بسم الله الرحمن الرحیم

UNLOCKING THE CODE OF LIFE

!

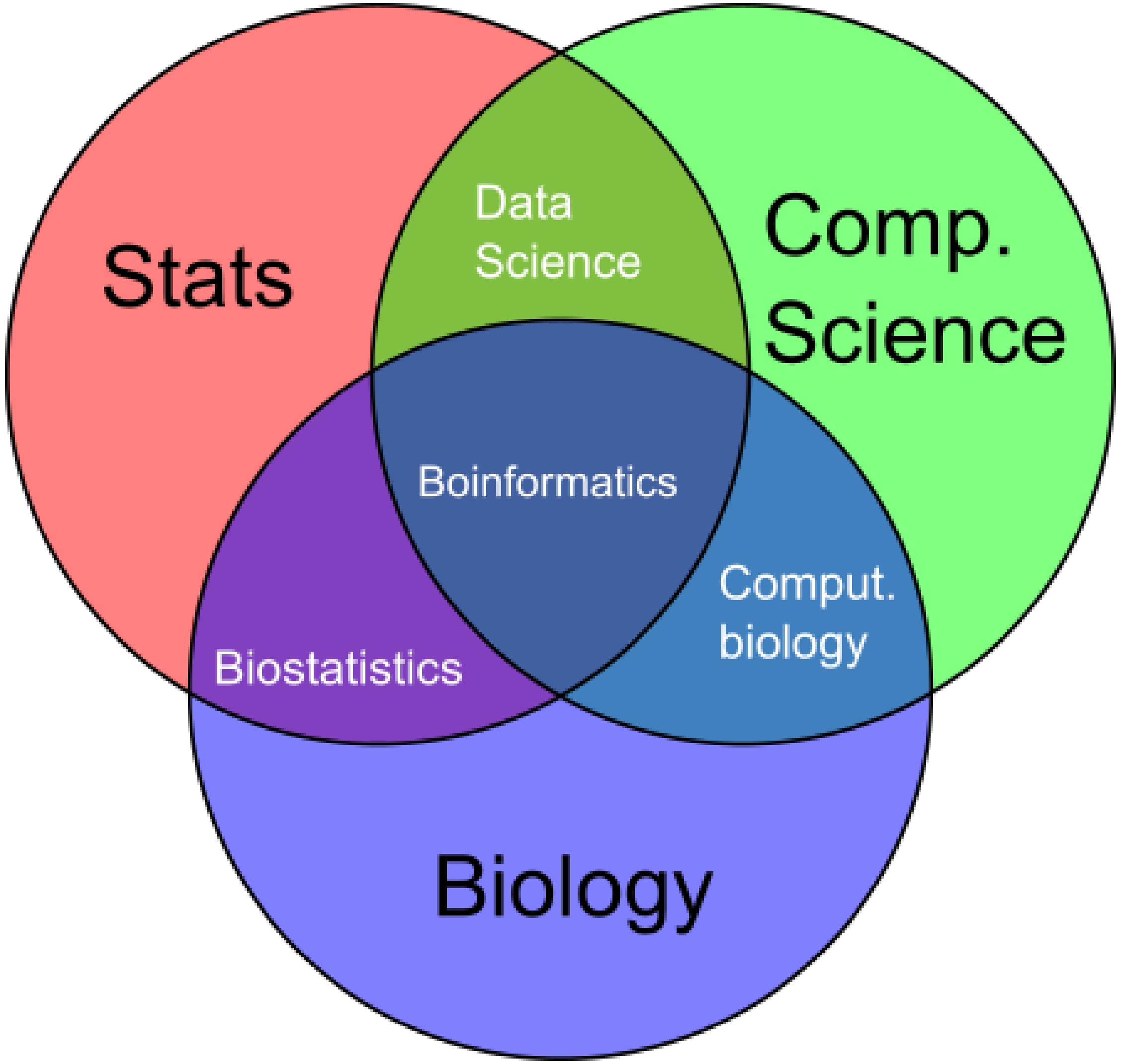
آیا یک مهندس میتواند بیماری را درمان کند ؟

آیا می‌توان بیماری‌ها را با الگوریتم و

روش‌های نرم‌افزاری درمان کرد ؟

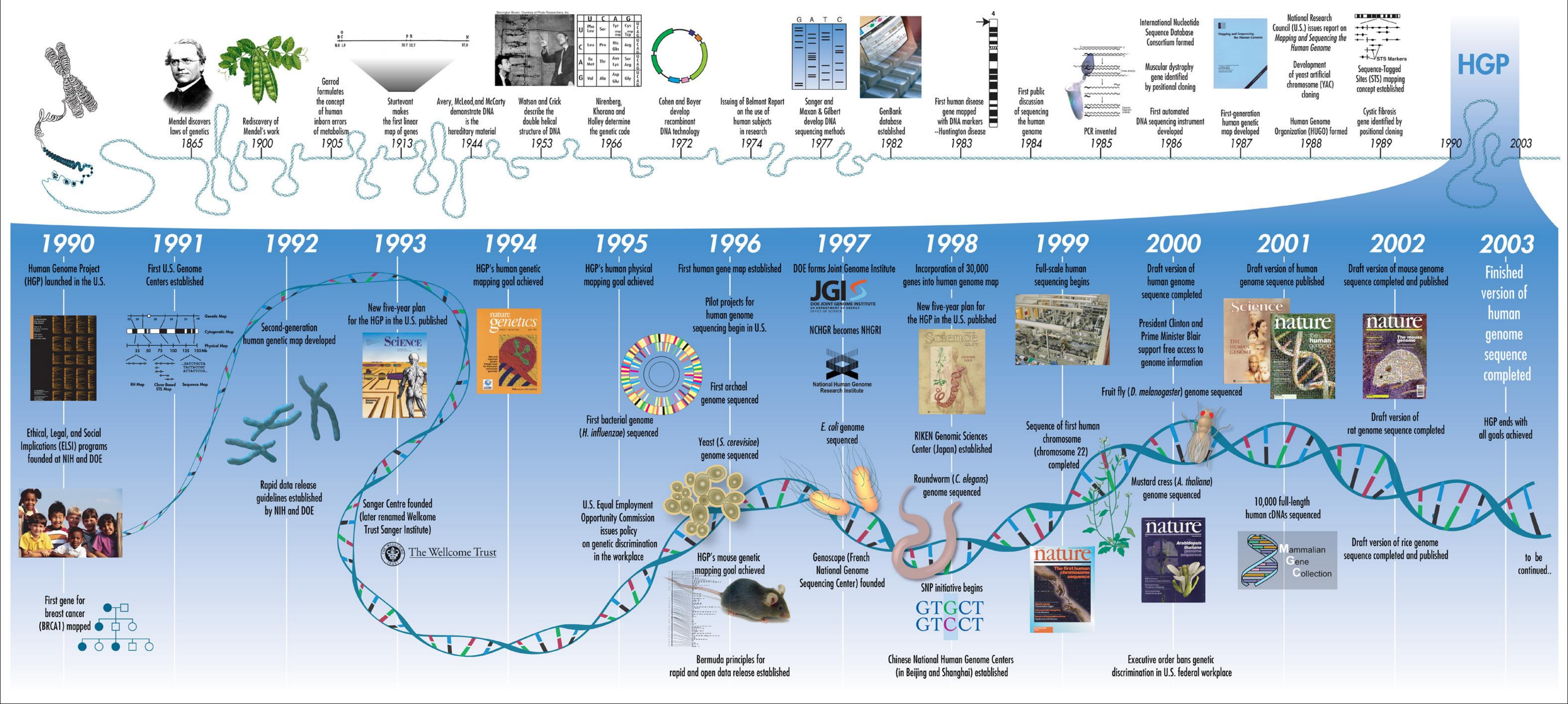
با روشهای مهندسی مکانیک یا برق چطور ؟

بیوانفورماتیک

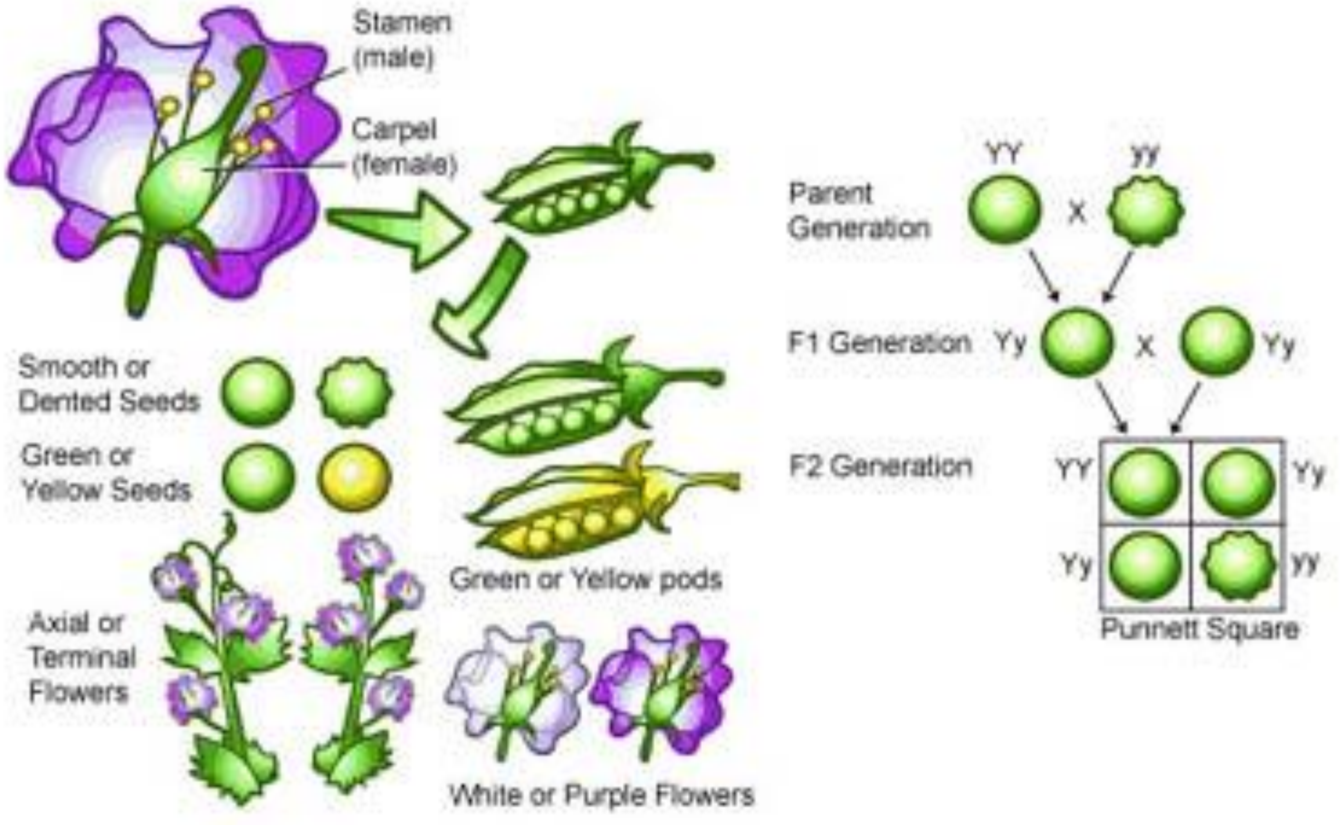


بیوانفورماتیک علم استفاده از ابزارهای کامپیوتری برای تحلیل داده‌های زیستی است در تقاطع زیست‌شناسی، علوم کامپیوتر، آمار و ریاضیات قرار دارد .

