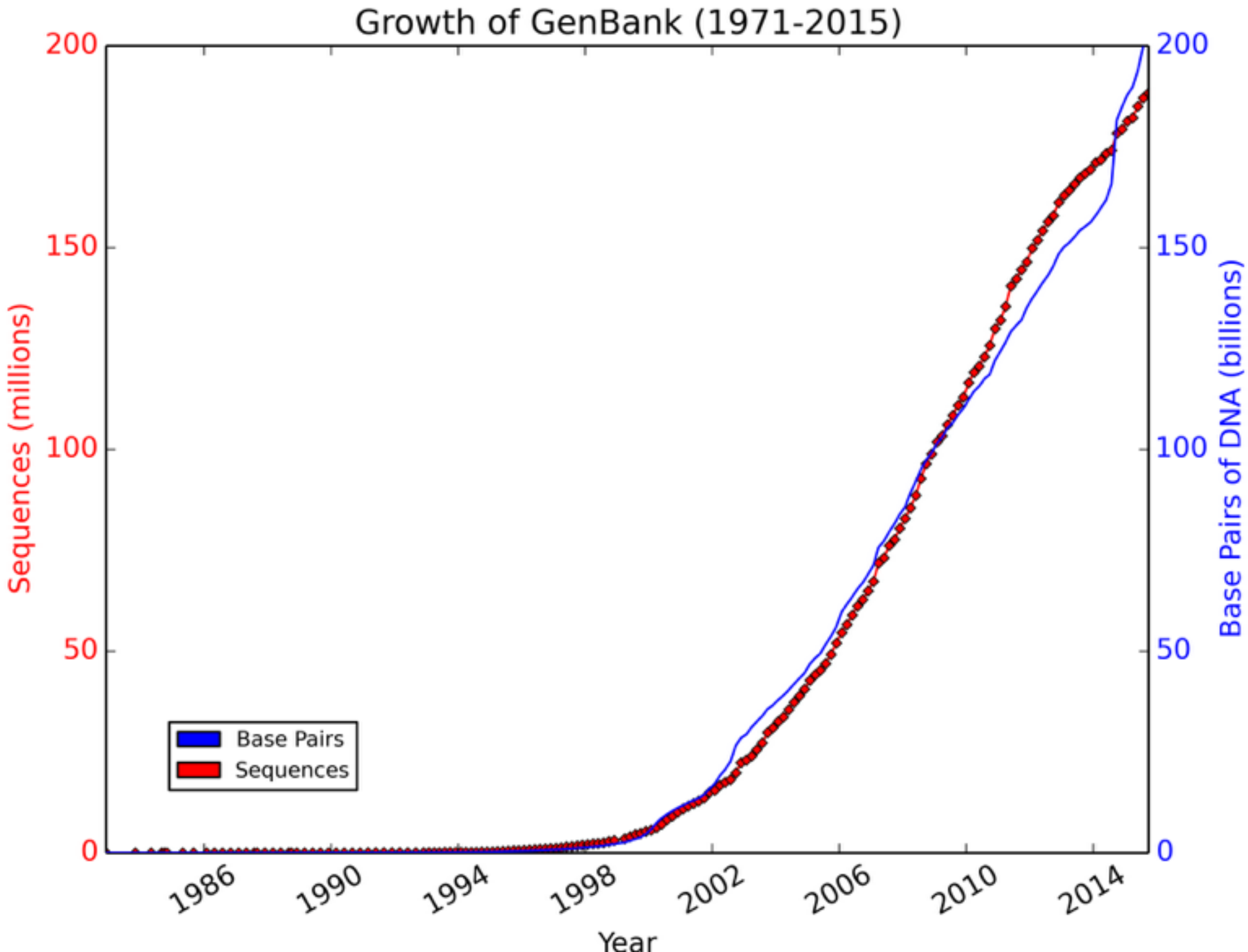
# What is it used for

- Optimizing yield
- Predicting organisms behaviour
- Medical diagnostics
  - Personal medicine
- Drug discovery

# Genomics

- Functional genomics
- Metagenomics
- Personal Genomics
- Epigenomics

# DNA database GenBank

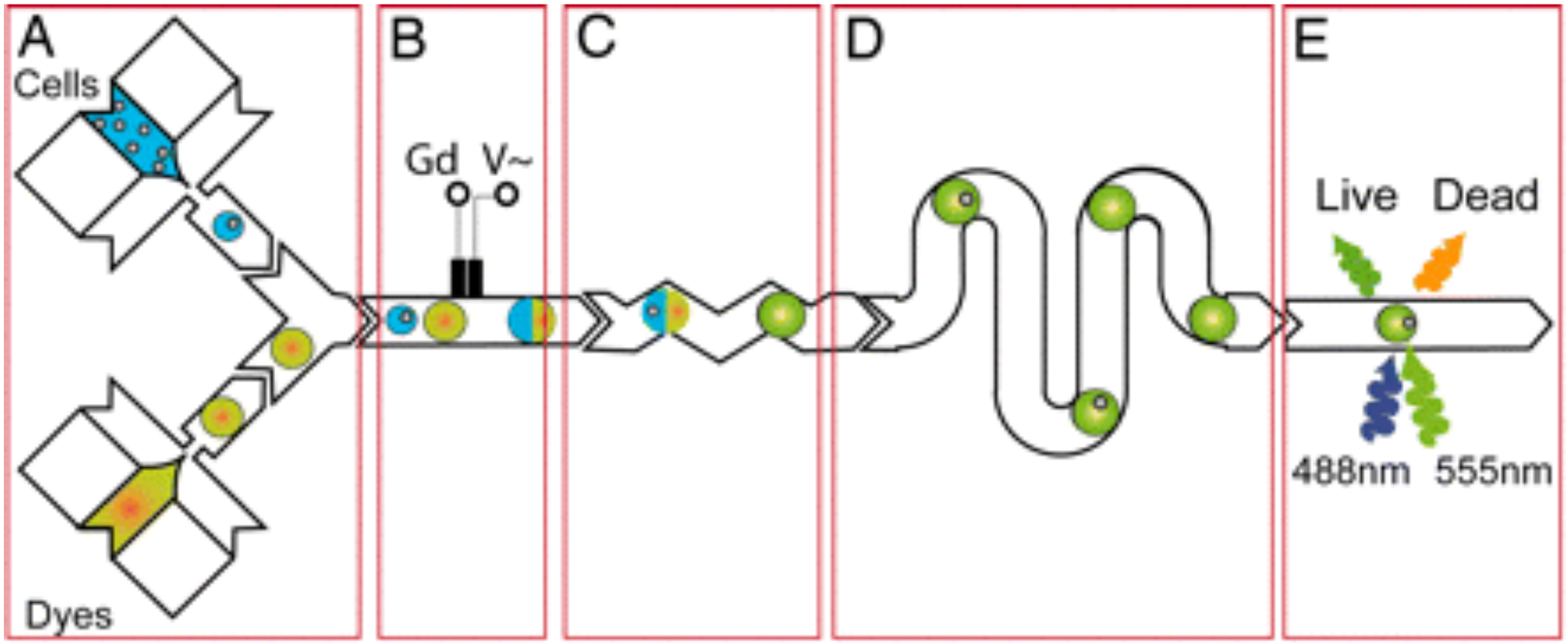


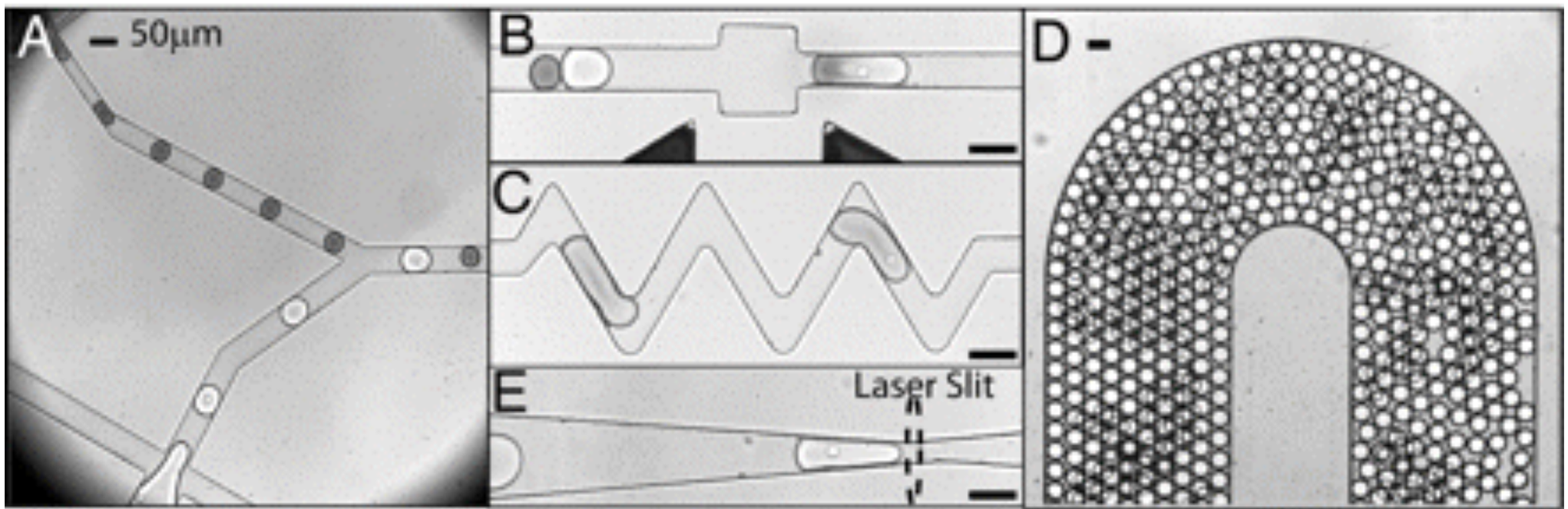
# Drivers

- “High Throughput Research”
  - Robotics
  - Databases
  - Visualisation
- Public tools
- Open data

