

Bachelor's Degree Program in BIOINFORMATICS

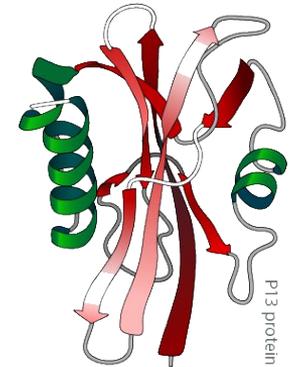
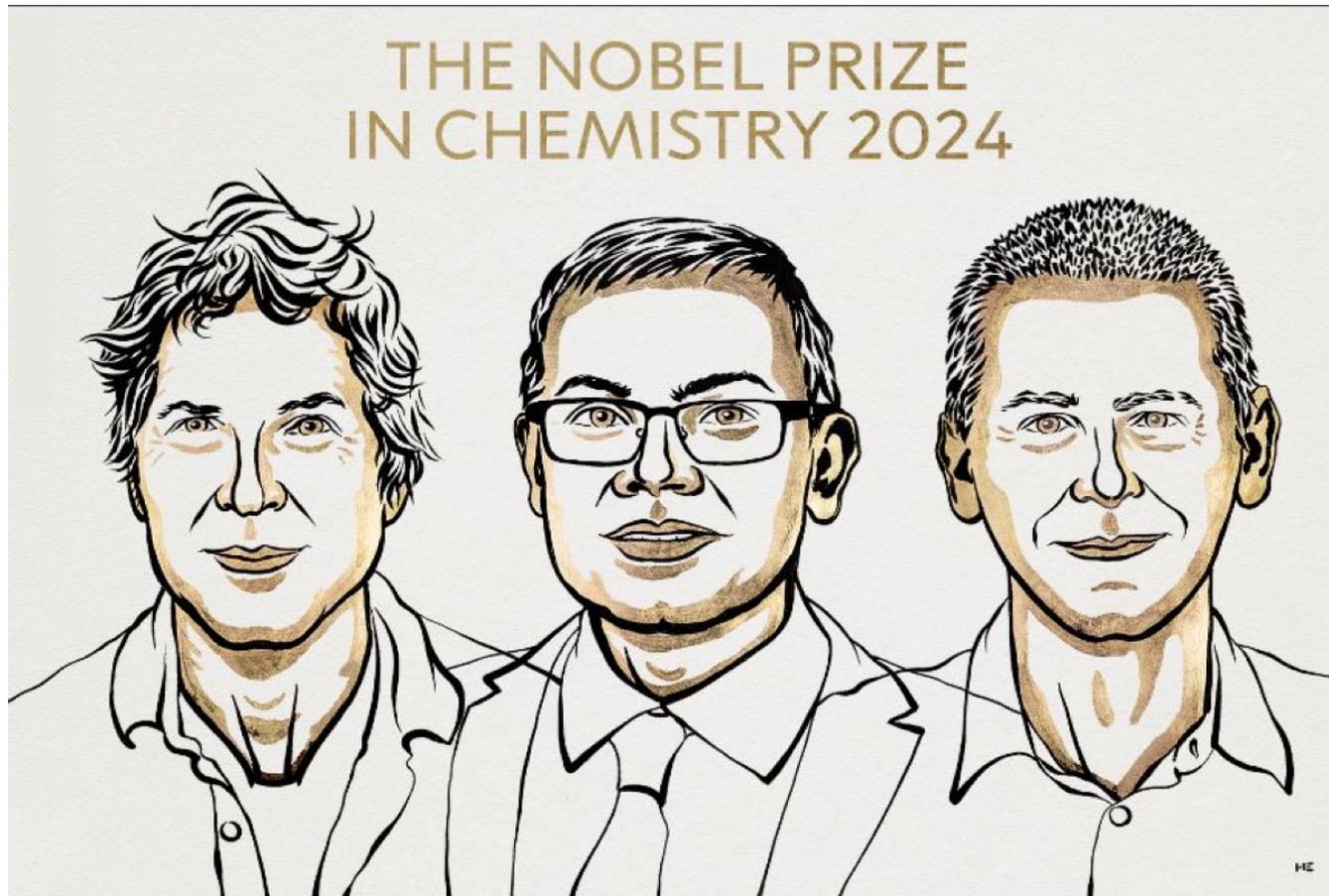


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UNIVERSITÀ DI ROMA

Prof. Alessandro Paiardini
Dipartimento di Scienze Biochimiche
Sapienza, Roma



Nobel Prize in Chemistry 2024



"...for fully understanding and mastering the chemical tools of life – proteins..."

"The 2024 Nobel Prize in Chemistry goes to scientists David Baker, Demis Hassabis, and John Jumper for their contribution to **computational protein design and protein structure prediction**"



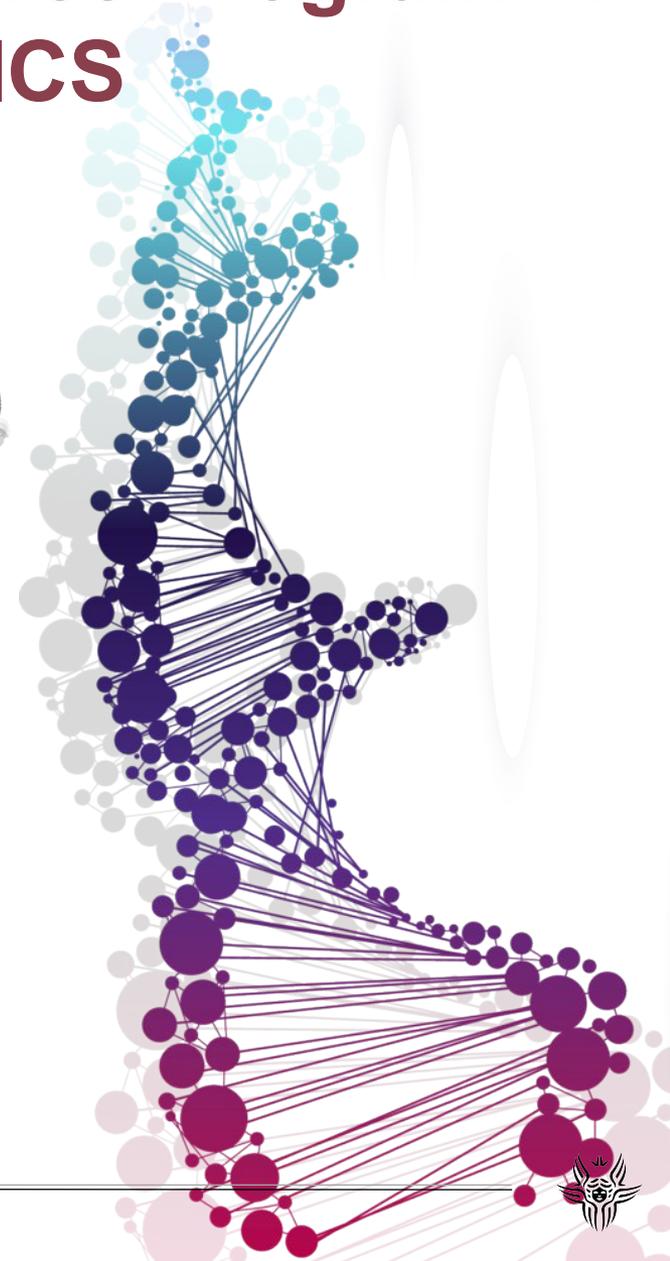
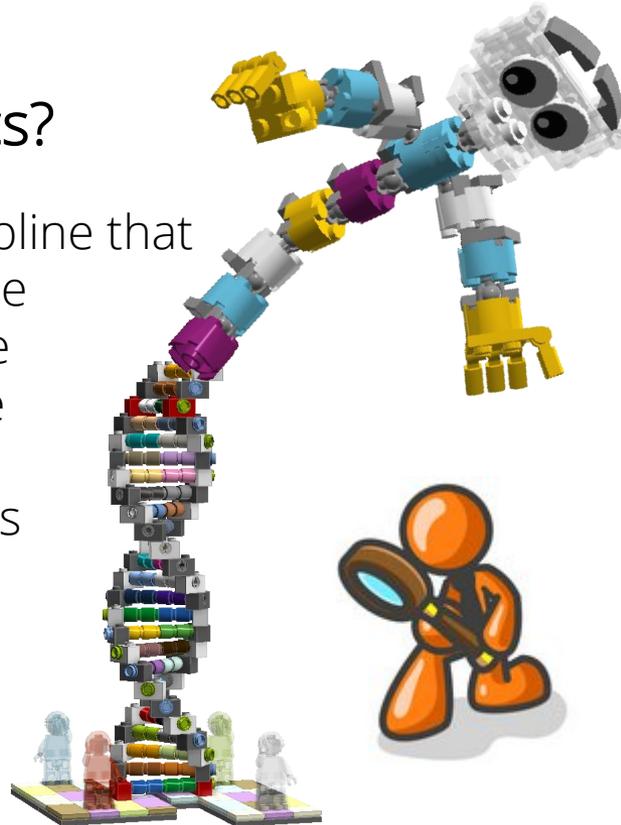