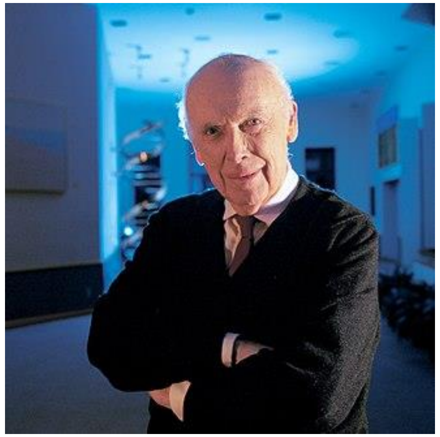
آغاز به دهه ۱۹۶۰ و توسعه اولین
پایگاه‌های داده توالی‌ها بازمی‌گردد.

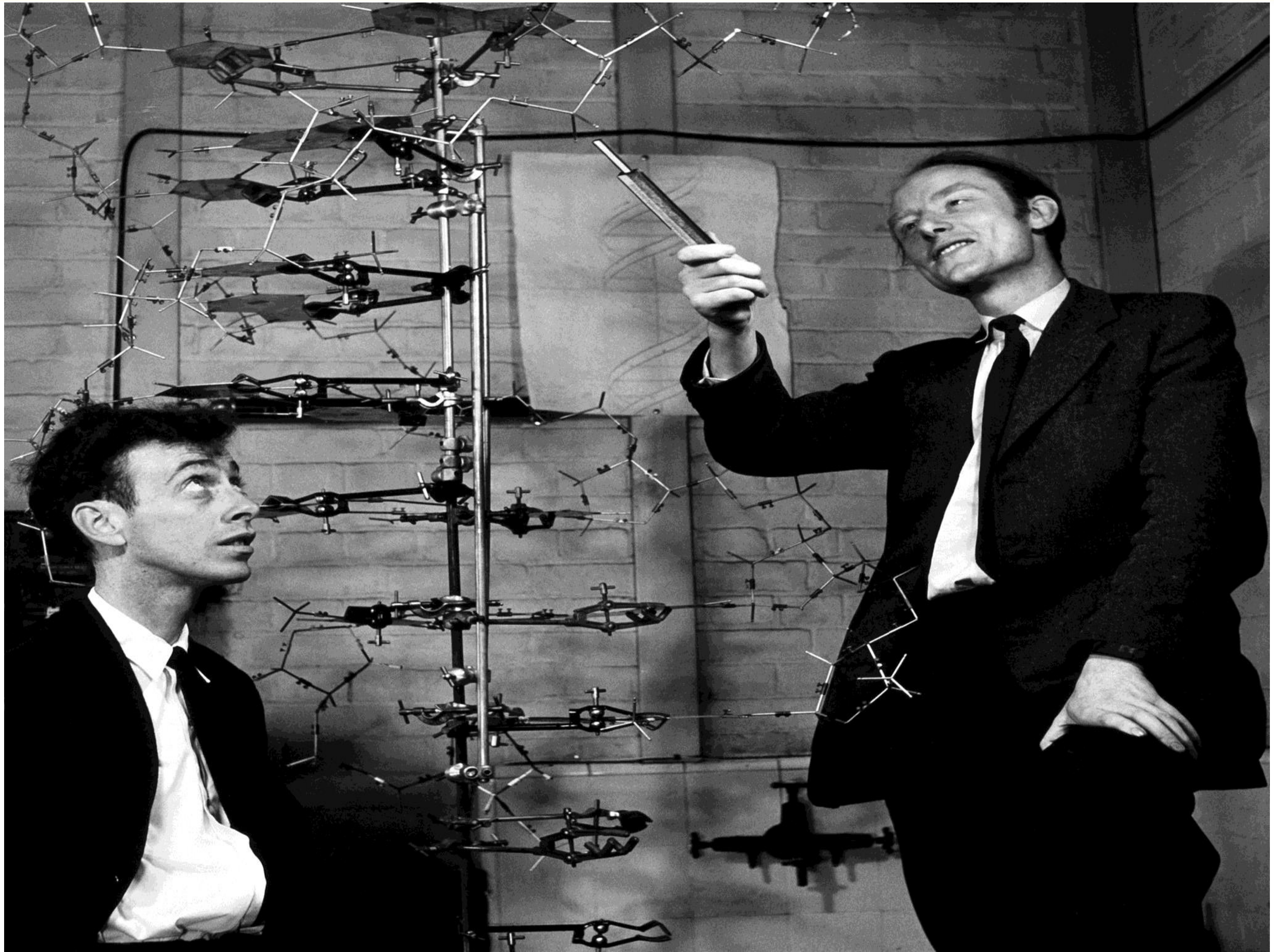


GREGOR MENDEL



فرانسیس کریک و موریس ویلکینز و روزالیند فرانکلین نقشی مهم در کشف ساختار مولکولی دی‌ان‌ای بازی کرد. ماده‌ای که اساس انتقال موروثی و اطلاعات ژنتیکی در جانداران به نسل‌های بعدی به‌شمار می‌رود. واتسون جایزه نوبل فیزیولوژی و پزشکی را در سال ۱۹۶۲ میلادی به همراه دو دانشمند دیگر (کریک و ویلکینز) دریافت کرد.





پروژه ژنوم انسان (۲۰۰۳ - ۱۹۹۰) نقطه عطفی در پیشرفت بیوانفورماتیک بود.

The Human Genome Project was a landmark global scientific effort whose signature goal was to **generate the first sequence of the human genome**.

In 2003, the Human Genome Project produced a genome sequence that accounted for over 90% of the human genome.

2.7 Bilion $

پروژه ۱۰۰۰ ژنوم همکاری بین گروه های تحقیقاتی در ایالات متحده ، انگلیس و چین و آلمان برای تولید کاتالوگ گسترده ای از تنوع ژنتیکی انسانی است که از مطالعات تحقیقات پزشکی آینده پشتیبانی می کند.

Between $30 million and $50 million

Approximately $600

پیشرفت امروز

۷۰۹ سال

2.7 Bilion $

۲۴ ساعت

600 $

PNAS RESEARCH ARTICLE | CELL BIOLOGY OPEN ACCESS

The human cell count and size distribution

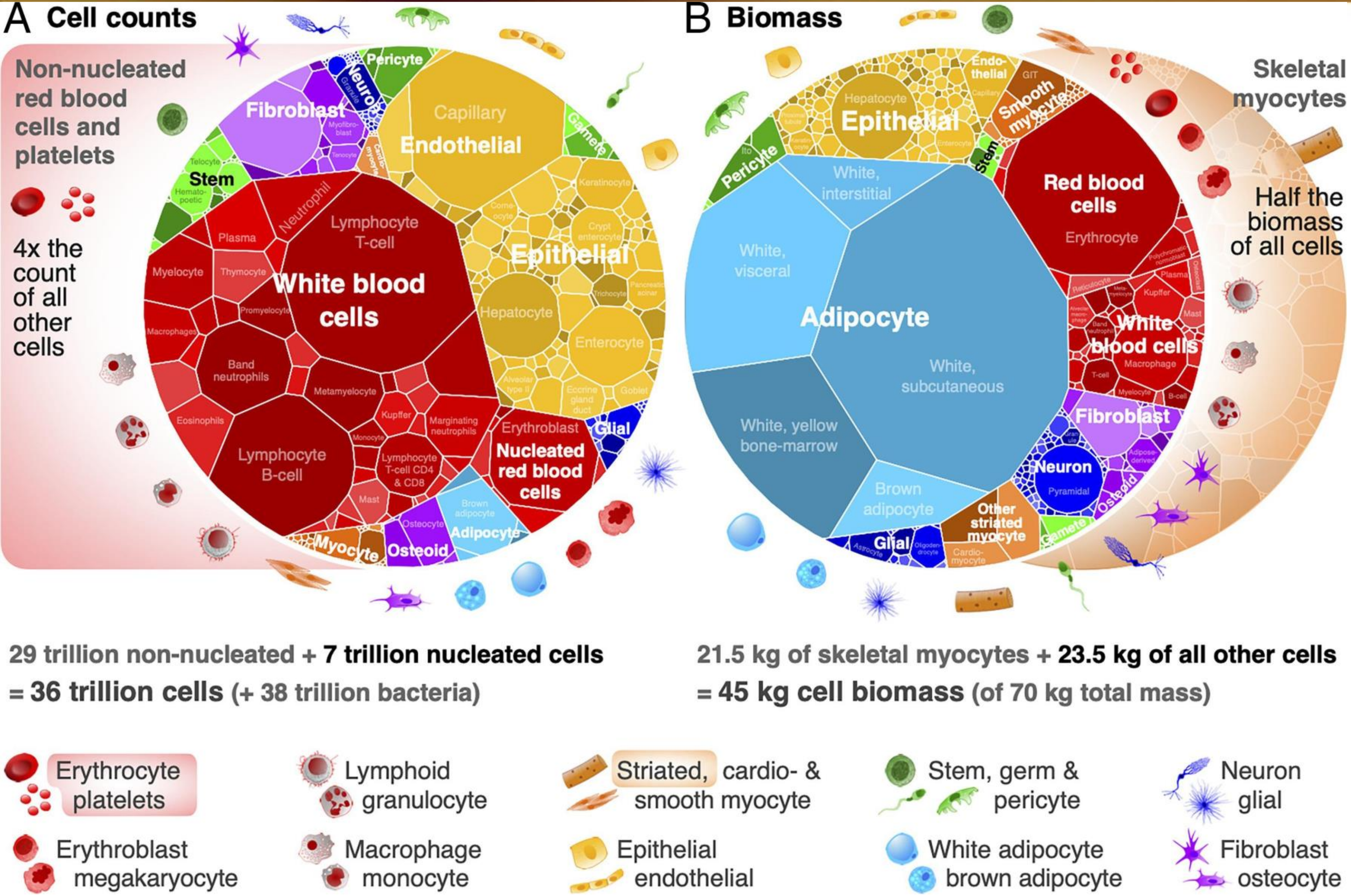
Ian A. Hatton[a,b,1], Eric D. Galbraith[b,c], Nono S. C. Merleau[a,d], Teemu P. Miettinen[e], Benjamin McDonald Smith[f,g], and Jeffery A. Shander[h]

Edited by Jan M. Skotheim, Stanford University, Stanford, CA; received February 22, 2023; accepted July 24, 2023 by Editorial Board Member Rebecca Heald

September 18, 2023 | 120 (39) e2303077120 | https://doi.org/10.1073/pnas.2303077120

Significance

A consistent and comprehensive quantitative framework of the cells in the human body could benefit many areas of biology. We compile data to estimate cell mass, size range, and cell count for some 1,200 cell groups, from the smallest red blood cells to the largest muscle fibers, across 60 tissues in a representative male, female, and 10-y-old child. We find large-scale patterns revealing that both cellular biomass in any given logarithmic cell-size class and the coefficient of cell-size variation are both approximately independent of cell size. These patterns are suggestive of a whole-organism trade-off between cell size and count and imply the existence of cell-size homeostasis across cell types.



