



Science, The Unifying Force

CUK, 22-Feb-2021

Ajith Kumar B P
IUAC, New Delhi

<https://scischool.in/talks/index.html>

Topic of discussion

Even though everyone is happy to enjoy the comforts provided by science and technology, there has been a tendency to oppose the basic tenets of science.

This talk is an attempt to make you familiar with this issue and give some pointers to the related reading materials.

- Ideas And Opinions by Albert Einstein

<https://namnews.files.wordpress.com/2012/04/29289146-ideas-and-opinions-by-albert-einstein.pdf>

- Enlightenment Now by Steven Pinker
- Sapiens by Yuval Noah Harari
- The Selfish Gene by Richard Dawkins
- DNA: The secret of life by James Watson
- The Telltale Brain by V S Ramachandran

Contents

- What is Science
- Impact of Science on our lives
- Criticisms against Science
- Threats to Science
- Through the lens of Science

Using publicly available data to make arguments based on that.

- <https://ourworldindata.org>
- https://www.who.int/about/bugs_drugs_smoke_chapter_1_smallpox.pdf
- <https://pubmed.ncbi.nlm.nih.gov/29432512/>

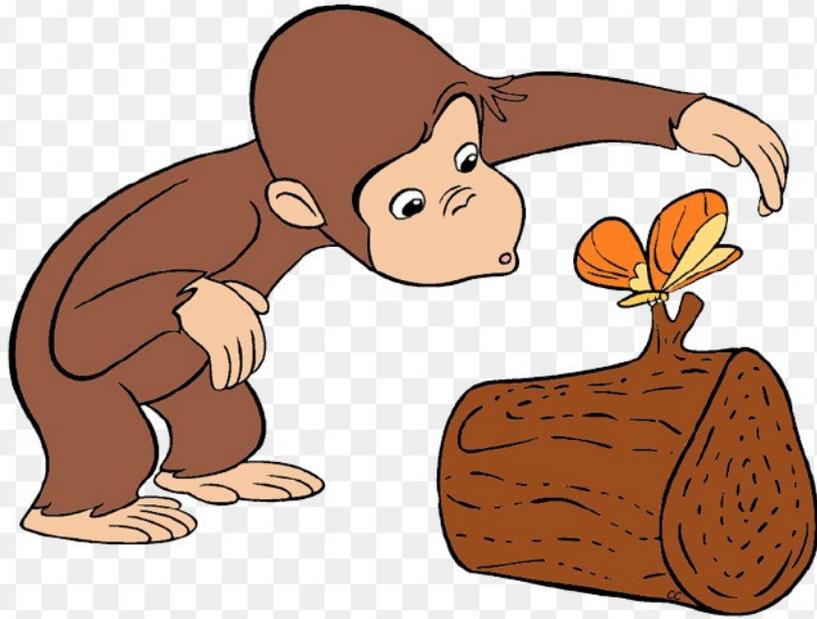
Art and Science

Where the world ceases to be the scene of our personal hopes and wishes, where we face it as free beings **admiring, asking, and observing**, there we enter the realm of Art and Science.

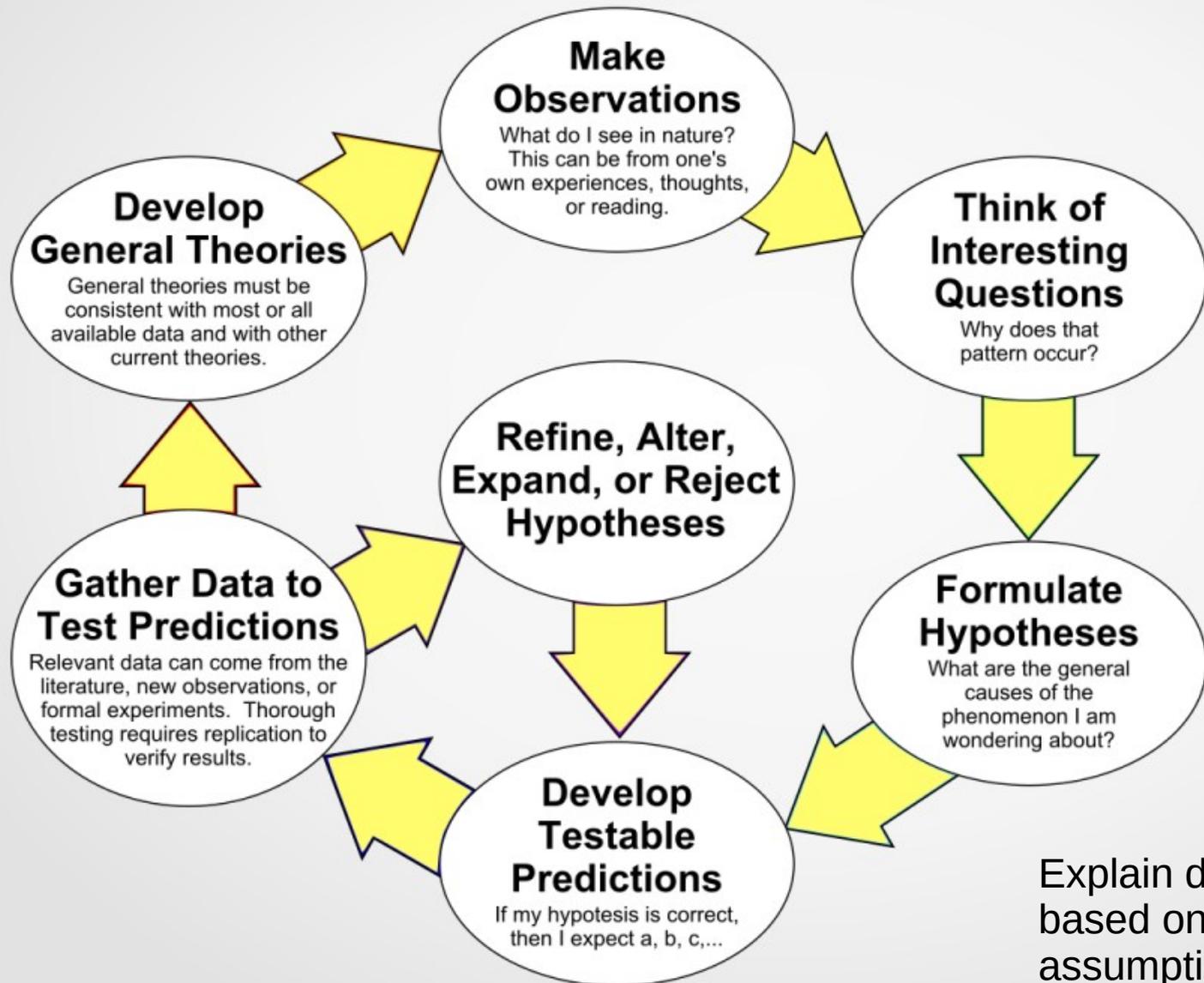
- If what is seen and experienced is portrayed in the language of logic, we are engaged in science.
- If it is communicated through forms whose connections are not accessible to the conscious mind but are recognized intuitively as meaningful, then we are engaged in art.

Albert Einstein

Search for truth, driven by our natural curiosity.

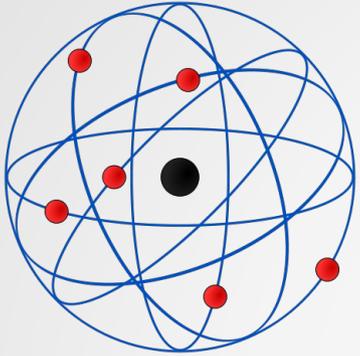


Scientific method is logical reasoning validated by observations

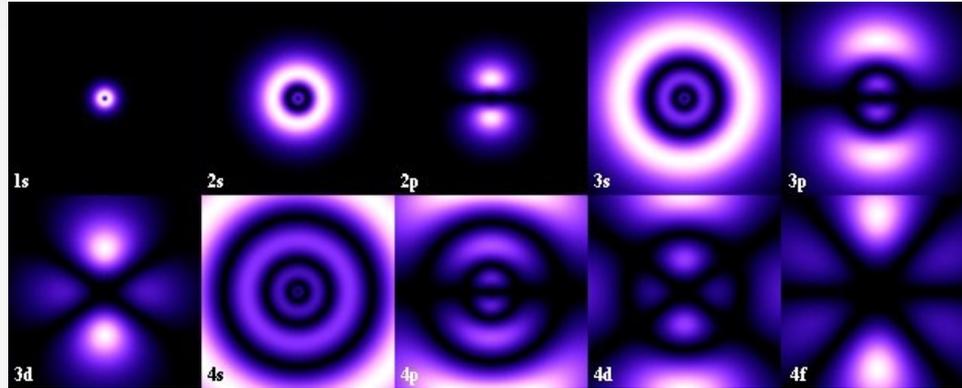


Explain diverse phenomena based on a minimal number of assumptions.