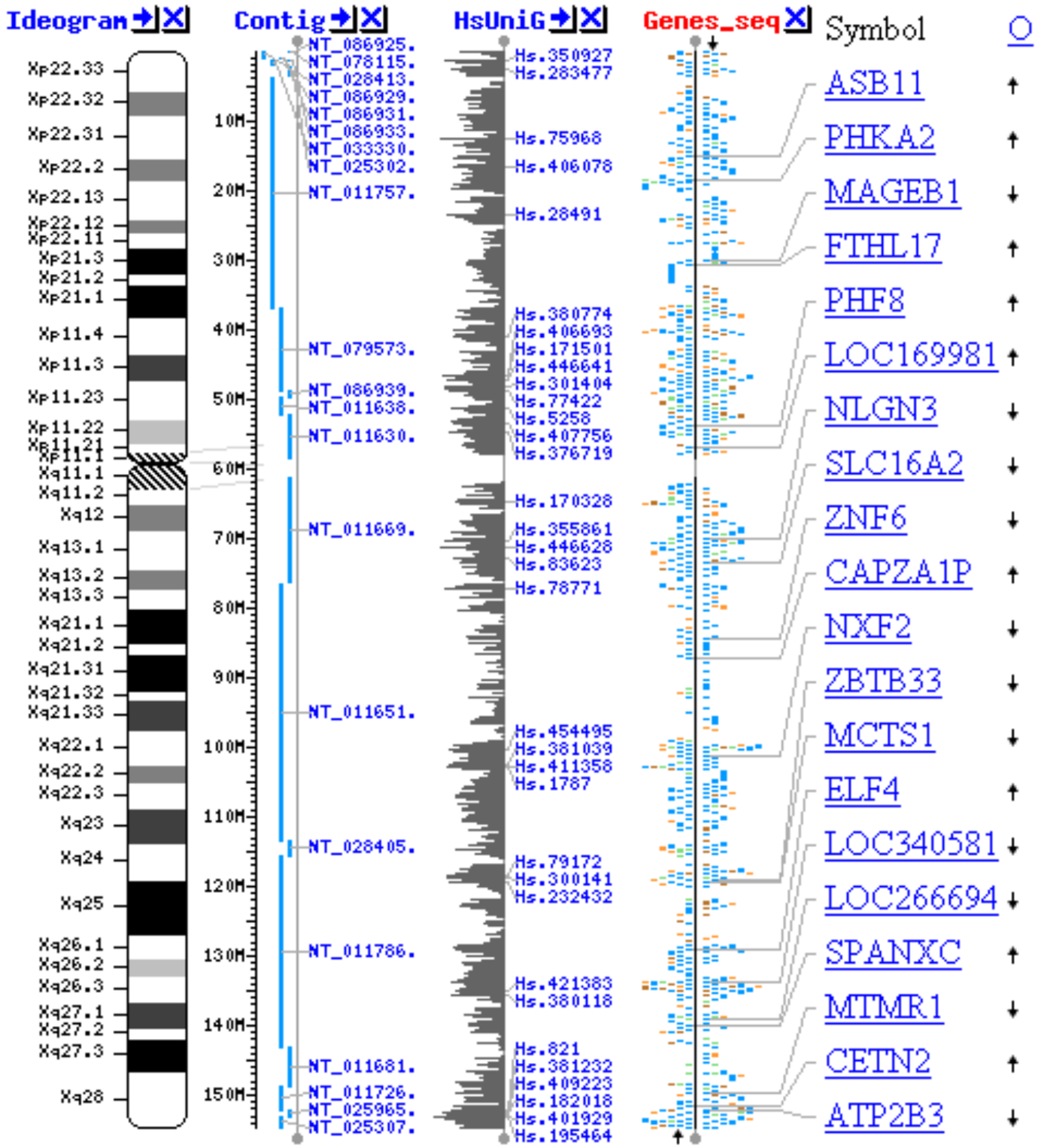
# High Throughput Screening

Eric Brouzes et al. PNAS 2009;106:14195-14200

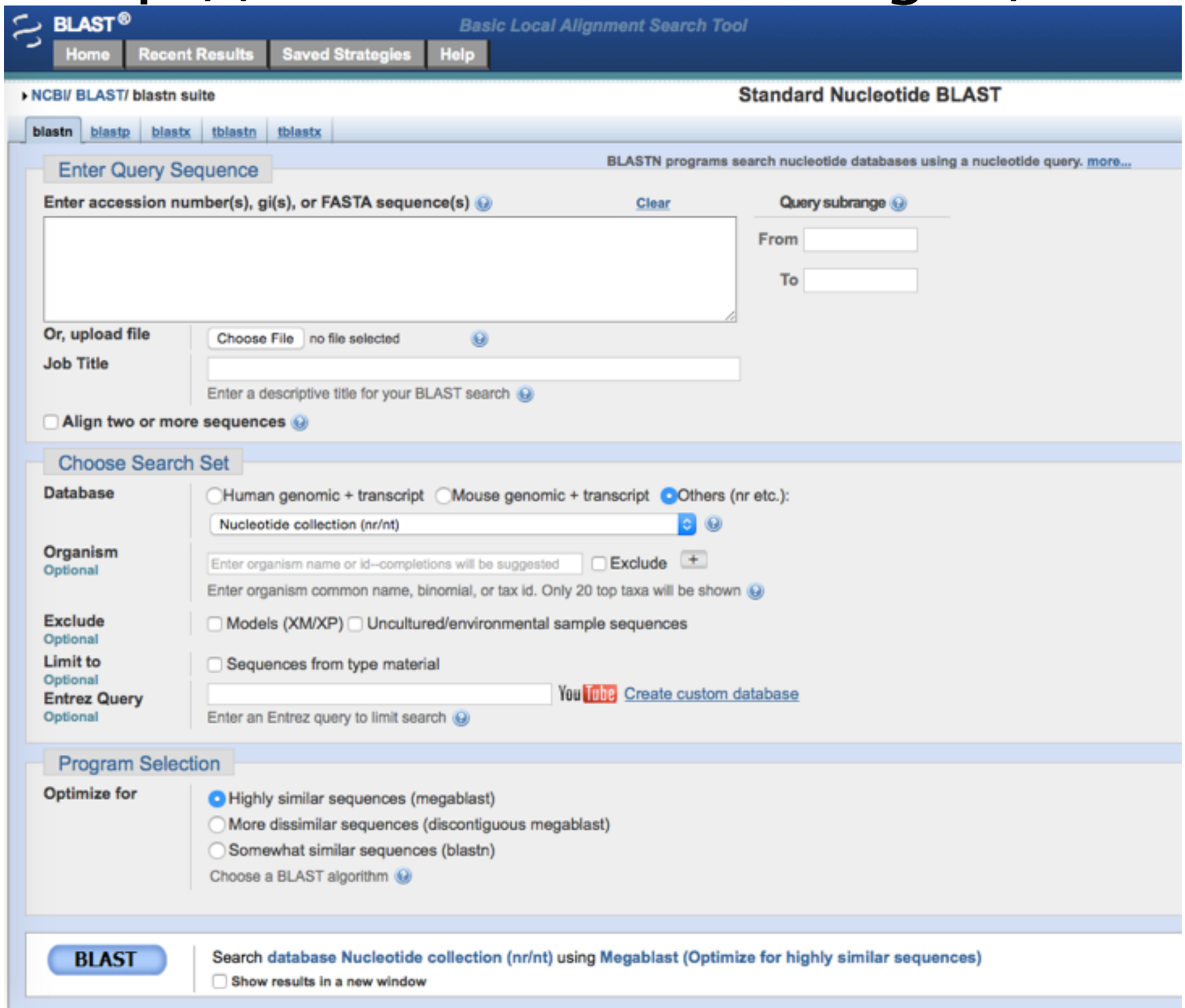


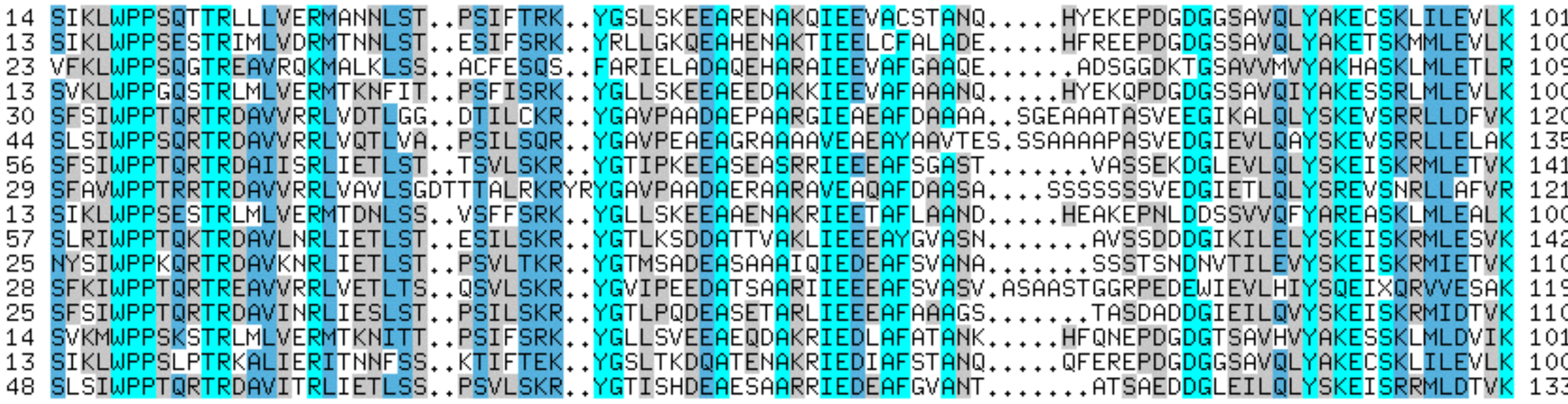
# Gene annotations



# BLAST: Basic Local Alignment Search Tool
# http://blast.ncbi.nlm.nih.gov/Blast.cgi



# Sequence Alignment

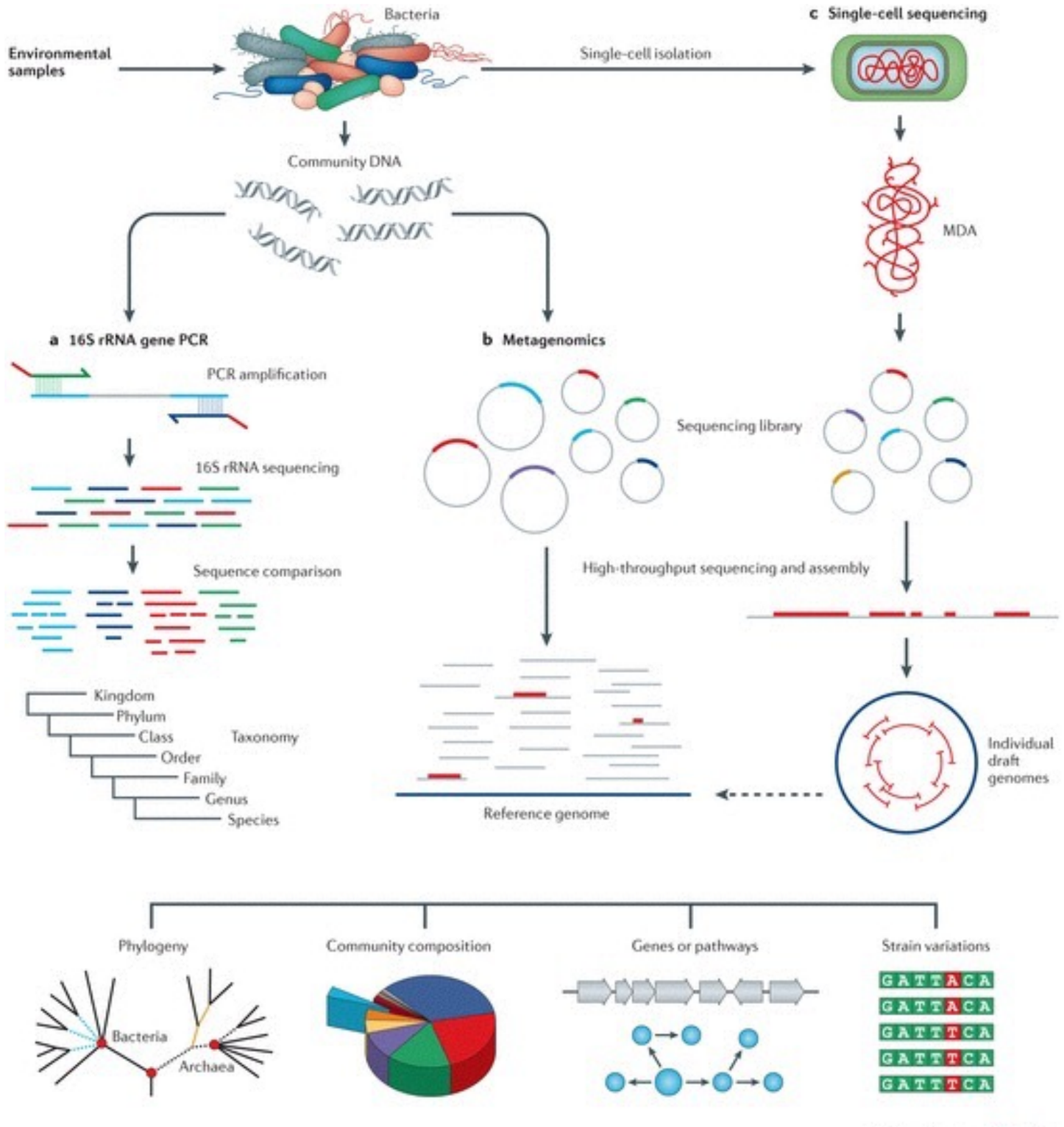


# Scoring Matrix BLOSUM

(**BLO**cks **SU**bstitution **M**atrix)

| | Ala | Arg | Asn | Asp | Cys | Gln | Glu | Gly | His | Ile | Leu | Lys | Met | Phe | Pro | Ser | Thr | Trp | Tyr | Val |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ala** | 4 | | | | | | | | | | | | | | | | | | | |
| **Arg** | -1 | 5 | | | | | | | | | | | | | | | | | | |
| **Asn** | -2 | 0 | 6 | | | | | | | | | | | | | | | | | |
| **Asp** | -2 | -2 | 1 | 6 | | | | | | | | | | | | | | | | |
| **Cys** | 0 | -3 | -3 | -3 | 9 | | | | | | | | | | | | | | | |
| **Gln** | -1 | 1 | 0 | 0 | -3 | 5 | | | | | | | | | | | | | | |
| **Glu** | -1 | 0 | 0 | 2 | -4 | 2 | 5 | | | | | | | | | | | | | |
| **Gly** | 0 | -2 | 0 | -1 | -3 | -2 | -2 | 6 | | | | | | | | | | | | |
| **His** | -2 | 0 | 1 | -1 | -3 | 0 | 0 | -2 | 8 | | | | | | | | | | | |
