

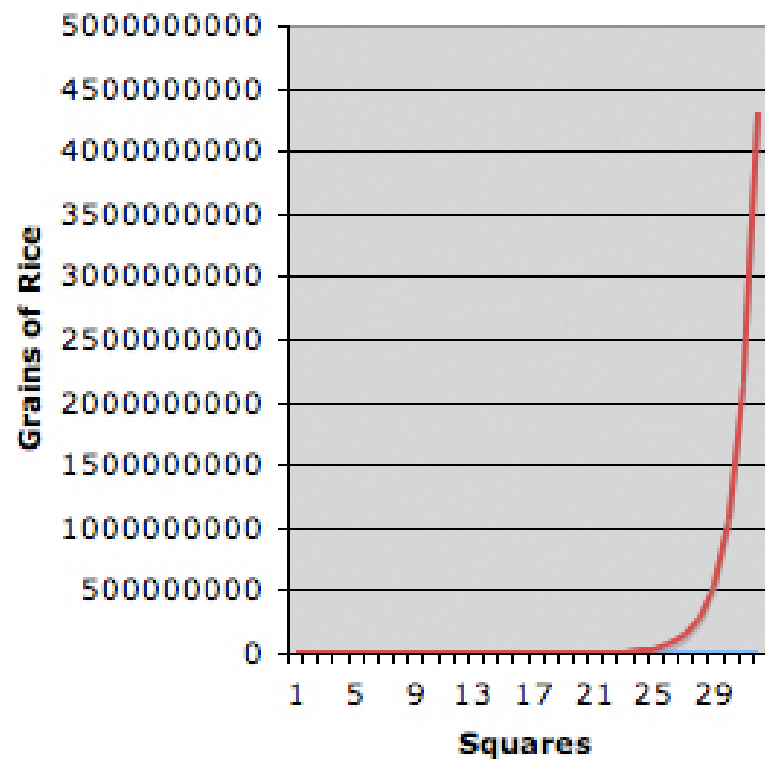
From Human-Engineered Intelligence to Re-engineered Biology and Living Machines

Machines are becoming biological and the biological is becoming engineered!

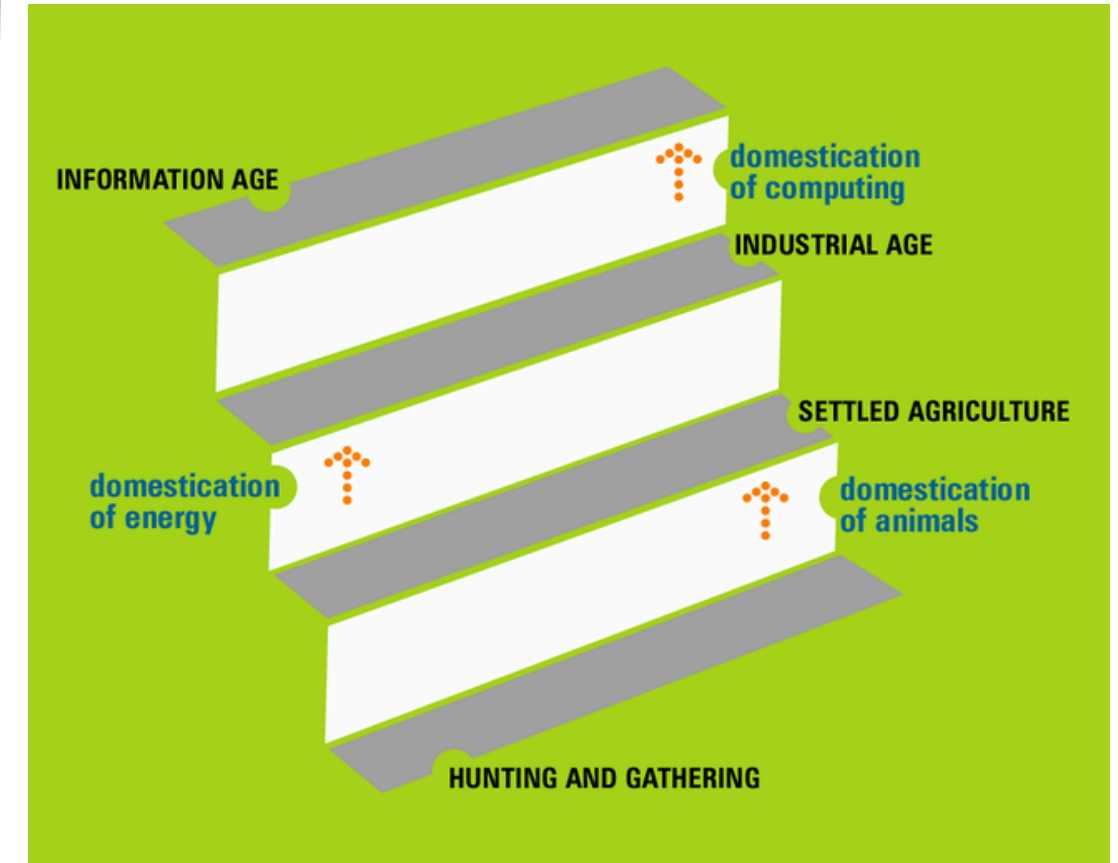
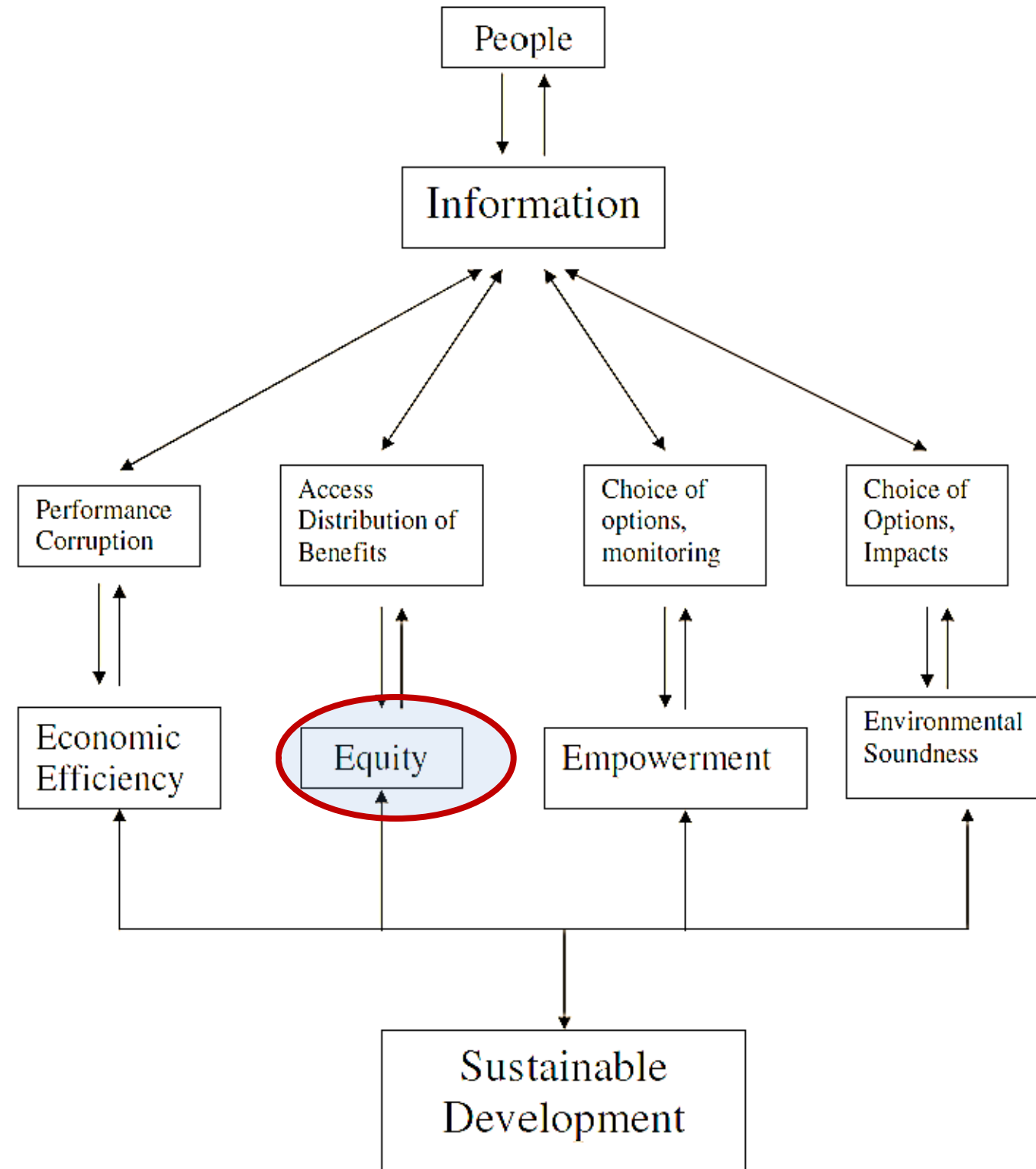
Kevin Kelly, [Out of Control: The New Biology of Machines](#), 1995