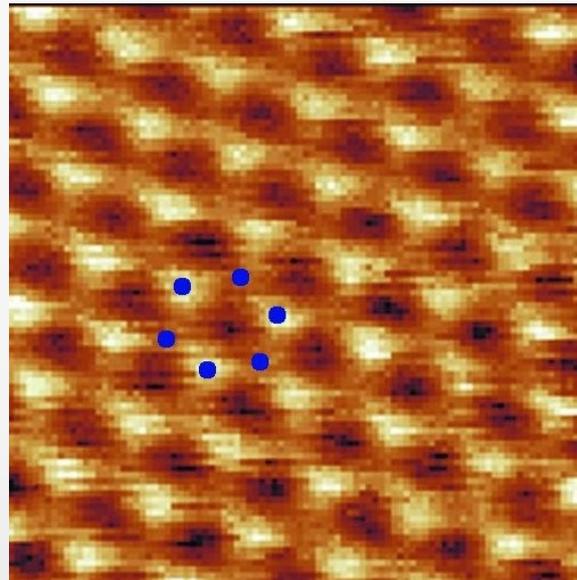
Understanding Nature by Modeling



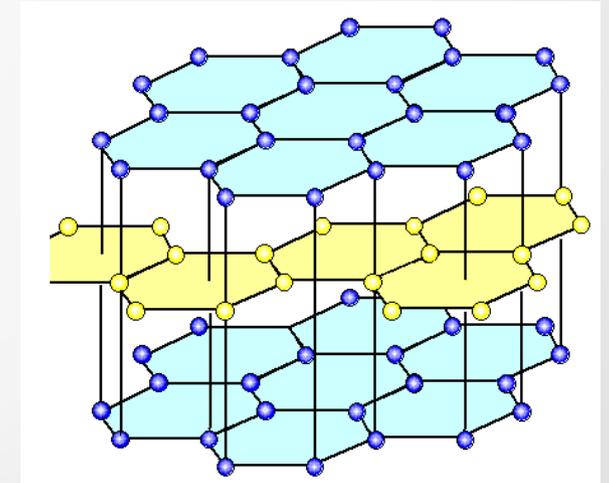
Rutherford Atom



Scanning Tunneling
Microscope



Graphite STM Image



Graphite Structure

Impact of Science on our lives

The world was dominated by dogma, faith, revelations, loyalty to the tribe and blind belief in sacred texts (in some regions even today).

Reason refined by Science and the ideas like Humanism and Progress replaced them to make drastic change in human life.

Some parameters:

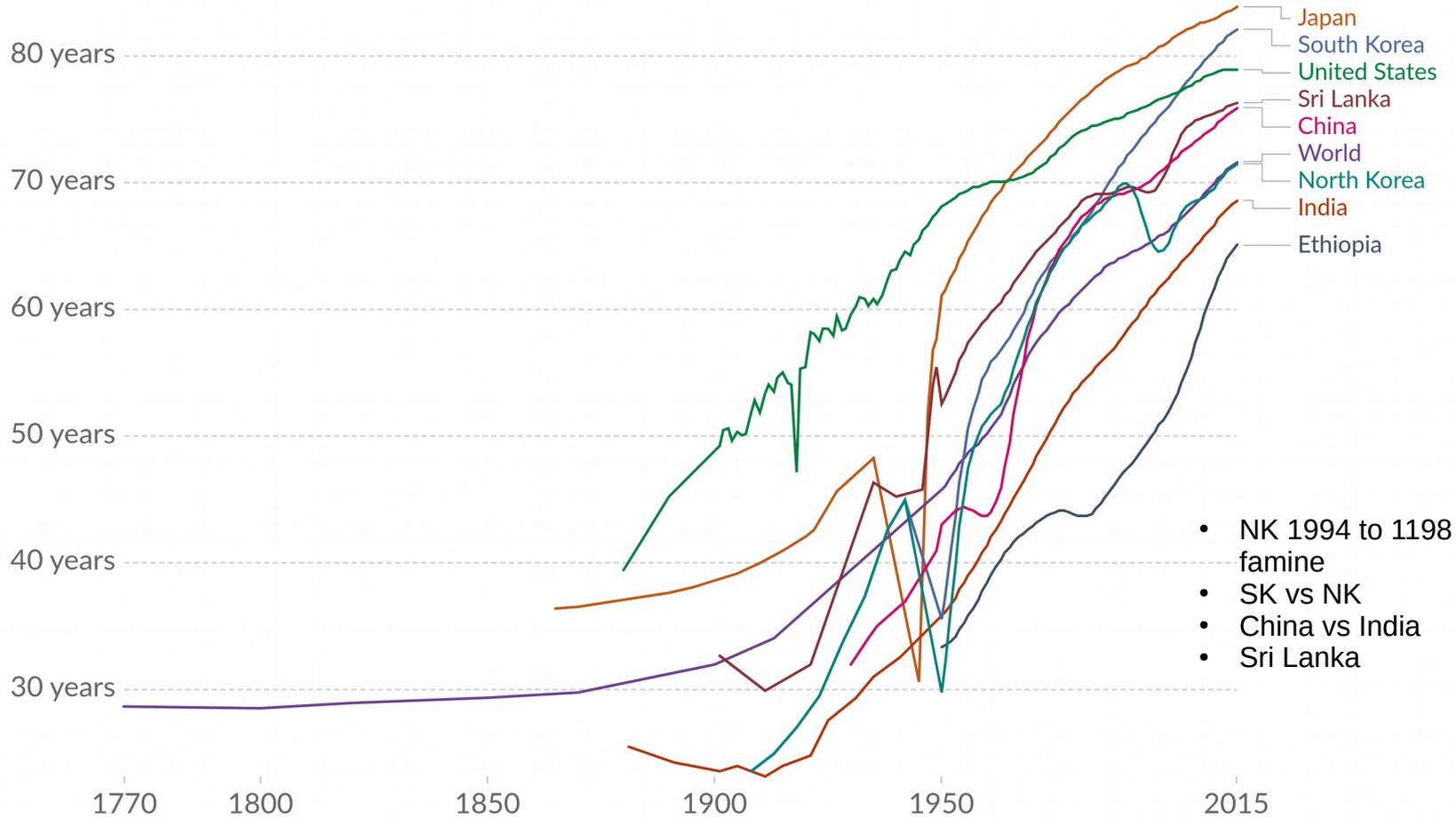
- Average life span, Child mortality, Maternal mortality
- Nutrition, Healthcare, Safety
- Education, Communication, Transportation

Knowledge affects our lives....

<https://ourworldindata.org/life-expectancy>

Life expectancy, 1770 to 2015

Our World
in Data



- NK 1994 to 1198 famine
- SK vs NK
- China vs India
- Sri Lanka

Source: Riley (2005), Clio Infra (2015), and UN Population Division (2019)

Note: Shown is period life expectancy at birth, the average number of years a newborn would live if the pattern of mortality in the given year were to stay the same throughout its life.

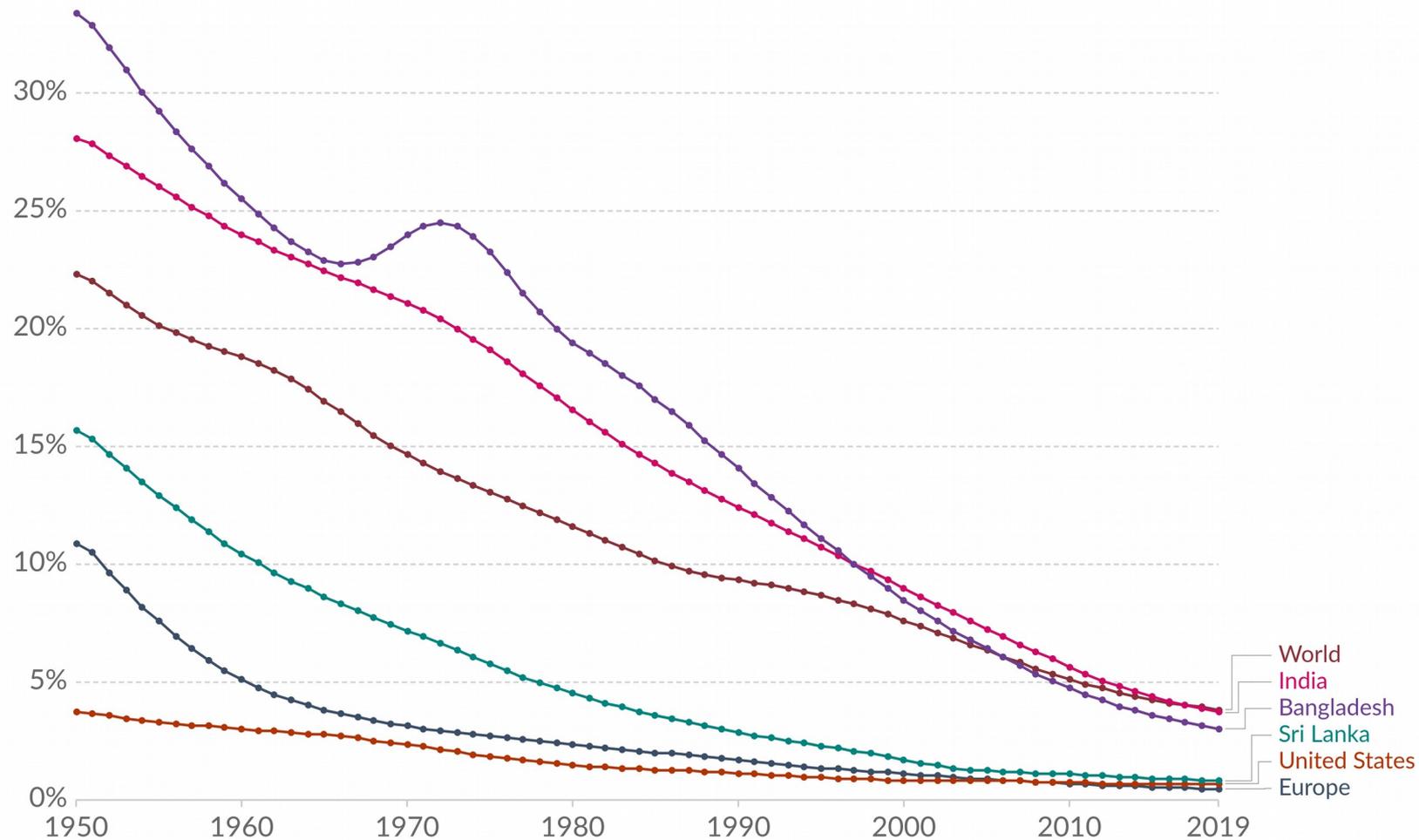
OurWorldInData.org/life-expectancy • CC BY

In the mid 18th century Europe, the fertility rate for women was 7.6 and the share of children who died before the age of 15 was 44%

Our World
in Data

Child mortality

Share of children, born alive, dying before they are five years old.