| **Ile** | -1 | -3 | -3 | -3 | -1 | -3 | -3 | -4 | -3 | 4 | | | | | | | | | | |
| **Leu** | -1 | -2 | -3 | -4 | -1 | -2 | -3 | -4 | -3 | 2 | 4 | | | | | | | | | |
| **Lys** | -1 | 2 | 0 | -1 | -3 | 1 | 1 | -2 | -1 | -3 | -2 | 5 | | | | | | | | |
| **Met** | -1 | -1 | -2 | -3 | -1 | 0 | -2 | -3 | -2 | 1 | 2 | -1 | 5 | | | | | | | |
| **Phe** | -2 | -3 | -3 | -3 | -2 | -3 | -3 | -3 | -1 | 0 | 0 | -3 | 0 | 6 | | | | | | |
| **Pro** | -1 | -2 | -2 | -1 | -3 | -1 | -1 | -2 | -2 | -3 | -3 | -1 | -2 | -4 | 7 | | | | | |
| **Ser** | 1 | -1 | 1 | 0 | -1 | 0 | 0 | 0 | -1 | -2 | -2 | 0 | -1 | -2 | -1 | 4 | | | | |
| **Thr** | 0 | -1 | 0 | -1 | -1 | -1 | -1 | -2 | -2 | -1 | -1 | -1 | -1 | -2 | -1 | 1 | 5 | | | |
| **Trp** | -3 | -3 | -4 | -4 | -2 | -2 | -3 | -2 | -2 | -3 | -2 | -3 | -1 | 1 | -4 | -3 | -2 | 11 | | |
| **Tyr** | -2 | -2 | -2 | -3 | -2 | -1 | -2 | -3 | 2 | -1 | -1 | -2 | -1 | 3 | -3 | -2 | -2 | 2 | 7 | |
| **Val** | 0 | -3 | -3 | -3 | -1 | -2 | -2 | -3 | -3 | 3 | 1 | -2 | 1 | -1 | -2 | -2 | 0 | -3 | -1 | 4 |

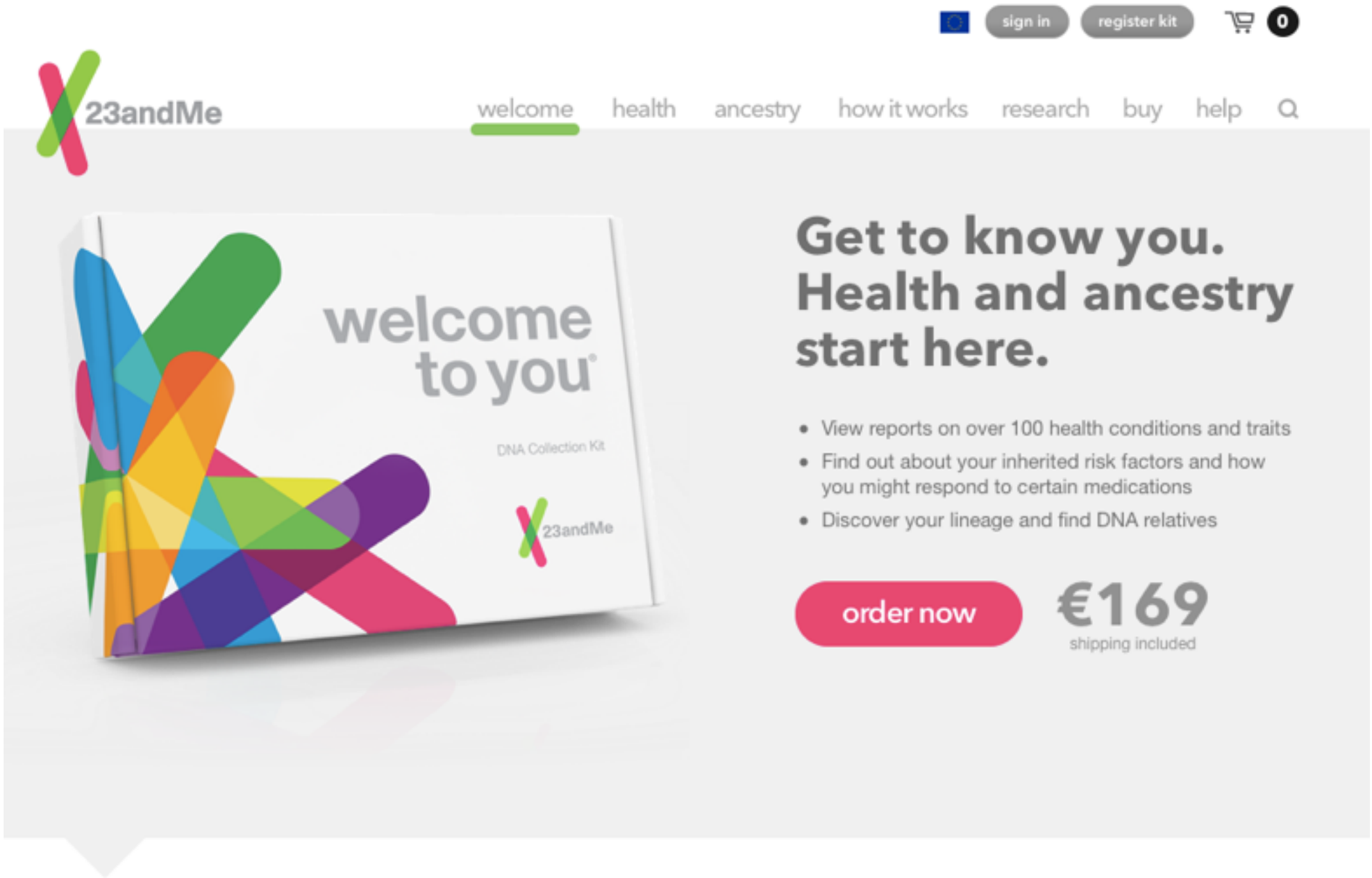
# Environmental DNA analysis



# Challenges

- Cross linking data / Data mining
  - Relate Genomics to Transcriptomics, Proteomics
  - Relate to structure
  - Relate to disease