Vijay Chandru
Digital University of Kerala
Indian Institute of Science
vijaychandru@iisc.ac.in

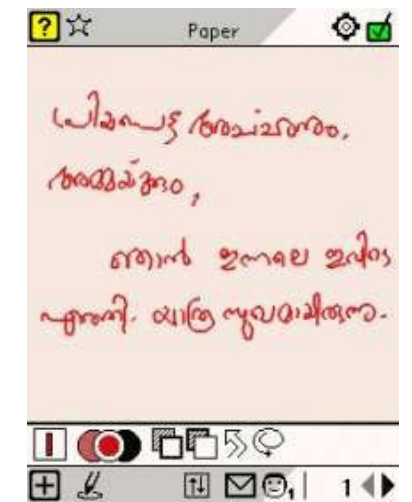
INFORMATION TRYPTICH



Sample Graph of Exponential Growth,
Representing the First Half of the Chessboard.
 $y=2^{(x-1)}$



Introducing the Amida Simputer. It's time to Rewrite.



Affordability Innovation in Emerging Economies A Case for India

“India has already succeeded in localizing - biopharmaceuticals, cinema, satellite and cellular communications, cable television and radio. Can it do the same for Computing?”
– Bruce Sterling, NY Times

Simputer the IT Innovation of 2001

Alphabet AI: “Yes, the Simputer was a handheld computer released in 2002 that was available before the iPhone, which was released in 2007.

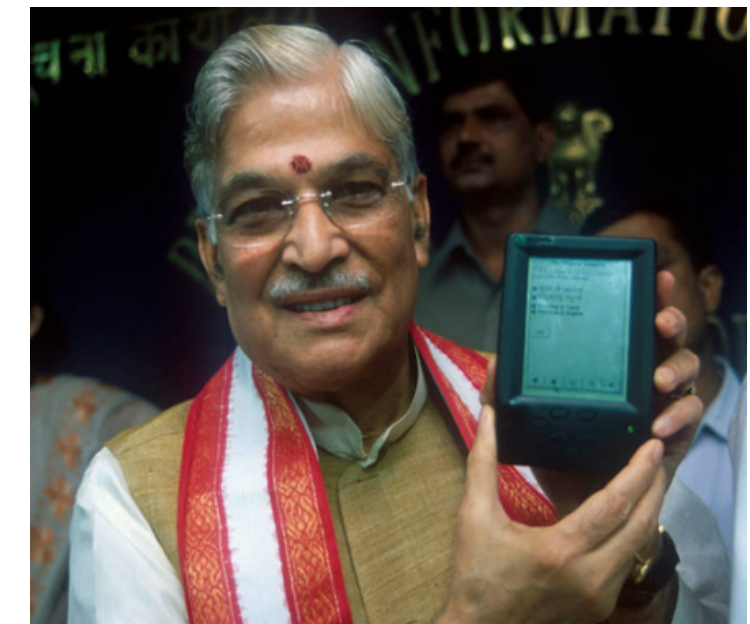
A Linux-based, open hardware device designed as a low-cost alternative to personal computers. It was the first handheld device with a USB master port, an accelerometer, and writing capabilities. The Simputer also had a browser for the Information Markup Language (IML), which was designed to provide a uniform user experience.”



Indian Institute of Science

<https://connect.iisc.ac.in> > 2021/12

Before the iPhone, there was the Simputer
By Debayan Dasgupta
The first example of academic entrepreneurship from IISc was an attempt to revolutionise personal computing in India