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What is Bioinformatics?

Bioinformatics is the discipline that focuses on the study of the "instruction manual" of life at all levels — from simple molecular interactions to increasingly complex levels of organization (cells, organisms, populations).

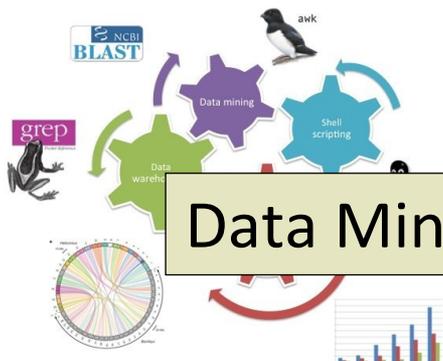




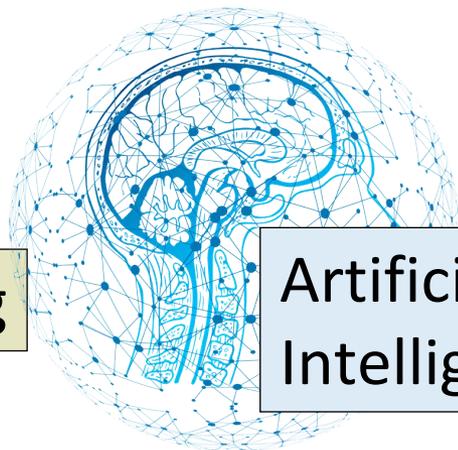
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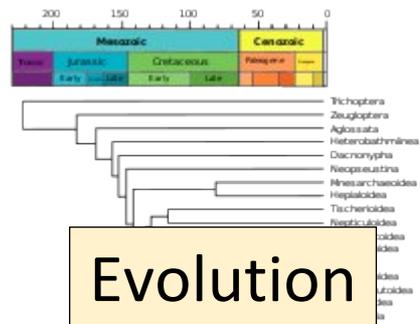
What does Bioinformatics deal with?