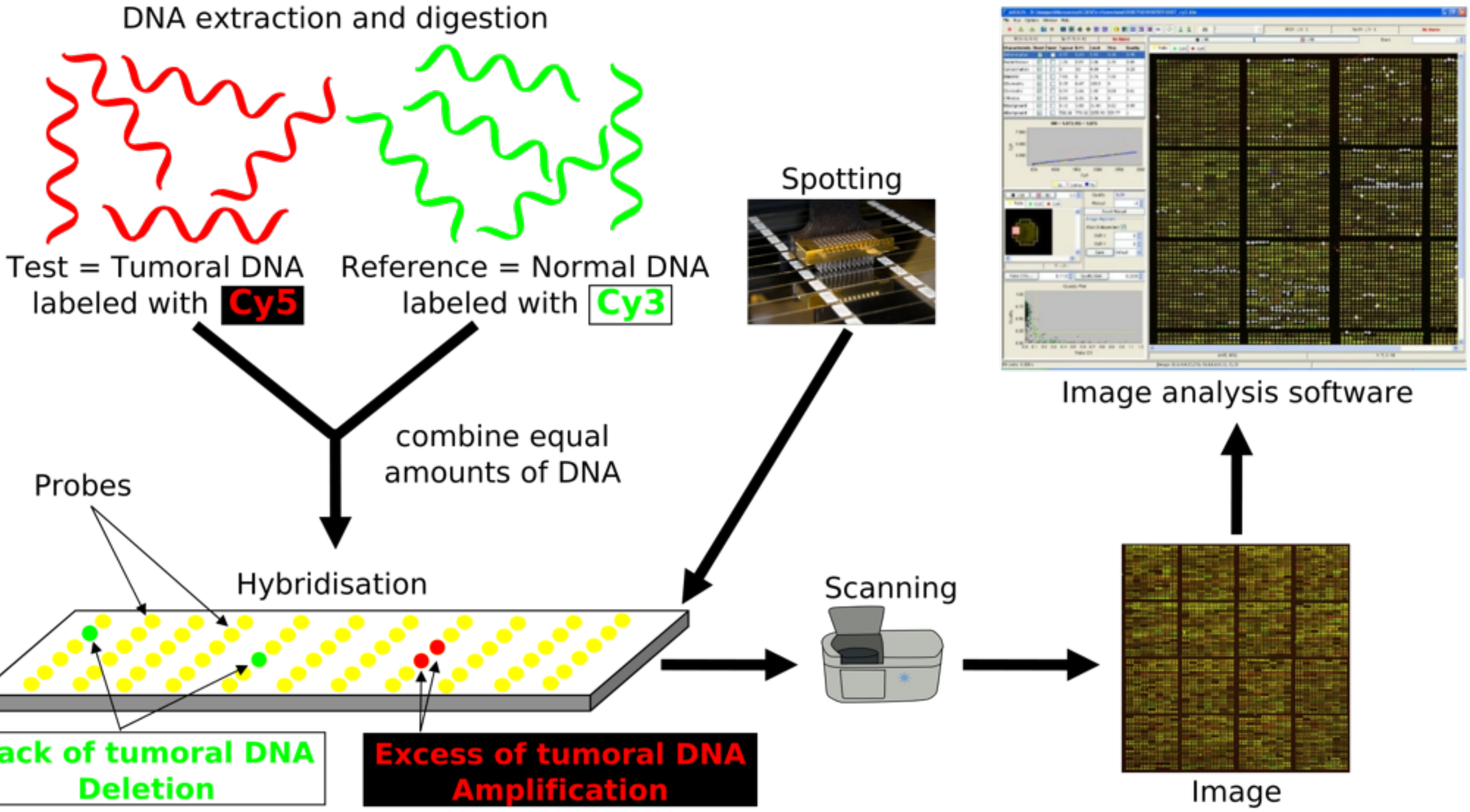
# Bio Informatics for the public




## What your DNA says about you.

Find out how your genetics relate to things like abnormal blood clotting, cystic fibrosis or response to certain medications. You can also see if your body metabolises caffeine quickly or if you're likely lactose intolerant. We believe the more you know about

# DNA Microarray Expression Analysis



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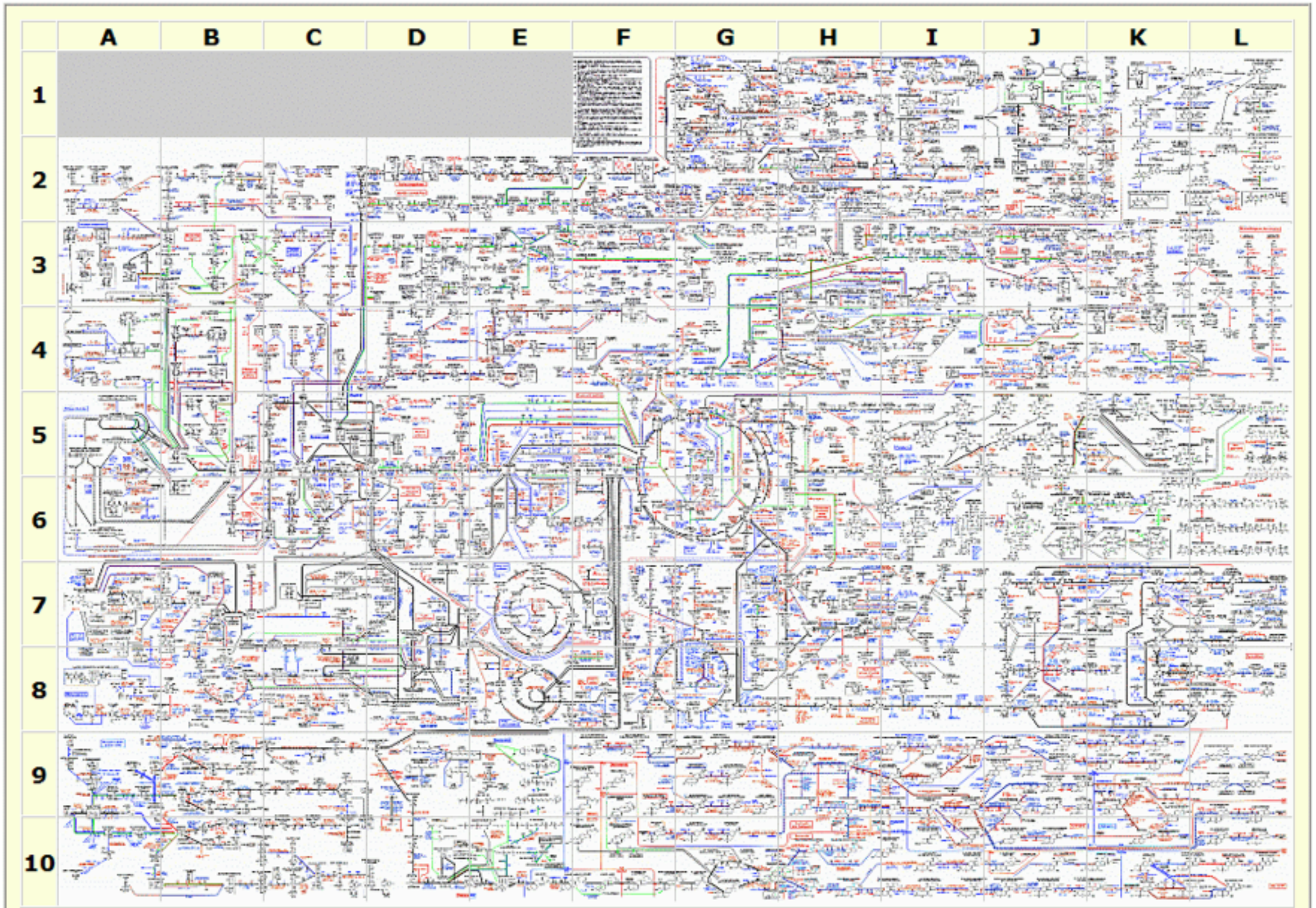
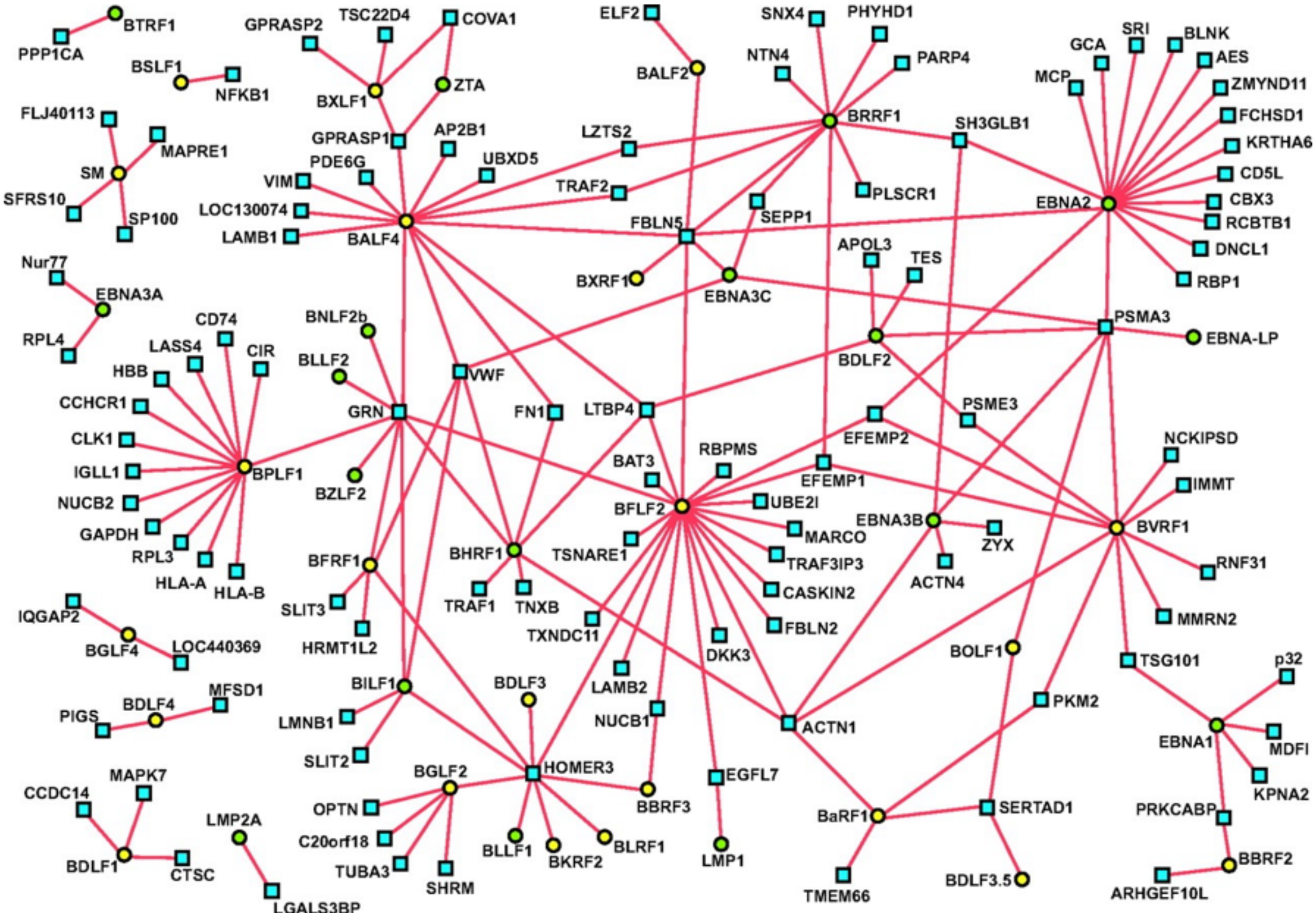
# Proteins