A remarkable correlated timeline in the history of science

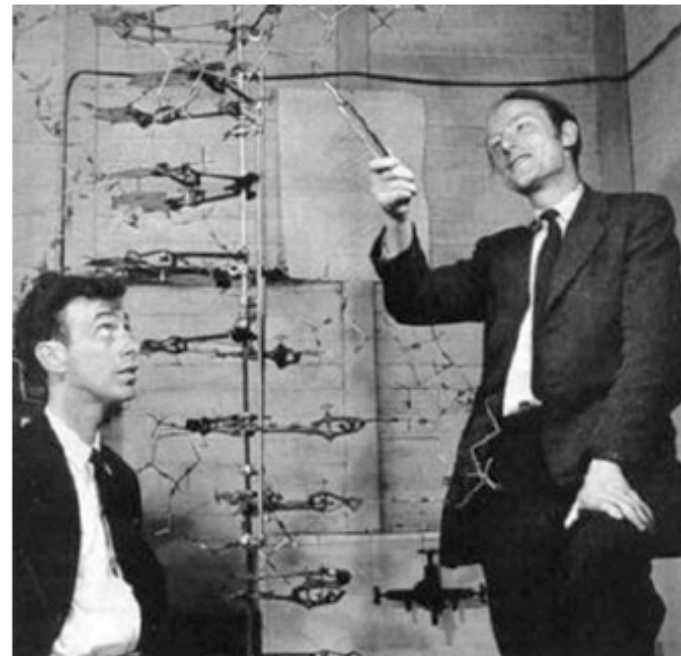
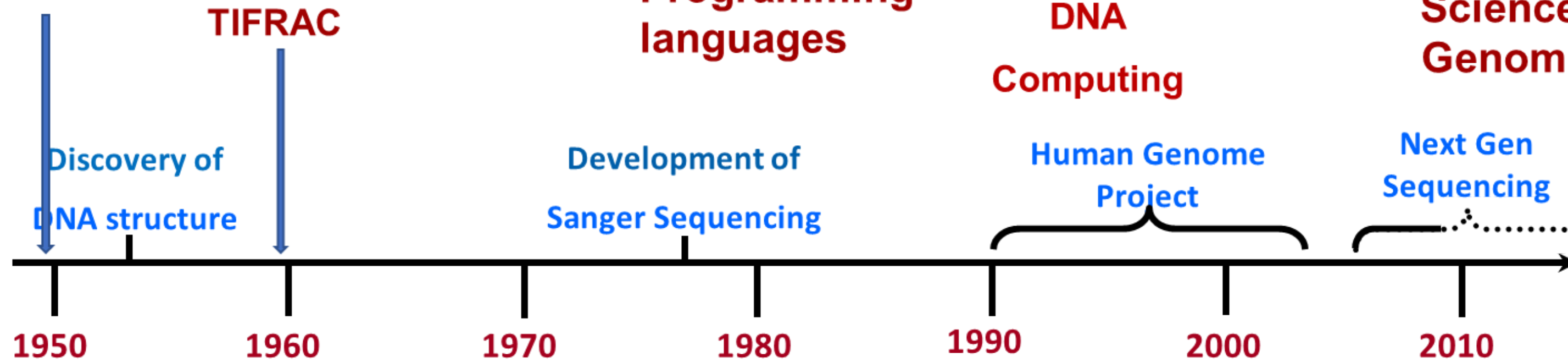
Universal Computing Machines

