Chula
Chulalongkorn University

Precision Medicine

: The Future is Catching Us

Asst. Prof. Amornpun Sereemaspun, MD., PhD.
Head, Division of Medical Genetics, Department of Anatomy,
Director, Center of Excellence in NanoMedicine,
Faculty of Medicine, Chulalongkorn University
Email: amornpun.s@chula.ac.th

‘ปตท.’ ลุยนวัตกรรม ‘มณีแดง’ ต้านชราระดับเซลล์ ทดสอบในคนปีนี้ (2566)

July 12, 2022

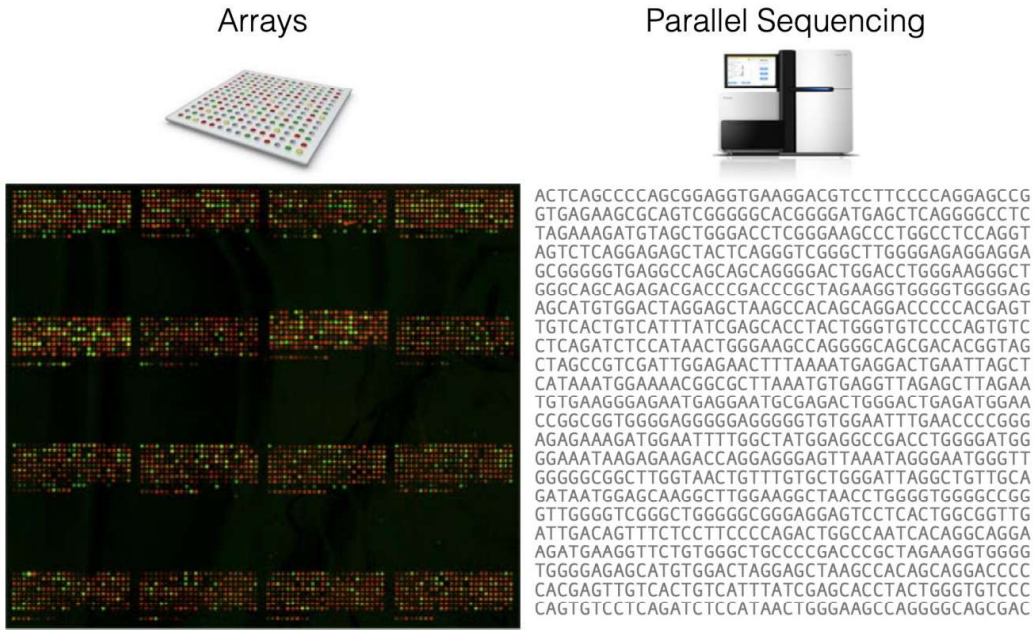
February 14, 2023

https://www.bangkokpost.com/business/2346563/ptt-to-commercialise-rejuvenating-dna

DNA Science: Y2K Twenty Years On

In the past

At present

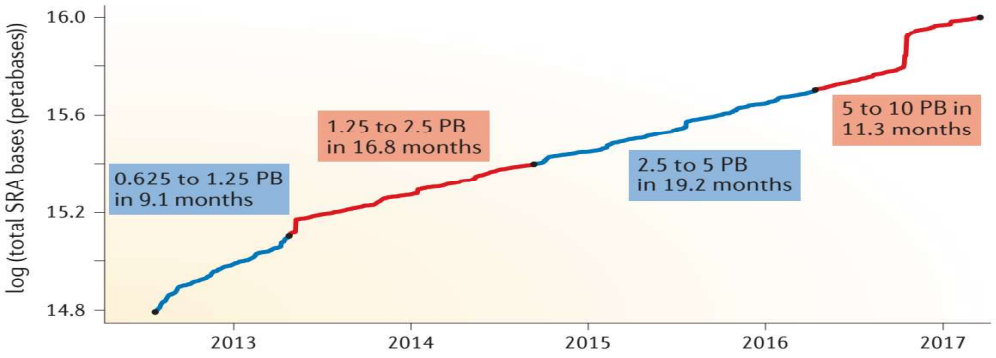


MinION: A Complete DNA Sequencer on a USB

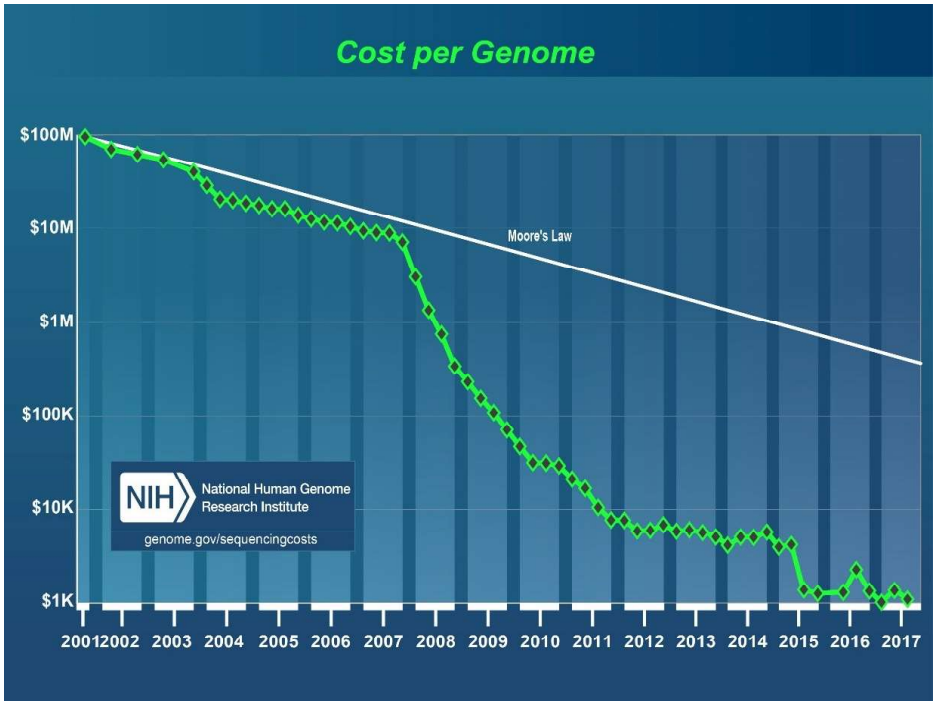
https://www.genengnews.com/insights/first-nanopore-sequencing-of-human-genome/