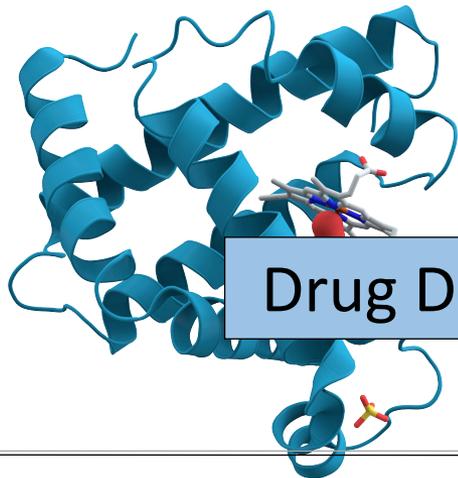
Data Mining



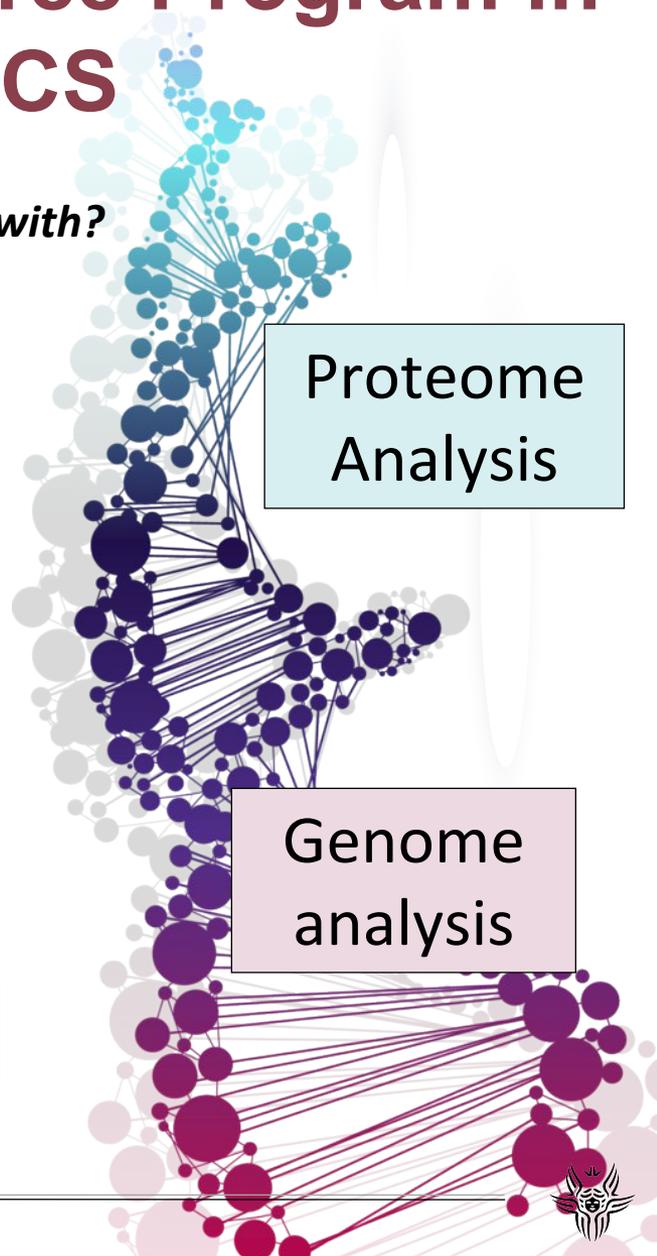
Artificial Intelligence



Evolution



Drug Design



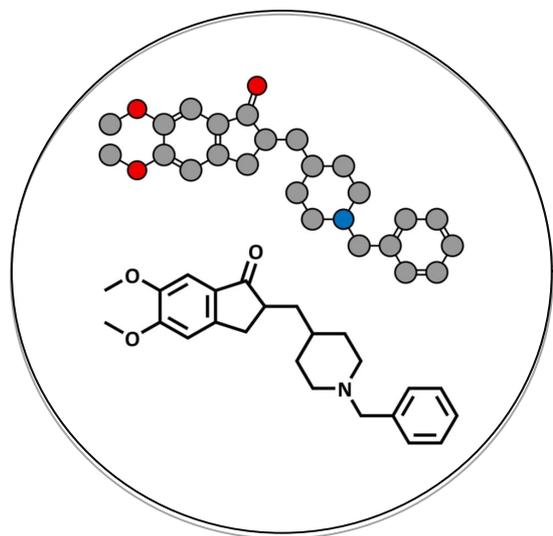
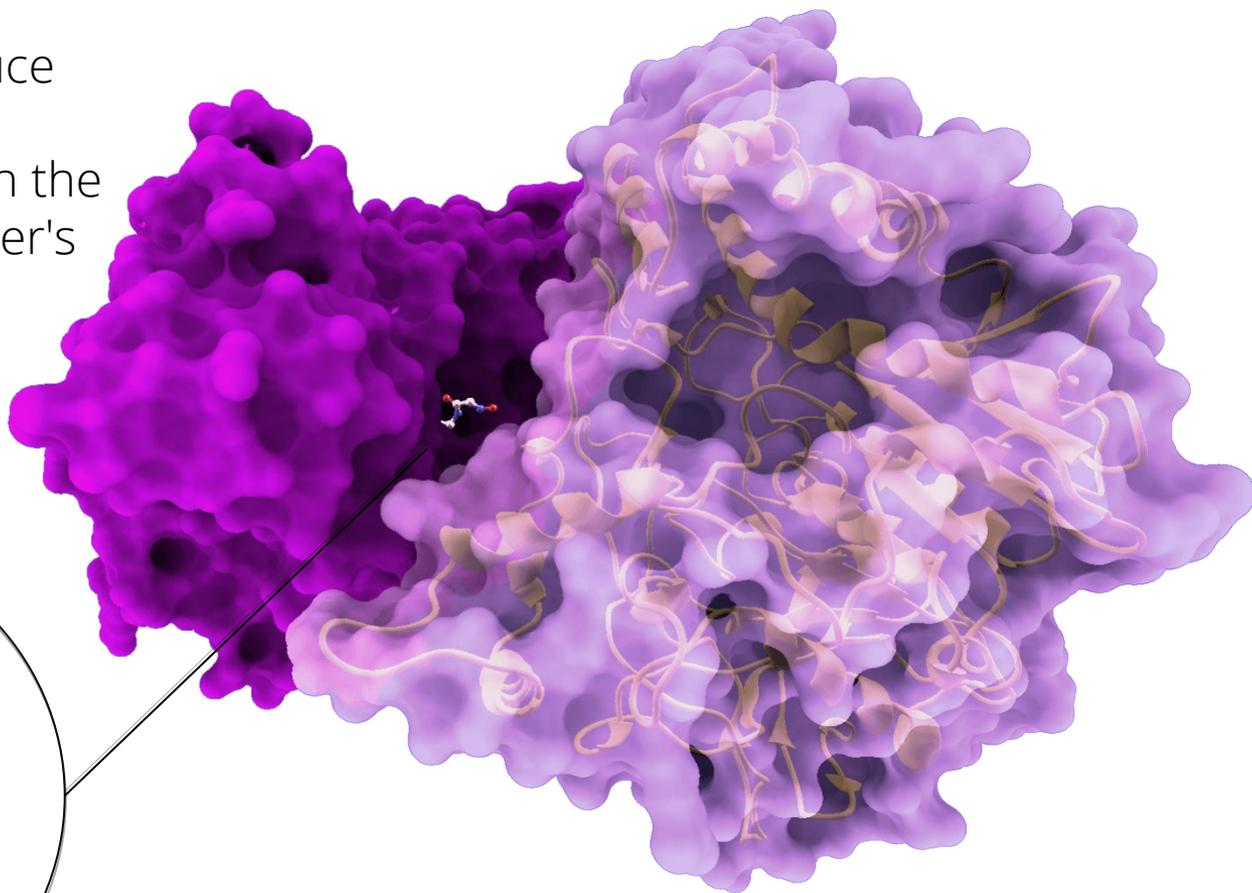
Proteome Analysis

Genome analysis

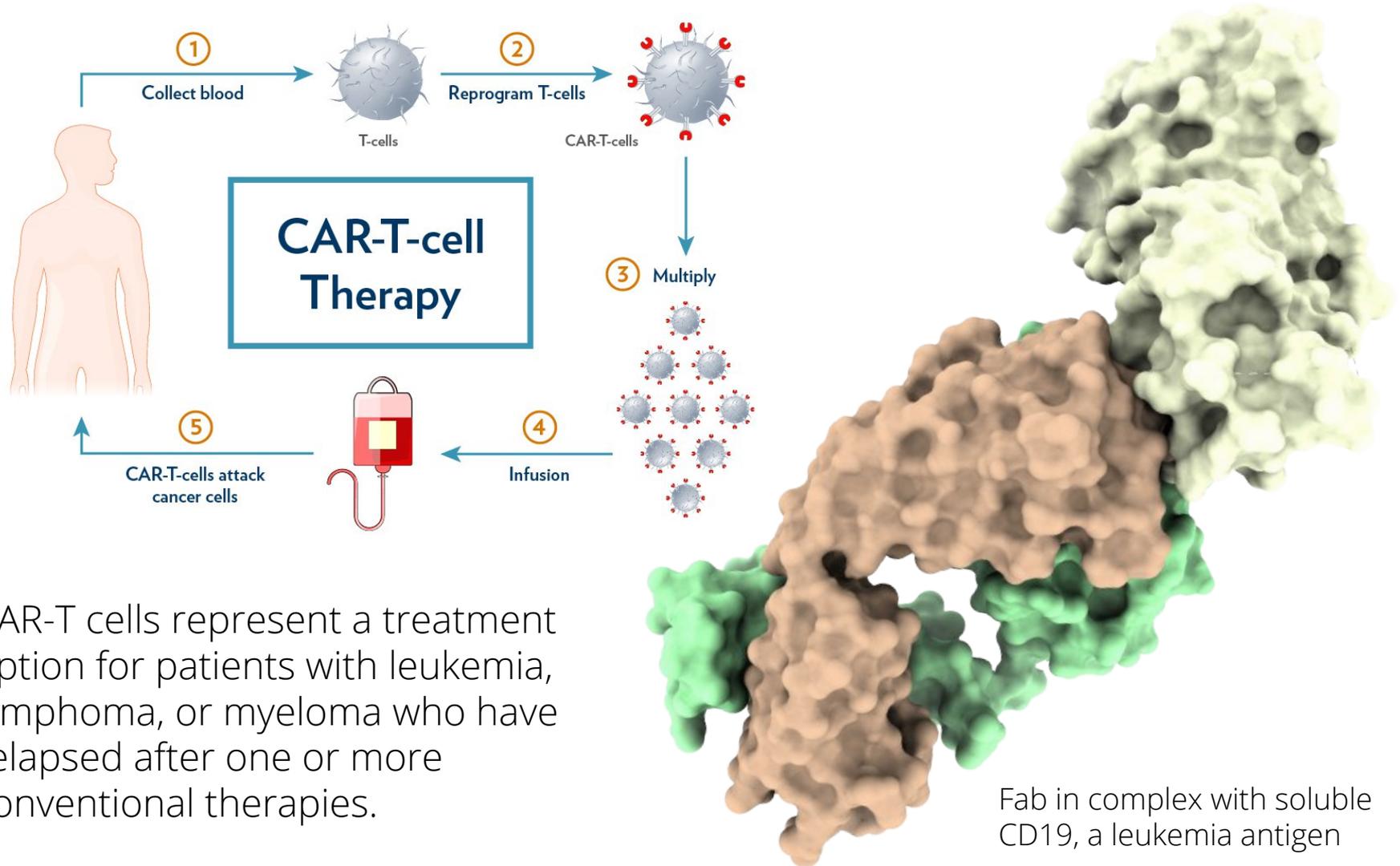


Rational Drug Design

Donepezil helps reduce the symptoms of dementia. It is used in the treatment of Alzheimer's disease.