Mathematical Theory of Communication

Operating Systems,
mainframes,
Programming
languages

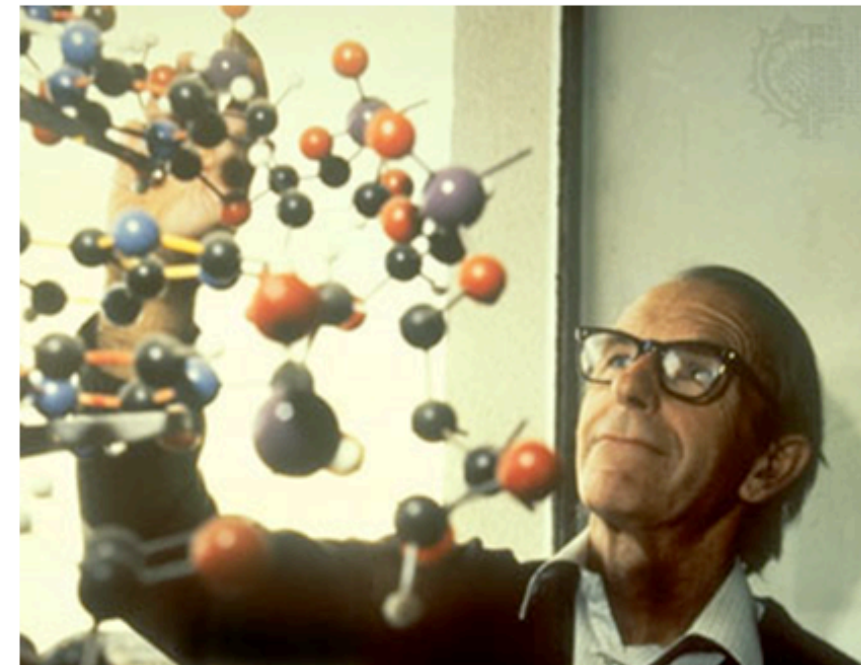
Internet
DNA
Computing

Data
Science in
Genomics



Watson & Crick

Nobel Prize in 1962



Frederick Sanger

Nobel Prizes in 1958 & 1980



Bill Clinton
Francis Collins



Presidential Initiative
Precision Medicine

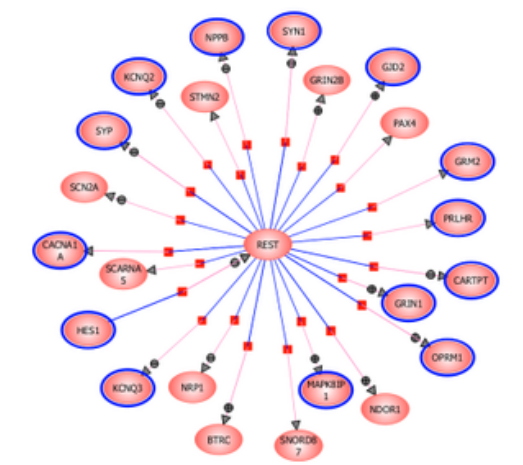
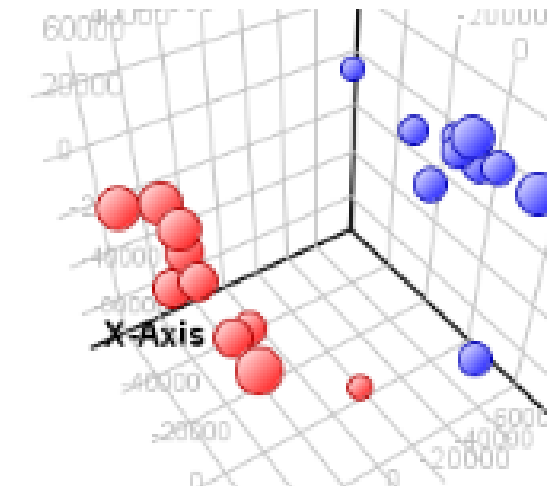
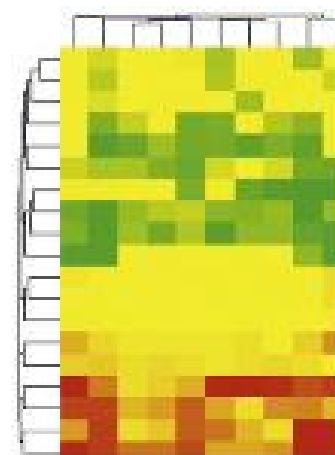
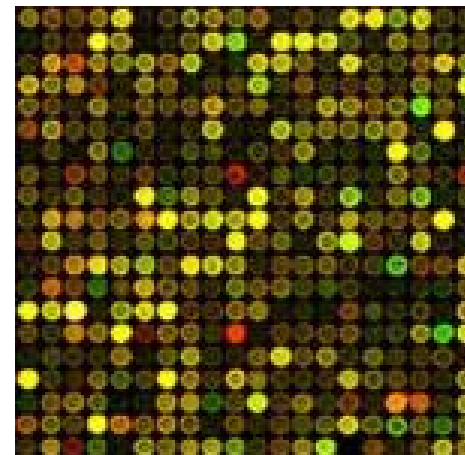
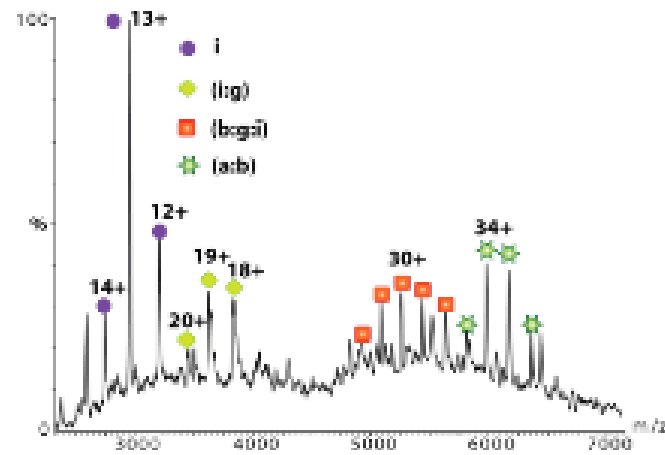
Tools for the 4th Paradigm of Biology

Machine Learning in Pre- Deep Learning Era

India's first AI Company? (2000)

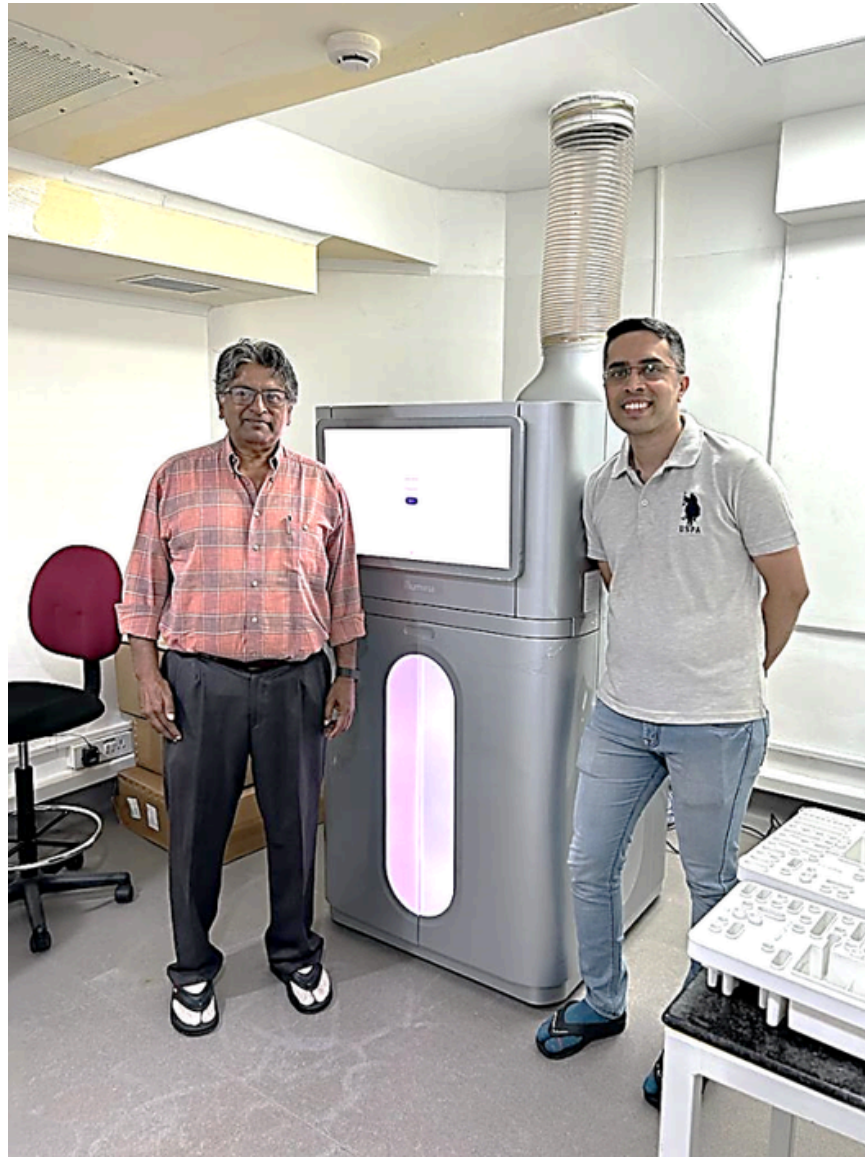


Cover the entire range of high-throughput data, including
Microarrays, Mass Spectrometry, Next-Generation
Sequencing, Microscopy etc



