# CMSC 423: Introduction to Biology and Bioinformatics

Part 3

### Part 1: The Central Dogma

## Part 2: DNA Sequencing

## Part 3: Bioinformatics Applications



WIKIPEDIA The Free Encyclopedia

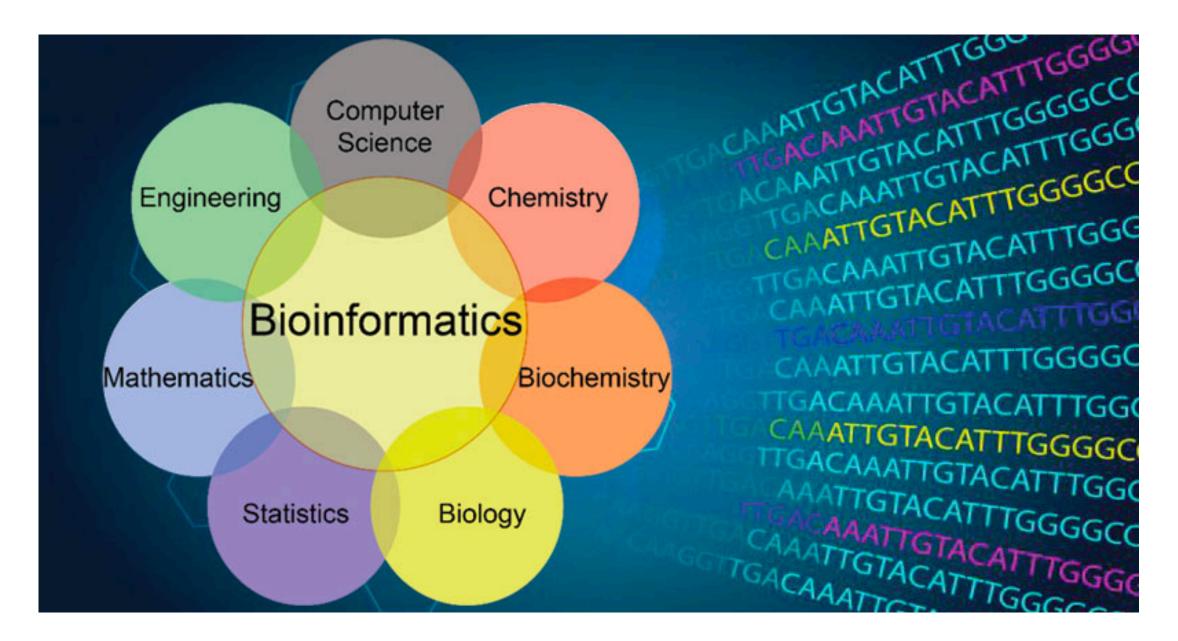
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### Bioinformatics

From Wikipedia, the free encyclopedia

For the journal, see Bioinformatics (journal).

**Bioinformatics** / bar.oo informatiks/ (•) listen) is an interdisciplinary field that develops methods and software tools for understanding biological data, in particular when the data sets are large and complex. As an interdisciplinary field of science, bioinformatics combines biology, computer science, information engineering, mathematics and statistics to analyze and interpret the biological data. Bioinformatics has been used for *in silico* analyses of biological queries using mathematical and statistical techniques. [*clarification needed*]



https://163602-560839-raikfcquaxqncofqfm.stackpathdns.com/wp-content/uploads/2018/12/Bioinformatics-Introductionand-Applications.jpg

### Brief History of Bioinformatics

- **1950-1970:** Before desktop computers and DNA sequencing, early bioinformatics focused on studying proteins
- **1970-1980:** Shift from protein to DNA analysis
- **1980-1990:** Parallel advances in biology and computer science
- **1990-2000:** Use of the internet and Human Genome Project drive progress
- 2000-2010: Introduction of next-generation sequencing causes exponential growth of data

Jeff Gauthier, Antony T Vincent, Steve J Charette, Nicolas Derome, A brief history of bioinformatics, *Briefings in Bioinformatics*, Volume 20, Issue 6, November 2019, Pages 1981–1996, <u>https://doi-org.proxy-um.researchport.umd.edu/10.1093/bib/bby063</u>

### The Human Genome Project

- Started in 1990, Completed in 2003
- Sequenced the 3 billion DNA letters in the human genome
- Covers about 99 percent of the human genome's gene containing regions



https://science.sciencemag.org/content/sci/331/6017/546.2/F 2.medium.gif

Cervical nolangiocarcinom **Uveal Melanoma** Breast Lobular **Lower Grade Glioma** Cutaneous Mela **Breast Ductal** Pancreati Head and Neck Adenocar hymoma Endometria Adr Colorectal **Kidney Papillary** Lung Liver Lung Squam Prostate Sarcoma anglioma & Pheochromocytoma Thyroid Uterine Carcinosarcoma Clear Cell Renal nvasive Urothelial Bladder Chromophobe Ren othelioma Acute Myeloid Leukemia

https://www.cancer.gov/about-nci/organization/ccg/research/structural-genomics/tcga/studied-cancers

#### DIVERSITY IN THE HUMAN MICROBIOME

The Human Microbiome Project has examined bacteria on 242 people. Some of the microbes living in and on the human body:



Propionibacterium acnes lives on the skin and nose of most people-----



Bacteroides is the most abundant genus in the gut of almost all healthy subjects



E. coli is present in the gut of the majority of healthy subjects but at very low abundance

SOURCE: Human Microbiome Project



Streptococcus dominates the oral cavity



Staphylococcus epidermidis colonizes external body sites

Lactobacillus species are predominant in the vagina



https://www.bostonglobe.com/business/2013/05/11/using-bacteria-for-good-not-evil/kc9zY0Lexp1O0KoppDdY4J/story.html



### https://nextstrain.org/ncov/global

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