Protein Engineering



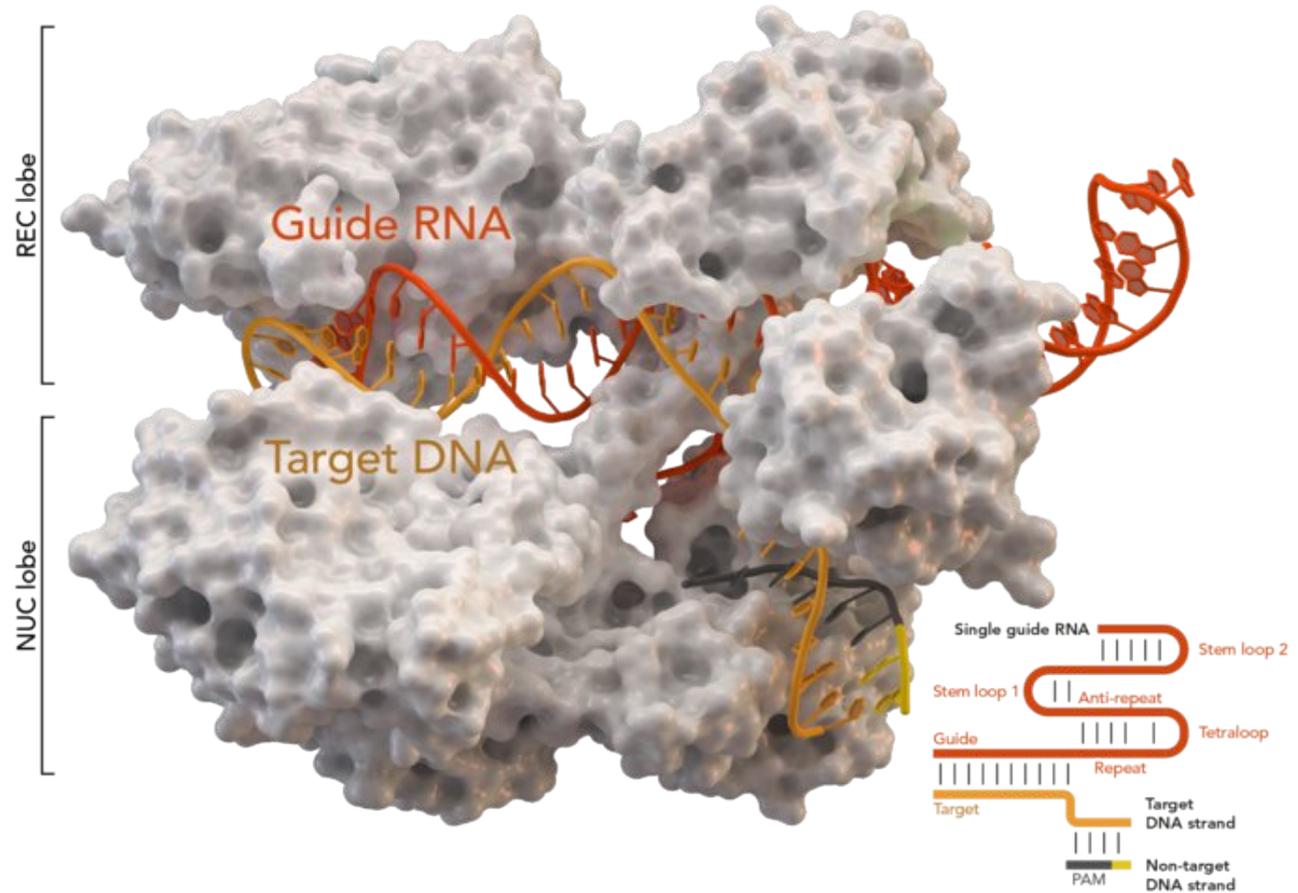
CAR-T cells represent a treatment option for patients with leukemia, lymphoma, or myeloma who have relapsed after one or more conventional therapies.

Fab in complex with soluble CD19, a leukemia antigen



Gene Therapy

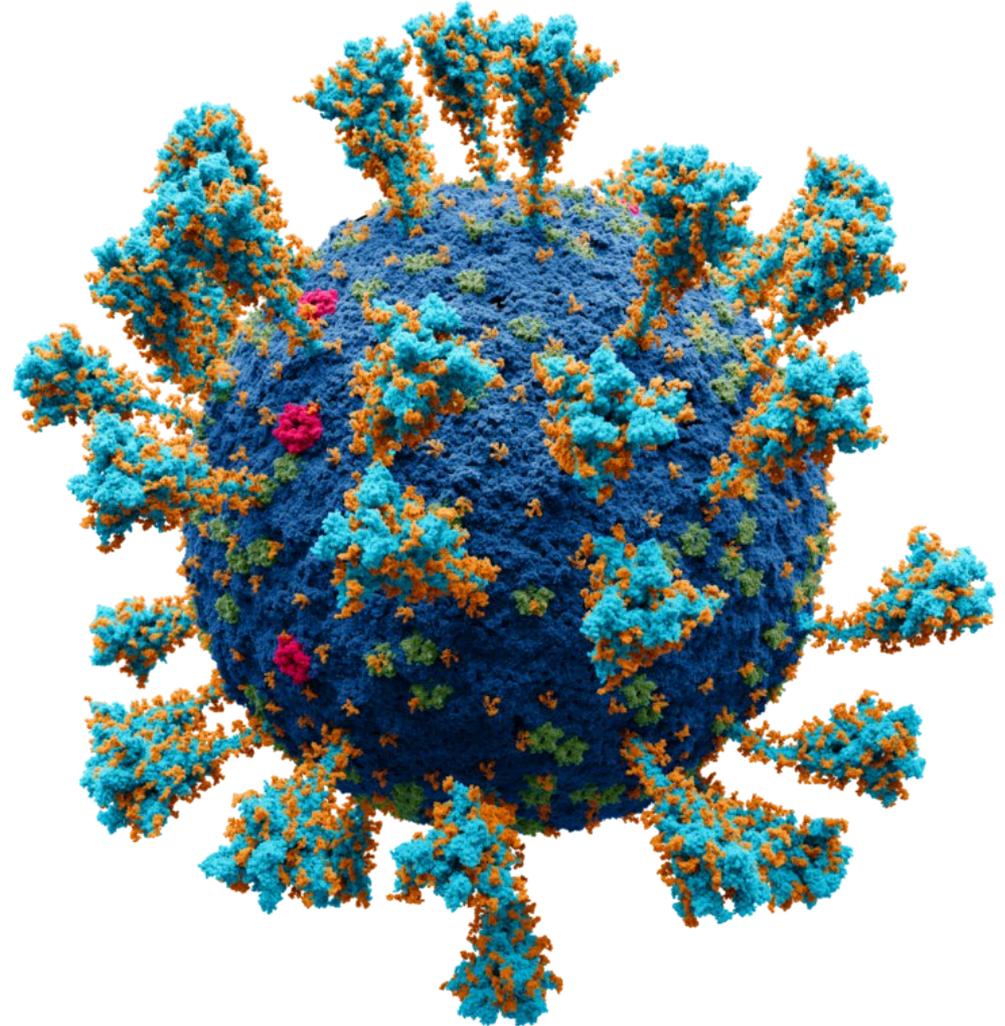
The CRISPR/Cas9 system is a genetic engineering approach that allows for modifications to the DNA of cells, paving the way for gene therapy.



ImmunoInformatics

The spike protein of SARS-CoV-2 is the main mechanism the virus uses to infect target cells.

Understanding its three-dimensional structure helps us design more effective monoclonal antibodies and vaccines against SARS-CoV-2 variants.



Artificial Intelligence in Bioinformatics

nature

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NEWS | 04 May 2023

How generative AI is building better antibodies

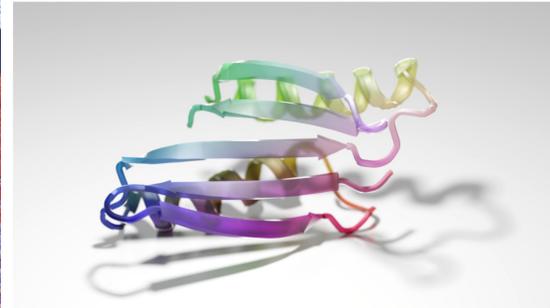
Language models similar to those behind ChatGPT have been used to improve antibody therapies against COVID-19, Ebola and other viruses.