**GeneSpring, Mass profiler Pro, Strand
NGS, Sarchitect, Grammatica, ...**
IMPACT: >35,000 citations

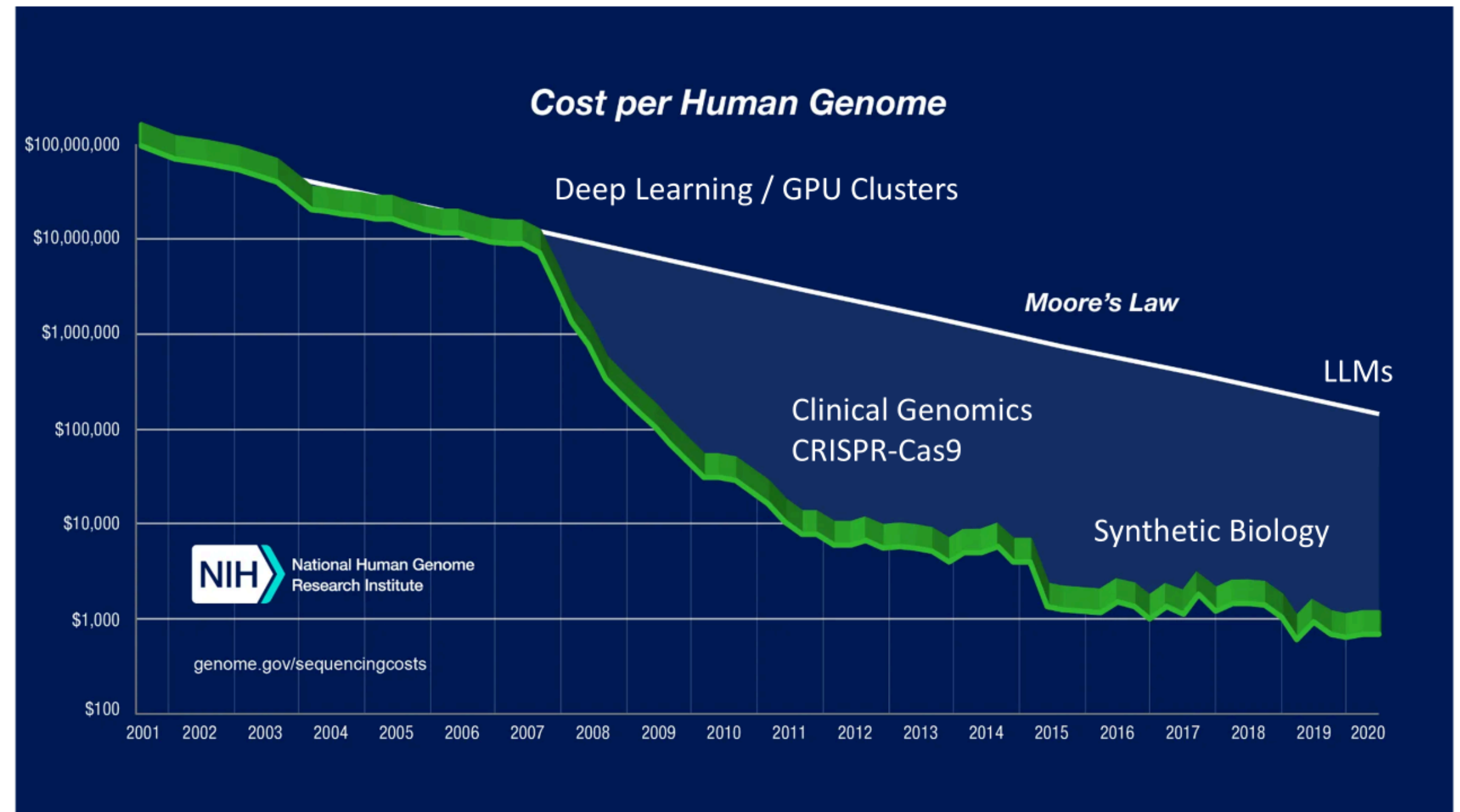
Affordable Solutions for the Democratization of Genomics in India



Illumina **NovaSeq x plus** at Strand, August 2023. 65 human whole genomes at 30x overnight. Genomic Health Insights - \$145 test 20,000 genes and a counseling session

The Democratization of Genomics

From 2.7B to <300\$ for WGS (Tipping Point \$100 WGS)

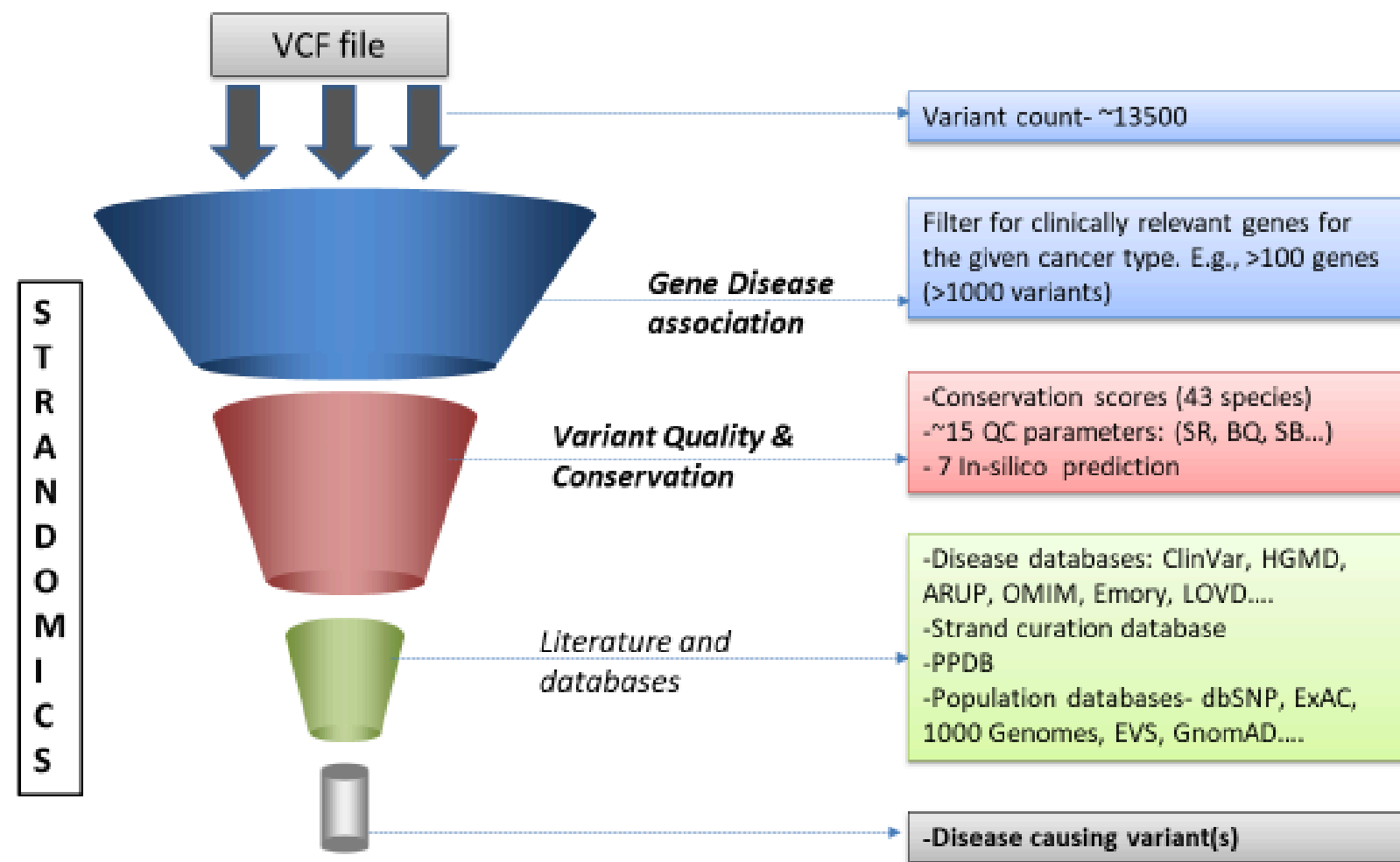


Strand Clinical Genomics Case Series: Summer 2013

Whodunit “Mystery of the Eyes” from *Genomic Quirks*
Ramesh Hariharan, IISc Press 2019