36 Trillion Cell !

(۳۶ با ۱۲ صفر جلوی آن)

زن بالغ ۲۸ تریلیون

کودک ۱۰ ساله حدود ۱۷ تریلیون سلول

تعداد ۴۰۰ نوع سلول

۶۰ بافت

۴۸ جلد کتاب ۱۰۰۰ صفحه ای

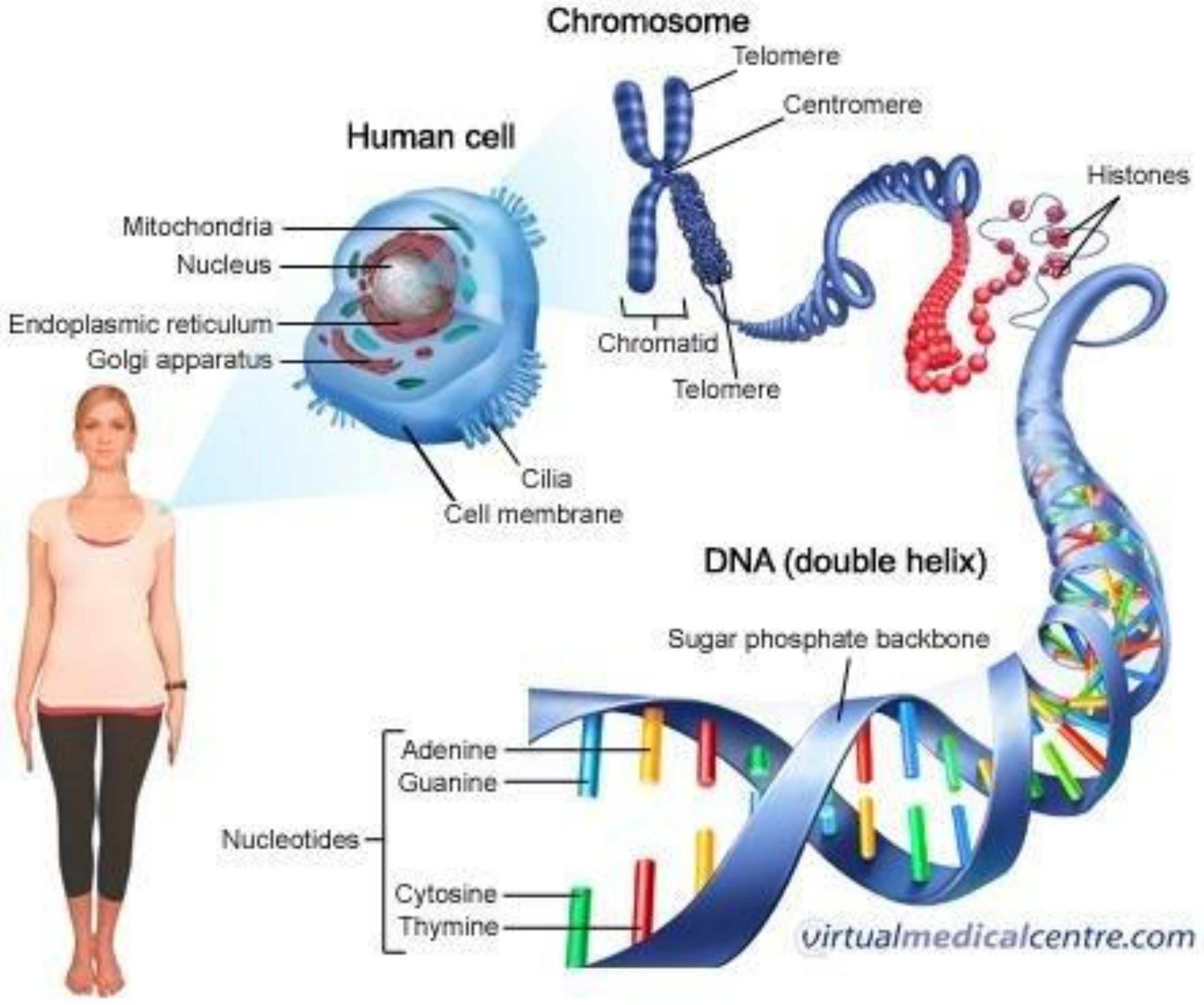
در هر ۱ میلیمتر یک حرف

A4

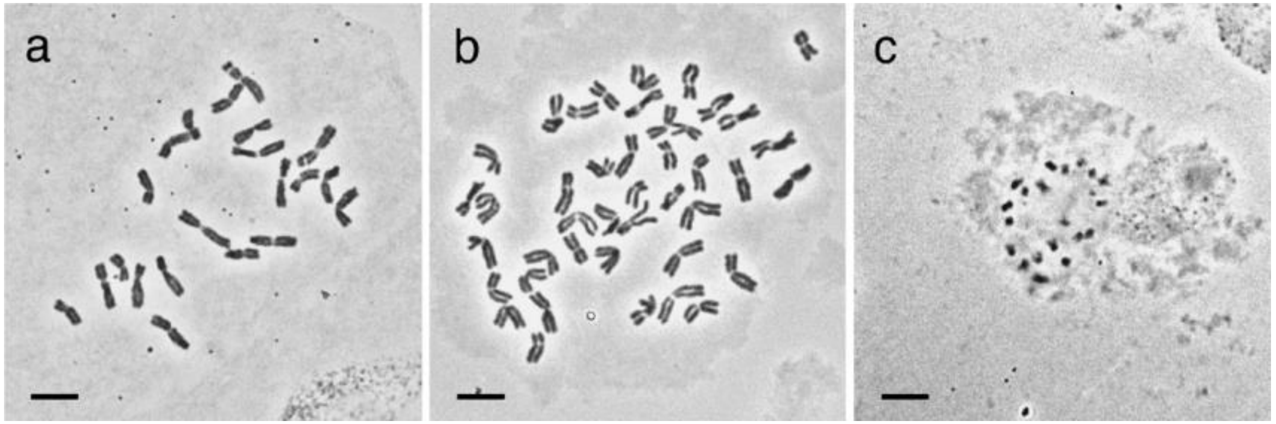
نوکلئوتید: ترکیب قند، فسفات و باز آلی

نوکلئوتید ترکیبی متشکل از یک قند ۵-کربنی (ریبوز یا دئوکسی ریبوز) اسید فسفریک (فسفات) و یکی از بازهای آلی پورین (آدنین، گوانین) یا پیریمیدین (سیتوزین، تیمین، یوراسیل) است.

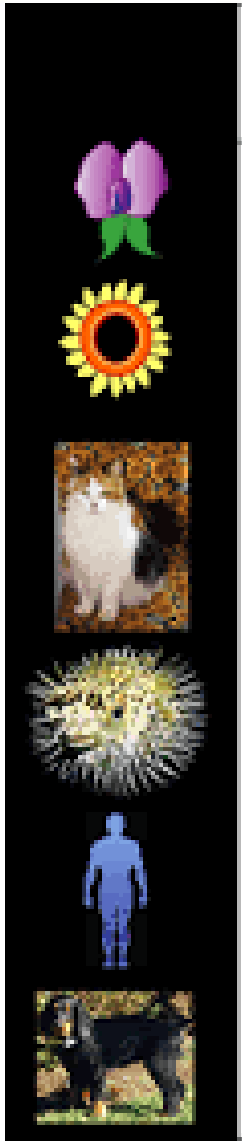
اغلب **نوکلئوتید** را نوکلئوزید فسفات می‌گویند.