Source: United Nations - Population Division (2019 Revision)

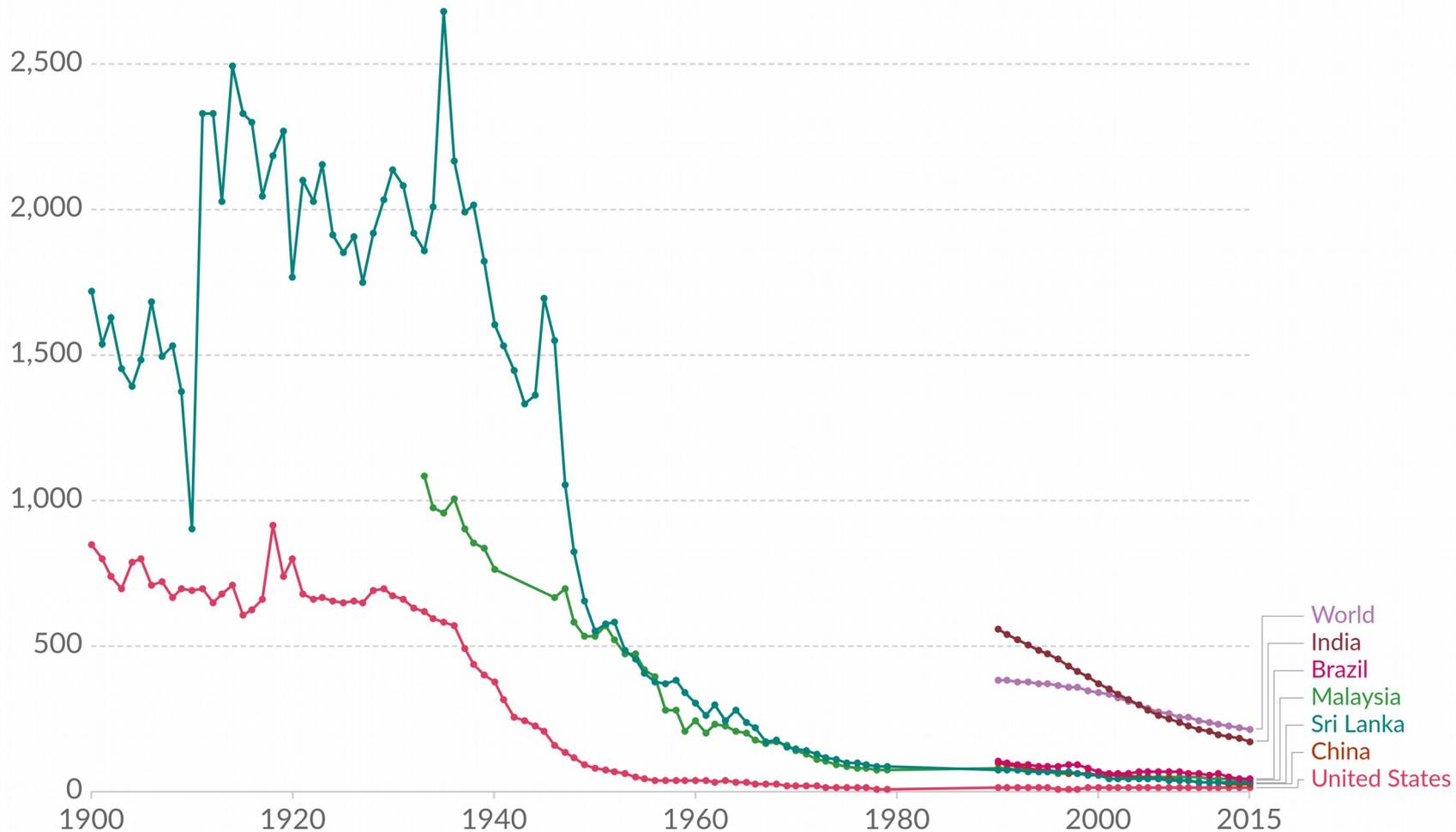
OurWorldInData.org/child-mortality/ • CC BY

What could be more tragic than a mother losing her life in the moment that she is giving life to her newborn?

Maternal Mortality Ratio, 1900 to 2015

The maternal mortality ratio is the number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births.

Our World
in Data



Source: Gapminder (2010) and World Bank (2015)

OurWorldInData.org/maternal-mortality • CC BY

All are not trusting science

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STATES ▾ ANDHRA PRADESH KARNATAKA KERALA **TAMIL NADU** TELANGANA OTHER STATES

NEWS > STATES > TAMIL NADU

TAMIL NADU

Woman, baby die during attempted child birth at home

 **SPECIAL CORRESPONDENT** PERAMBALUR , JANUARY 11, 2021 16:32 IST
UPDATED: JANUARY 11, 2021 16:32 IST

SHARE ARTICLE | f | t | u | u | e | 0 | PRINT | A | A | A

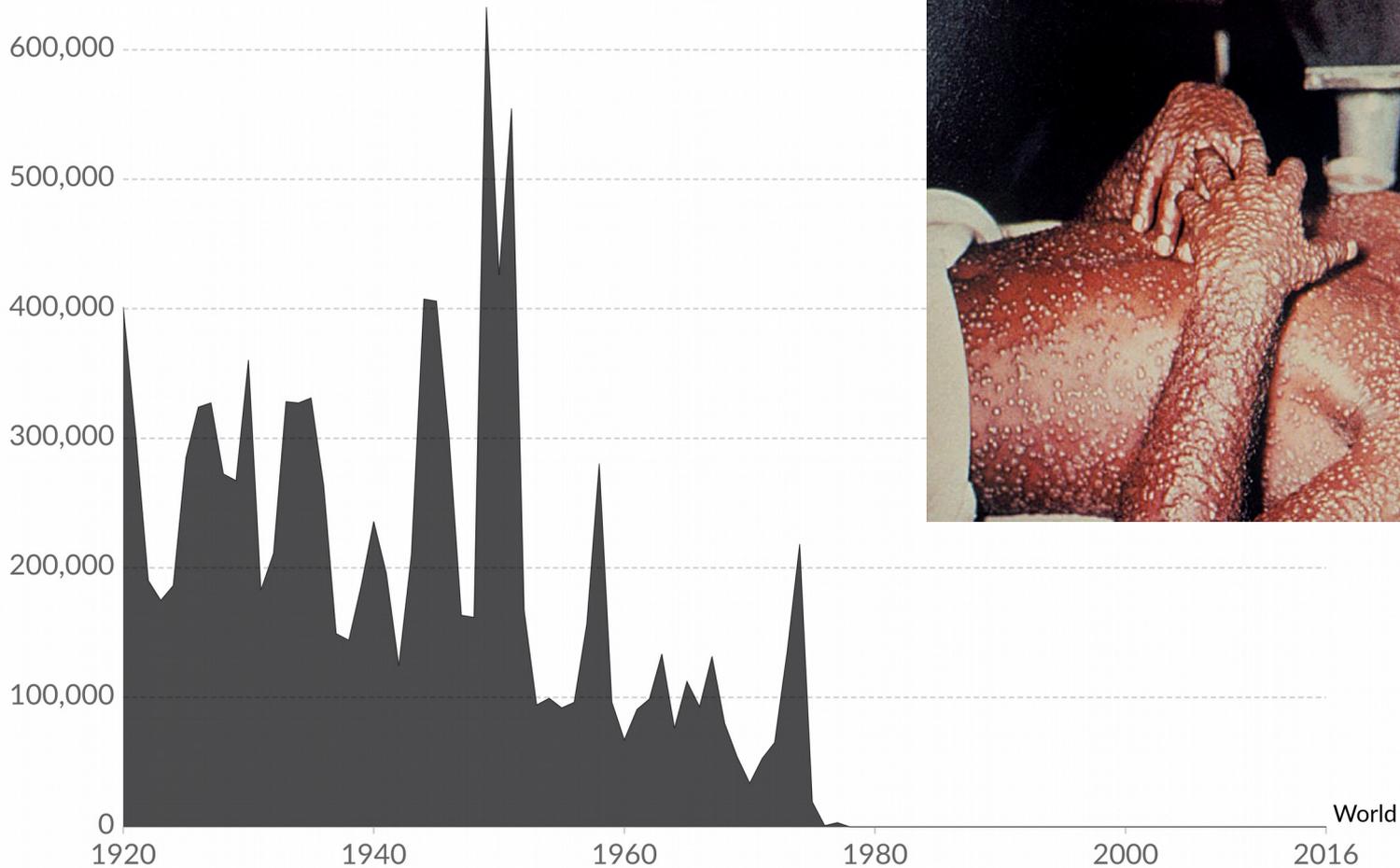
As per preliminary enquiries, the woman's husband had attempted to perform normal delivery at his residence. A detailed enquiry was underway

Officials of the Health Department have begun an enquiry into the death of a nurse and her still born baby, reportedly due to the complications developed while attempting delivery at her home under the supervision of her husband, an acupuncture practitioner.