Interpretation Work flow: Knowledge Challenge



The Holmes Investigation Ramesh

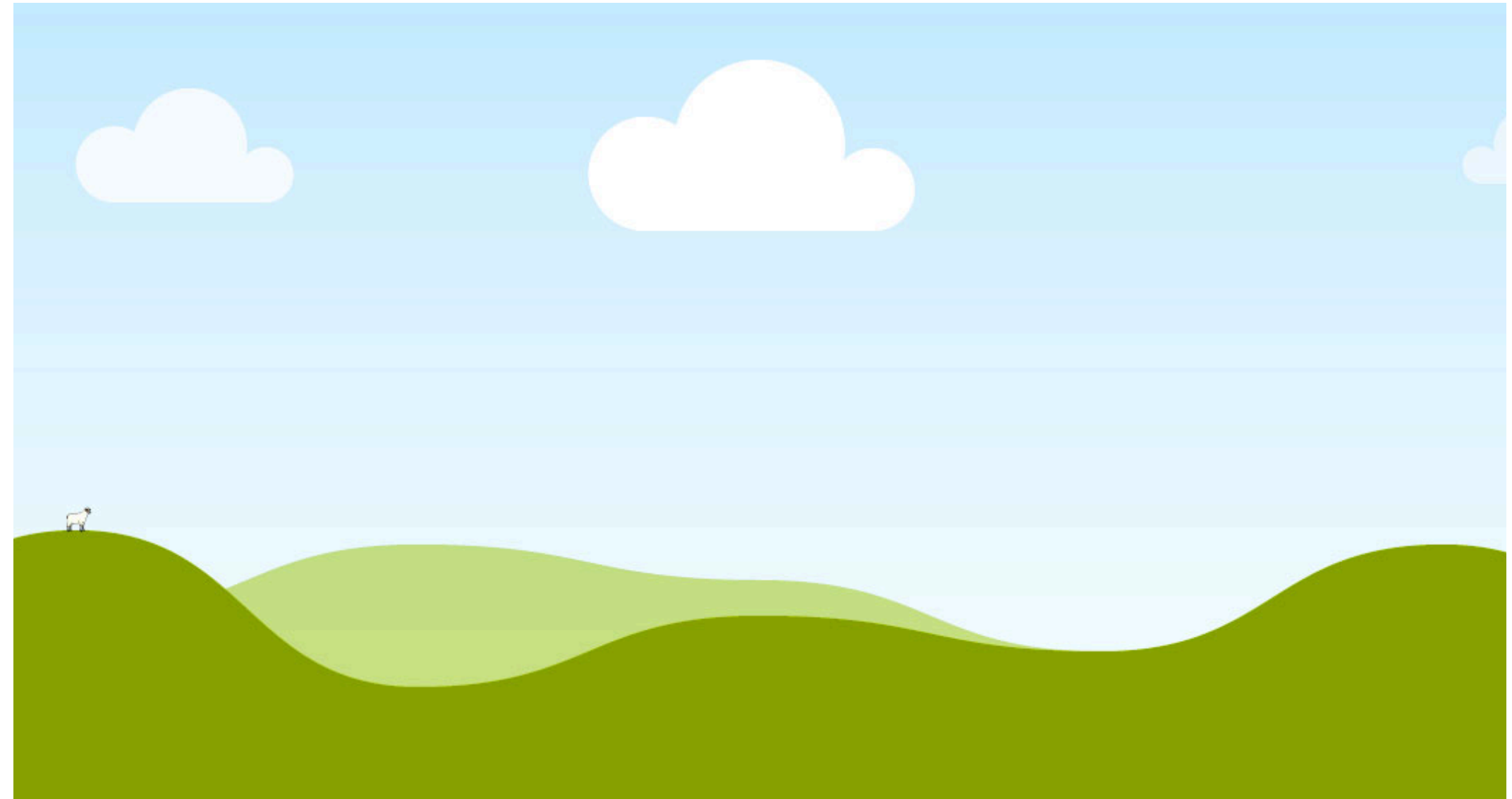
Suspects:

Fibulin 5 (Flbn5)

Filamin A (FLNA)

Ethics in a Posthuman Future

Meanwhile, a 3rd child is on the way. What should the advice to the parents be?



“**Biotechnology** presents us with a special moral dilemma, because any reservations we may have about progress need to be tempered with a **recognition of its undisputed promise.... Hanging over the entire field of Genetics has been the specter of Eugenics** – that is the deliberate breeding of people for certain selected heritable traits”

Francis Fukuyama, *Our Posthuman Future*, 2002

The next step is a constitutional right to health



Kailash Satyarthi

OCTOBER 12, 2021 00:02 IST


UPDATED: OCTOBER 12, 2021 07:21 IST

Presently, any investment in health care has failed to translate into a sense of security and sanctuary for many Indians