DNA Sequencing: Big Data in Life Sciences and Genomics

Factor1 - Increase databases



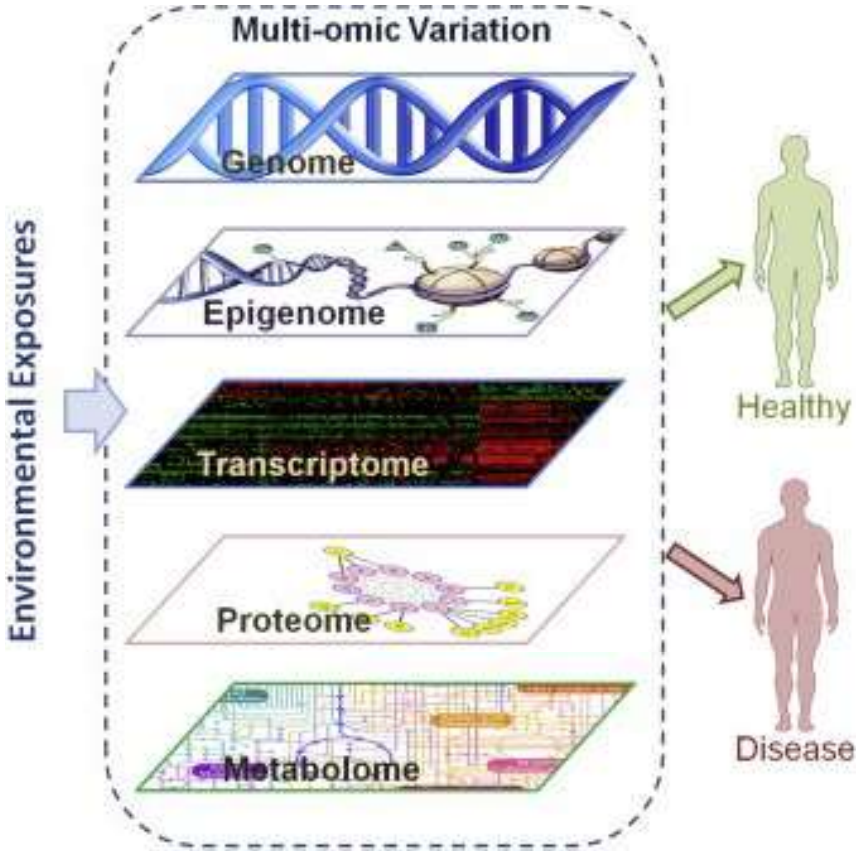
Factor 2 - Decrease unit cost

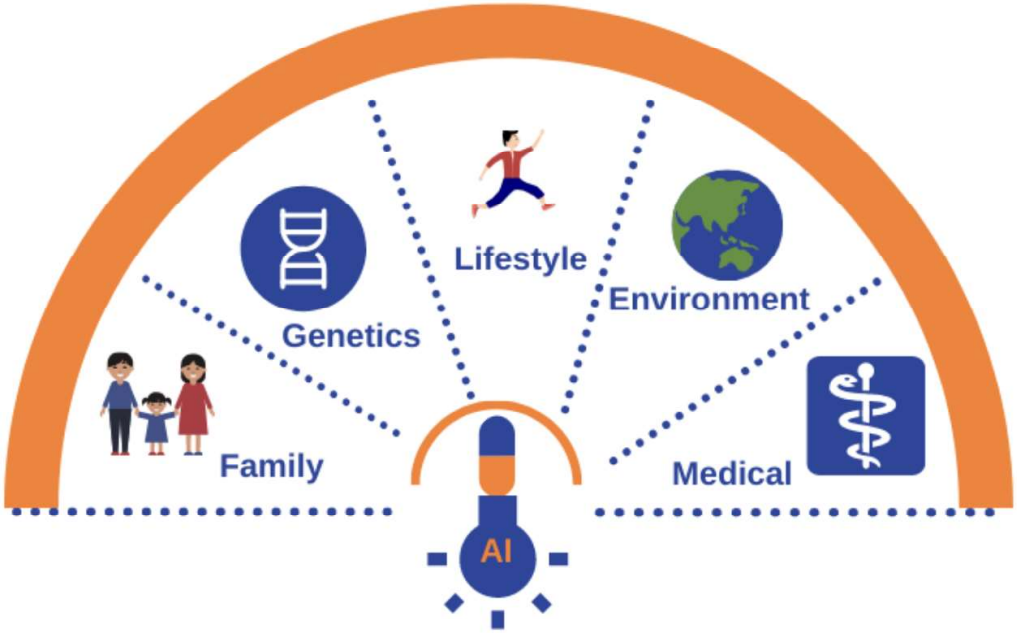


E.R. Mardis, Nature (2011), B. Langmead &A. Nellore, Nature Reviews Genetics (2018)

https://www.genome.gov/27565109/the-cost-of-sequencing-a-human-genome/

Precision Medicine : New Normal Era of MEDICINE





https://blog.crownbio.com/pdx-personalized-medicine

Is there a way to bridge the gap between healthspan and lifespan?

3 Best Examples of Current Precision Medicine

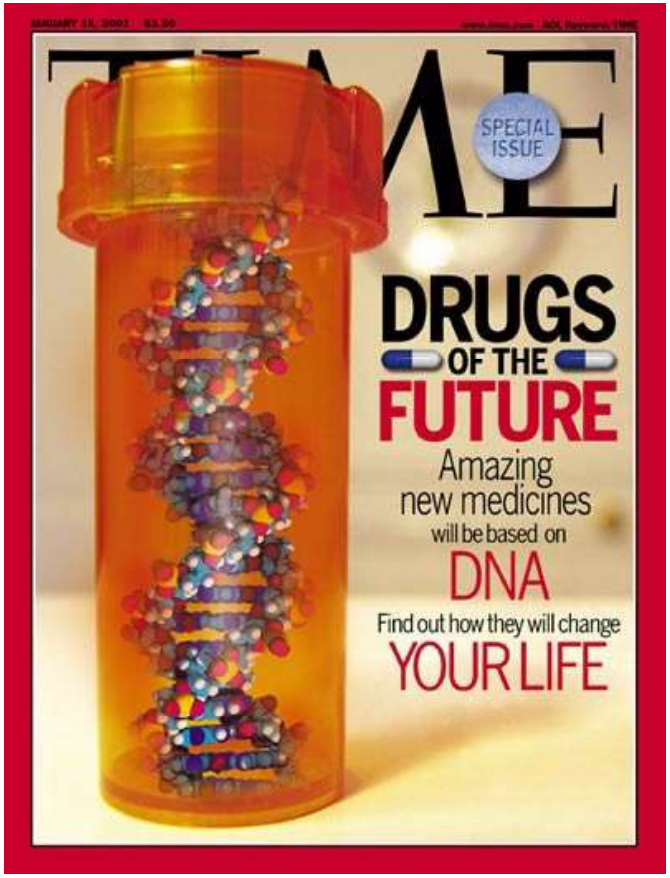
- **Genomic Sequencing Services**
- **DNA Editing**
- **Longevity Medicine and Epigenetics**

Healthcare Innovative Platform

- Smart Drugs
- Smart Diagnostics
- Smart Medical Devices
- Smart Medical Services

- ***Smart Drugs***
- Smart Diagnostics
- Smart Medical Gadget
- Smart Medical Service

Biologics & Personalized Medicine



January 2001

May 2006

- ***Smart Drugs***
- Smart Diagnostics
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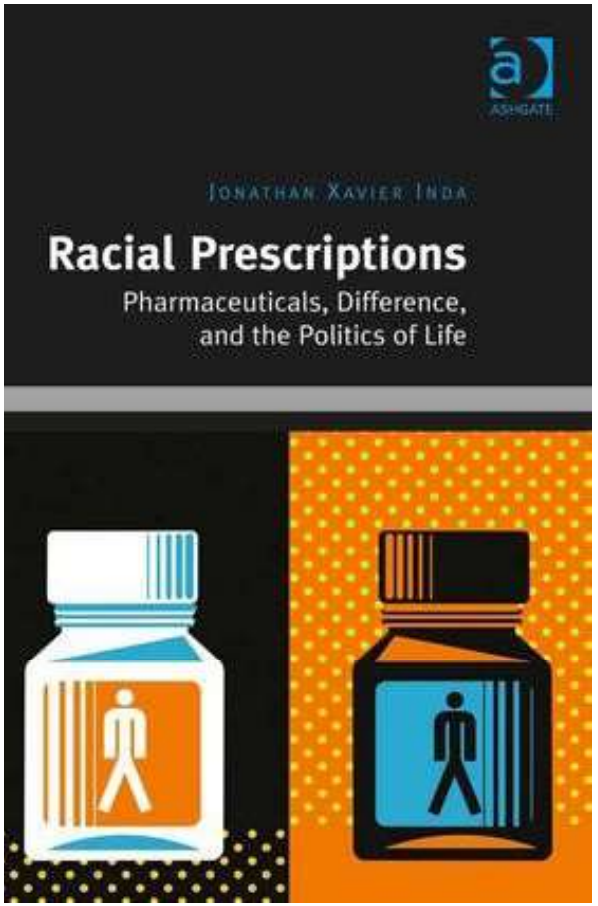
Personalized Medicine



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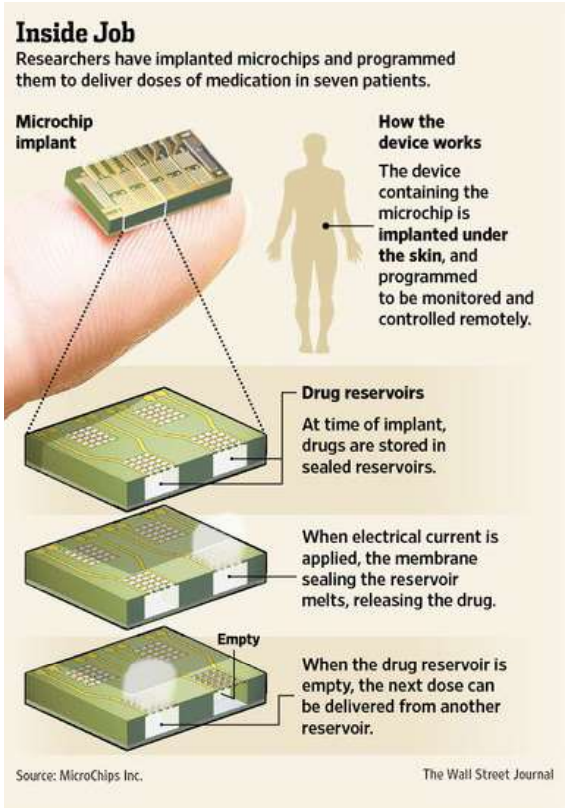
Implanted Drug Delivery System: Microchip Drug

Science Translational Medicine AAAS

First-in-Human Testing of a Wirelessly Controlled Drug Delivery Microchip
Robert Farra *et al.*
Sci Transl Med , (2012);
DOI: 10.1126/scitranslmed.3003276

Researchers from Microchips Inc. say they successfully loaded a microchip with a drug for osteoporosis, implanted it in seven patients and programmed it wirelessly to release doses of the medication.



