

ALGORITHMS OF BIOINFORMATICS

Hidden Messages

23 October 2025

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2.1 Biology Big Picture

Biology

- ▶ *biology* = the scientific study of *living* things
 - ▶ originally *naturalists*: individual people manually **observing** plants and animals
e. g., *Darwin's finches*
 - ▶ gradually more scientific: controlled experiments, isolated mechanisms
e. g., *Mendel's inheritance experiments on peas*
 - ▶ gradually more focus on molecular/chemical mechanisms: microscopes, biochemistry

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 - ▶ gradually more focus on molecular/chemical mechanisms: microscopes, biochemistry
 - ▶ now clear: fundamental mechanisms (and origins!) of life are microscopic
- ↪ fundamental mechanisms to be found in *molecular biology*

Bioinformatics

- ▶ 20th Century: discovery of DNA and genes
 - ▶ DNA stores information about biomolecules in **discrete form**
human genome: 3.055 billion letter string over alphabet $\{A, C, G, T\}$ (!)
 - ↪ genetic information can **copied** precisely
mutations are errors in the copying
 - ▶ double strands (backup!) and “coiling up” into chromosomes protects data
 - ▶ production of chemicals in living cells (*proteins*) is determined by *genes* (parts of DNA)



▶ Zoom in on DNA

<https://youtu.be/wZoz0rFluiw>

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- ↪ *Life itself has inherently computational components!* 🤖
- ↪ Computer science can contribute to the understanding these! ↪ *bioinformatics*



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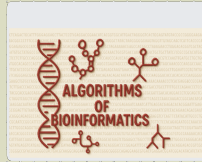
- ▶ But also: biology increasingly a data-centric field
 - ▶ much of knowledge discovery intrinsically reliant on computational analysis of collected data
 - ▶ e. g., reading the 3 billion letters of DNA is not possible with current lab techniques
 - ↪ use computers to puzzle it together (see *Sequencing Unit*)
 - ▶ “*in silico*” experiments

Collection of (more or less) Fun Sources

Collaborative Mindmap
on  infinity maps

- ▶ Share useful resources
- ▶ Structure knowledge hierarchically
- ▶ Link on Campuswire / ILIAS

*There's tons to learn,
new things discovered every day,
and it's about life itself!*



Algorithms of Bioinformatics

BIOLOGY MINDMAP & SOURCES

Microbiology



The Origin of Life



Bioinformatics Lectures



Pop science



Microscopy to watch



Cooperation



Molecular Biology 101

Molecular Biology (Britannica concise)

- ▶ concerned with chemical structures and processes of biological phenomena at the molecular level
- ▶ developed out of biochemistry, genetics, and biophysics
- ▶ particularly concerned with the study of **proteins**, nucleic acids, and enzymes

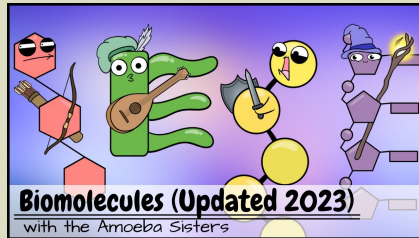
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Biology = lots of terminology and names ...

We will focus on mechanisms over terms, but a bit of context helps
let's make it at least whimsical (and maybe memorable)



▶ Biomolecules (Updated 2023)
<https://youtu.be/1Dx7LDwINLU>