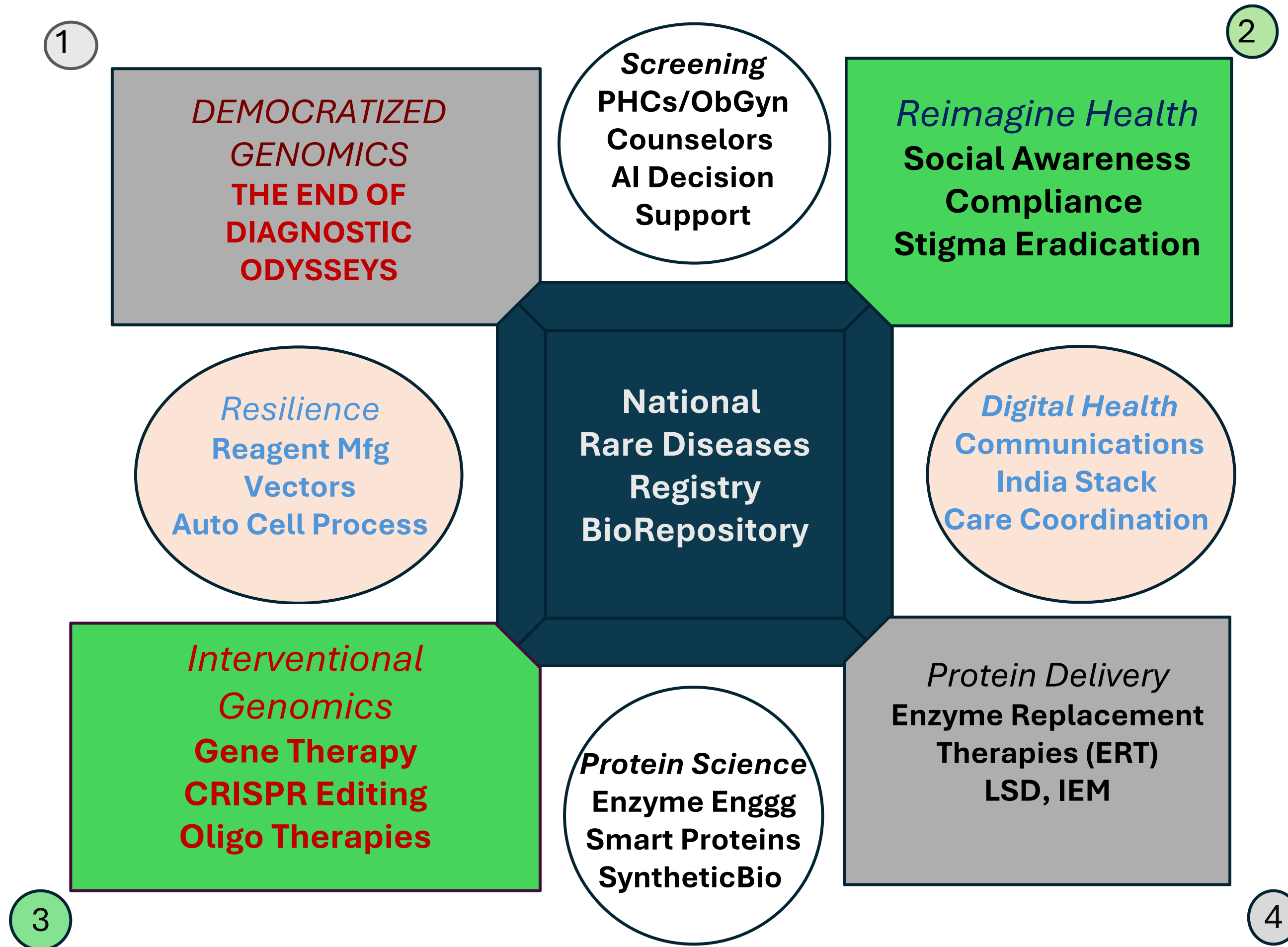
CENTRE FOR HEALTH, EDUCATION AND TECHNOLOGY +91 8023602820 Chet@Chetindia.Org Chetindiabl

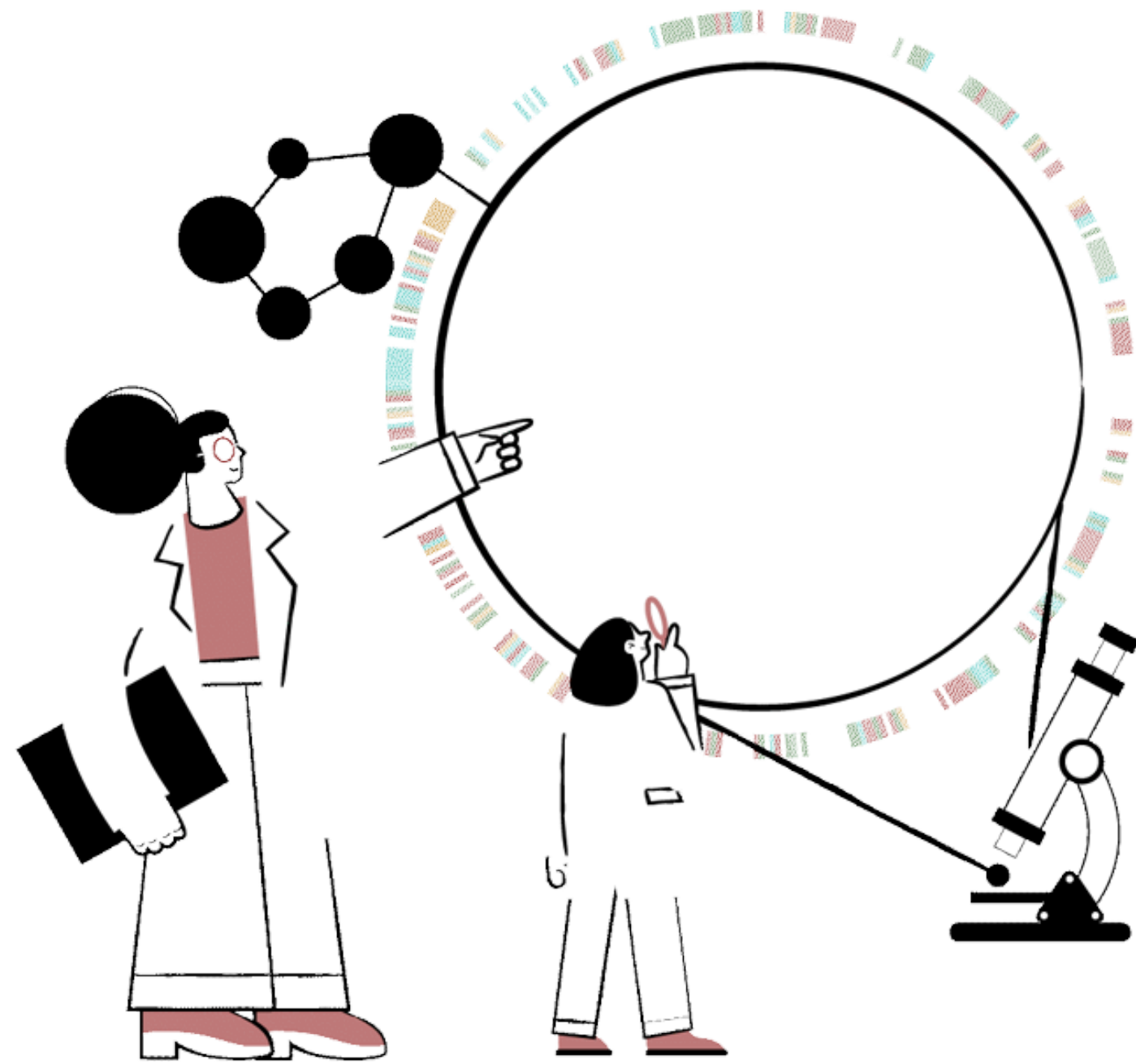
  [HOME](#) [ORPHAN DISEASES](#) [PATIENTS / FAMILIES](#) [ABOUT US](#)