Univ. of Washington deep learning 'hallucinate' protein designs from

BY CHARLOTTE SCHUBERT on December 2, 2021 at 7:52 am

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How AI is changing the way scientists engineer drugs, biosensors, enzymes and more

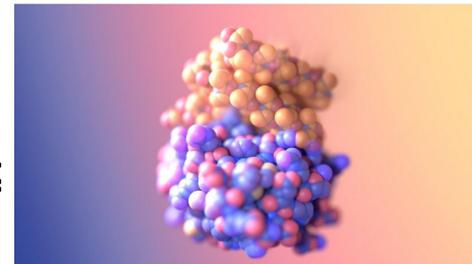
BY CHARLOTTE SCHUBERT on July 10, 2023 at 7:42 am

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GeekWire INDEPENDENT COVERAGE SUPPORTED BY Google Cloud

BOT OR NOT?

BOT OR NOT? This special series explores the evolving relationship between humans and machines, examining the ways that robots, artificial intelligence and automation are impacting our work and lives.



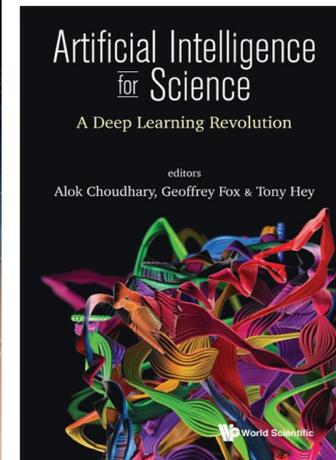
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Google Cloud

AI that Empowers

Delivering impact, from faster insights to smarter security, with Google Cloud.

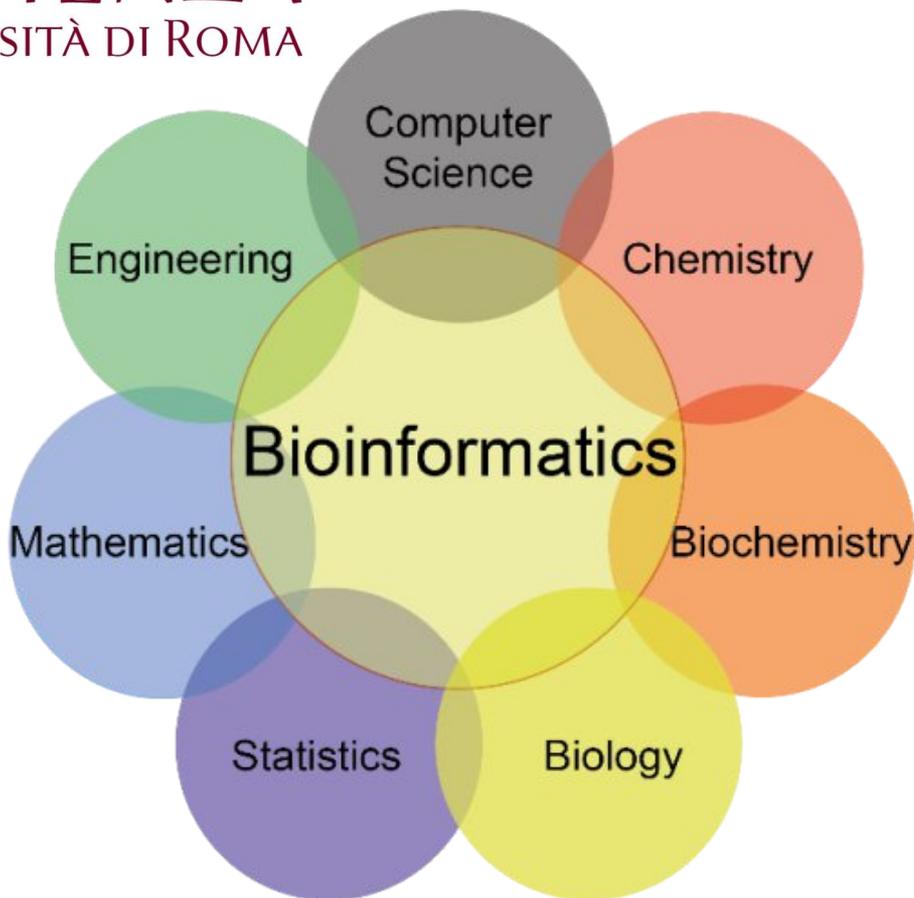
[Learn more](#)





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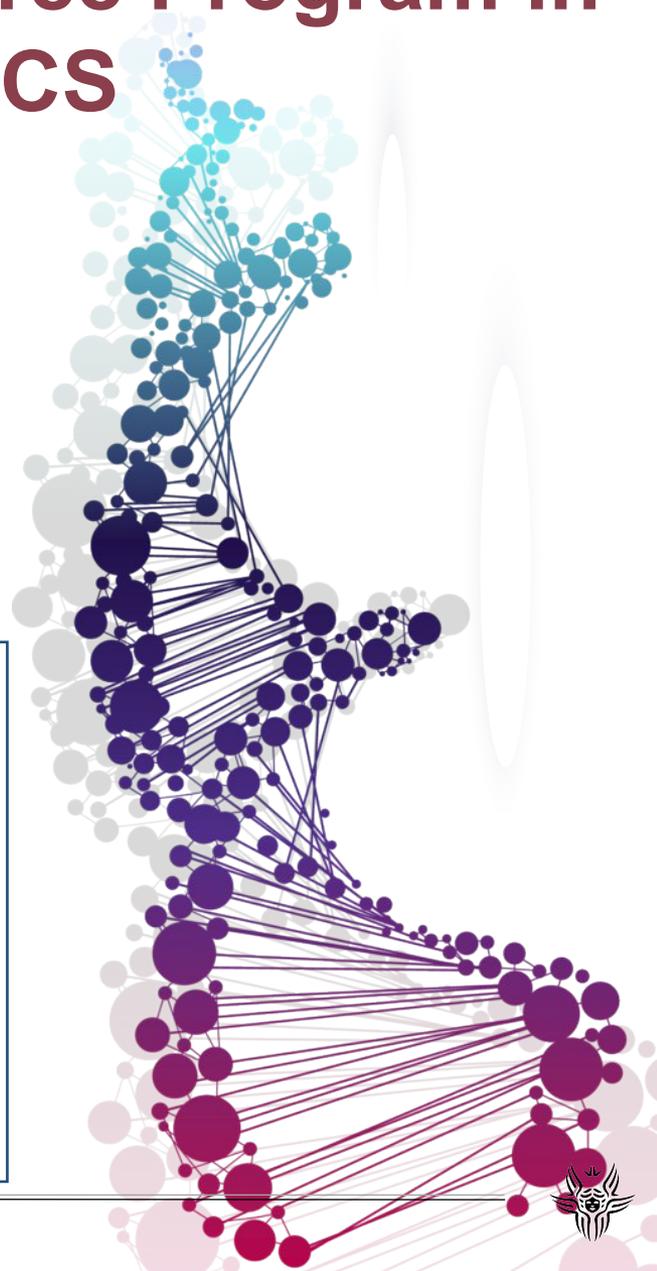


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- *Faculty of Pharmacy and Medicine*
 - *Faculty of Information Engineering, Computer Science and Statistics*
 - *Faculty of Mathematical, Physical and Natural Sciences*
- *Admission Requirements: Entrance Exam (English TOLC-F)*
 - *The program has a limited number of places (50), with admission for 45 EU students and 5 non-EU students.*
 - *The test consists of multiple-choice questions in Mathematics, Physics, Chemistry, and Biology.*
 - *No English language proficiency certificate is required.*