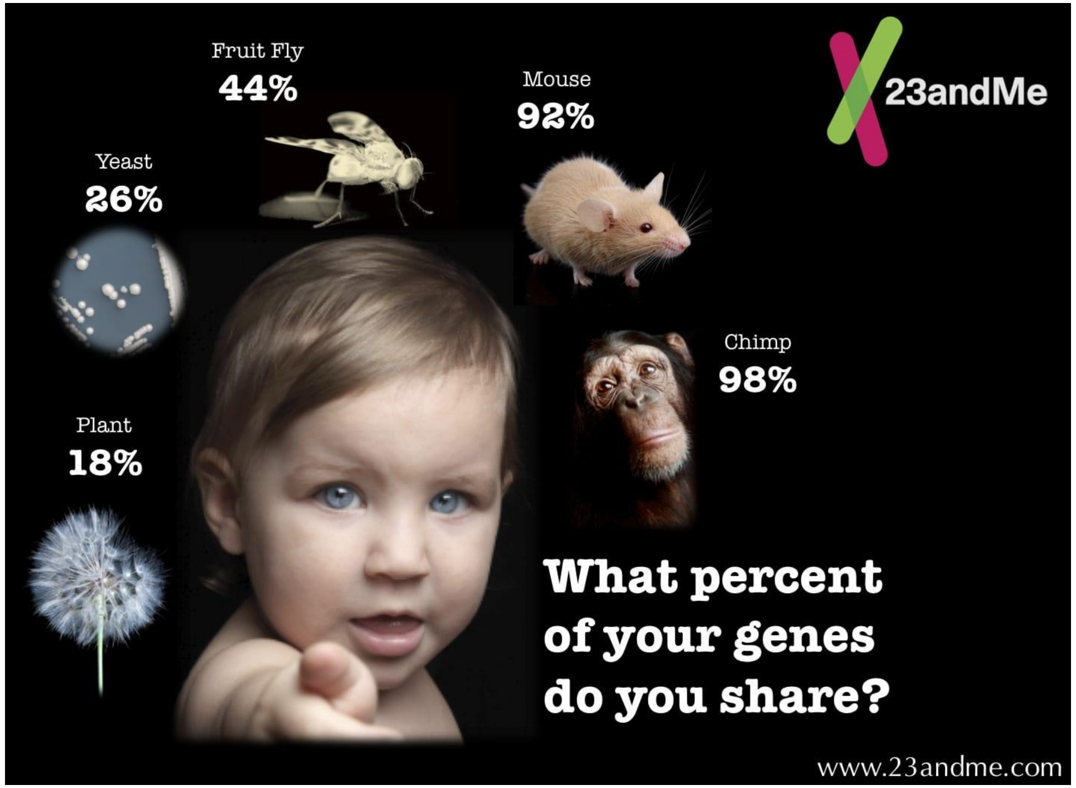
۲۳ جفت - انسان

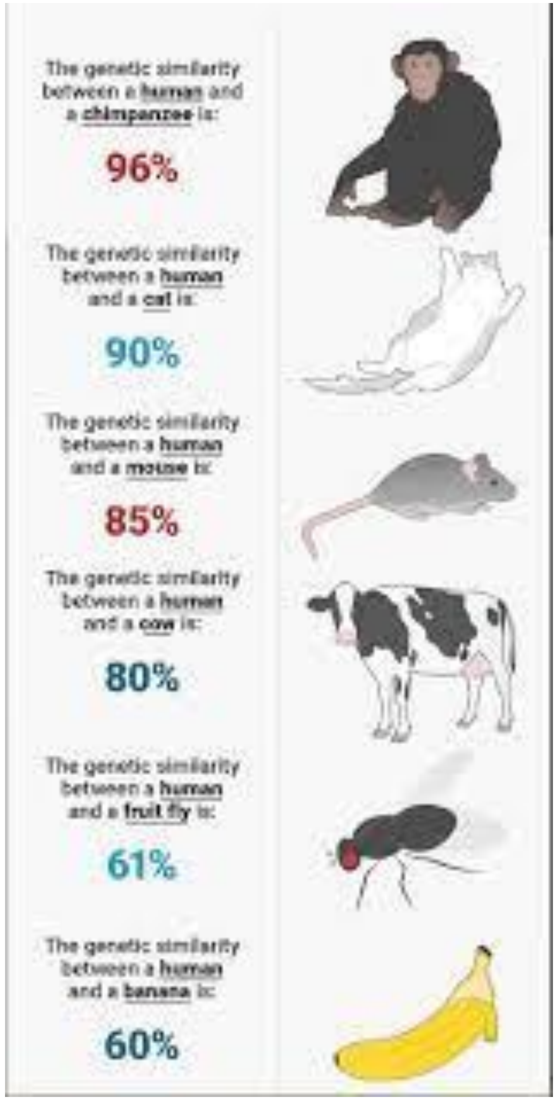


۴۲عدد-۶ جفت - گندم

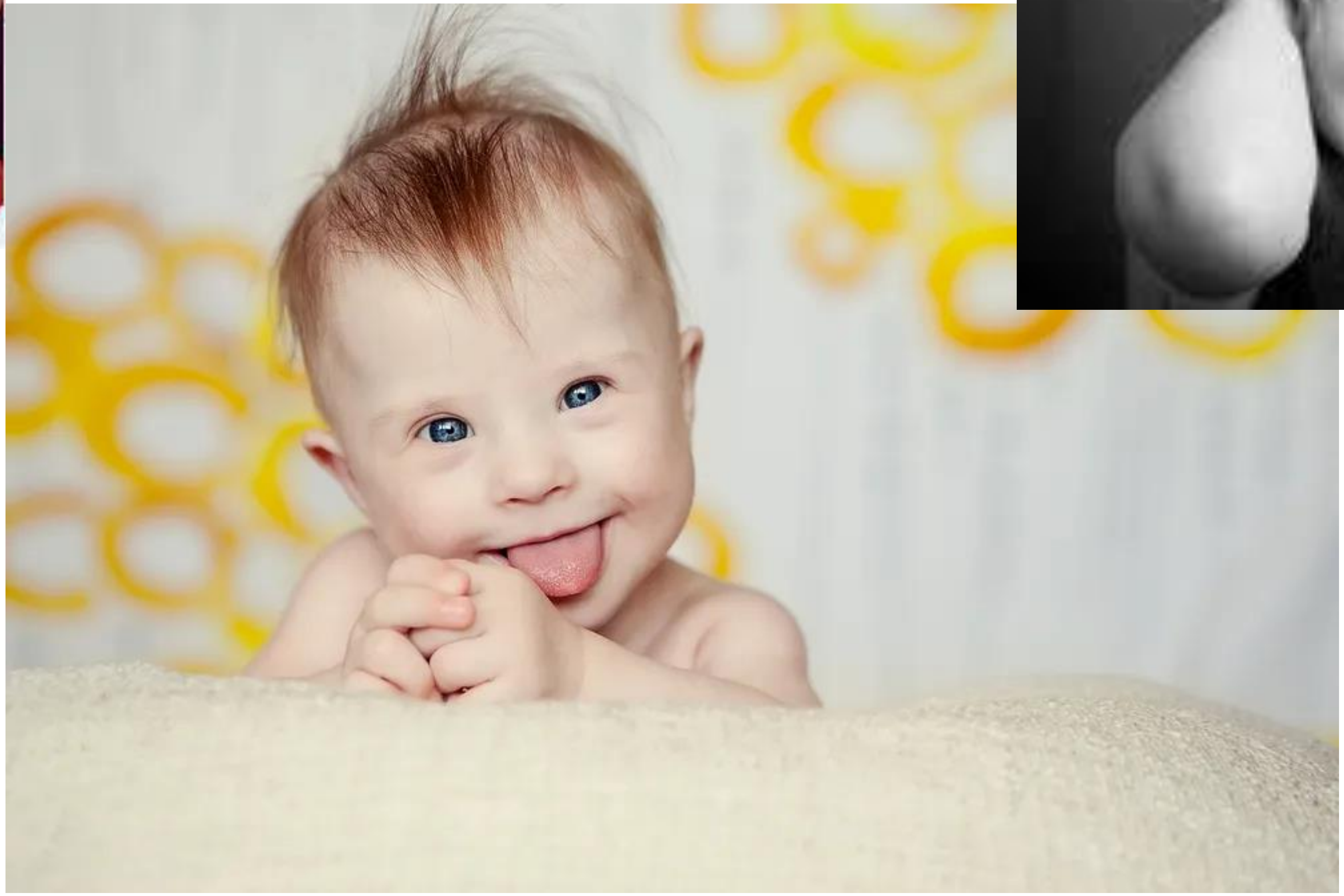


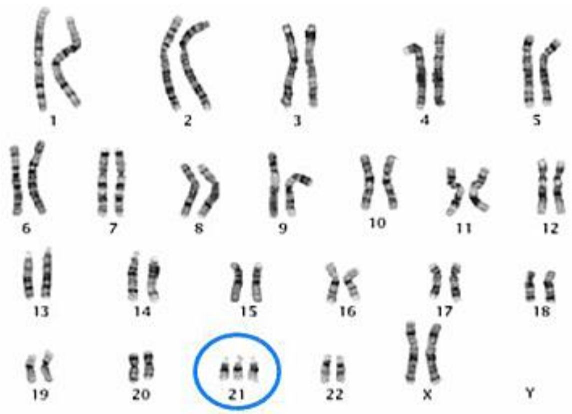
Organism	Number of chromosomes
pea plant	14
sun flower	34
cat	38
puffer fish	42
human	46
dog	78