Smallpox killed 300 million people during 20th century

https://www.who.int/about/bugs_drugs_smoke_chapter_1_smallpox.pdf

Global number of reported smallpox cases

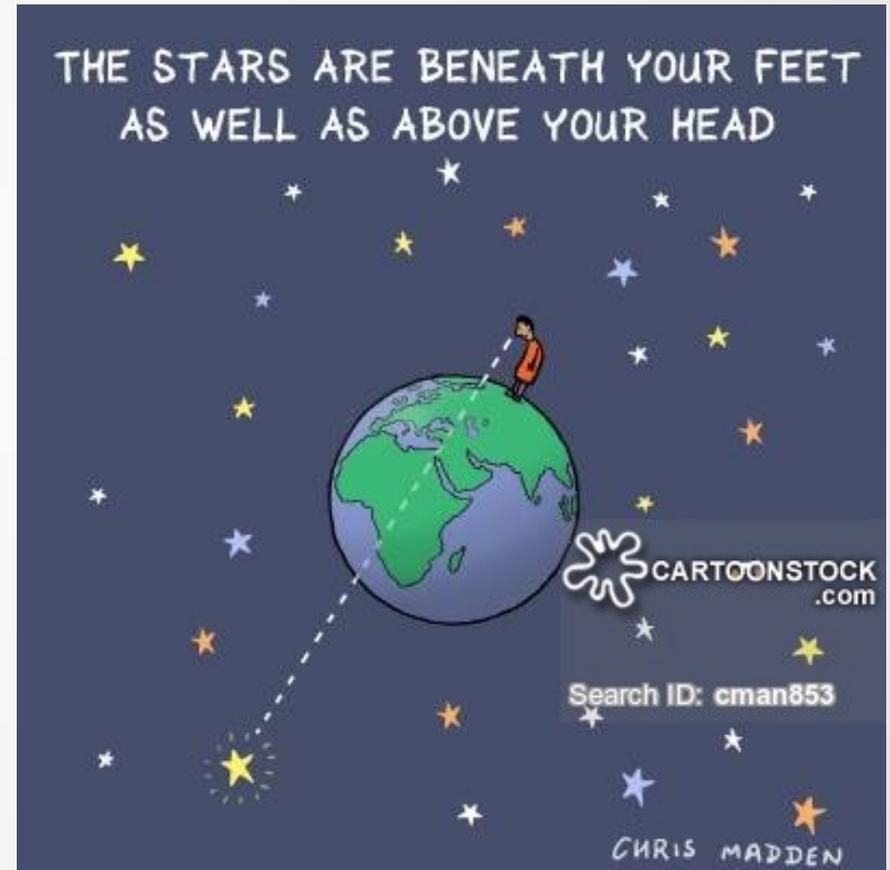
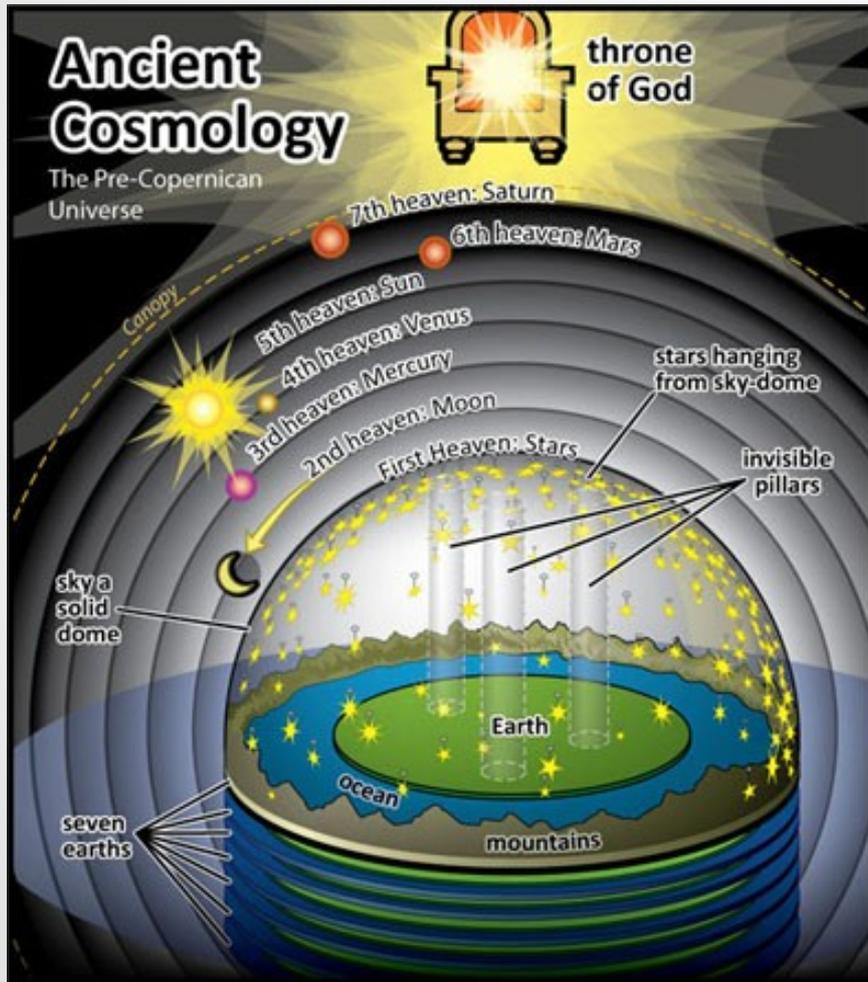


Our World
in Data

Source: World Health Organization (2011)

CC BY

Science has changed our world view



Charges against Science

- Spoiled our Natural way of life.
- Spoiling the Environment.
- Only provides Material Comforts, **lacks Spirituality**
- Armed conflicts have become more deadly
- Contradicting sacred texts

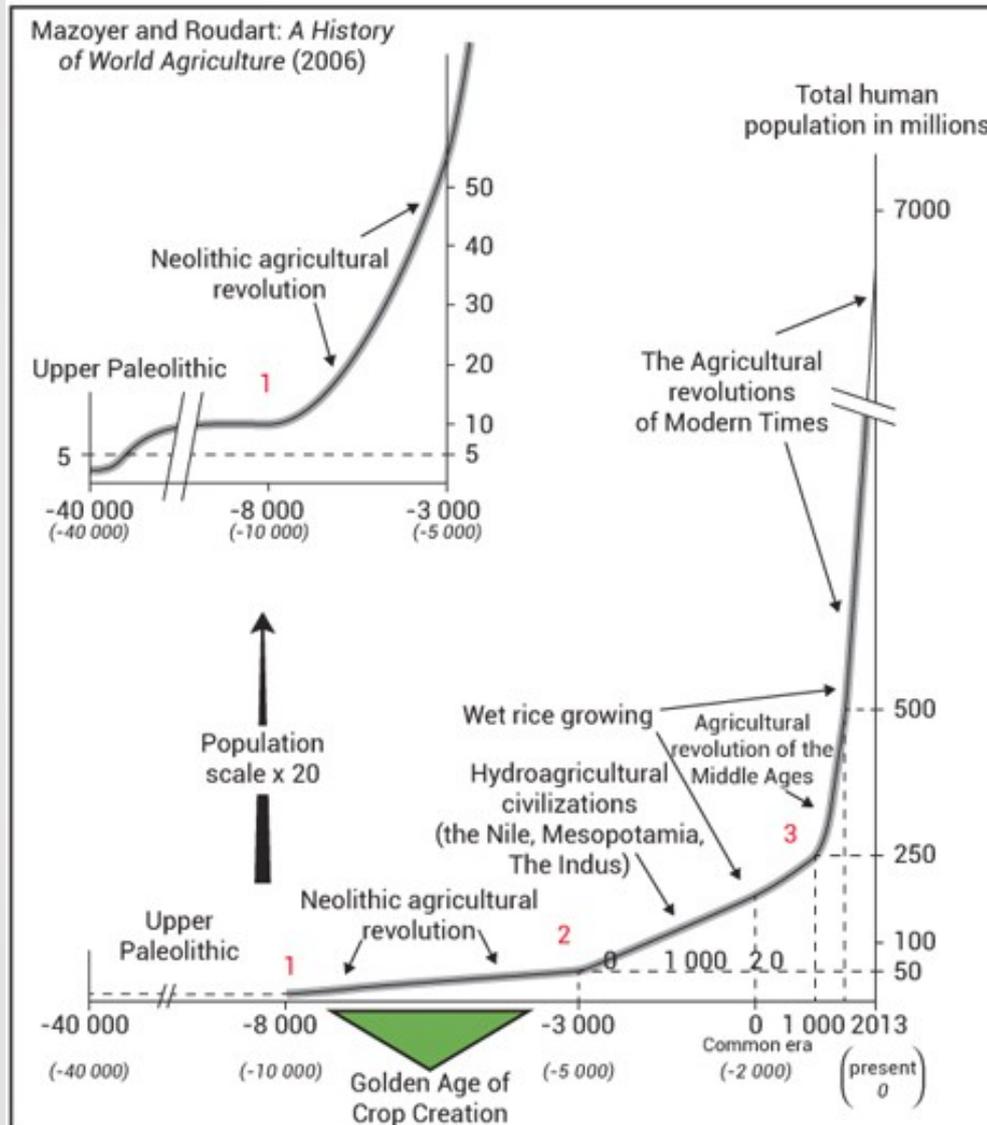
1. Affecting Nature, what really happened ?