- Smart Drugs
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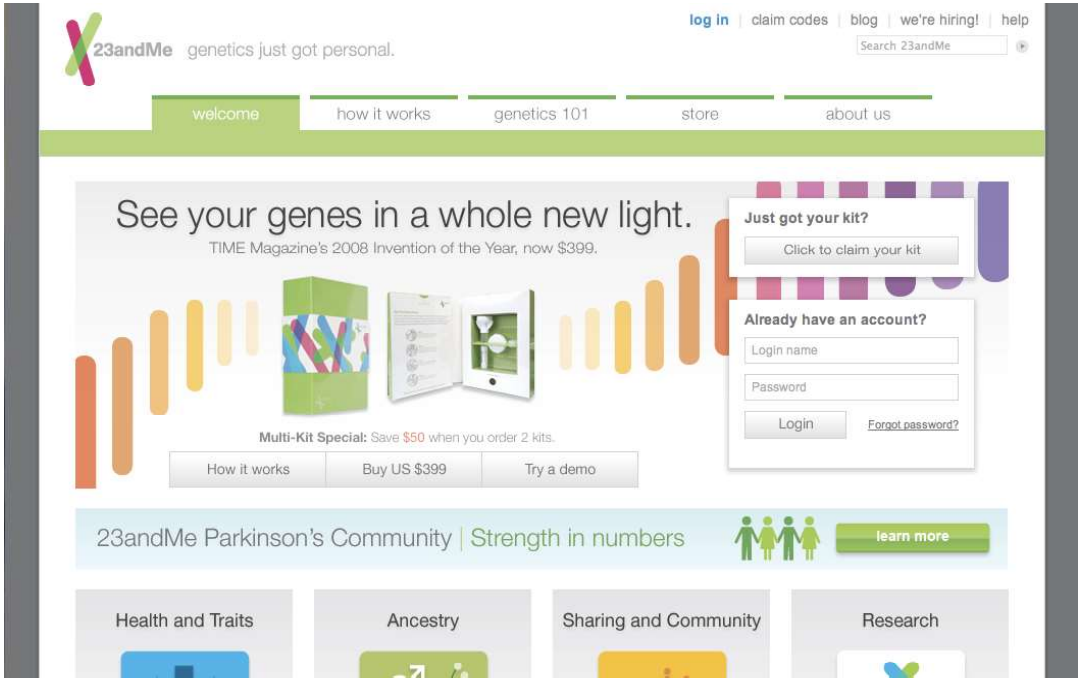
Direct-To-Customer (DTC) Lab Testing

Google Thailand

23andMe



- Smart Drugs
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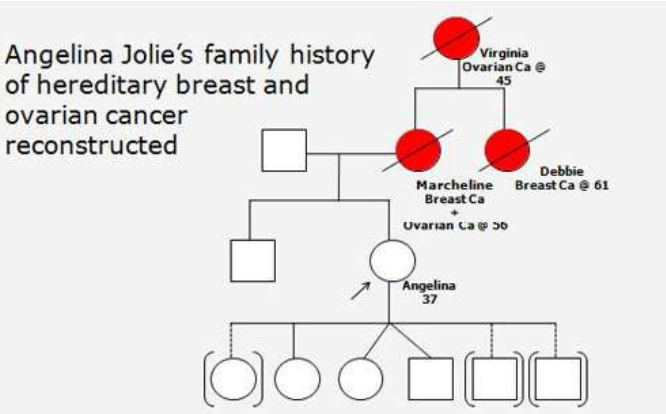
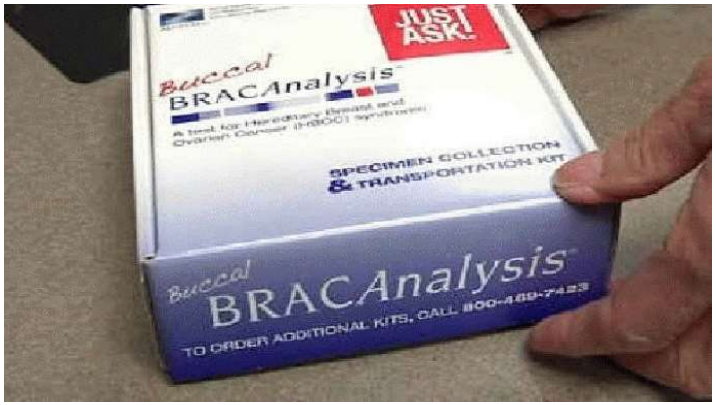
Angelina Effect:
Point-Of-Care Testing (POCT) Lab





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Artificial Intelligence (AI) in medicine

https://www.healthcare.digital/single-post/2018/04/20/

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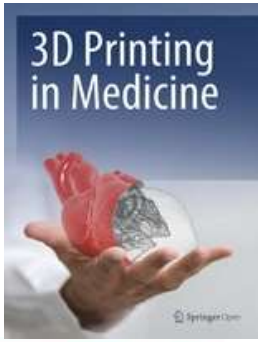
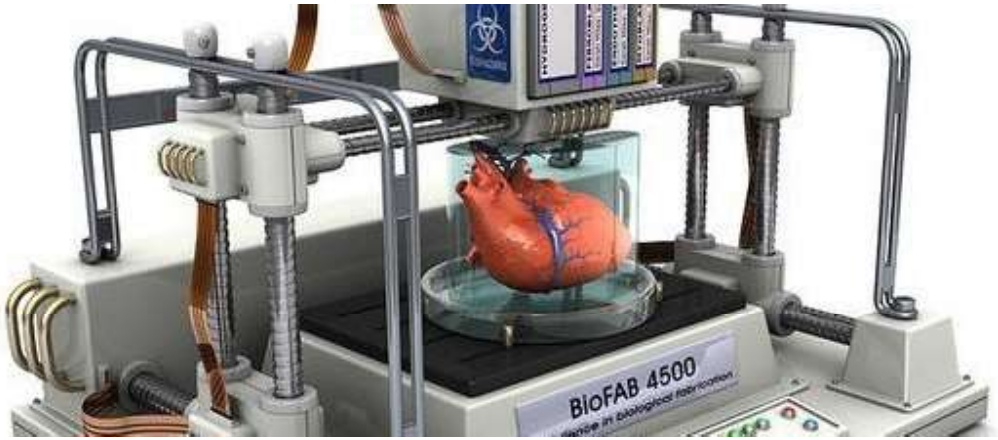
3D Bioprinter in medicine





Source: https://3dprintingindustry.com

- Smart Drugs
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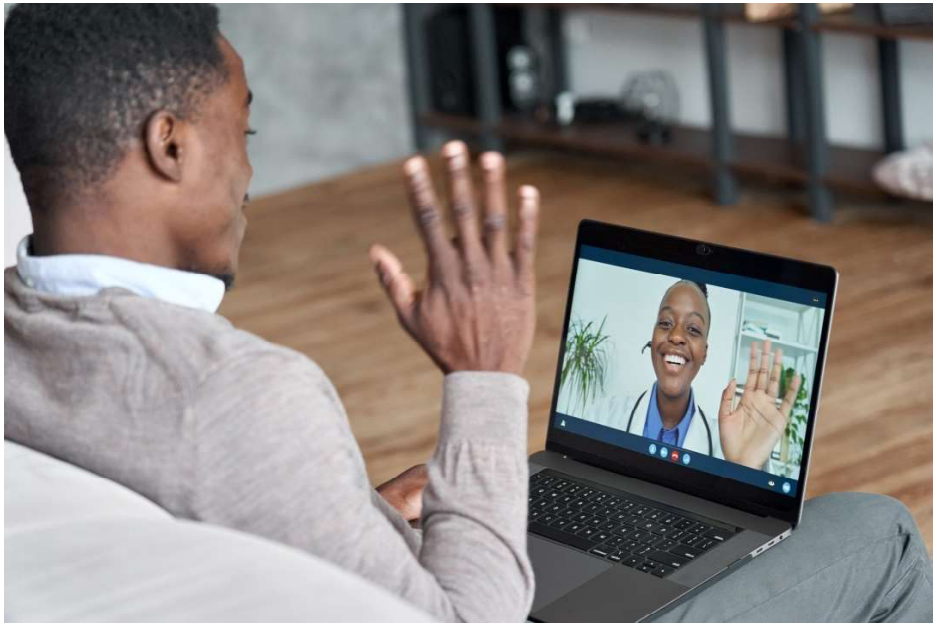
Telemedicine & Vending machine