*Courses begin: **October 2025***



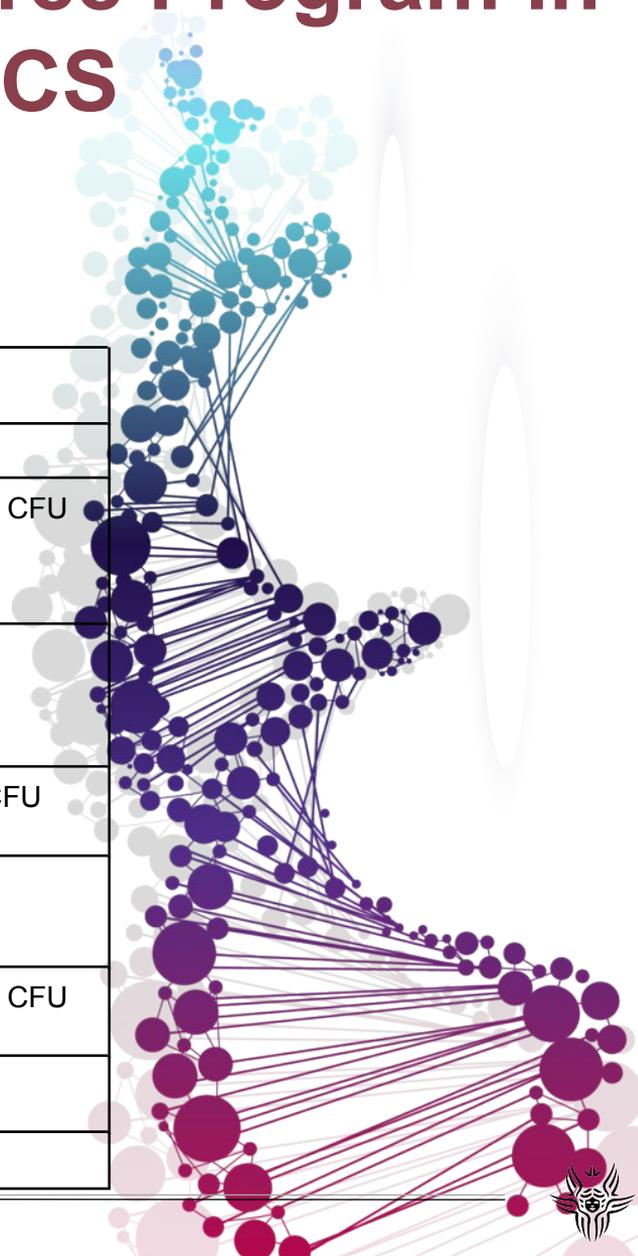


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I year

| I semester | II semester |
|---|---|
| Principles of Mathematics 1 (6 CFU MAT/09) | Introduction to biomedical statistics 1 (6 CFU MED/01) |
| Principles of Mathematics 2 (6 CFU MAT/09) | Biology of the cell 1 (6 CFU BIO/13) |
| Organic and inorganic chemistry 1 (6 CFU CHIM/03) | Organic and inorganic chemistry 2 (6 CFU CHIM/06) |
| Principles of Physics (6 CFU FIS/07) | Biology of the cell 2 (6 CFU BIO/13) |
| Principles of computer science I (6 CFU INF/01) | Introduction to biomedical statistics 2 (6 CFU SECS-S/01) |
| | |
| 30 CFU | 30 CFU |



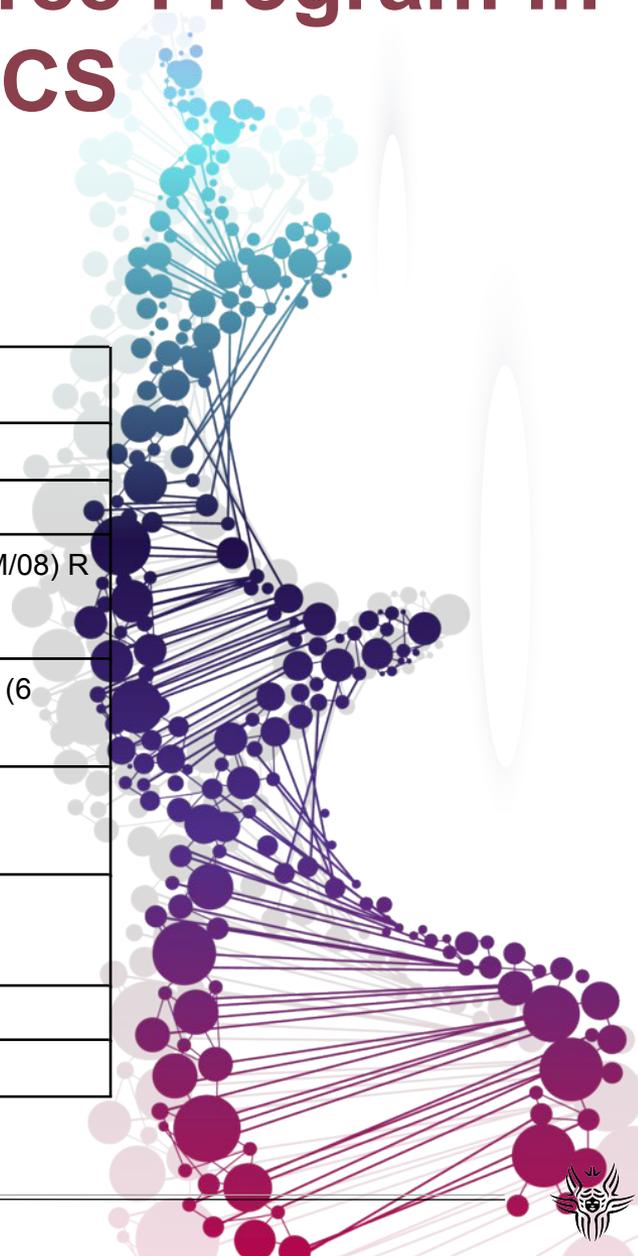


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II year

| I semester | II semester |
|--|---|
| Molecular biology 1 (6 CFU BIO/11) | Molecular biology 2 (6 CFU BIO/11) |
| Genetics and computational genomics (6 CFU BIO/18) | Pharmaceutical chemistry (6 CFU CHIM/08) R |
| | Immunology and molecular pathologies (6 CFU MED/04) |
| Principles of computer science II (6 CFU ING-INF/05) | |
| Biochemistry 1 (6 CFU BIO/10) | Biochemistry 2 (6 CFU BIO/10) |
| Microbiology (6 CFU BIO/19) | Bioinformatics I (INF/01) |
| 30 CFU | 30 CFU |