How we ended up considering Fertilizers, Pesticides and later on the Genetically Modified Crops

- 1) Humans became different from other animals after learning to handle fire (~150000 years ago).
- 2) The Neolithic Revolution, also called the Agricultural Revolution, marked the transition in human history from small, nomadic bands of hunter-gatherers to larger, agricultural settlements and early civilization. **The first attack on the environment.** (~ 10000 BC)

http://www.scielo.br/scielo.php?script=sci_arttext&pid=S2197-00252013000300001

The beginning of Agriculture and Population growth



- Farming increased population resulting in more farming.
- By 8000 BC, the population increased to about 10 million.
- By 3000 BC, it reached 50 million.
- Reached One billion in 1825
- Food production increased at a slower pace, resulting in poverty. Green revolution helped in reducing poverty.
- Reached four billion in 1975

Do we really want to go back to 19th century ??

Feeding 4 billion, the Green Revolution

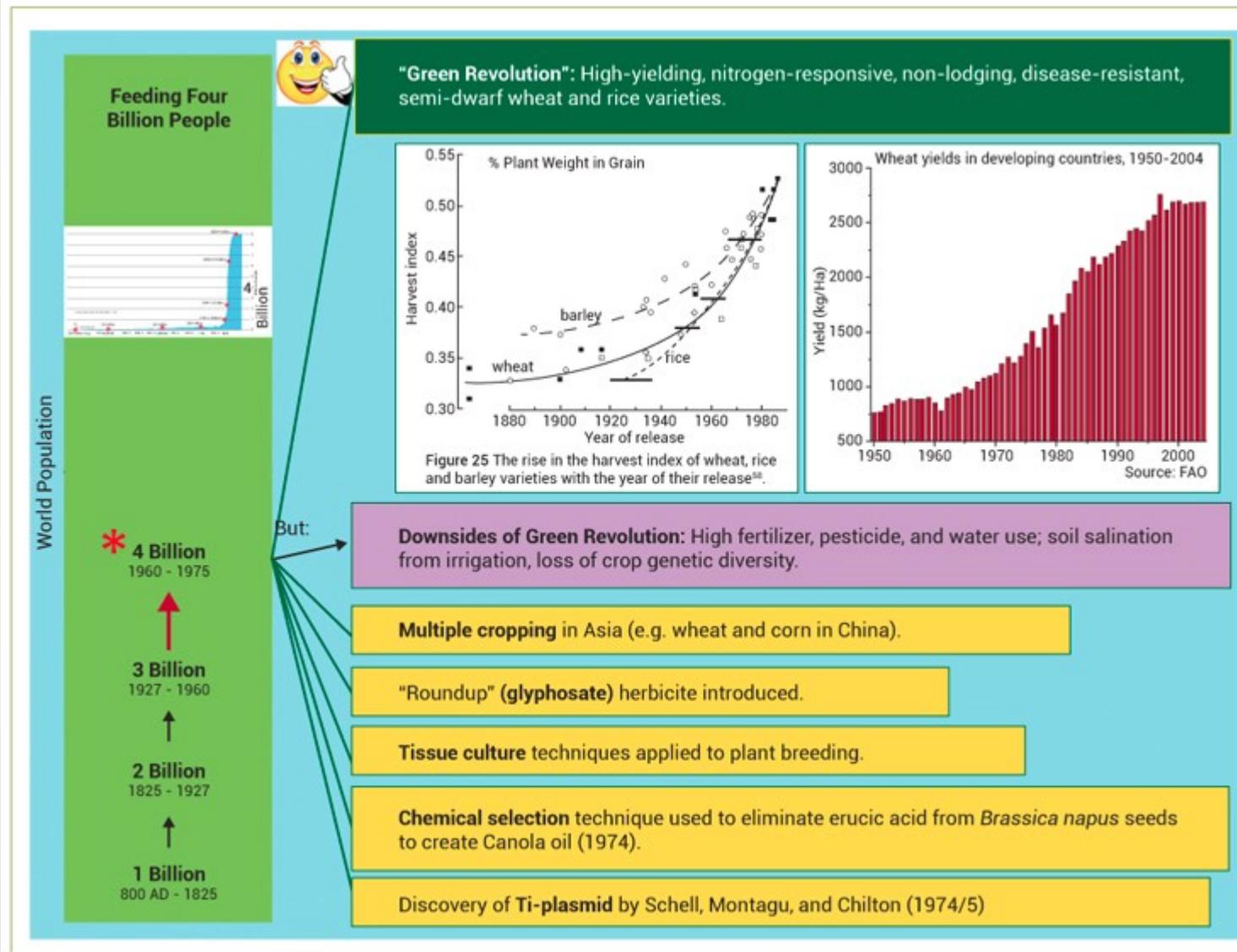
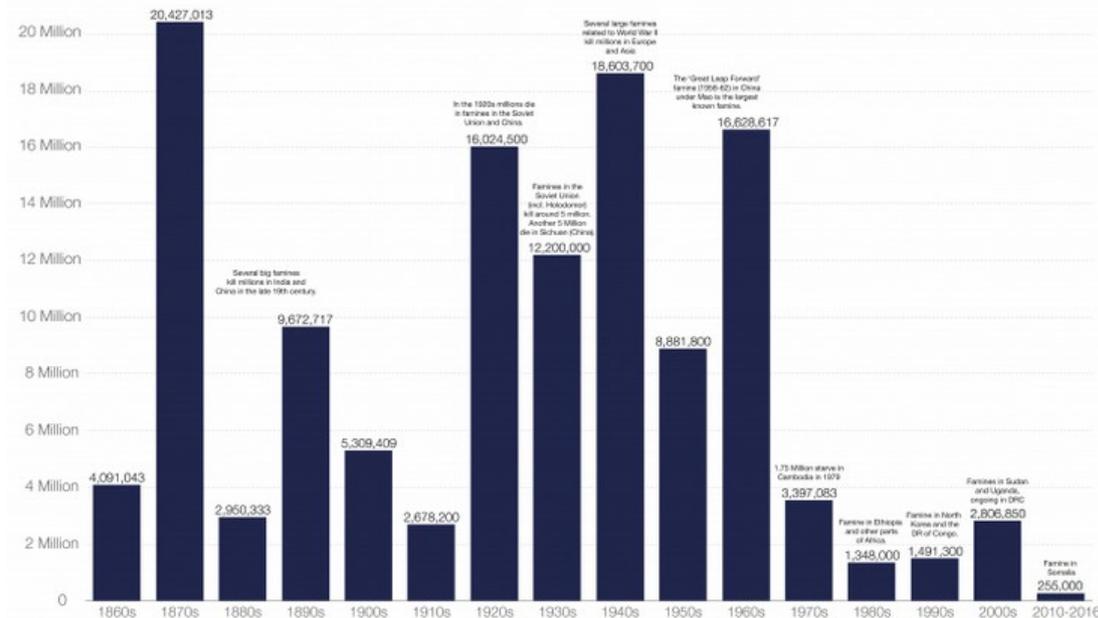


Figure 7. Feeding four billion people.

Famine victims worldwide since the 1860s

The excess mortality due to famines shown here is presented in detail on [OurWorldInData.org](https://ourworldindata.org).
For famines that happened at the end of a decade and the beginning of the next decade the famine victims are split by decade on a year by year basis.
For famines for which different excess mortality estimates are published the midpoint between these estimates is shown here.

Our World
in Data



Data source: [OurWorldInData.org/famines](https://ourworldindata.org/famines) [The dataset was constructed by Joe Hasell and Max Roser]
This visualization is available at [OurWorldInData.org](https://ourworldindata.org). There you find the full dataset and more research and visualizations on famines and global development. Licensed under CC-BY-SA

Many parts of the world were facing food shortage. Situation was not different in independent India.

The book given below narrates the story of Indo-US relations including the PL-480 aid program.

https://www.files.ethz.ch/isn/139676/1993-06_India_US_Estranged.pdf

How to feed the 9 billion in 2050

Current Assessment: To keep pace with population growth and the growth of the middle class in developing countries the current rate of food production will have to DOUBLE by 2050.