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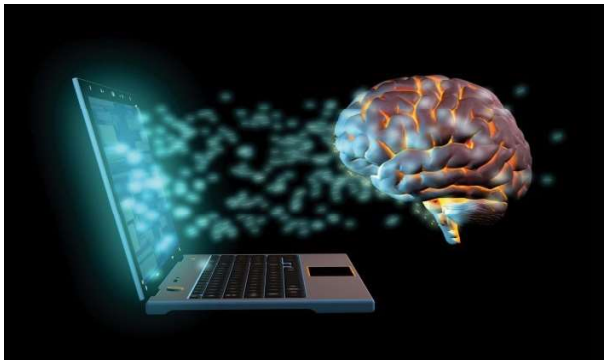
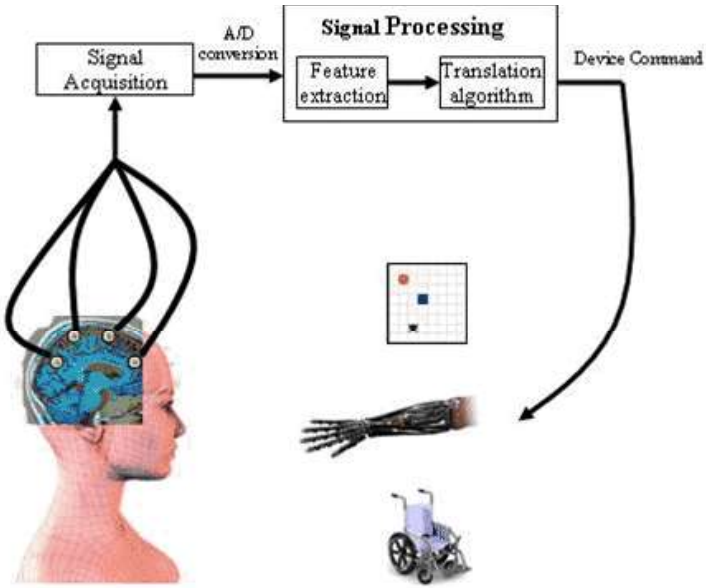
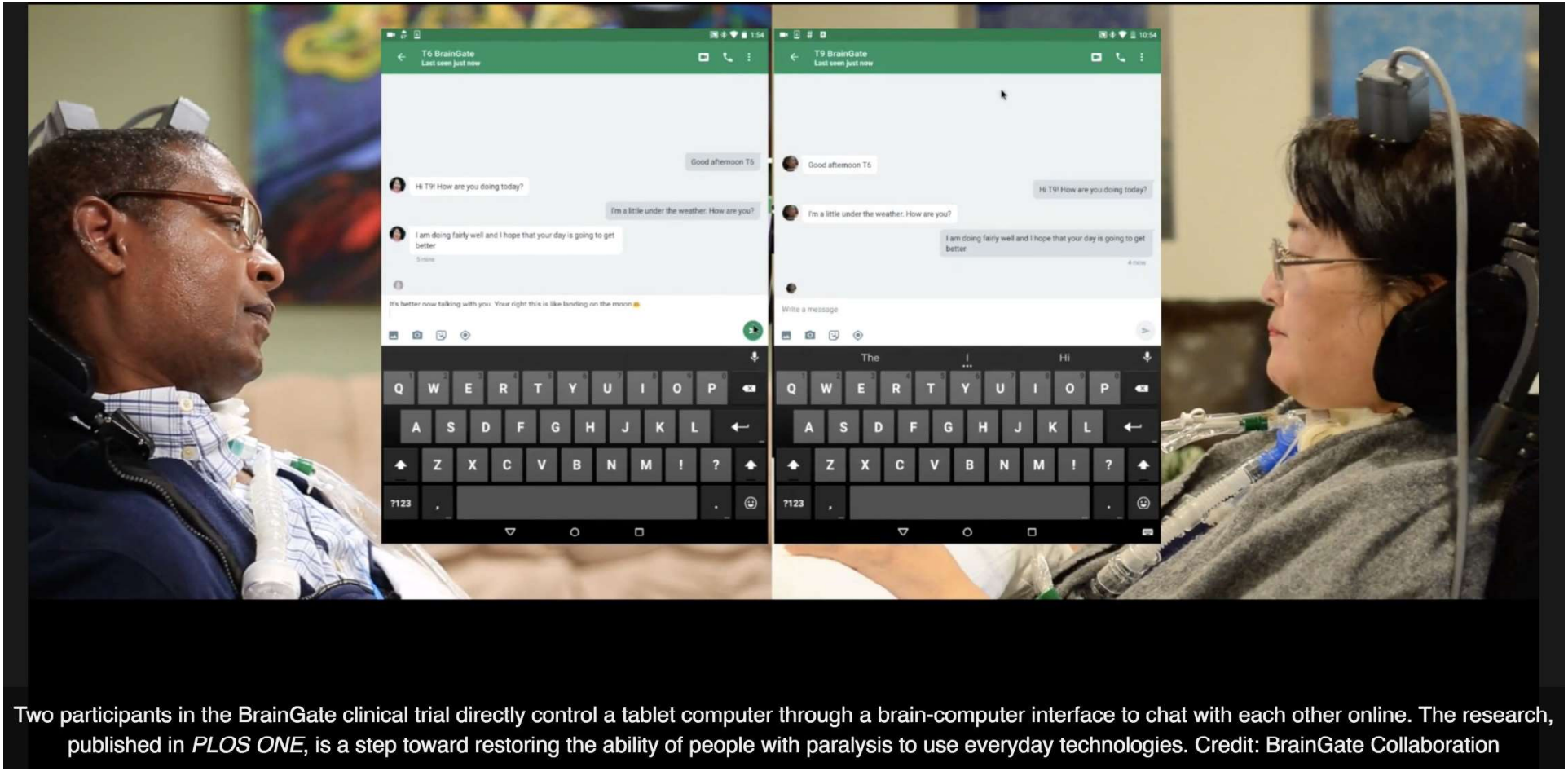
Brain-Computer Interface





Brain-Computer Interface



Two participants in the BrainGate clinical trial directly control a tablet computer through a brain-computer interface to chat with each other online. The research, published in *PLOS ONE*, is a step toward restoring the ability of people with paralysis to use everyday technologies. Credit: BrainGate Collaboration

https://techxplore.com/news/2018-11-brain-computer-interface-enables-people-paralysis.html