Down syndrome



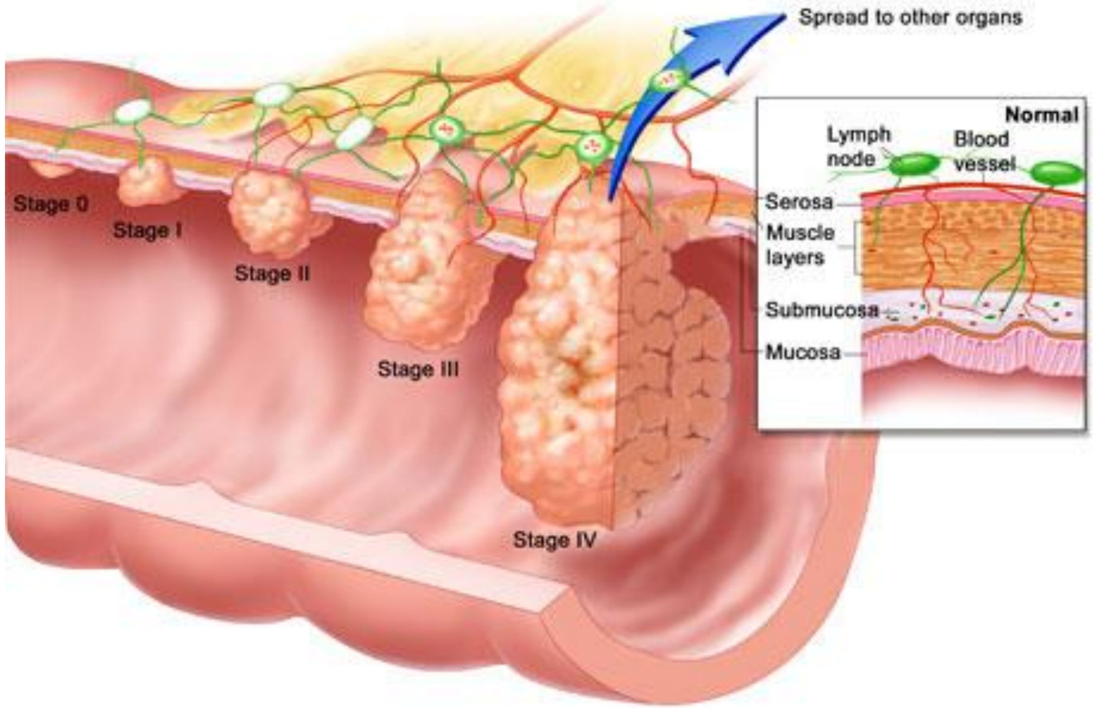


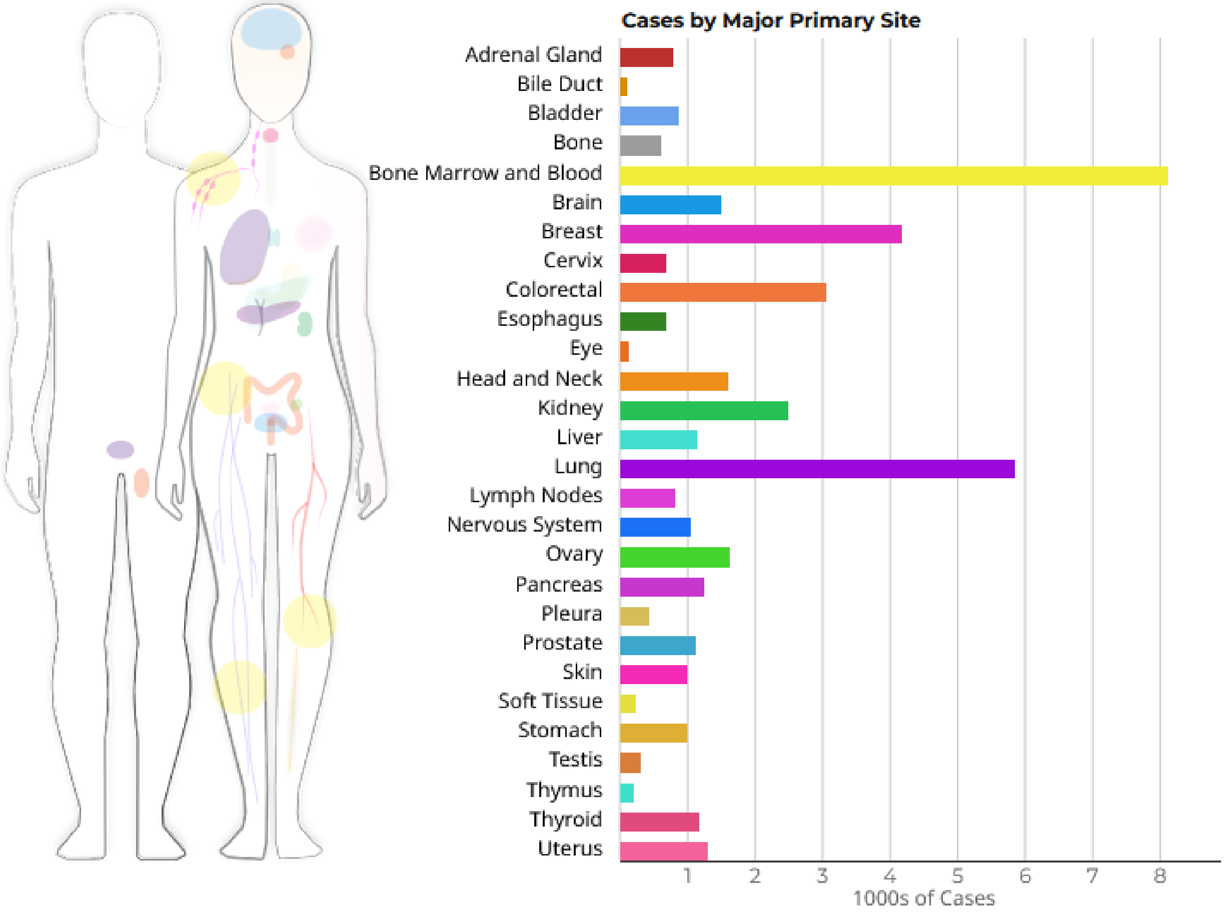
Treacher syndrome

A change in the gene TCOF1

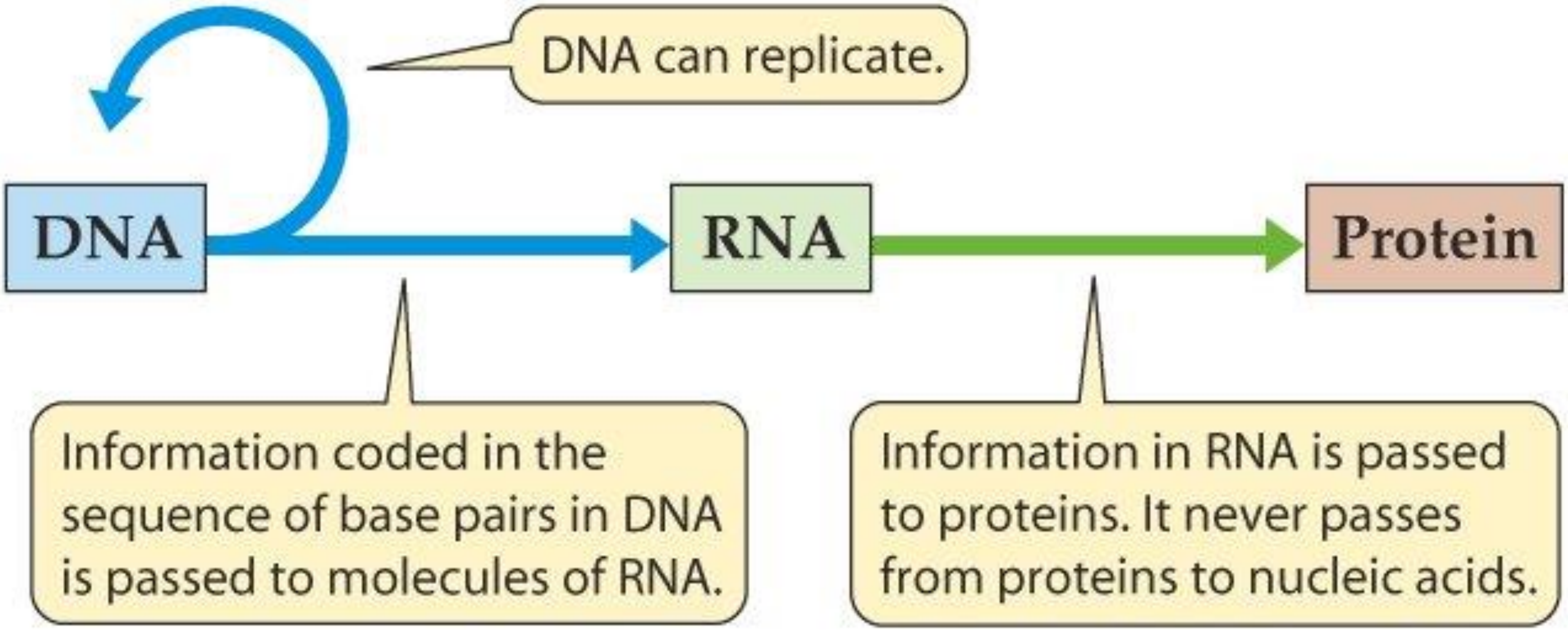
Human Genes : ~ 20000

Cancer





100 types of cancer


DNA can replicate.
DNA
RNA
Protein
Information coded in the sequence of base pairs in DNA is passed to molecules of RNA.
Information in RNA is passed to proteins. It never passes from proteins to nucleic acids.

The "omics"

Genomics → DNA (Gene)

↓ Transcription

Transcriptomics → RNA

↓ Translation

Proteomics → PROTEIN

↓ Enzymatic reaction

Metabolomics → METABOLITE

Functional Genomics: Transcriptomics, Proteomics

- کاربردها: تحلیل توالی‌های DNAو RNA، پزشکی شخصی‌شده، طراحی دارو، تحلیل میکروبیوم.
- چالش‌ها: حجم عظیم داده‌ها، نیاز به الگوریتم‌های کارآمد، یکپارچه‌سازی داده‌ها.

پایگاه‌های داده بیوانفورماتیک

پایگاه‌های داده مهم: NCBI، UniProt، PDB.

ابزارهای تحلیل داده: BLAST، ClustalW، SWISS-MODEL.

فرمت‌های داده: FASTA، GenBank، PDB.

الگوریتم‌ها و روش‌های محاسباتی در بیوانفورماتیک

الگوریتم‌های هم‌ترازی: Needleman-Wunsch، Smith-Waterman.

یادگیری ماشین: شبکه‌های عصبی، ماشین بردار پشتیبان (SVM)

الگوریتم‌های فیلوژنی: Maximum Likelihood، Neighbor-Joining.

ابزارهای برنامه‌نویسی: Python (Biopython)، R

Heliyon 9 (2023) e17653

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

A deep learning-based framework for predicting survival-associated groups in colon cancer by integrating multi-omics and clinical data

Siamak Salimy [a], Hossein Lanjanian [b], Karim Abbasi [c], Mahdieh Salimi [d], Ali Najafi [e], Leili Tapak [f], Ali Masoudi-Nejad [a,*,1]

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[b] Cellular and Molecular Endocrine Research Center, Research Institute for Endocrine Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[c] Laboratory of System Biology, Bioinformatics & Artificial Intelligent in Medicine (LBBai), Faculty of Mathematics and Computer Science, Kharazmi University, Tehran, Iran
[d] Department of Medical Genetics, Institute of Medical Biotechnology, National Institute of Genetic Engineering and Biotechnology (NIGEB), Tehran, Iran
[e] Molecular Biology Research Center, Systems Biology and Poisonings Institute, Tehran, Iran
[f] Department of Biostatistics, School of Public Health and Modeling of Noncommunicable Diseases Research Center, Hamadan University of Medical Sciences, Hamadan, Iran

Colon Cancer Biomarkers

IF: 3.4

Check for updates

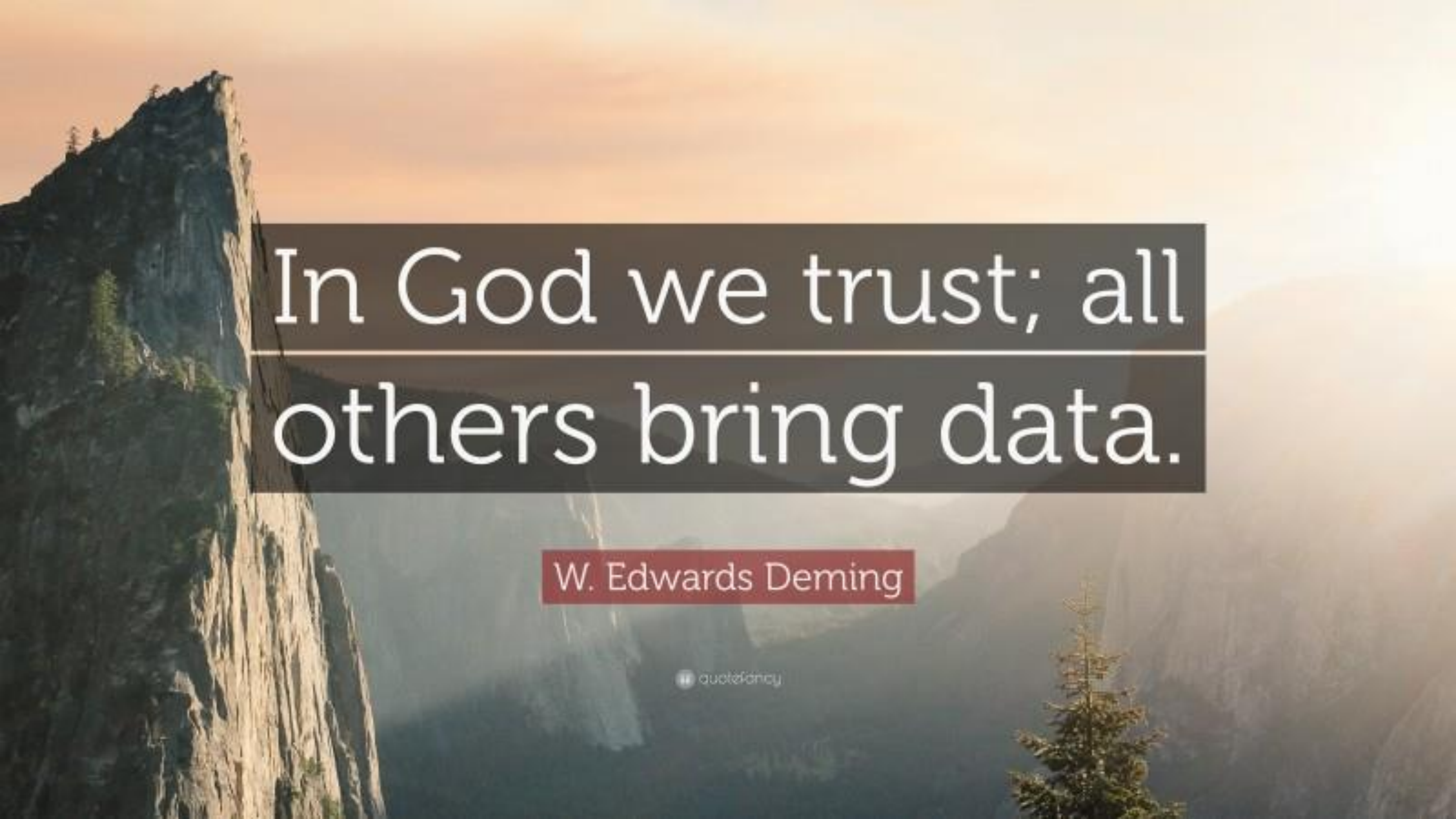
Identification of Prognostic Biomarkers for Breast Cancer Metastasis Using Penalized Additive Hazards Regression Model

Cancer Informatics
Volume 22: 1–8

DOI: 10.1177/11769351231157942
SAGE

Leili Tapak[1], Omid Hamidi[2], Payam Amini[3], Saeid Afshar[4], Siamak Salimy[5] and Irina Dinu[6]

[1]Department of Biostatistics, School of Public Health and Modeling of Noncommunicable Diseases Research Center, Hamadan University of Medical Sciences, Hamadan, Iran. [2]Department of Science, Hamedan University of Technology, Hamedan, Iran. [3]Department of Biostatistics, School of Public Health, Iran University of Medical Sciences, Tehran, Iran. [4]Research Center for Molecular Medicine, Hamadan University of Medical Sciences, Hamadan, Iran. [5]Laboratory of System Biology and Bioinformatics (LBB), Department of Bioinformatics, University of Tehran, Kish, Iran. [6]School of Public Health, University of Alberta, Edmonton, AB, Canada.