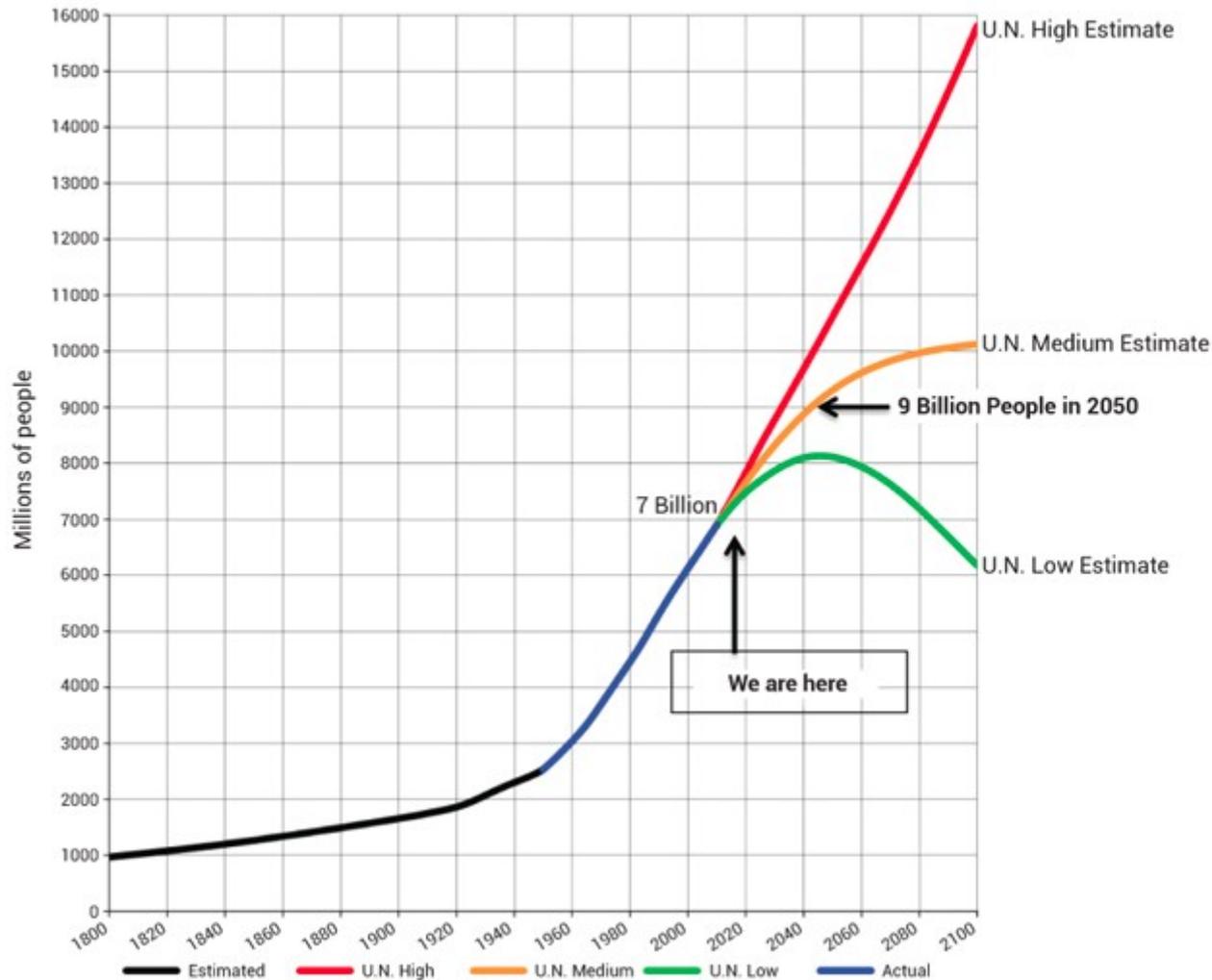
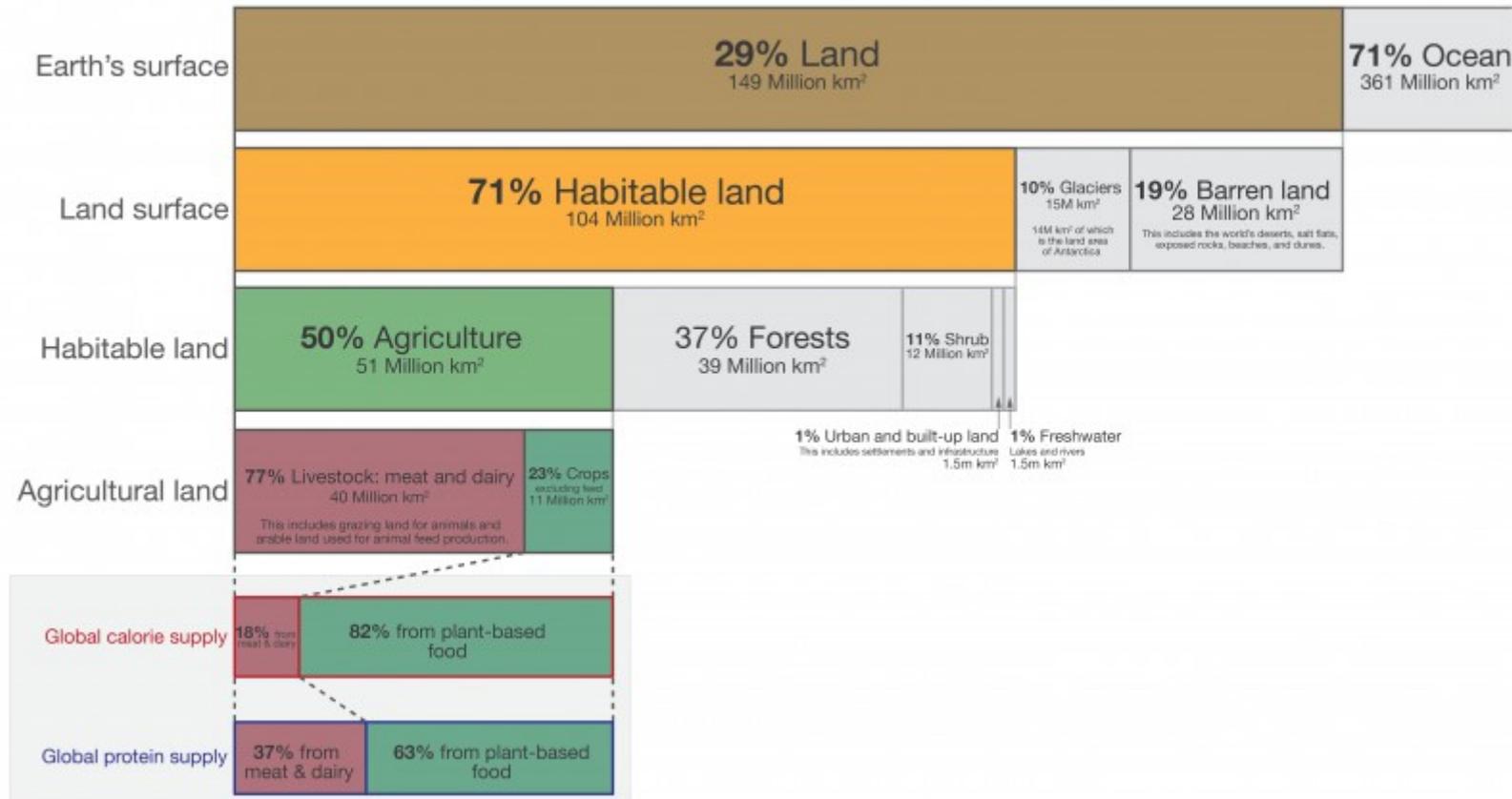


Figure 11. U.N. projections of human population growth to 2100.

Land Usage for Agriculture

Global land use for food production

Our World
in Data



Data source: UN Food and Agriculture Organization (FAO)

OurWorldinData.org - Research and data to make progress against the world's largest problems.

Licensed under CC-BY by the authors Hannah Ritchie and Max Roser in 2019.

Globally, to produce the same amount of crops as in 1961, we need only 30% of the farmland. In other words, to go back to those days you need three times more land.

What is the solution for survival ?

- Sustaining life requires energy.
- Plants get it from sun. Animals feed on plants and other animals.

Photosynthesis

carbon dioxide + water + light energy = glucose + oxygen

Respiration

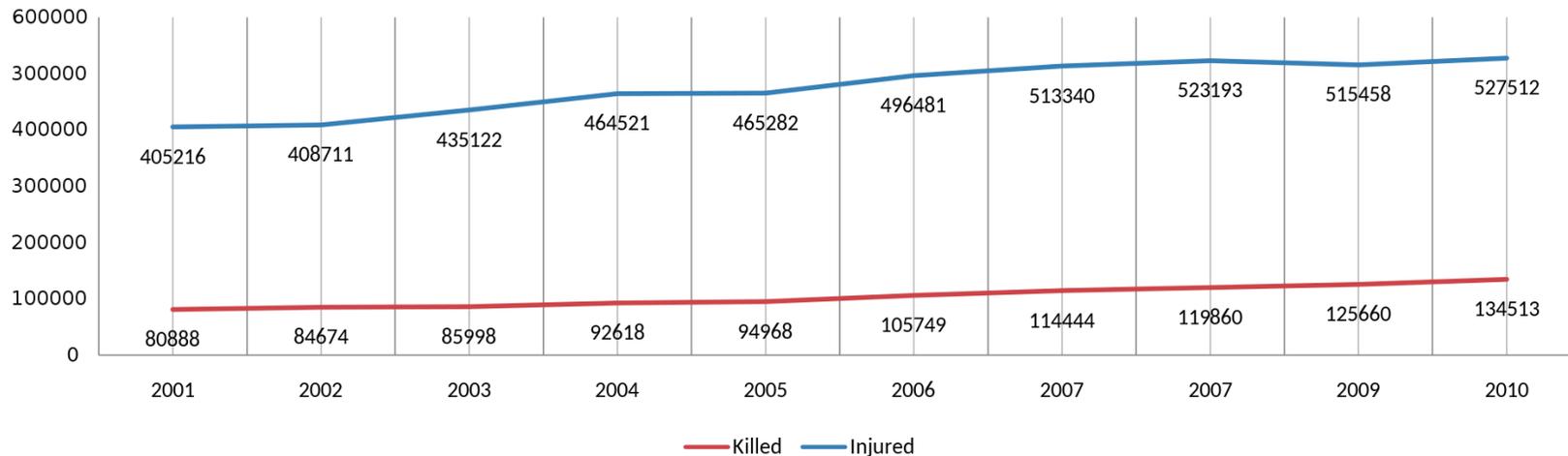
glucose + oxygen = energy + carbon dioxide + water

- The ultimate solutions may be to master Photosynthesis
- Until then, the only option is to produce more food using less land.
- Environment should be protected using new technology
- Going back is not a solution

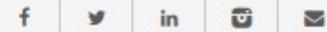
“Olden days were better” is a common human fallacy, not based on facts. Everyone will say “my school days were better” , conveniently forgetting the hardships faced during that period.