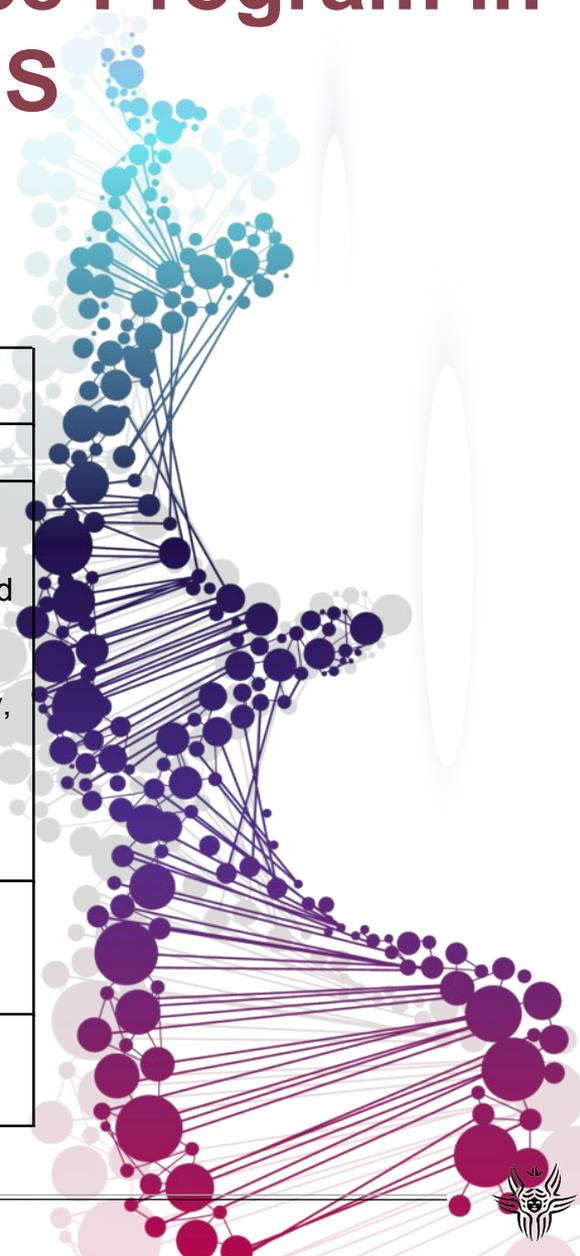




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| III year | |
|---|---|
| I semester | II semester |
| Bioinformatics II (6 CFU ING-INF/06) | 24 CFU a scelta tra: Modelling and simulation of biomolecular dynamical systems, Signal processing and information theory Algorithms , Complex biomolecular networks, Plant functional genomics, Principles of general pathology, Optimization methods for computational biology, Bioinformatics in plant pathology, Artificial Intelligence, Big Data, etc.. |
| Bioethics (6 CFU MED/02) | Stage For training (1-2 mesi, 18 CFU) |
| Molecular biology and genomics (6 CFU BIO/11) | |





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Bachelor's Degree Program in BIOINFORMATICS

Access to Master's Degree
Programs (Sapienza
University)

Medical Area

- Medical Biotechnology
- Pharmaceutical Biotechnology

Biological Area:

- Genetics and Molecular Biology (**English**)
- Biology and Cellular Technologies
- Genomic, Industrial and Environmental Biotechnologies
- Neurobiology
- Biochemistry (**English**)

Information Technologies and Engineering Area:

- Data Science (**English**)
- Engineering in Computer Science (**English**)
- Biomedical Statistics
- Biomedical Engineering (*work in progress...*)





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MASTER DEGREES (IT)

Università degli Studi di Milano:
laurea magistrale in Biotecnologie
molecolari e Bioinformatica

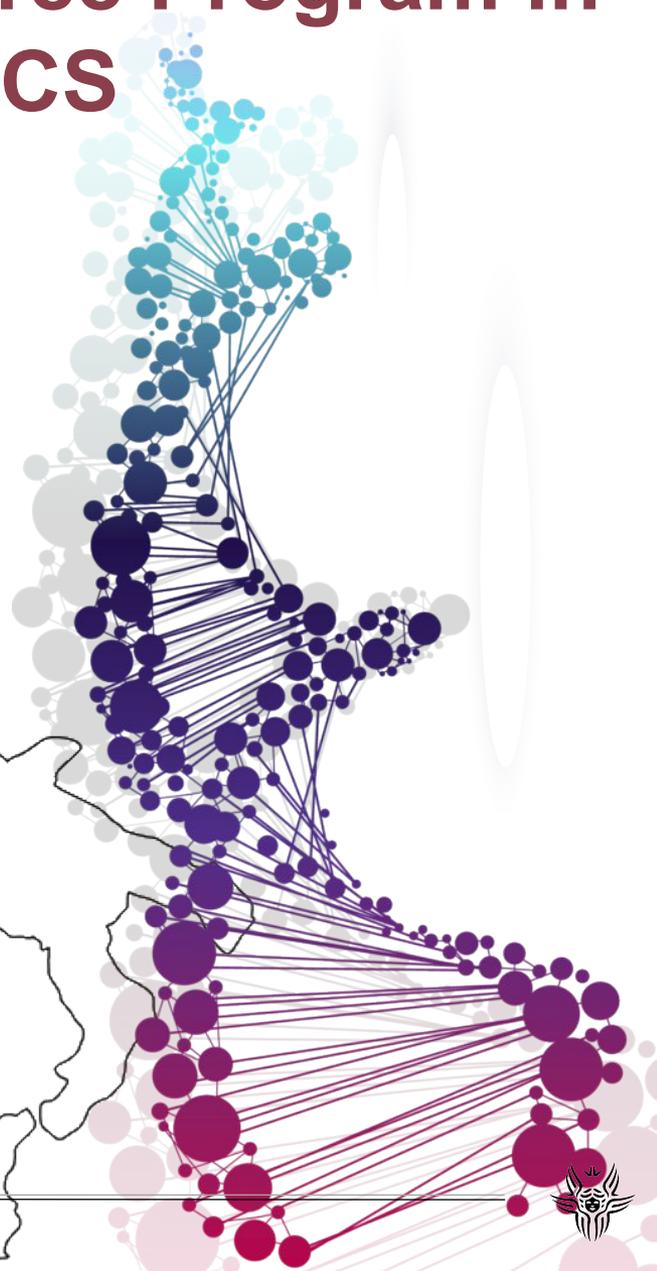
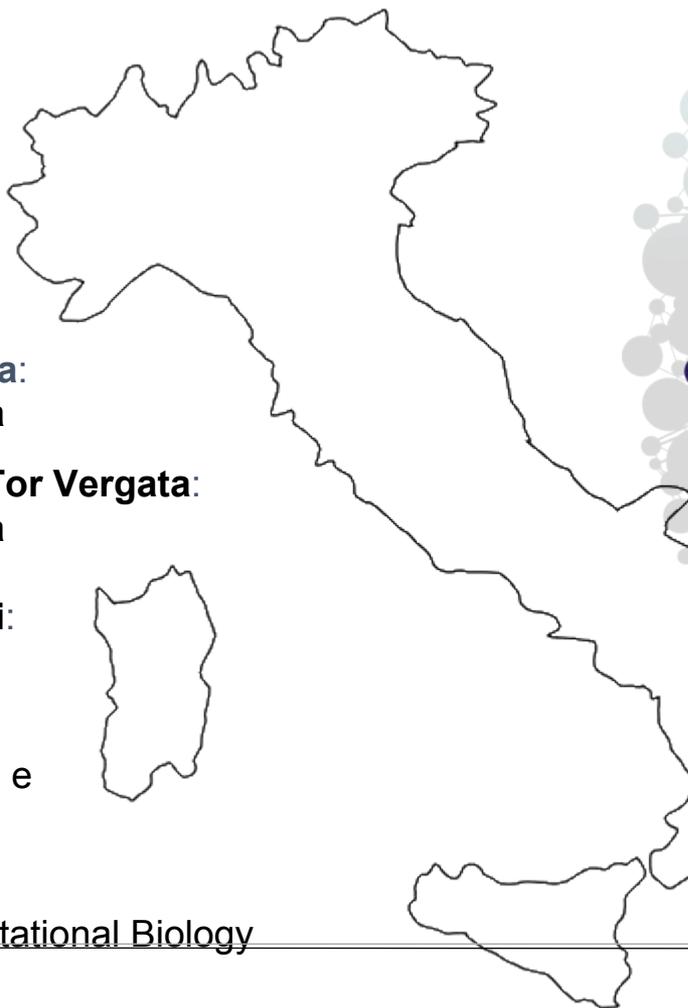
Università degli Studi di Bologna:
laurea magistrale in Bioinformatica

Università degli Studi di Roma Tor Vergata:
laurea magistrale in Bioinformatica

Università degli Studi di Cagliari:
Master di II liv. in Bioinformatica,

Università di Verona:
laurea magistrale in bioinformatica e
biotecnologie mediche