CHET
No Disease Orphan - 2030



A MASTER PLAN FOR RARE DISEASES IN INDIA



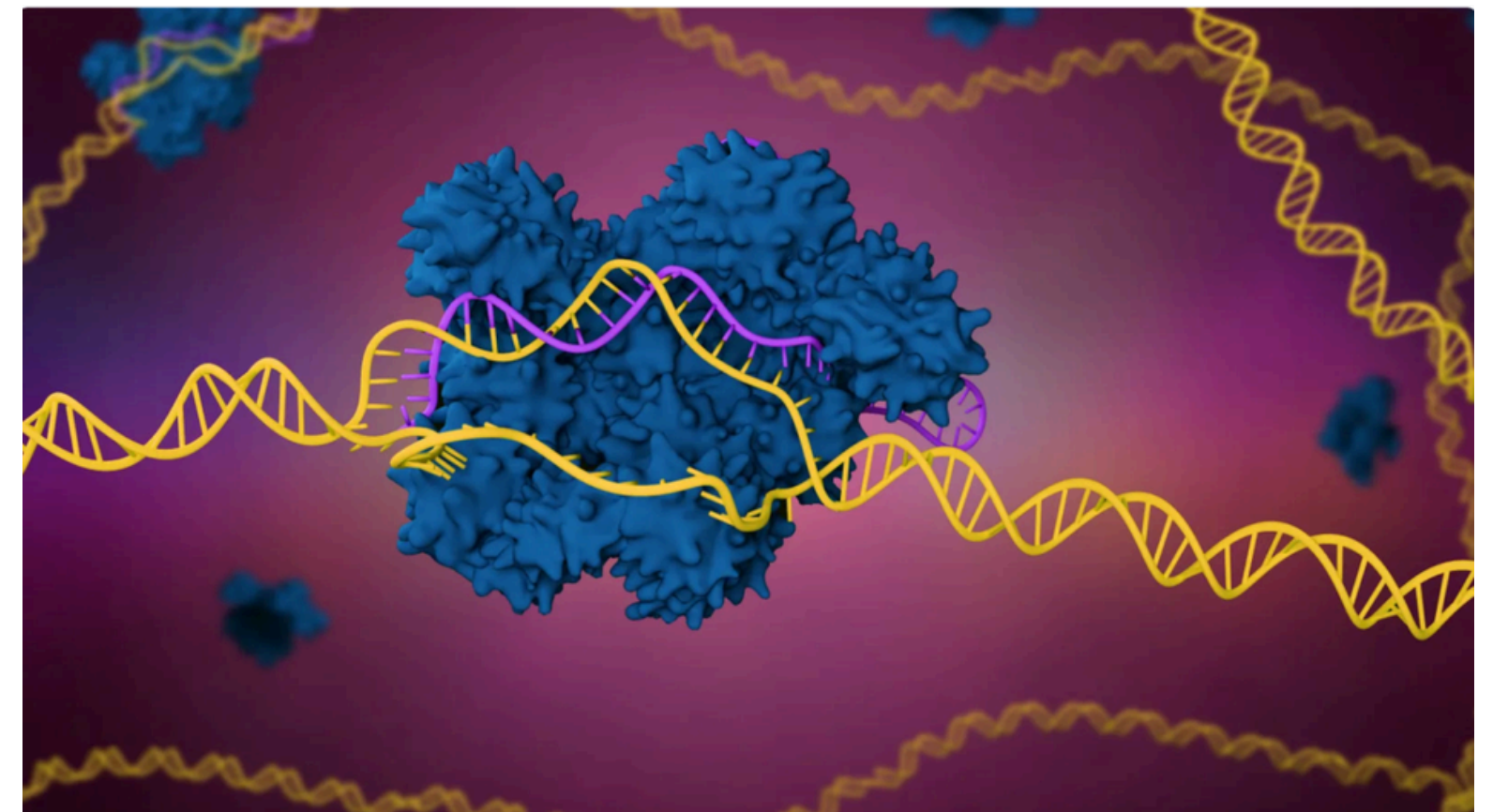


Bacterial Defence Mechanism

*CRISPR: clustered regularly interspaced
short palindromic repeats*



Nobel (Chemistry) 2020 to Doudna & Charpentier



The Anthropocene

“We are facing the most dangerous moment in human history.”

- **CLIMATE CHANGE**
- **ENVIRONMENTAL DEGRADATION**
- **FOOD SECURITY**
- **HEALTH SECURITY**

Challenges are Opportunities

Breakthrough Biotechnology



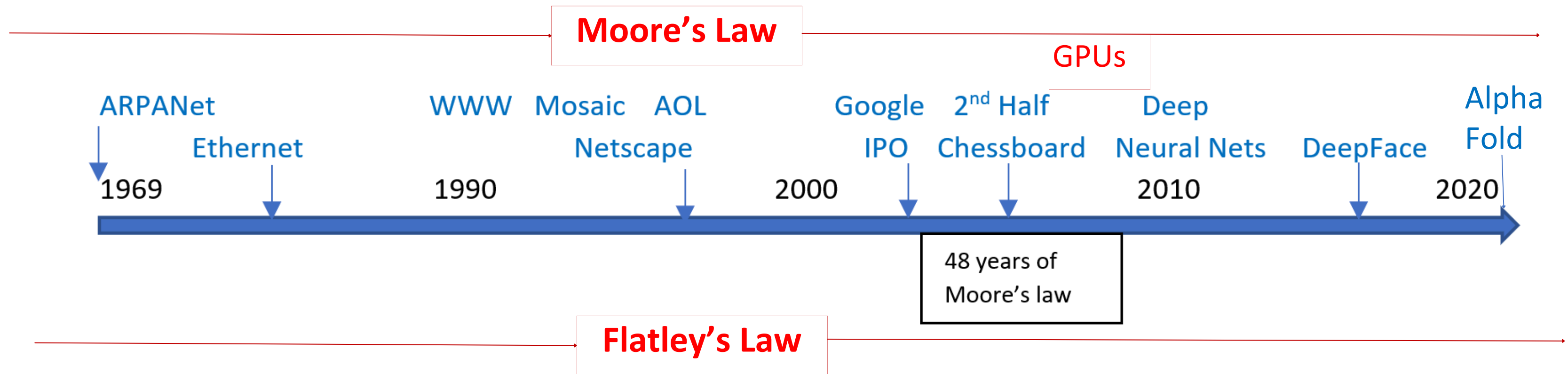
Heat Risk Dashboard: A Common Operational Picture

This is not just a forecast or a dashboard – it is an operational system that links predictions with field checks and real actions on the ground.

Link to Dashboard

<https://karnatakaheatriskforecast.vercel.app/forecast>

The Second Machine Age by Eric Brynjolfsson and Andrew McAfee 2014



Age of Living Machines - Biology the next revolution

by Susan Hockfield American Institute of Physics, Science Communication Award 2020