Dangers, old and new.

Total Number of Persons Killed and Injured due to Road Accidents in India from 2001 to 2010



THE HINDU



MENU



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NATIONAL

India recorded 1.2 million snakebite deaths in the past two decades



Shiv Sahay Singh

KOLKATA, JULY 10, 2020 18:01 IST
UPDATED: JULY 11, 2020 12:11 IST

2. The **lacking** Spirituality

- It is considered as a monopoly of religions
- Conventional religions offers:
 - God
 - Holy book
 - Prophets and Revelations
 - Stories about the origin of the Universe and Life
 - ‘Miracles’ (<https://www.bbc.com/news/world-asia-india-35129463>)
 - Lessons on Morals and Ethics

What about Science ??

Concept of God

I do not believe in a personal God and I have never denied this but have expressed it clearly. If something is in me which can be called religious then it is the unbounded admiration for the structure of the world so far as our science can reveal it.

Albert Einstein , 1954

- https://www.update.uu.se/~fbendz/library/ae_scire.htm
- <http://assets.press.princeton.edu/chapters/s6681.pdf>

Your choices:

- The one plays with billions of galaxies and the complex molecules of life.
- or
- The one takes your ten rupees to give you some advantage over the others.

The Holy book

If there is only one God, there could be only one Holy Book

What is it ?

The Holy book

- It's this Universe.
- At present , only Science is reading it.
- Mathematics seems to be the language. Space, Time, Energy, Elementary particles, Atoms and Molecules could be considered as the letters, words and sentences.
- Religions stopped reading it when they made their own versions.

Prophets, to whom the eternal truths are revealed..



असतो मा सद्गमय ।
तमसो मा ज्योतिर्गमय ।
मृत्योर्मा अमृतं गमय ।

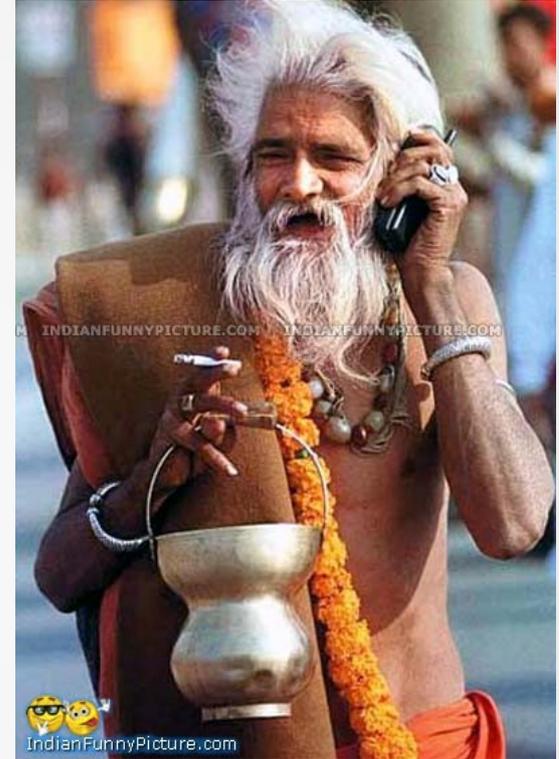
Brihadaranyaka Upanishad.

$$\nabla \cdot \mathbf{D} = \rho$$

$$\nabla \cdot \mathbf{B} = 0$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

$$\nabla \times \mathbf{H} = \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$$

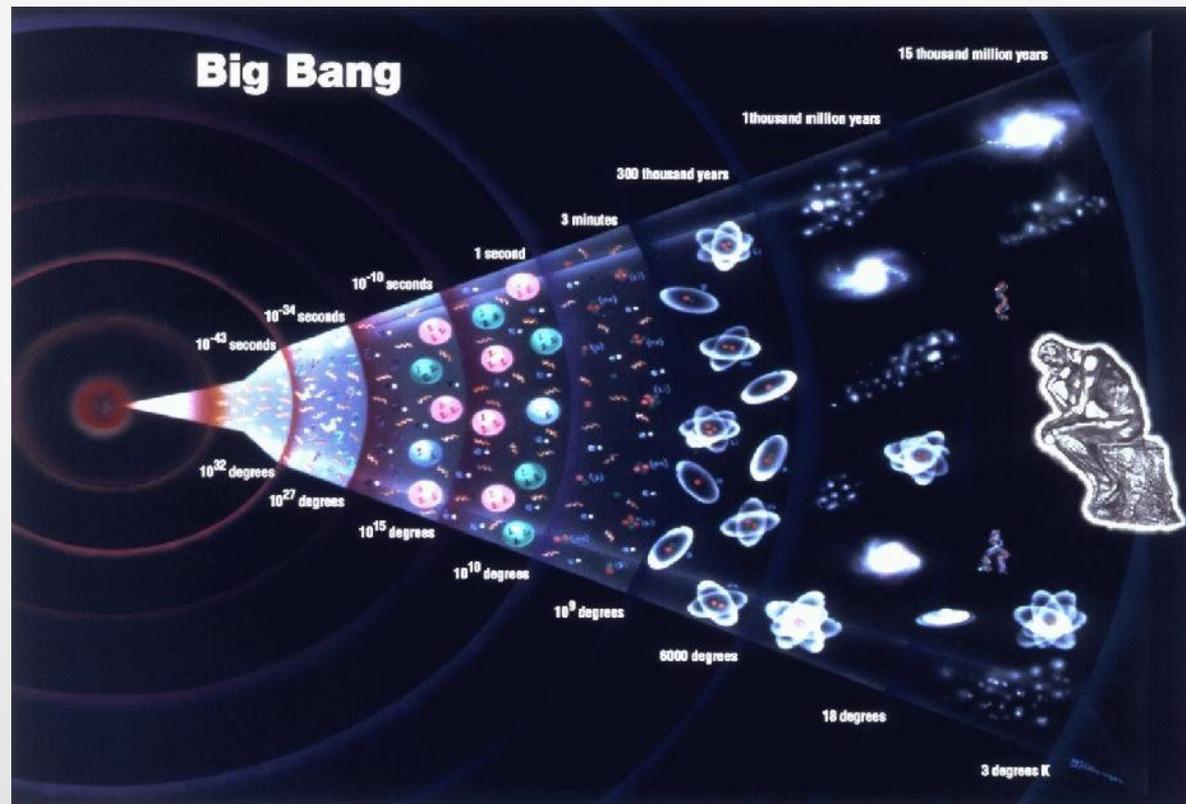


All religions were fascinated by light. Science discovered that **visible light is electromagnetic waves**. This truth was revealed to J C Maxwell and eventually different kinds of temples were built.

(Later on the General Theory of Relativity also entered this temple, GPS)