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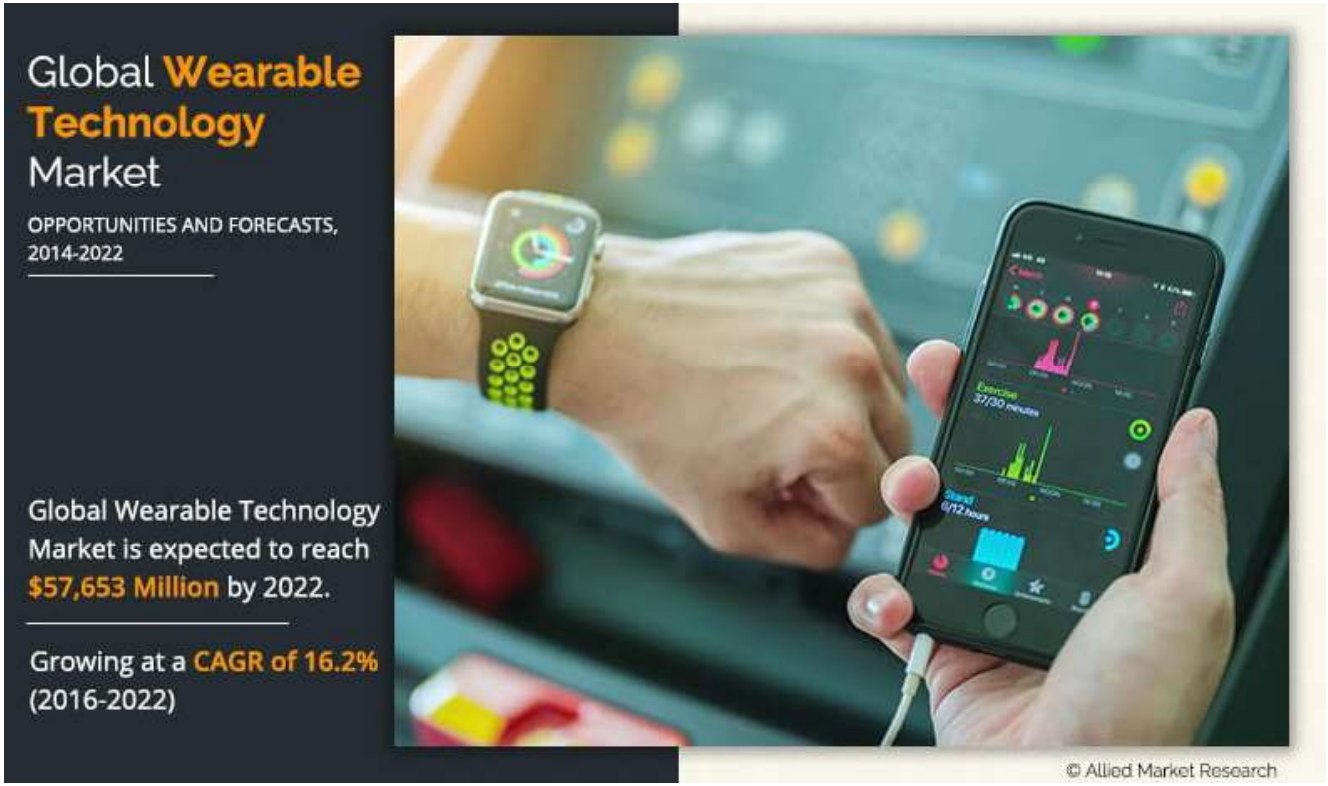
Wearable devices : Internet of Medical Thing (IoMT)



IoMT

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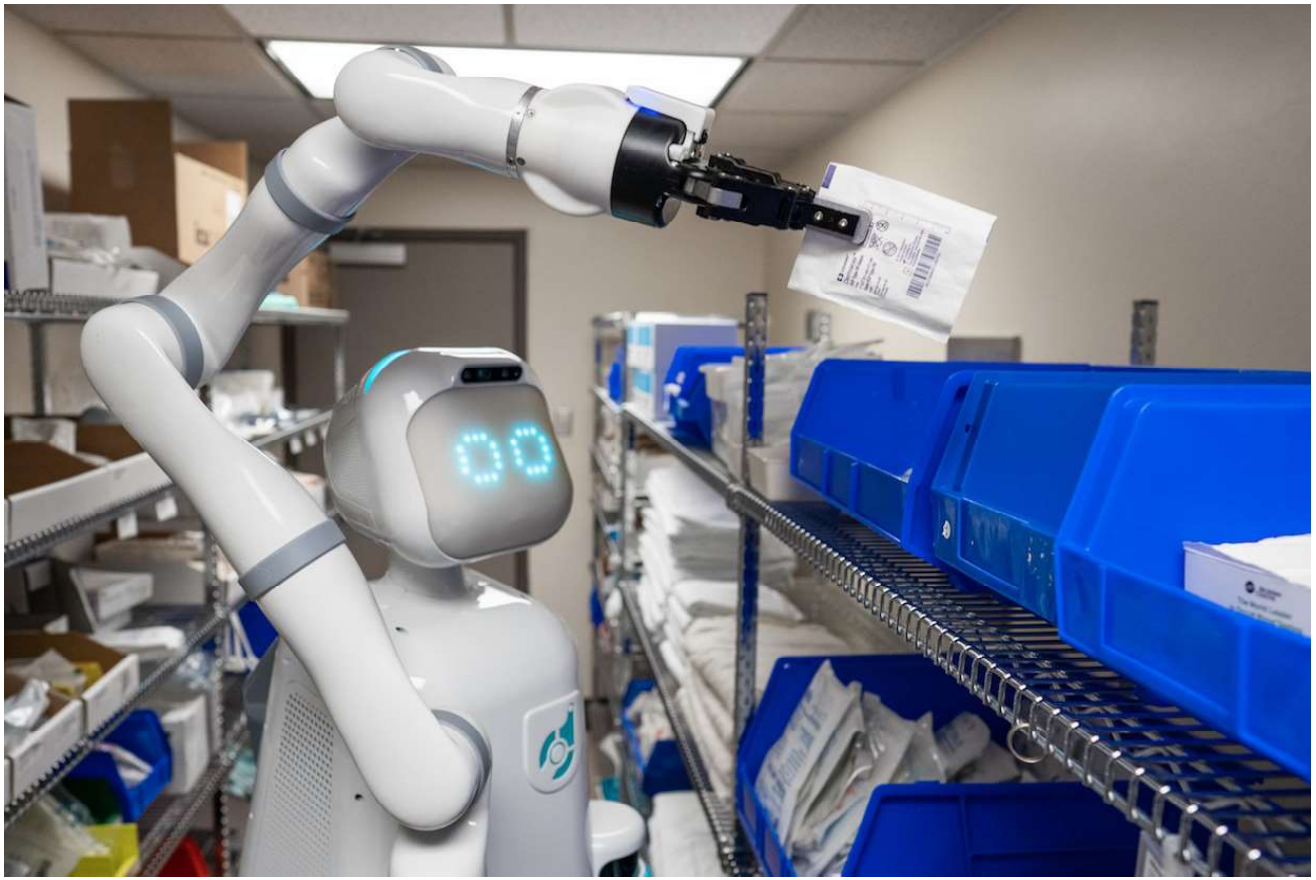
Diligent Robotics



FROM: https://spectrum.ieee.org/automaton/robotics/medical-robots/how-diligents-robots-are-making-a-difference-in-texas-hospitals

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Diligent Robotics in Texas Hospitals

ABB's YuMi the Next Generation of Collaborative Robot

Moxi, in hospitals in Texas

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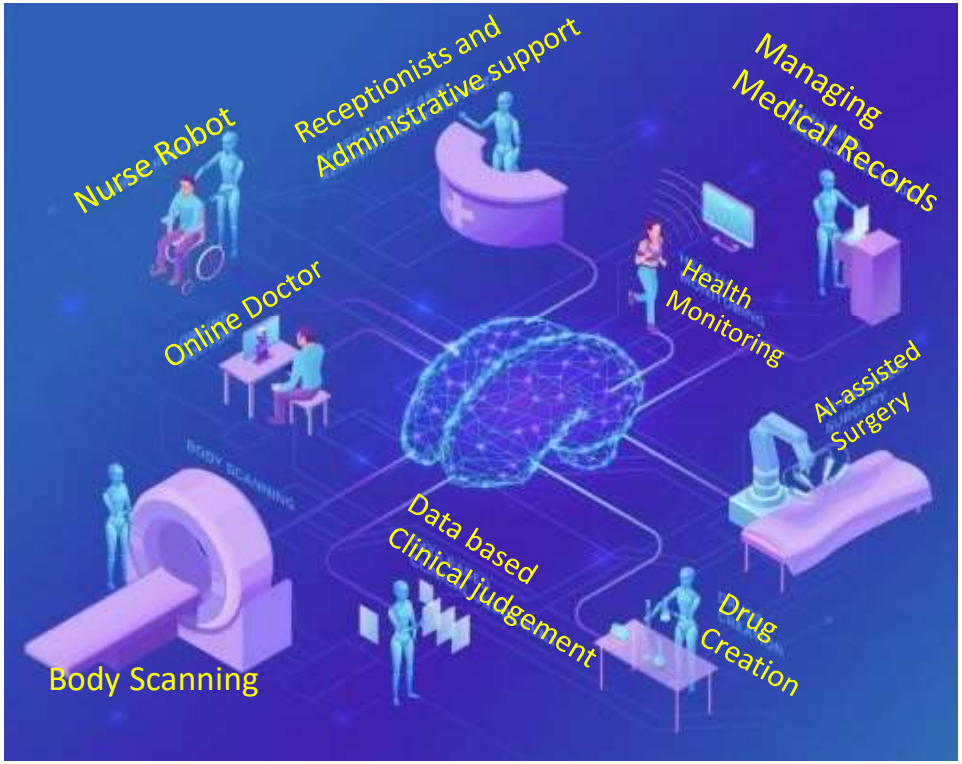
Artificial Intelligence (AI) in medicine