# Biochemical Pathways of the Cell



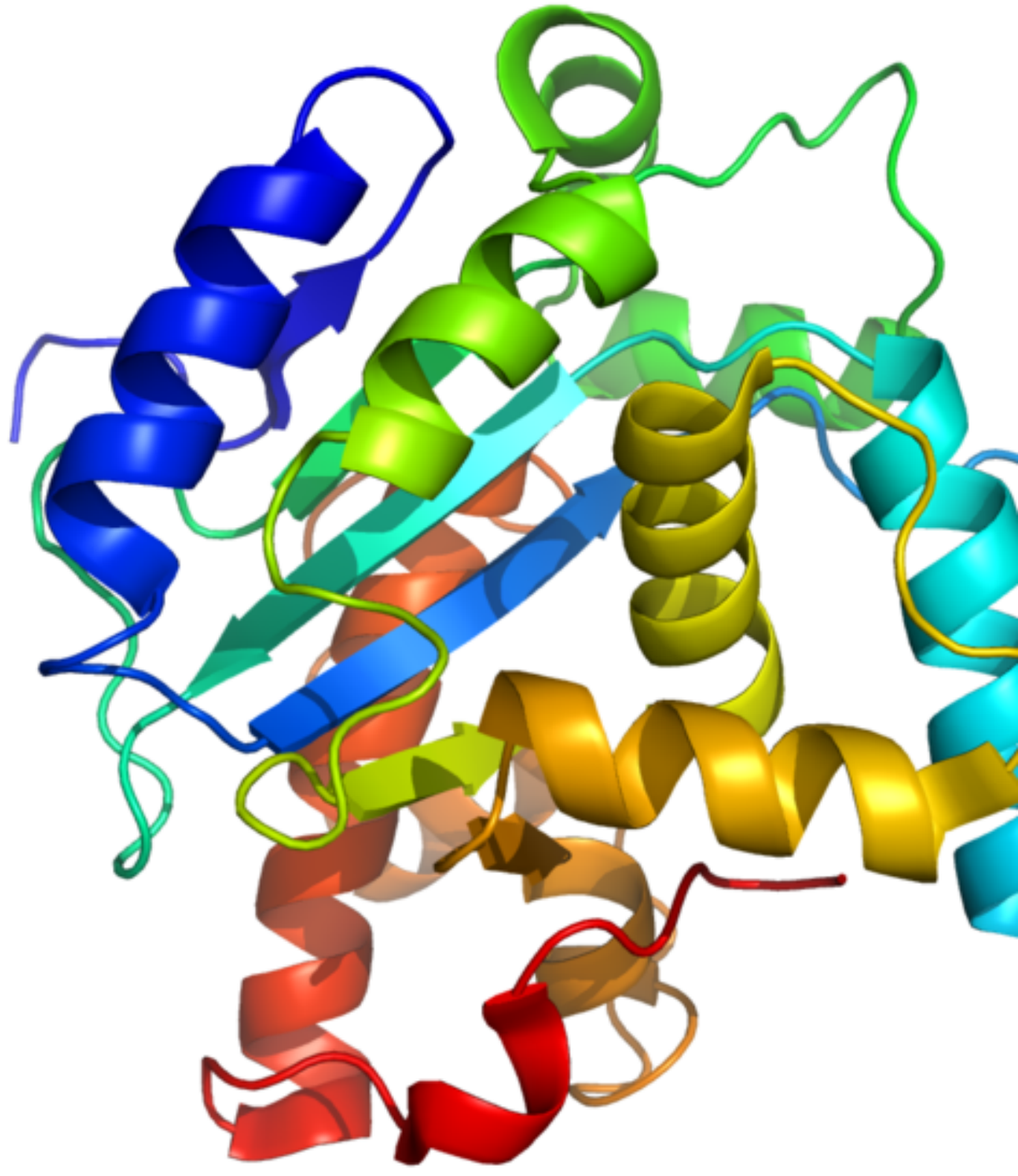
# Protein interaction mapping: MS



# What is this?

Simon Eugstar - CC-BY-SA 3.0

Debstart - CC-BY-SA 3.0

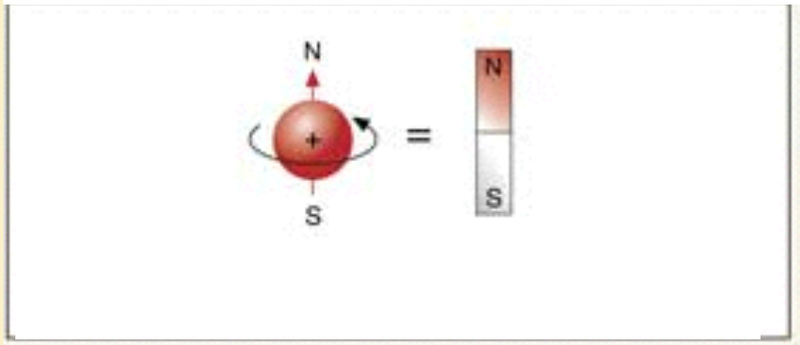


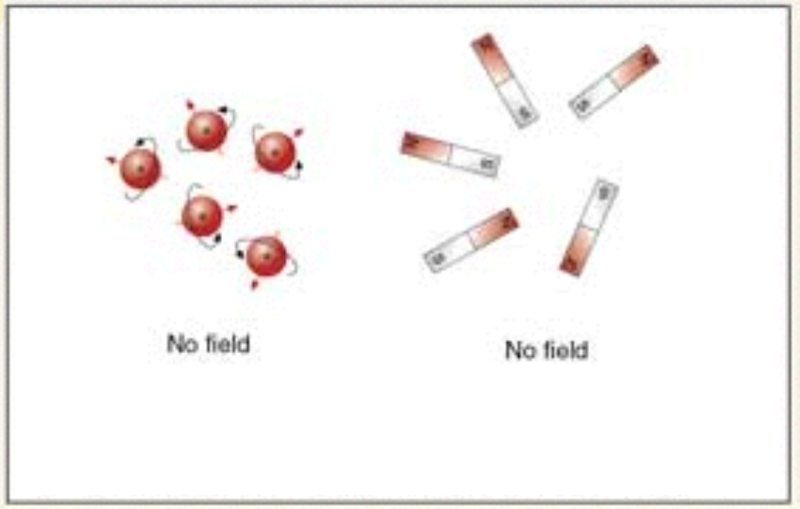
# NMR Machines

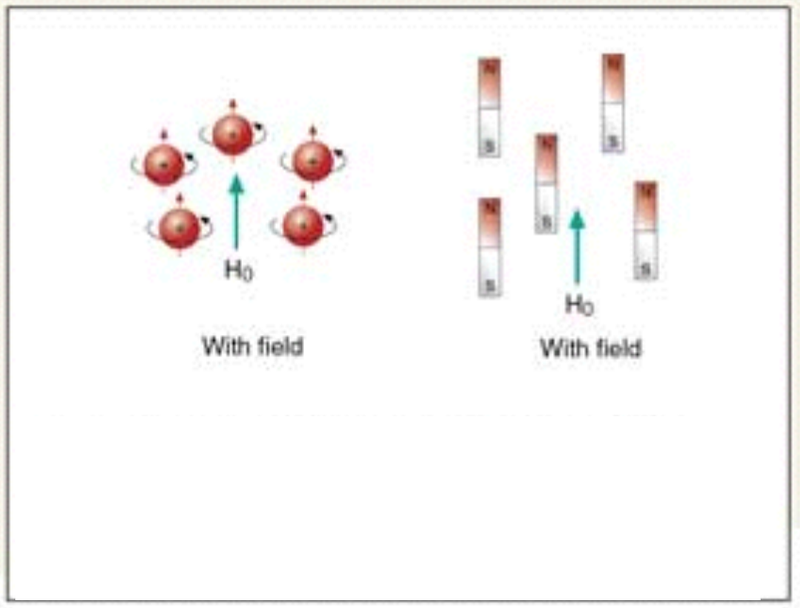