Università di Trento:
Master in Quantitative and Computational Biology





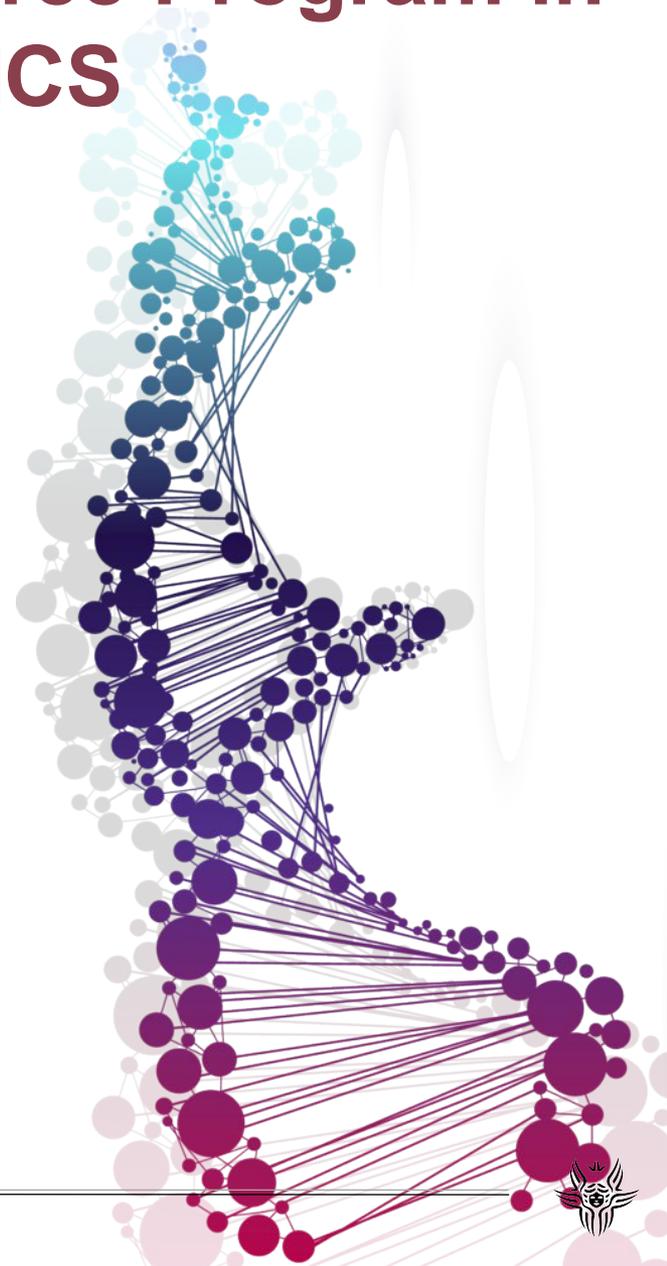
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Study Abroad Period at a Higher Education Institutions

- Attending courses and taking the related exams
- Conducting research for the preparation of the thesis
- Carrying out internships, research, lab work, clinical practice



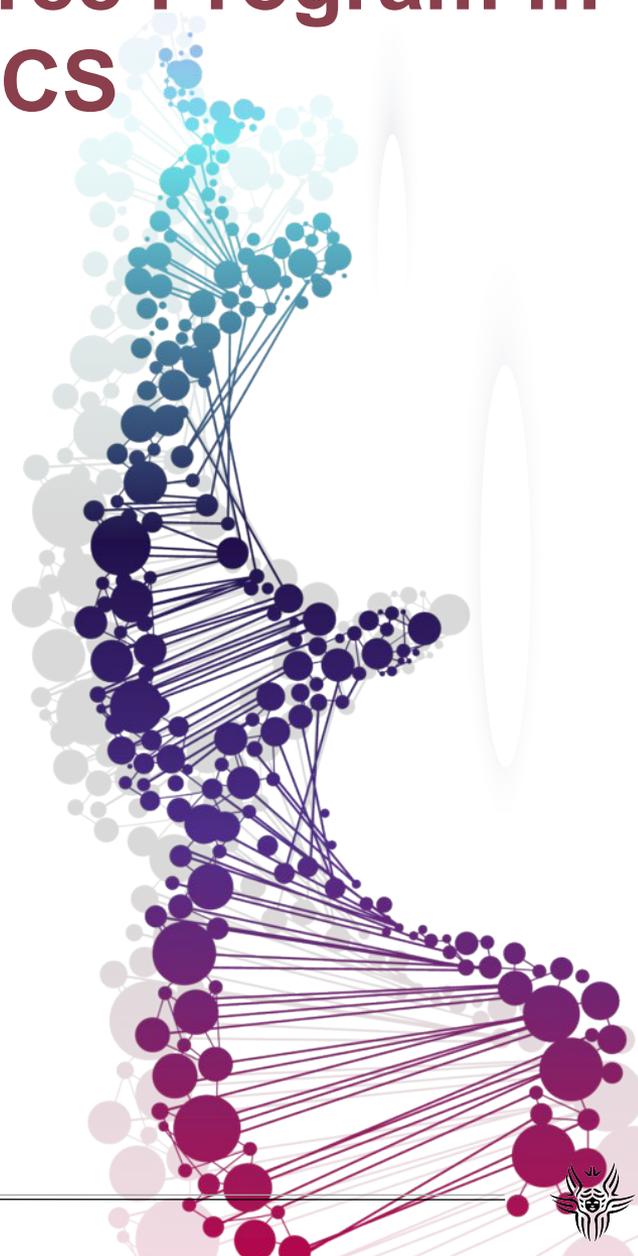
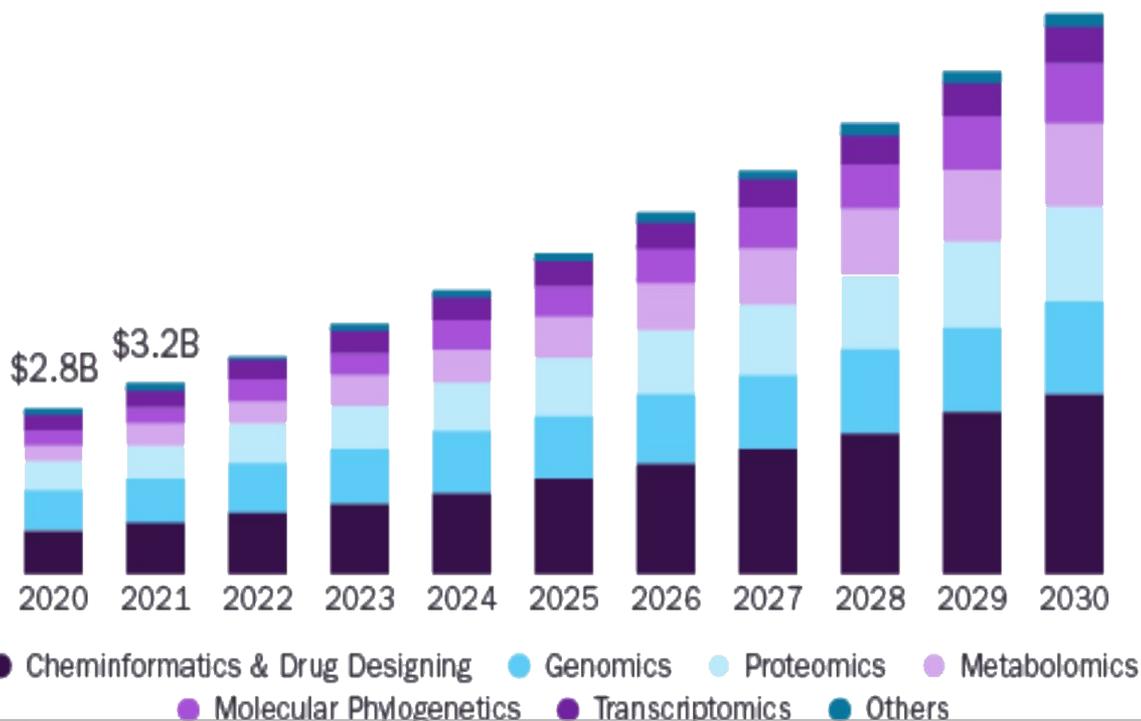


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U.S. Bioinformatics Market

Size, by Application, 2020 - 2030 (USD Billion)





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*WELCOME TO THE
BIOINFORMATICS WORLD!*