9 Applications of AI in medicine:

- Online doctor
- AI-based surgical assistance
- Nurse robotics
- Body Scanning
- Receptionist & Admin support
- Health monitoring
- Medical record manager
- Drug manager and creator
- Clinical judgement tool



SOURCE: https://medicalfuturist.com/top-ai-algorithms-healthcare/

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Augmented Reality (AR) in Medical Education

- Smart Drugs
- Smart Diagnostics
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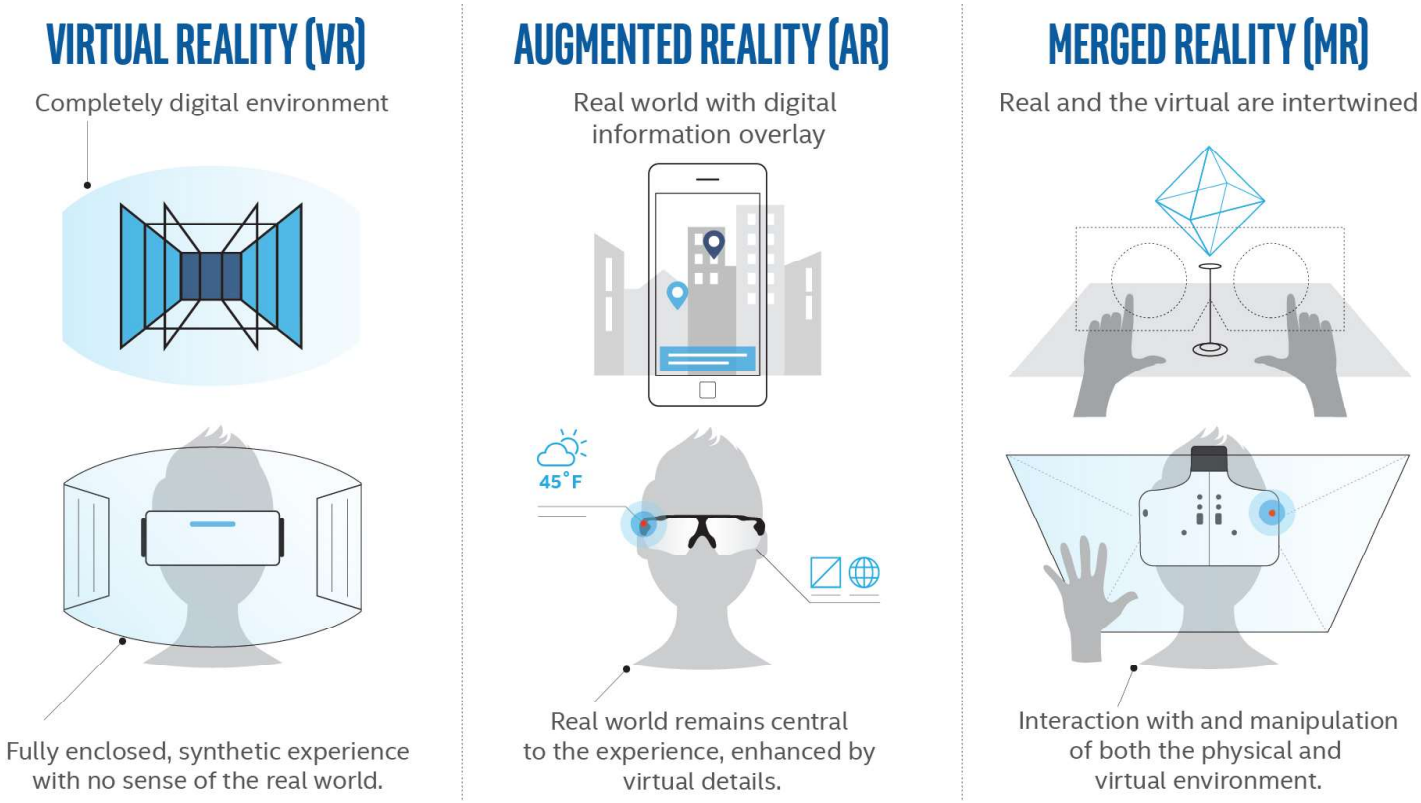
- ***Smart Medical Service***

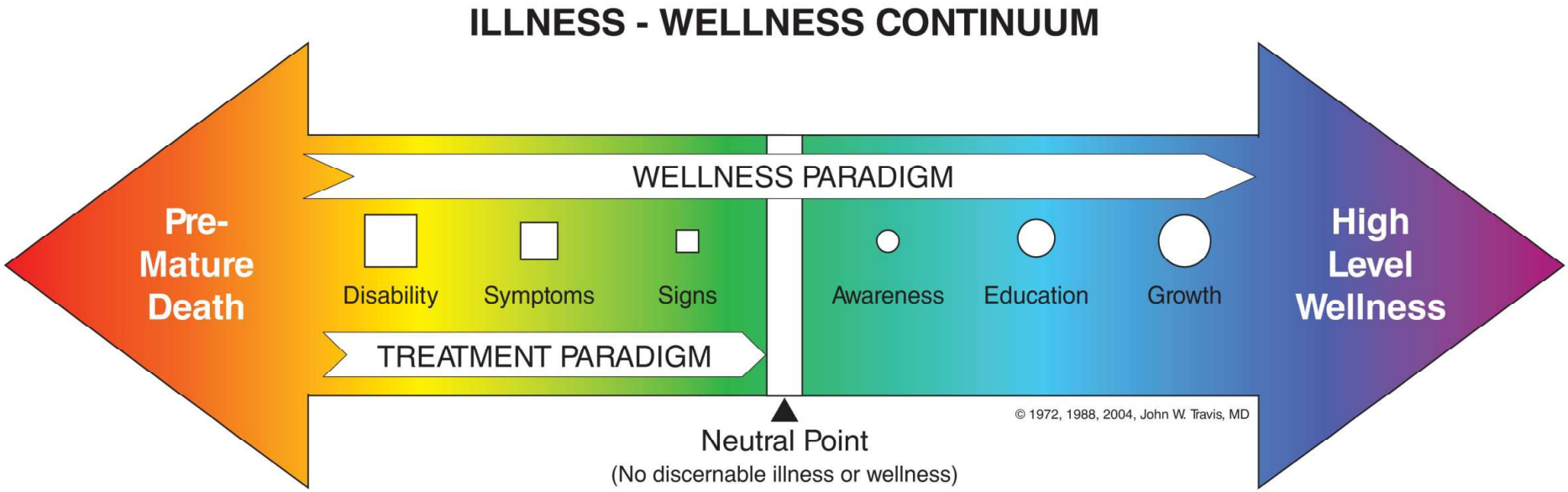
Virtual Reality/Augmented Reality/Merged Reality



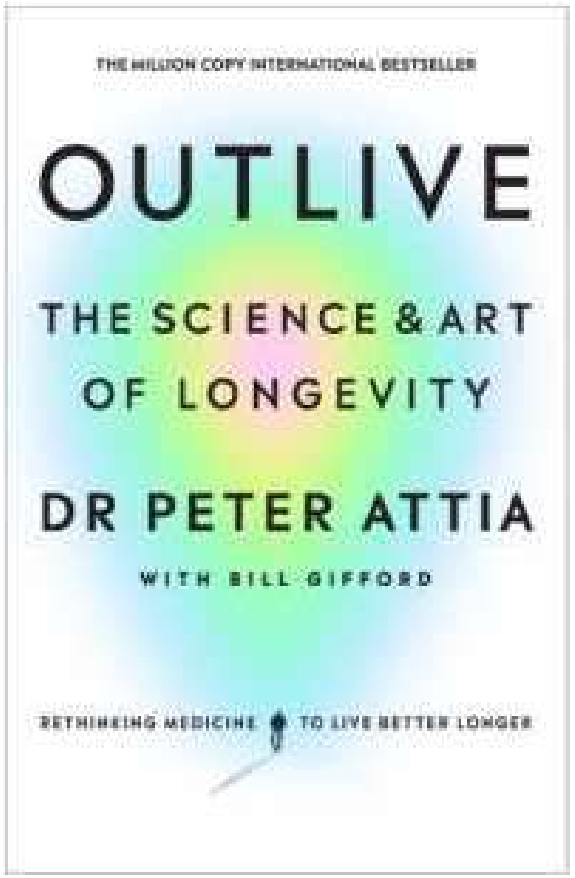
Source: https://img.online-station.net/_content/2018/1004/gallery/1538651339.jpg