MartinSaunders

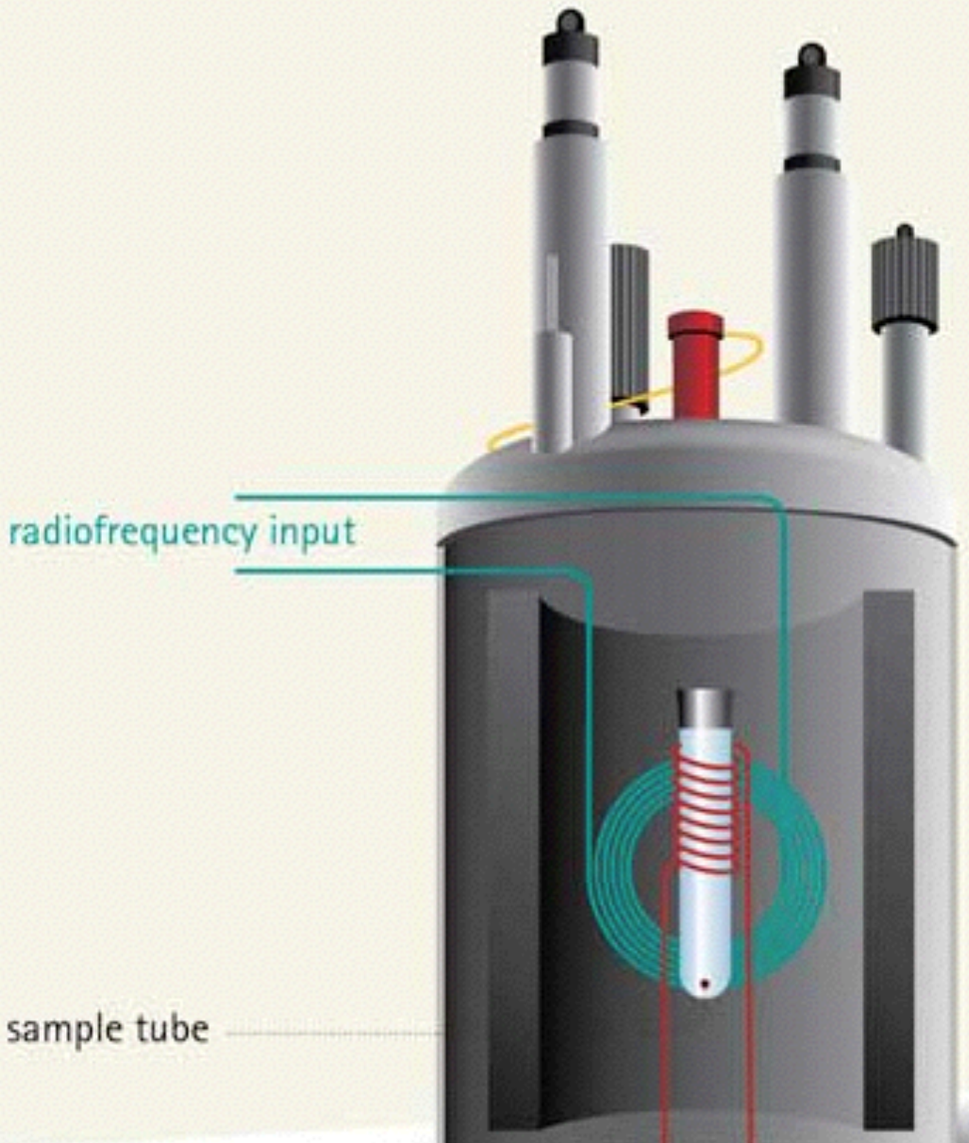

Public Domain

# NMR principles

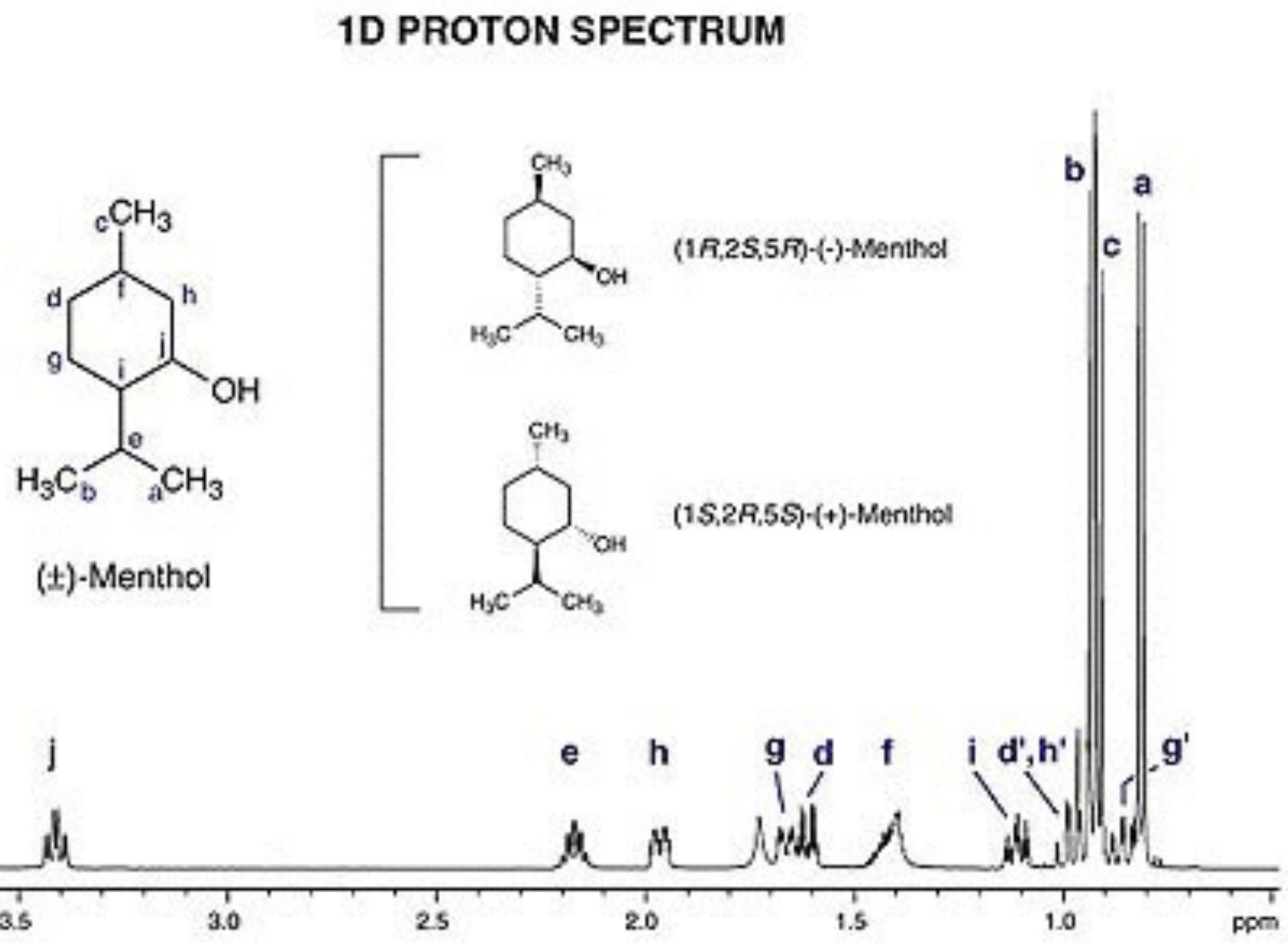


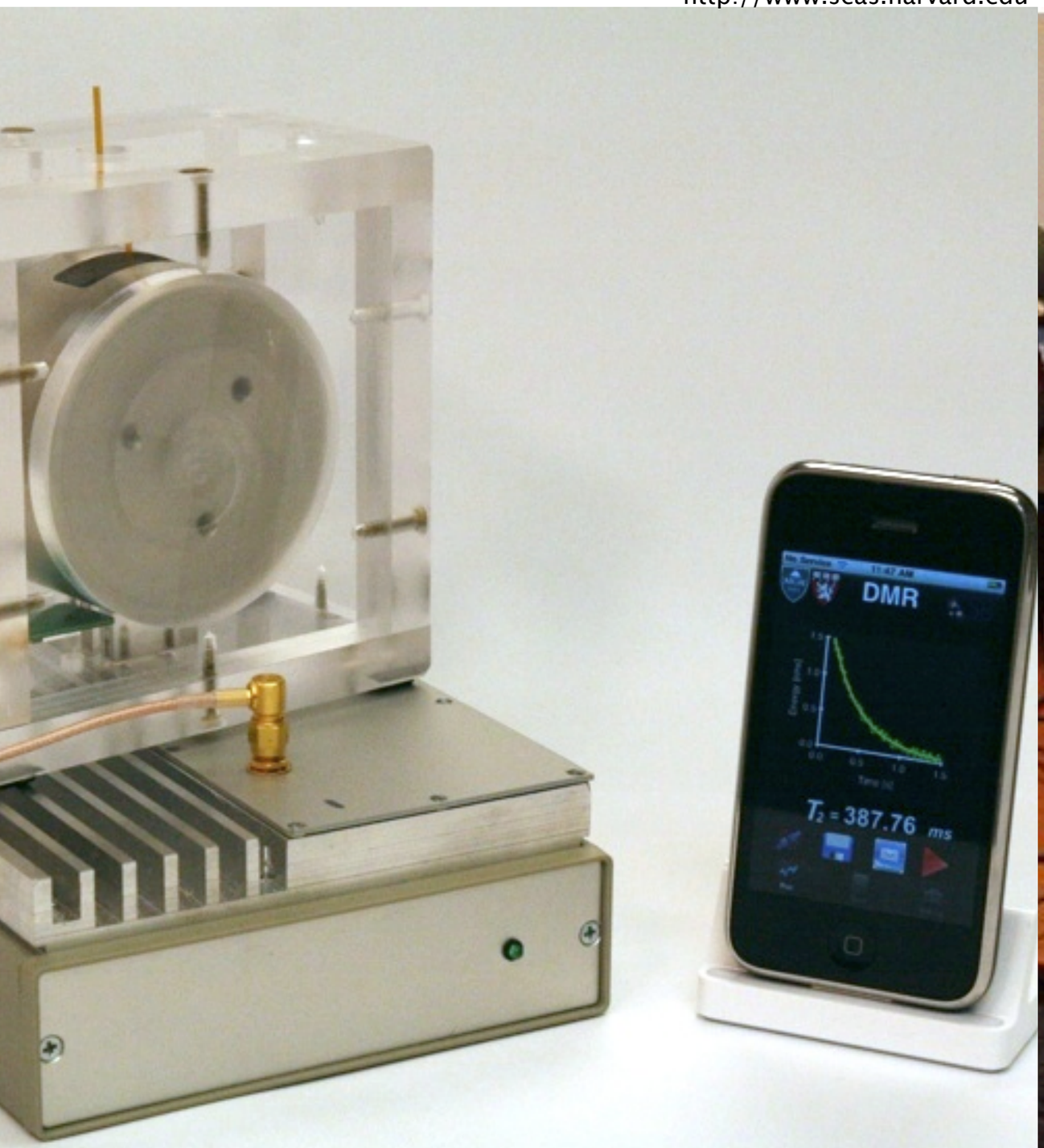



# NMR Spectrum

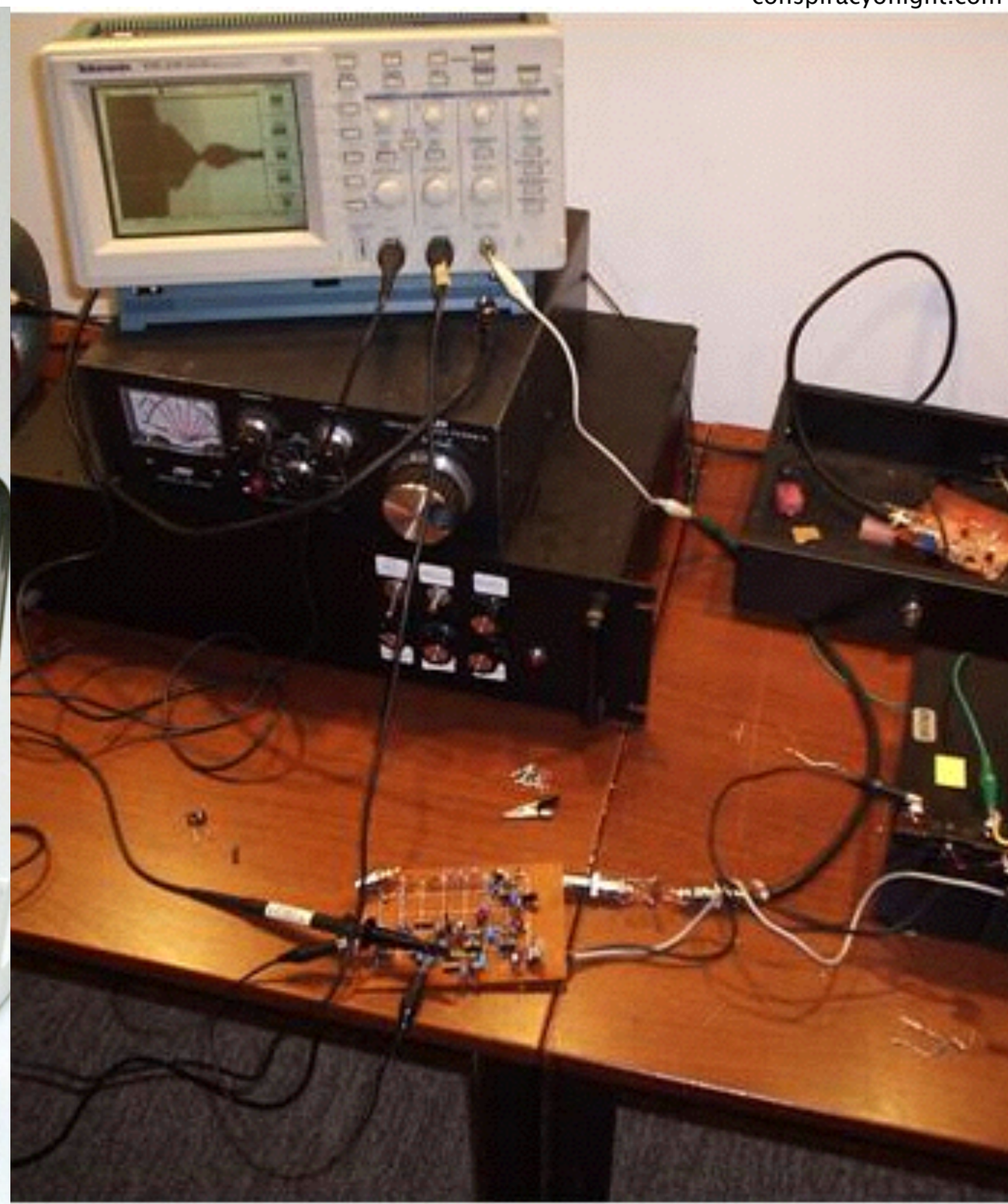


# DIY NMR?

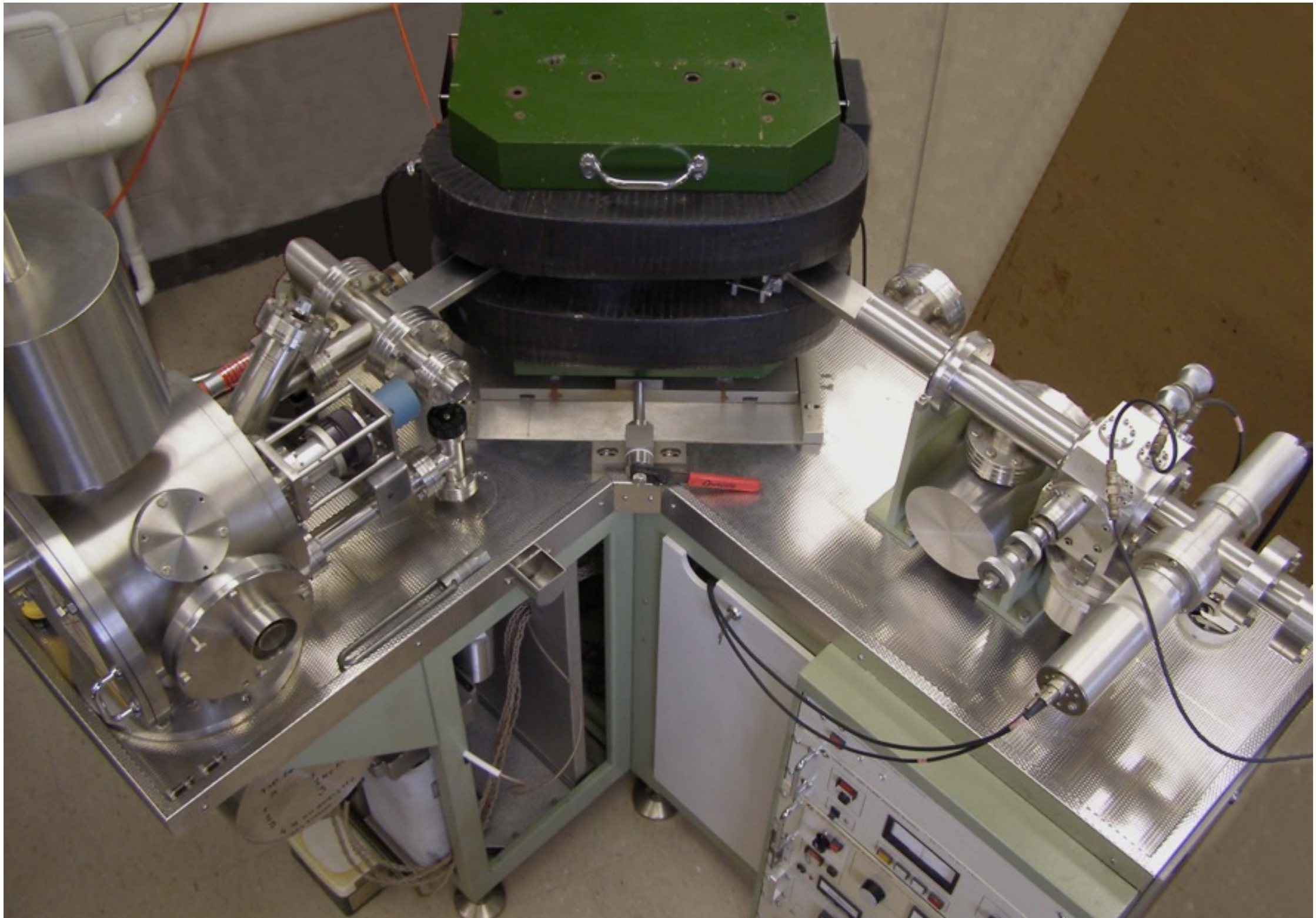