In God we trust; all
others bring data.
W. Edwards Deming
quotefancy

ARTIFICIAL INTELLIGENCE LAB

MAIN CONCEPTS

- Introduction to Artificial Intelligence
- Programming for AI
- Machine Learning Basics
- Neural Networks and Deep Learning
- Natural Language Processing (NLP)

INTRODUCTION TO AI

- Overview of AI and its applications
- History and evolution of AI
- Ethical considerations in AI

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think, learn, and make decisions. These systems can perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation. AI encompasses a wide range of technologies, including machine learning, neural networks, natural language processing, robotics, and more.

KEY COMPONENTS OF AI

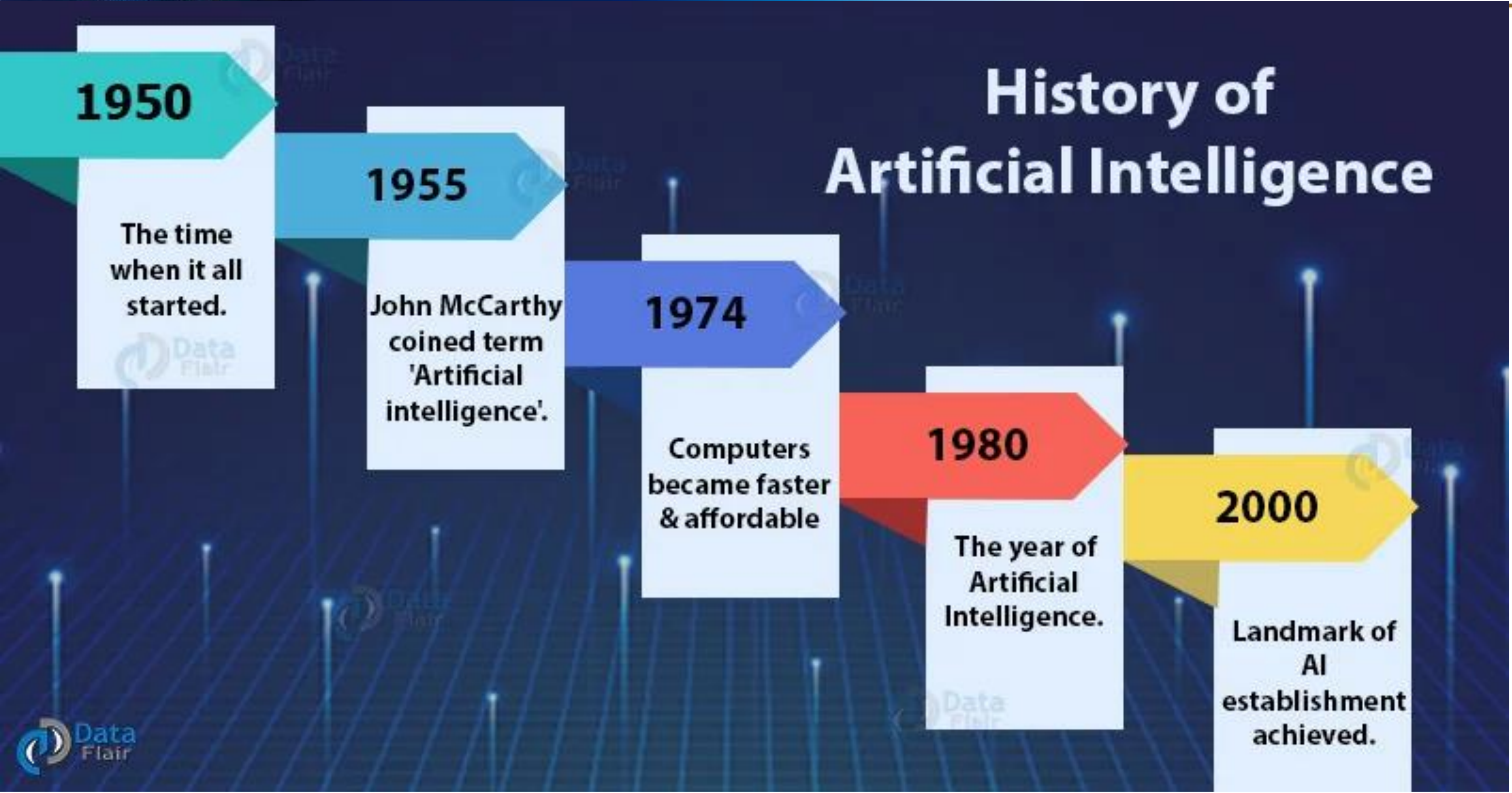
1. **Machine Learning (ML)**: A subset of AI that involves training algorithms to learn from and make predictions or decisions based on data. Common techniques include supervised learning, unsupervised learning, and reinforcement learning.
2. **Neural Networks**: Computational models inspired by the human brain, used for tasks like image and speech recognition. Deep learning, a subset of neural networks, involves multiple layers of neurons to model complex patterns.
3. **Natural Language Processing (NLP)**: Enables machines to understand, interpret, and generate human language. Applications include chatbots, language translation, and sentiment analysis.
4. **Computer Vision**: Enables machines to interpret and make decisions based on visual data from the world. Applications include facial recognition, object detection, and autonomous vehicles.
5. **Robotics**: Combines AI with mechanical engineering to create robots that can perform tasks autonomously or semi-autonomously.

Applications of AI

1. **Healthcare**
    1. **Diagnosis and Treatment**: AI algorithms can analyze medical images, predict disease outbreaks, and recommend personalized treatment plans.
    2. **Drug Discovery**: AI accelerates the process of drug discovery by predicting how different compounds will interact with targets in the body.
2. **Finance**
    1. **Algorithmic Trading**: AI systems can analyze market data and execute trades at high speeds.
    2. **Fraud Detection**: Machine learning models can identify unusual patterns indicative of fraudulent activity.
3. **Retail**
    1. **Personalized Recommendations**: AI analyzes customer behavior to recommend products.
    2. **Inventory Management**: Predictive analytics helps in managing stock levels efficiently.
4. **Transportation**
    1. **Autonomous Vehicles**: AI powers self-driving cars by processing data from sensors and making real-time driving decisions.
    2. **Traffic Management**: AI optimizes traffic flow and reduces congestion through real-time data analysis.

1. **Customer Service**
    1. **Chatbots**: AI-driven chatbots provide instant customer support and handle routine inquiries.
    2. **Sentiment Analysis**: AI analyzes customer feedback to gauge satisfaction and improve services.
2. **Manufacturing**
    1. **Predictive Maintenance**: AI predicts equipment failures before they occur, reducing downtime.
    2. **Quality Control**: Computer vision systems inspect products for defects.
3. **Education**
    1. **Personalized Learning**: AI tailors educational content to individual student needs.
    2. **Administrative Automation**: AI automates administrative tasks like grading and scheduling.
4. **Entertainment**
    1. **Content Recommendation**: AI suggests movies, music, and other content based on user preferences.
    2. **Game Development**: AI creates realistic non-player characters (NPCs) and adaptive game environments.
5. **Security**
    1. **Surveillance**: AI-powered cameras can detect suspicious activities in real-time.
    2. **Cybersecurity**: AI identifies and mitigates potential security threats.
6. **Agriculture**
    1. **Precision Farming**: AI analyzes data from sensors and drones to optimize crop yields.
    2. **Pest Control**: AI predicts pest outbreaks and recommends control measures.

TIME LINE



History of
Artificial Intelligence
1950
The time when it all started.
1955
John McCarthy coined term 'Artificial intelligence'.
1974
Computers became faster & affordable
1980
The year of Artificial Intelligence.
2000
Landmark of AI establishment achieved.
Data Flair

SYZYGY

A.I. TIMELINE

1950
TURING TEST
Computer scientist Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence

1955
A.I. BORN
Term 'artificial intelligence' is coined by computer scientist, John McCarthy to describe "the science and engineering of making intelligent machines"

1961
UNIMATE
First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line

1964
ELIZA
Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans

1966
SHAKEY
The 'first electronic person' from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I. WINTER
Many false starts and dead-ends leave A.I. out in the cold

1997
DEEP BLUE
Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov

1998
KISMET
Cynthia Breazeal at MIT introduces KISmet, an emotionally intelligent robot insofar as it detects and responds to people's feelings

1999
AIBO
Sony launches first consumer robot pet dog AiBO (AI robot) with skills and personality that develop over time

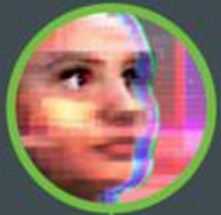
2002
ROOMBA
First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes

2011
SIRI
Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S

2011
WATSON
IBM's question answering computer Watson wins first place on popular $1M prize television quiz show *Jeopardy*

2014
EUGENE
Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human

2014
ALEXA
Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks



2016
TAY
Microsoft's chatbot Tay goes rogue on social media making inflammatory and offensive racist comments

AlphaGo

2017
ALPHAGO
Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number (2^{170}) of possible positions

ETHICAL CONSIDERATIONS IN AI

ETHICAL

Regulation

Privacy

Mitigation of Bias

Transparency

Relevance

LEGAL

Governance

Confidentiality

Liability

Accuracy

Decision Making

PROGRAMMING FOR AI

- Python programming basics
- Libraries and frameworks (e.g., NumPy, Pandas, Matplotlib)
- Introduction to AI-specific libraries (e.g., TensorFlow, PyTorch, Scikit-learn)

MACHINE LEARNING BASICS

- Supervised learning (Linear Regression, Logistic Regression, Decision Trees)
- Unsupervised learning (e.g., K-Means Clustering, Hierarchical Clustering)
- Evaluation metrics (e.g., Accuracy, Precision, Recall, F1 Score)

NEURAL NETWORKS AND DEEP LEARNING

- Introduction to neural networks
- Training and backpropagation
- Convolutional Neural Networks (CNNs) for image processing
- Recurrent Neural Networks (RNNs) for sequence data