Medicine in the 20th Century
rition
Hearing Loss
Diabetes
Arthritis
Alzheimer
Parkinson
Cancer
Heart Disease
and Stroke

Medicine in the 21st Century



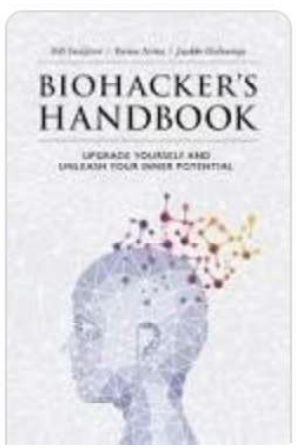
Outlive: The Science & Art of Longevity

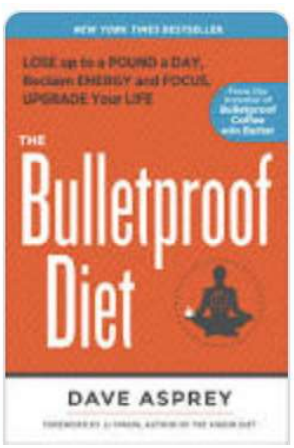


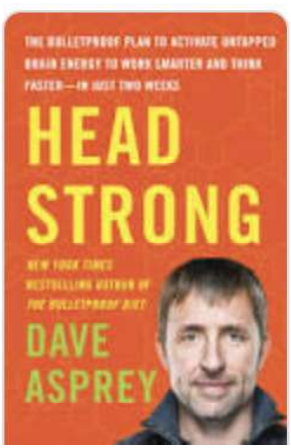
https://www.youtube.com/watch?v=qeoE0Iau4BE

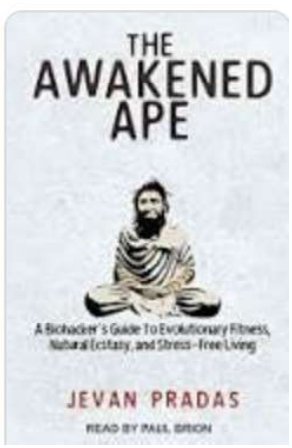

BIOHACKING

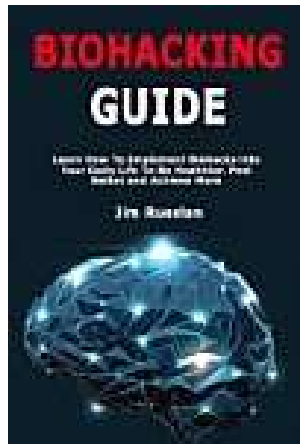
Reverse Aging : Biohacking Your Life

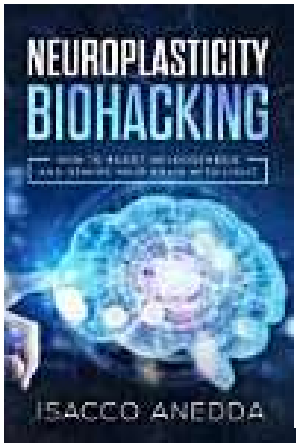


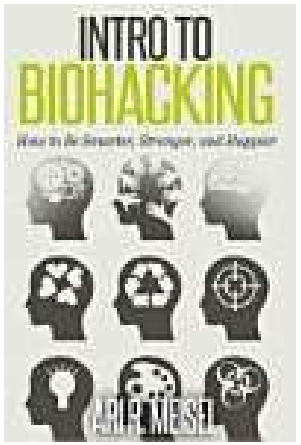


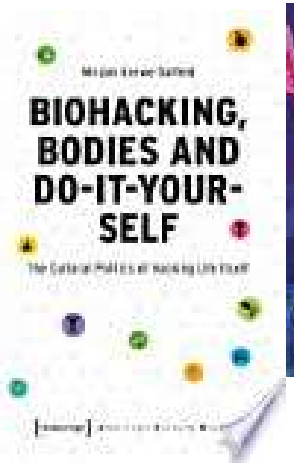


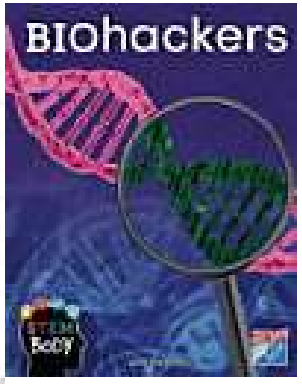


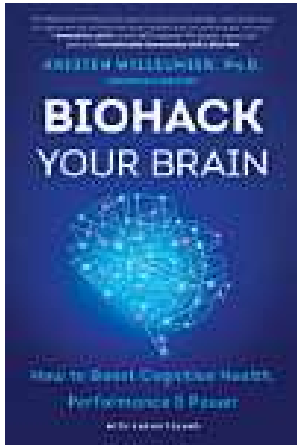












Cell 2013

เหตุแห่งความชรา 9 ประการ

Leading Edge Review

เหตุแห่งความชราระดับ เซลล์ 9 ประการ
9 hallmarks of aging:

- 1. การสูญเสียเสถียรภาพของจีโนม
- 2. การสึกกร่อนหรือการหดสั้นลงของเทโลเมียร์
- 3. การเปลี่ยนแปลงของภาวะเหนือพันธุกรรม (epigenetic)
- 4. การขาดภาวะสมดุลของโปรตีน
- 5. การลดลงหรือความผิดปกติจากเดิมของ nutrient-sensing
- 6. การเสื่อมสภาพการทำงานของไมโทคอนเดรีย
- 7. การเกิดเซลล์ชราภาพ (cellular senescence)
- 8. การเกิดการลดการทำงานของสเต็มเซลล์
- 9. การเกิดการเปลี่ยนแปลงของการติดต่อสื่อสารระหว่างเซลล์

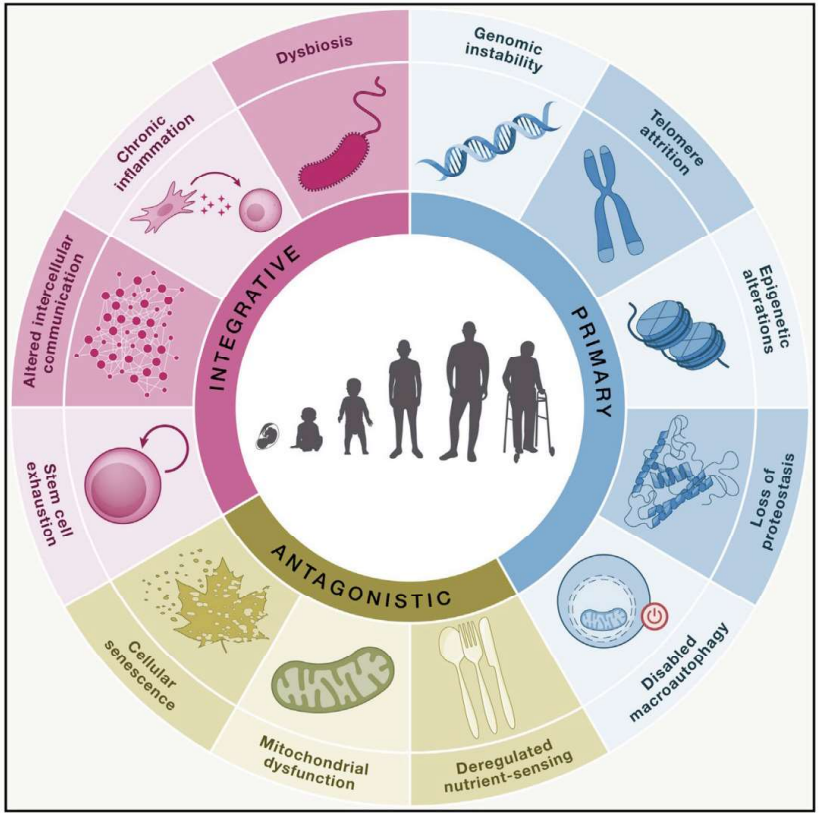
Cell, Volume 153, Issue 6, 1194-1217, 6 June 2013

Cell 2023

เหตุแห่งความชรา 12 ประการ (9 + 3)