http://www.seas.harvard.edu



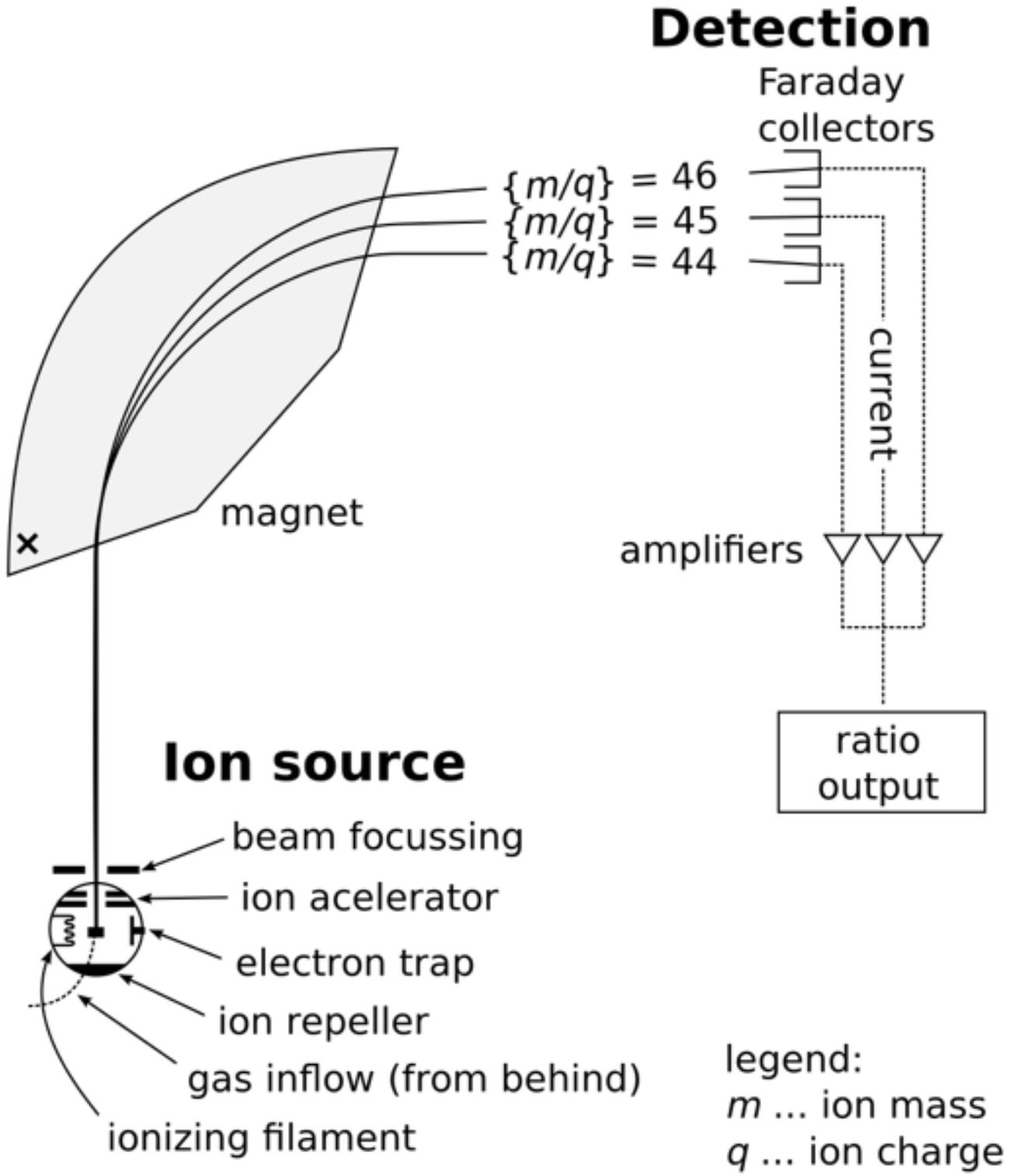

conspiracyoflight.com



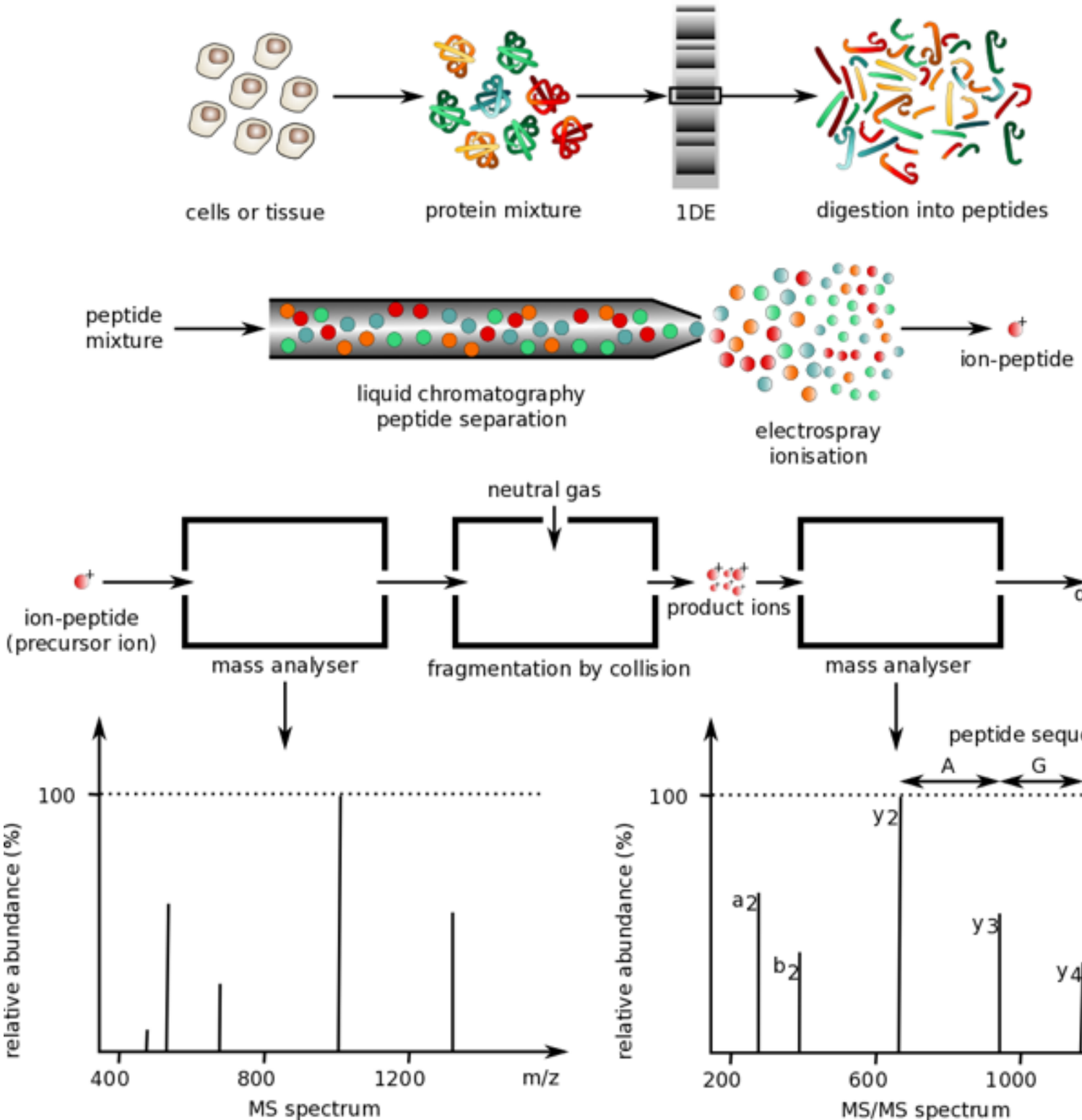
# Mass Spectrometer



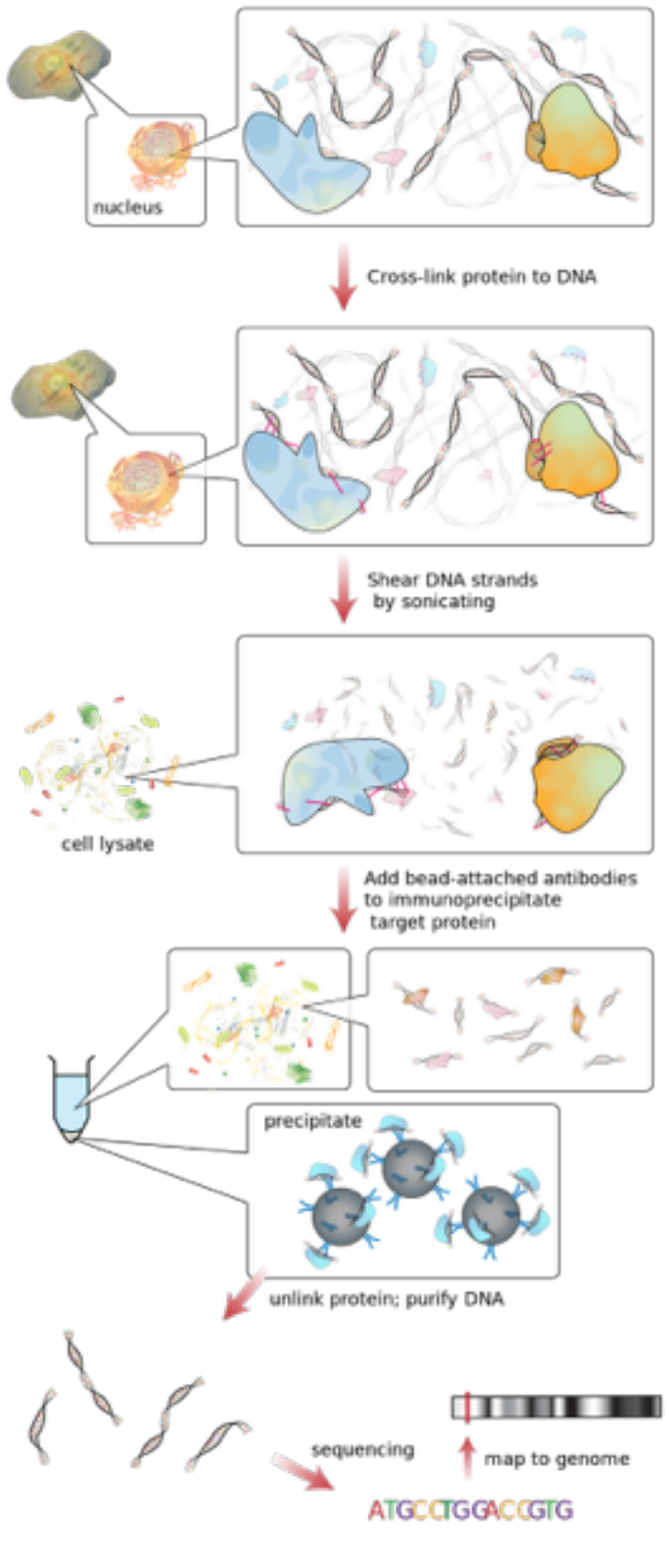
# Simple Mass Spectrometry



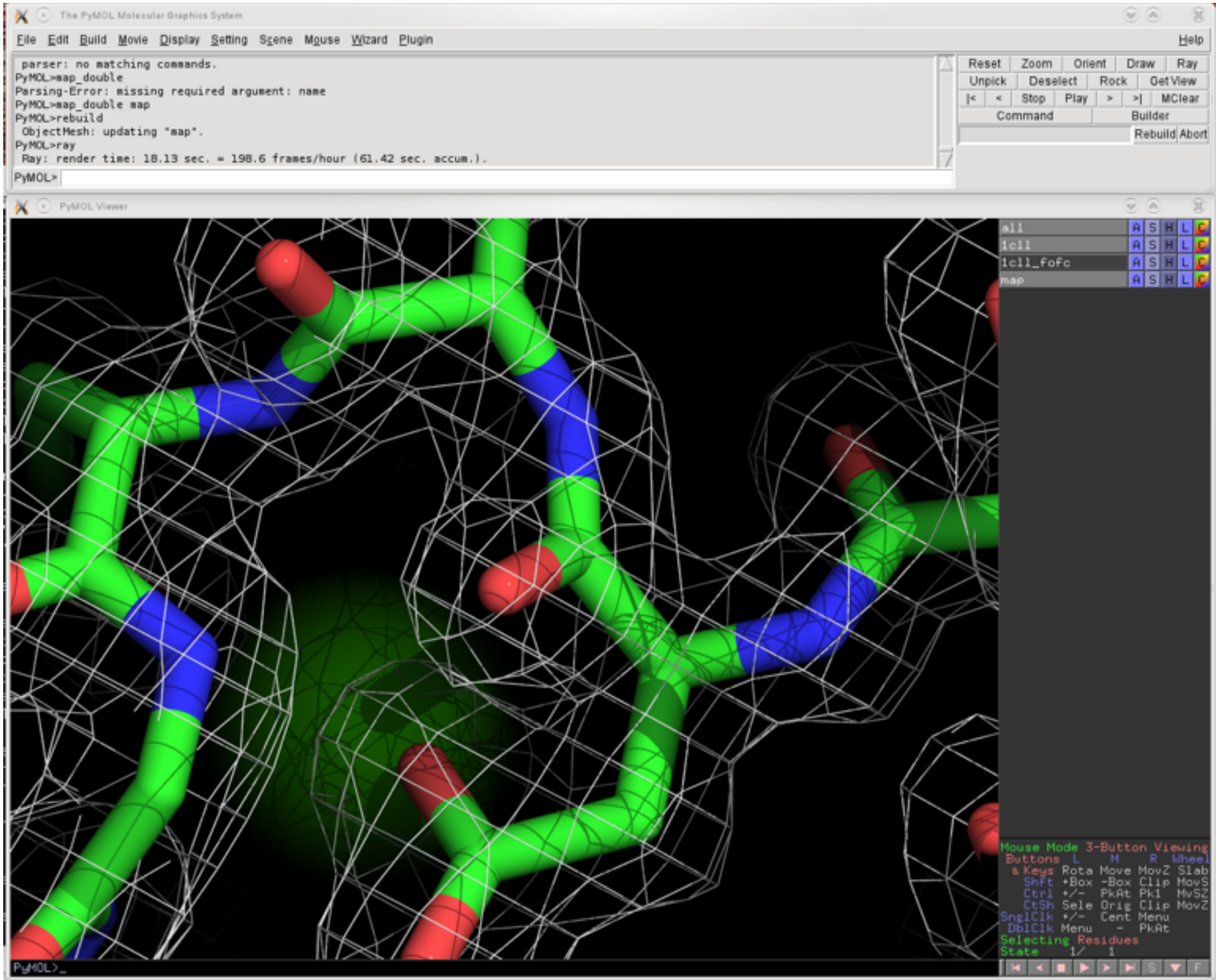
# Mass Spectrometry



# Chromatin ImmunoPrecipation ChIP



# Visualisation PyMol



# Issues

- Ethical
  - Who owns bio data?
  - Who decides what to use data for?
  - Is de-personalized bio information possible?

- Legal
  - Genetic discrimination

- Imagine:
  - You are immune to Zika virus. Are you entitled to royalties on the vaccine derived from your blood?