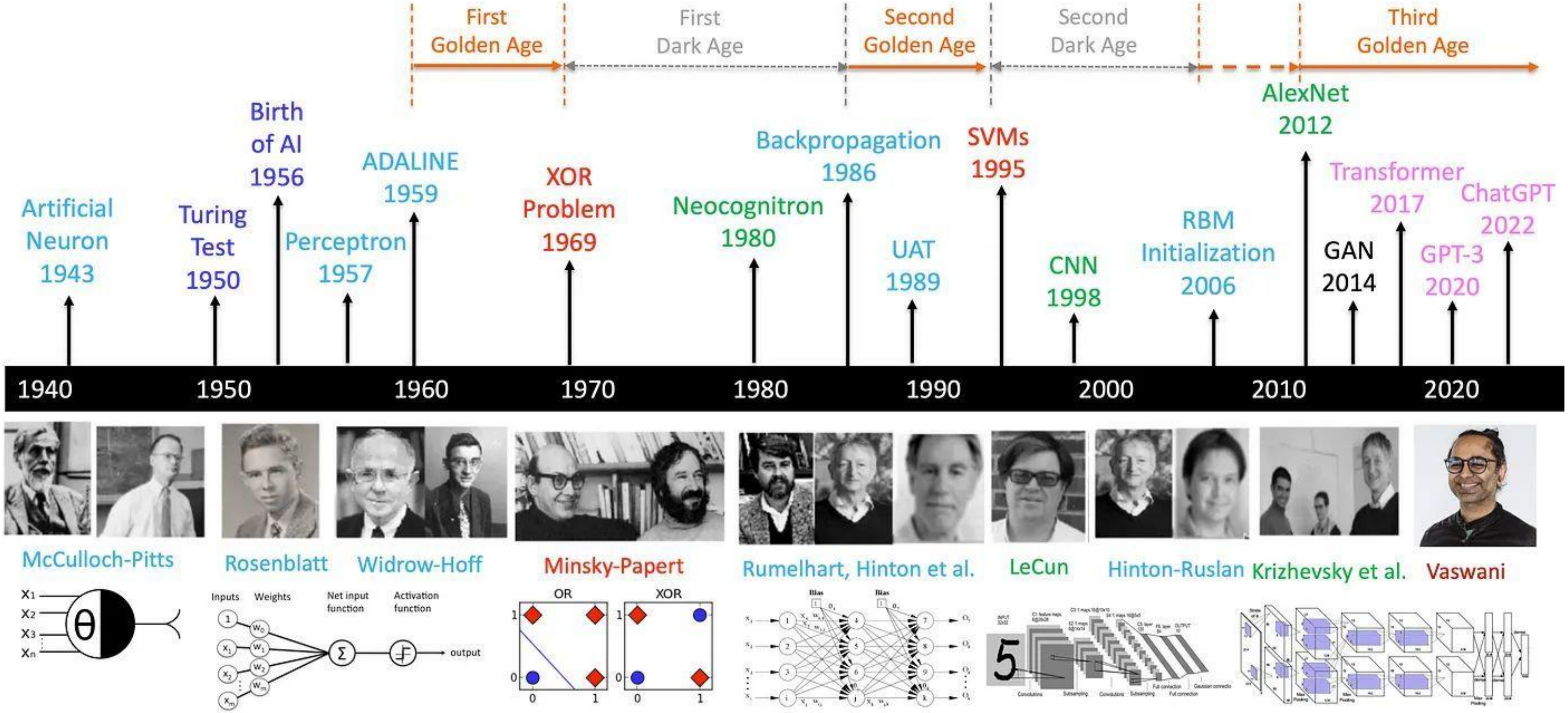
NATURAL LANGUAGE PROCESSING (NLP)

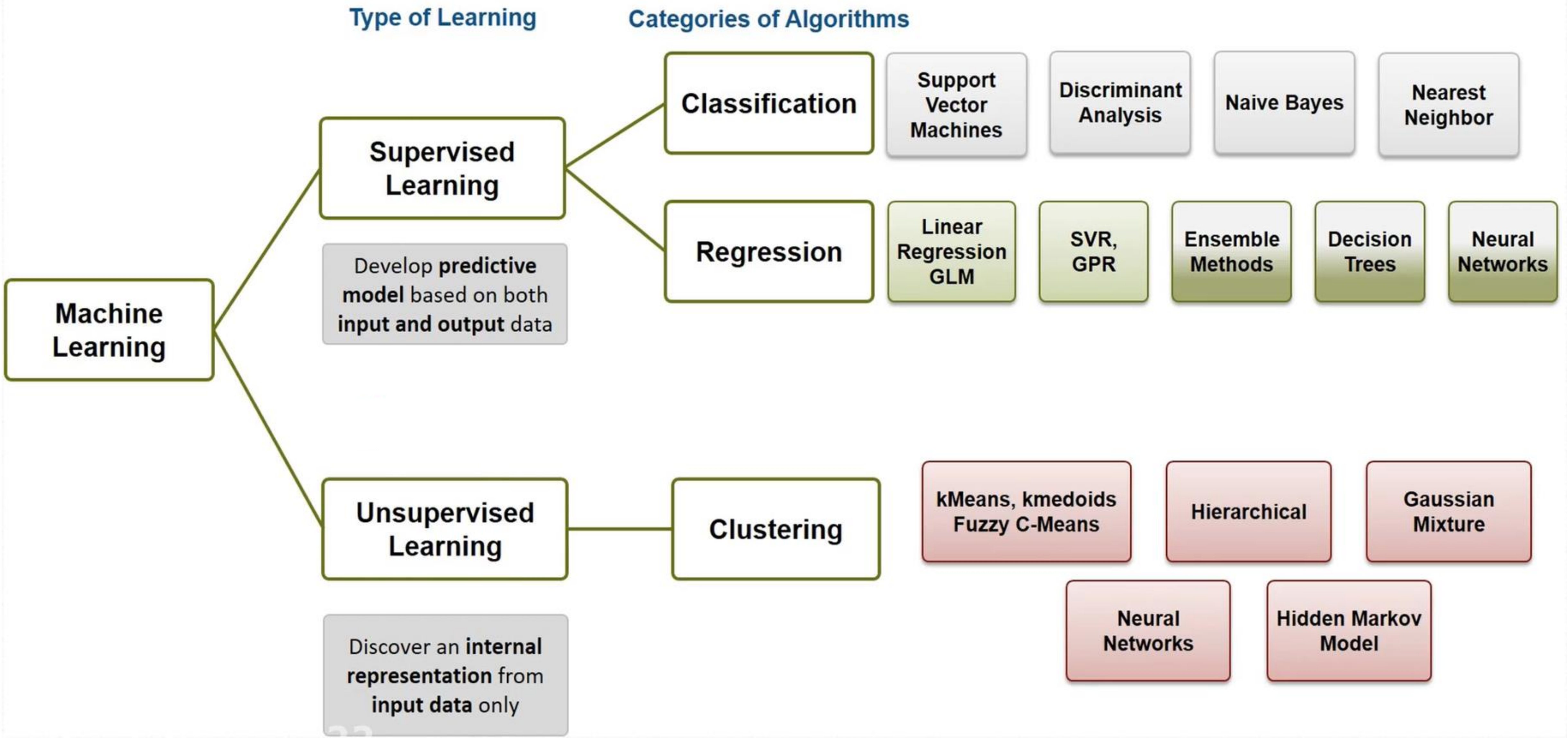
- Text preprocessing (e.g., tokenization, stemming, lemmatization)
- Sentiment analysis
- Language models (e.g., Word2Vec, BERT)

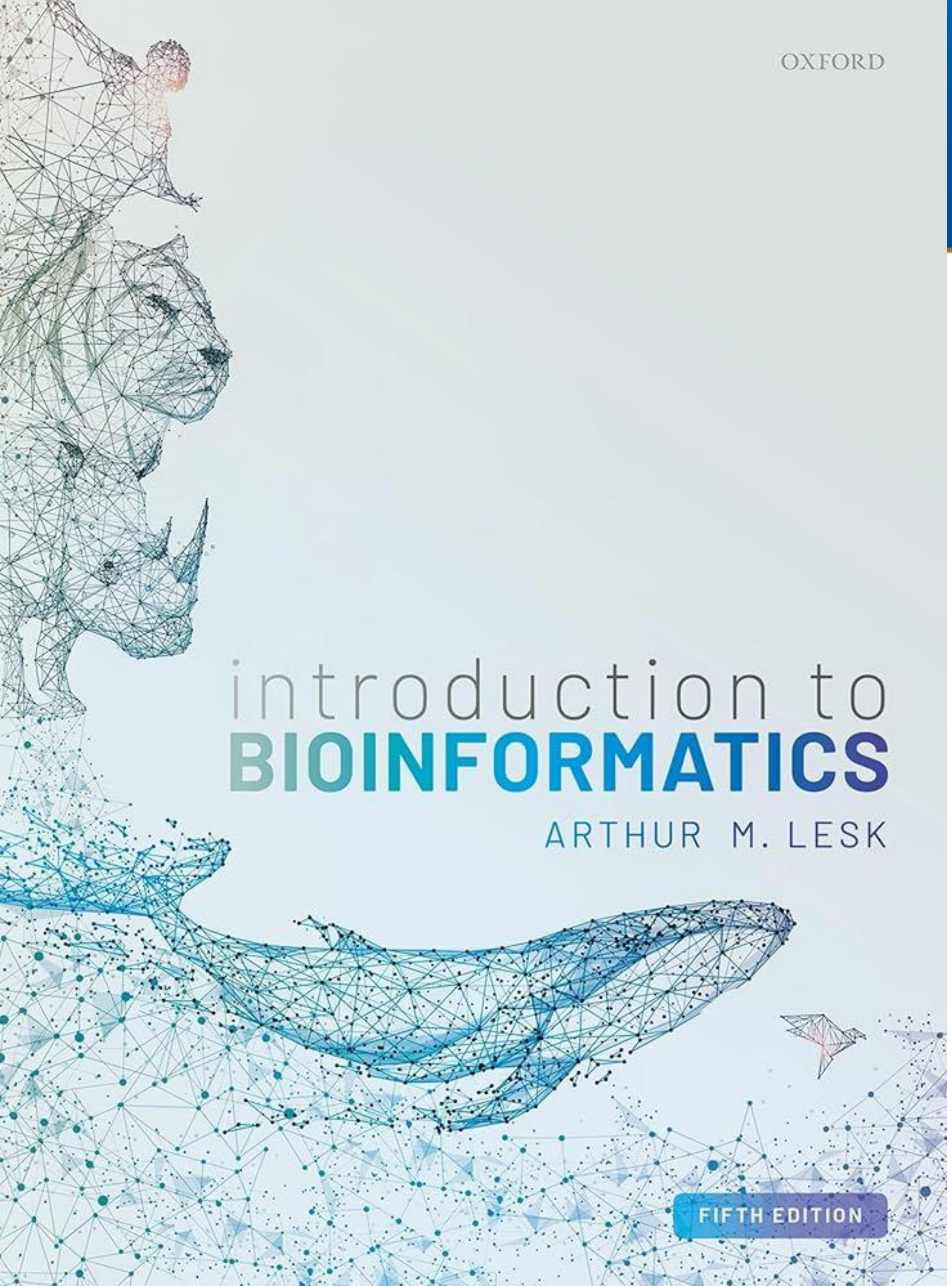
A Brief History of AI with Deep Learning
تاریخچه هوش مصنوعی