- Genomic instability
- Telomere attrition
- Epigenetic alterations
- Loss of proteostasis
- Disabled macroautophagy
- Deregulated nutrient-sensing
- Mitochondrial dysfunction
- Cellular senescence
- Stem cell exhaustion
- **Altered intercellular communication**
- **Chronic inflammation**
- **Dysbiosis**

Molecular and Biological Hallmarks of Ageing



Cell: Volume 186, Issue 2, 19 January 2023, Pages 243-278

Development of CRISPR/Cas9 method for genome editing receives Nobel Prize in Chemistry 2020

Using the genetic scissors, researchers can edit the genome of practically all living things

© Nobel Prize Outreach. Photo: Bernhard Ludewig

Emmanuelle Charpentier

Prize share: 1/2

© Nobel Prize Outreach. Photo: Brittany Hosea-Small

Jennifer A. Doudna

Prize share: 1/2

https://www.nobelprize.org/prizes/chemistry/2020/popular-information/

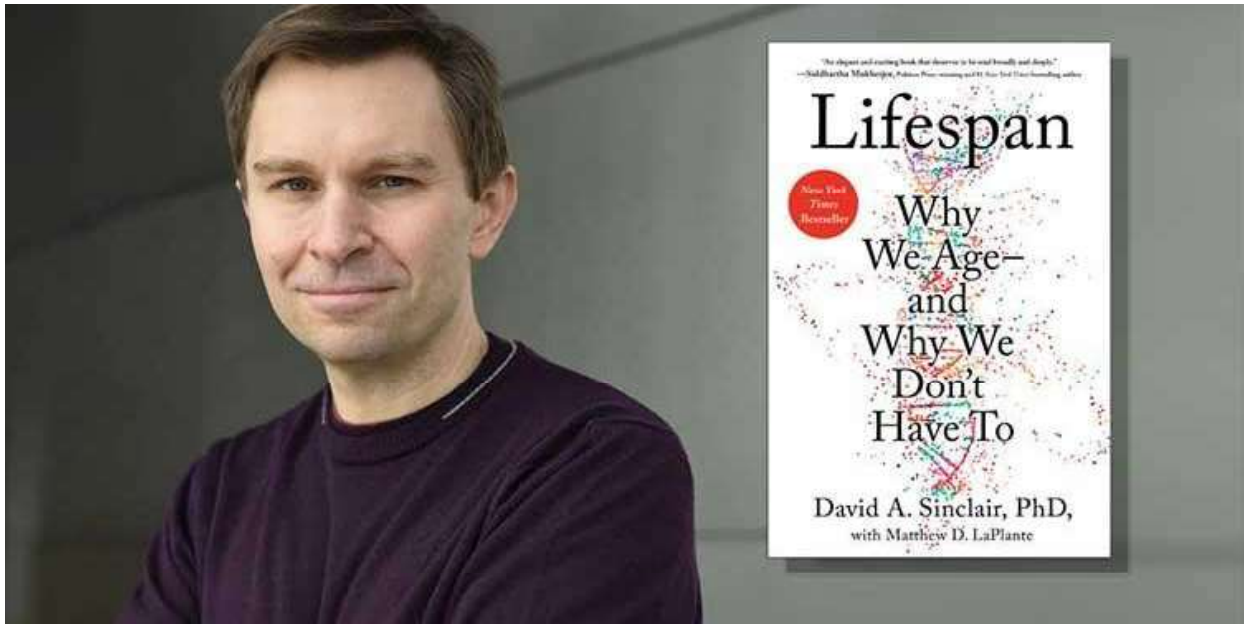
Cell

“Loss of epigenetic information as a cause of mammalian aging”

Yang et al., 2023, Cell 186, 305–326

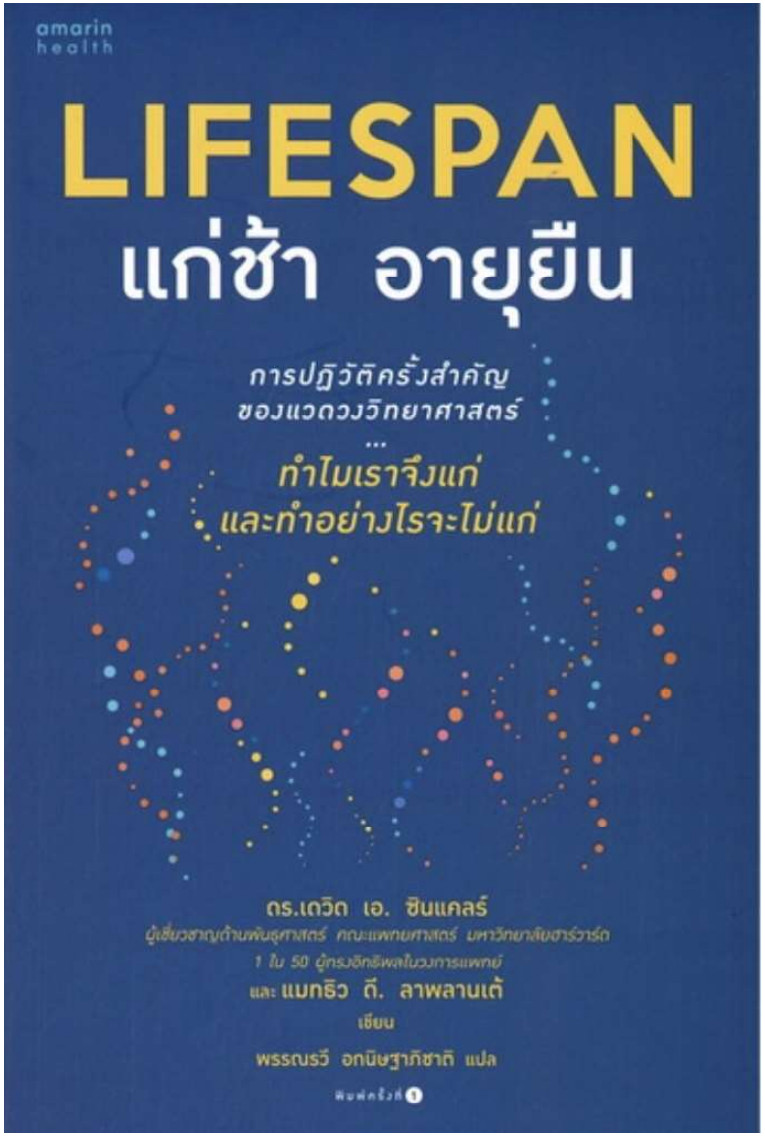
https://sohealthy.com/scientific-research-on-nmn-and-nad-supplements-reveals-anti-ageing/

ศาสตราจารย์ ดร. เดวิด ซินแคลร์

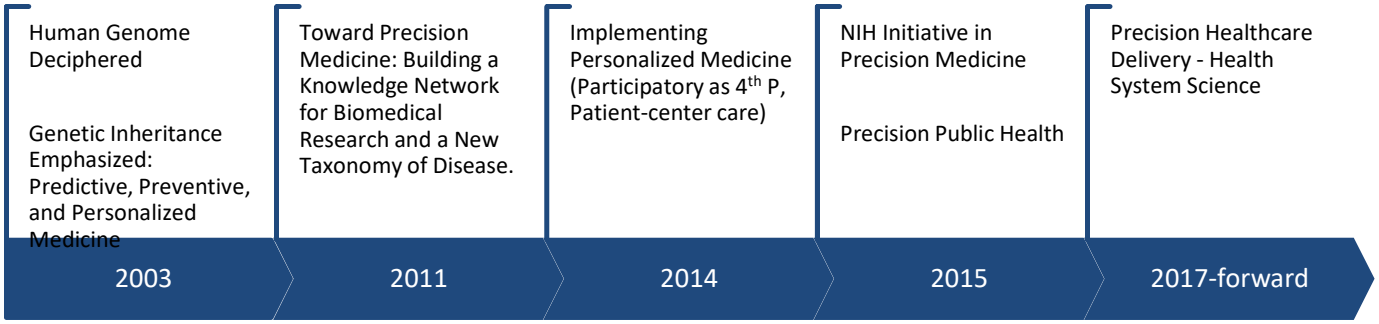


Prof. David A. Sinclair, Ph.D.

- A professor of genetics at Harvard Medical School
- A leading innovator of his generation
- Named by *Time* as "one of the 100 most influential people in the world"



Healthy Longevity: Summary



An easy way to embrace healthspan is to remember the 5 Fs:

Family

Fitness

Food

Fun

Finances