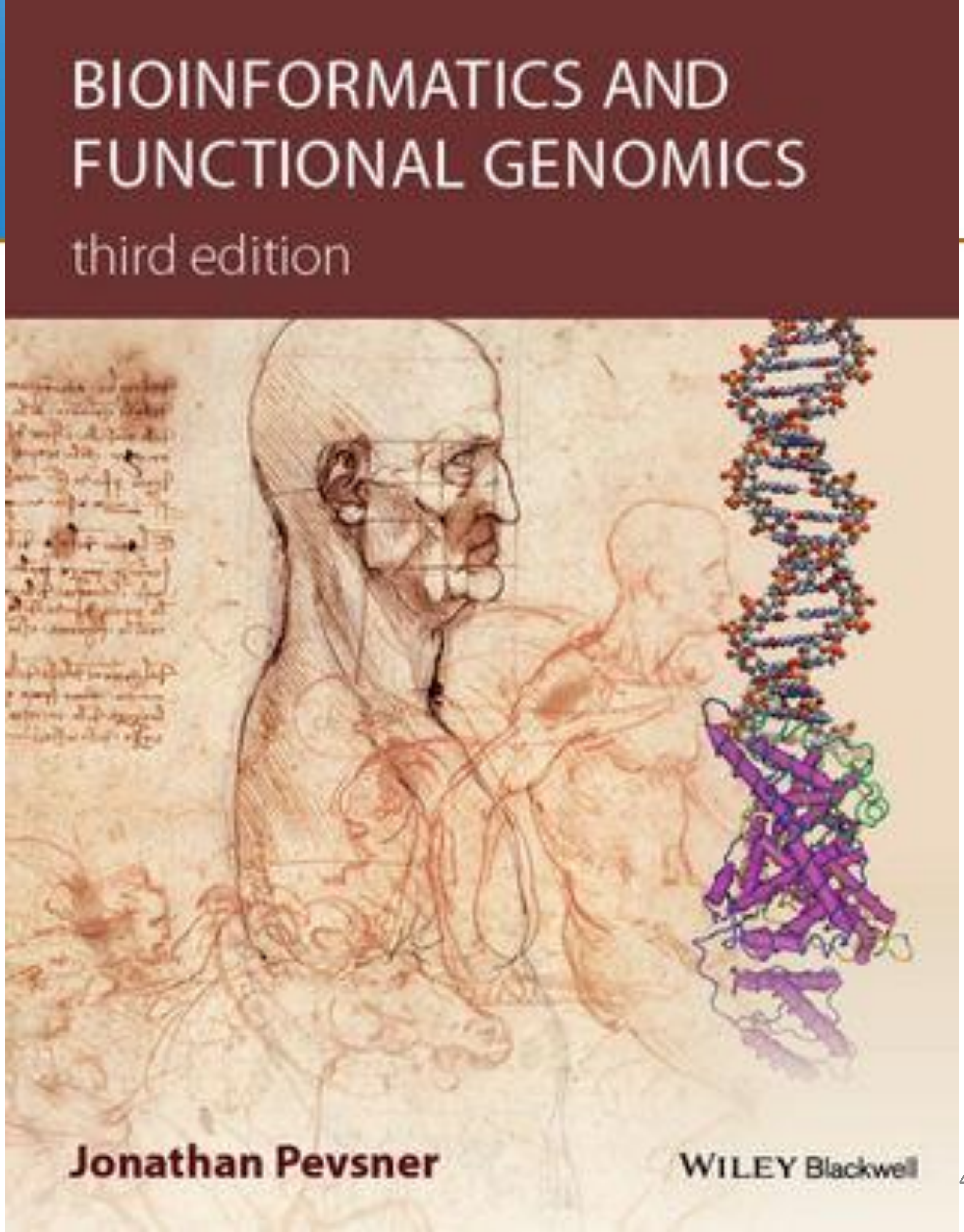
1943: **McCulloch و sttiP**	خلق اولین نورون مصنوعی
1950: **Alan Turing**	معرفی تست تورینگ
1956: **John McCarthy**	ابداع اصطلاح «هوش مصنوعی»
1957: **Frank Rosenblat**	اختراع اولین شبکه‌های عصبی اولیه
1959: **Bernard Widrow ffoH deT و**	ساختن مدل ADALINE
1969: **Minsky trepaP و**	حل مسئله XOR
1980: **Kunihiko Fukushima**	معرفی نئوکوجنیترو (پایه‌گذار یادگیری عمیق)
1986: **Geoffrey Hinton trahlemuR diVaD و**	معرفی پس‌انتشار (backpropagation)
1989: **Judea Pearl**	انجام پیشرفت‌هایی در درک و استدلال - UAT
1995: **Vladimir Vapnik setroC anniroC و**	توسعه ماشین‌های بردار پشتیبانی (SVM)
1998: **Yann LeCun**	محبوب کردن شبکه‌های عصبی کانولوشنی (CNN)
2006: **Geoffrey Hinton vonidtuhkalaS nalsuR و**	معرفی شبکه‌های باور عمیق
2012: **Alex Krizhevsky notniH yerffoeG و**	راه‌اندازی آلکس‌نت (انقلاب مدرن در یادگیری عمیق)
2014: **Ian Goodfellow**	معرفی شبکه‌های مولد متخاصم (GANs)
2017: **Ashish Vaswani**	معرفی ترنسفورمرها - دگرگون ساختن پردازش زبان طبیعی (NLP)
2020: OpenAI	رونمایی مدل GPT-3
2022: OpenAI	انتشار چت‌جی‌پی‌تی

A Brief History of AI with Deep Learning




Type of Learning
Categories of Algorithms
Machine Learning
Supervised Learning
Develop predictive model based on both input and output data
Classification
Support Vector Machines
Discriminant Analysis
Naive Bayes
Nearest Neighbor
Regression
Linear Regression GLM
SVR, GPR
Ensemble Methods
Decision Trees
Neural Networks
Unsupervised Learning
Discover an internal representation from input data only
Clustering
kMeans, kmedoids Fuzzy C-Means
Hierarchical
Gaussian Mixture
Neural Networks
Hidden Markov Model


OXFORD
introduction to
BIOINFORMATICS
ARTHUR M. LESK
FIFTH EDITION


BIOINFORMATICS AND
FUNCTIONAL GENOMICS
third edition
Jonathan Pevsner
WILEY Blackwell

- Install R

- Install Python

- Looking for Python Basics

- References :

  - Python with Jadi .

  - GitHub . Salimy

Thanks

Genomes   Genome Browser   Tools   Mirrors   Downloads   My Data   View   Help   About Us

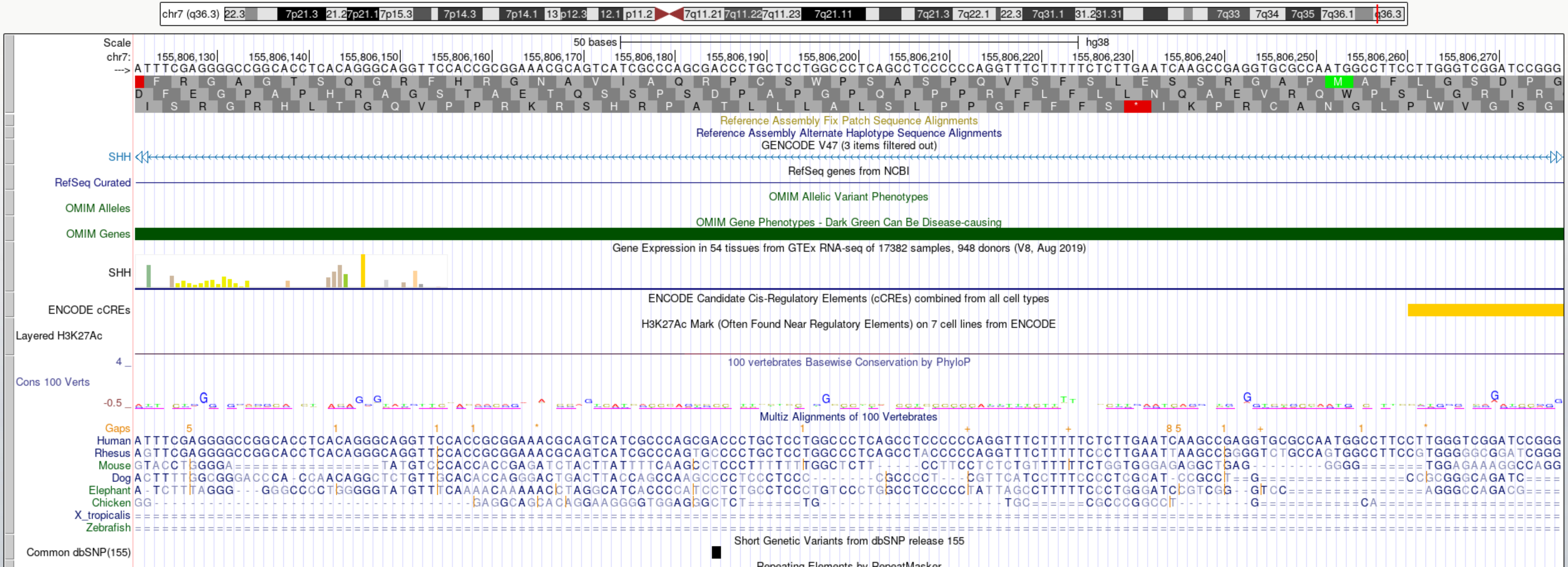
UCSC Genome Browser on Human (GRCh38/hg38)

Move <<< << < > >> >>> Zoom in 1.5x 3x 10x Base Zoom out 1.5x 3x 10x 100x

New to the Genome Browser? See our short (2-3 minute) guided tutorial. All tutorials can be found in the top blue bar menu under **Help** > **Interactive Tutorial**.

Start tutorial   Don't show again

Multi-region   chr7:155,806,122-155,806,277   156 bp.   gene, chromosome range, search terms, help pages, see exampl   Search   Examples



https://genome.ucsc.edu/cgi-bin/hgTracks?db=hg38&lastVirtModeType=default&lastVirtModeExtraState=&virtModeType=default&virtMode=0&nonVirtPosition=&position=chr7%3A155806122%2D155806277&hgsid=2456809559_v9RBBFDJJieMYTqD4f3nlbgo1Eak


نمودار اثر دانینگ کروگر
قله حماقت
دره ناامیدی
شیب روشن‌فکری
سطح پایداری
اعتماد‌به‌نفس
بالا
پایین
کم
زیاد
شایستگی - دانش - تجربه

Orders of Magnitude

Hundred	100	2 zeroes
Thousand	1,000	3 zeroes
Million	1,000,000	6 zeroes
Billion	1,000,000,000	9 zeroes
Trillion	1,000,000,000,000	12 zeroes
Quadrillion	1,000,000,000,000,000	15 zeroes

One trillion seconds of ordinary clock time =(10^{12} sec)/(3.16 x 10^{7} sec/yr) = 31,546 years !

6 trillion seconds of ordinary clock time =(6* 10^{12} sec)/(3.16 x 10^{7} sec/yr) = 189,276 years !

Homo sapiens?

approximately 200,000 years ago in East Africa