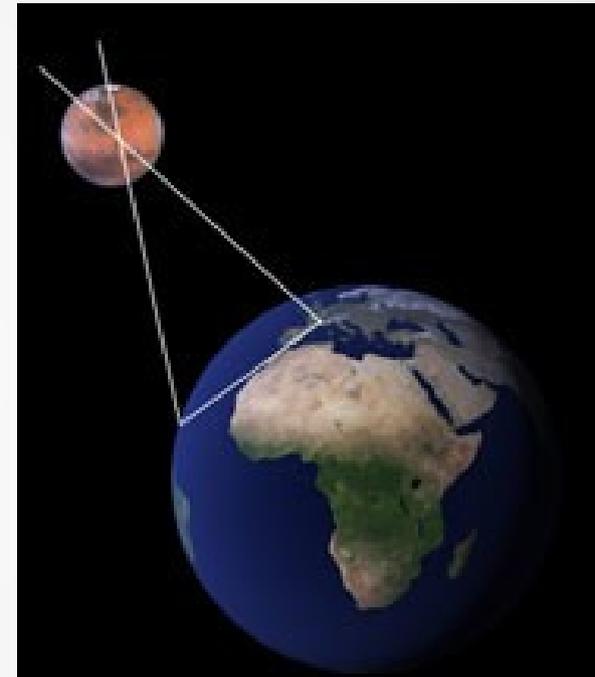
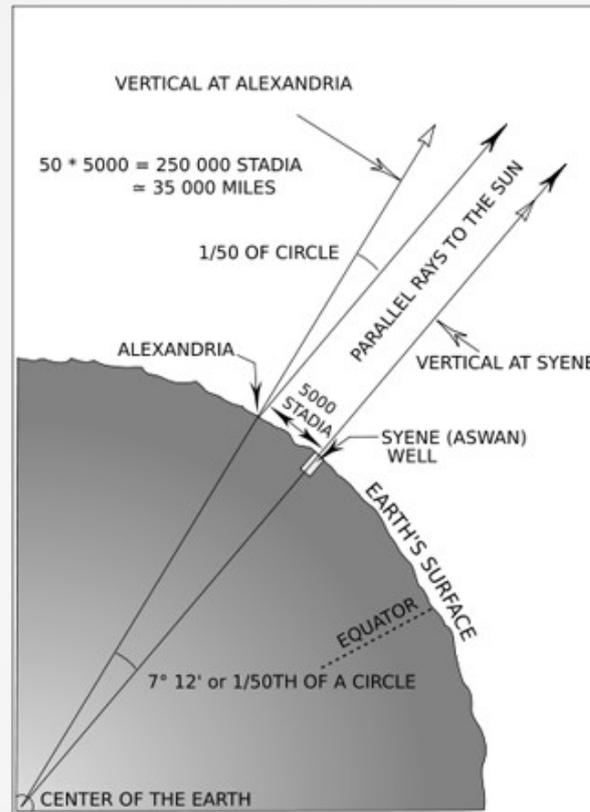
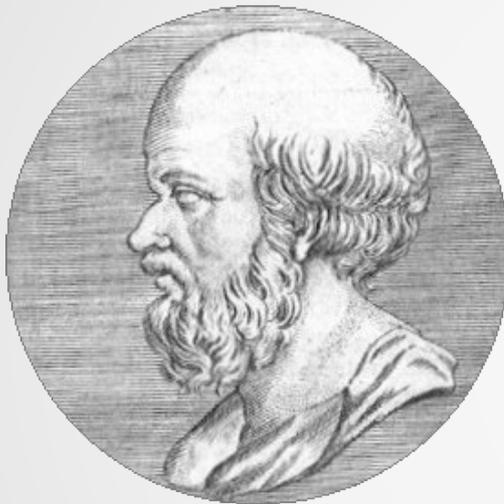
Creation stories

At some moment all of **space** was contained in a single point from which the Universe **has been expanding** ever since. Modern measurements place this moment at approximately **13.8 billion years** ago.



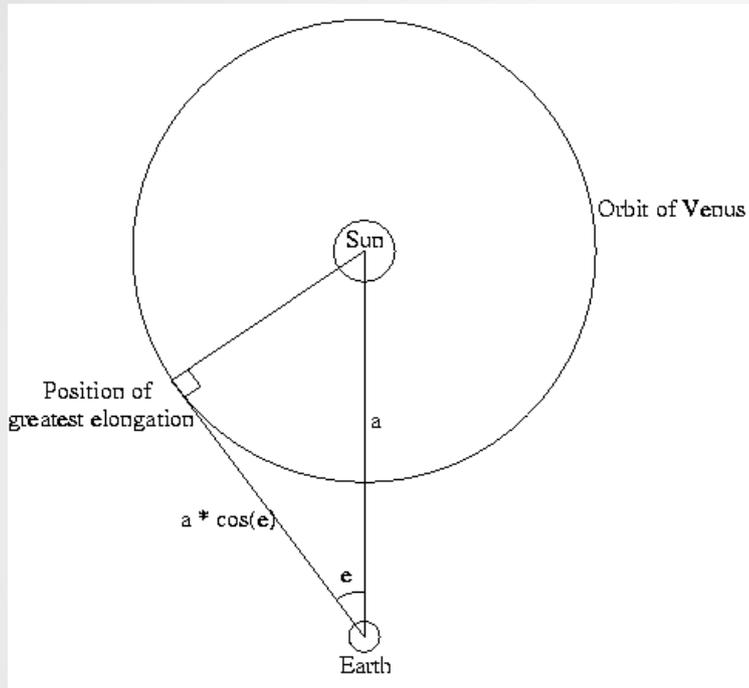
A school level explanation of Bigbang

ERATOSTHENES METHOD FOR DETERMINING THE SIZE OF THE EARTH

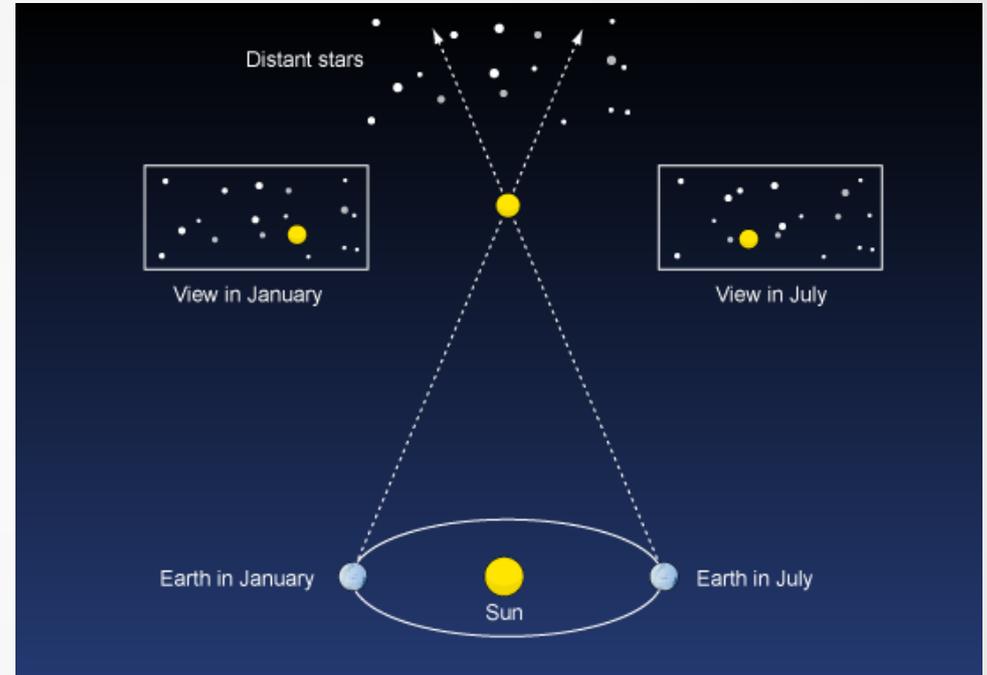


- Size of Earth. Erasthosthenes (276 - 194 BC)
- Parallax method can be used to find distance to a nearby planet.

Distance to Sun and Stars



Measure the position on Venus during Sunset / rise. From the angle distance to Sun can be calculated



Measure the position of the star with Six months interval and use parallax method, to calculate the **distance to a star**.

All elements have Signatures, Spectral lines

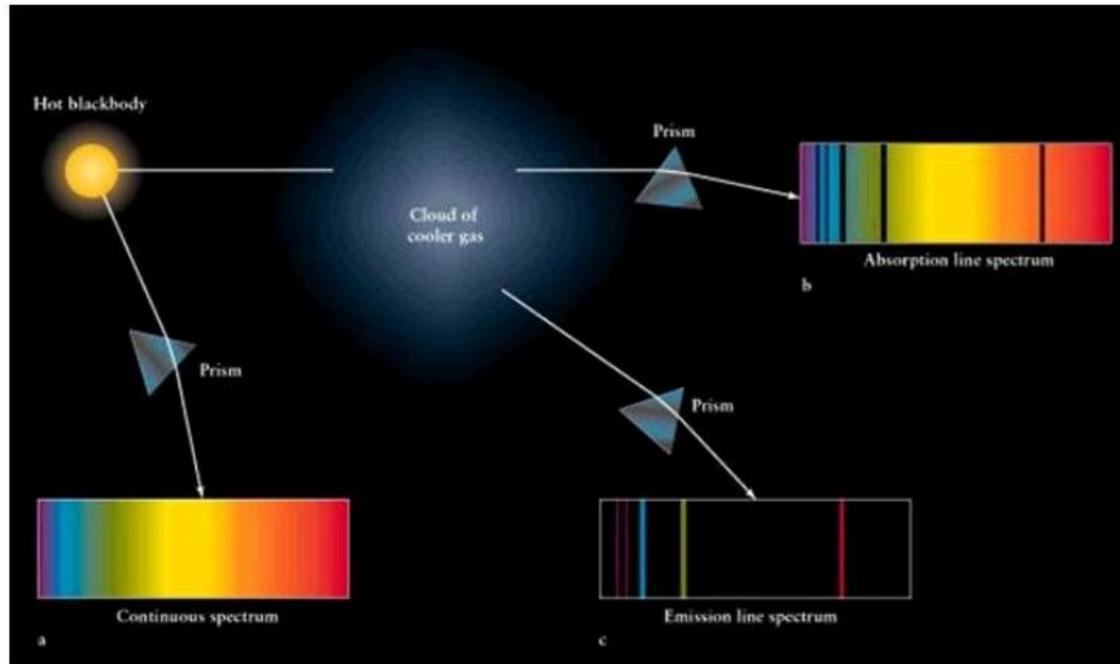
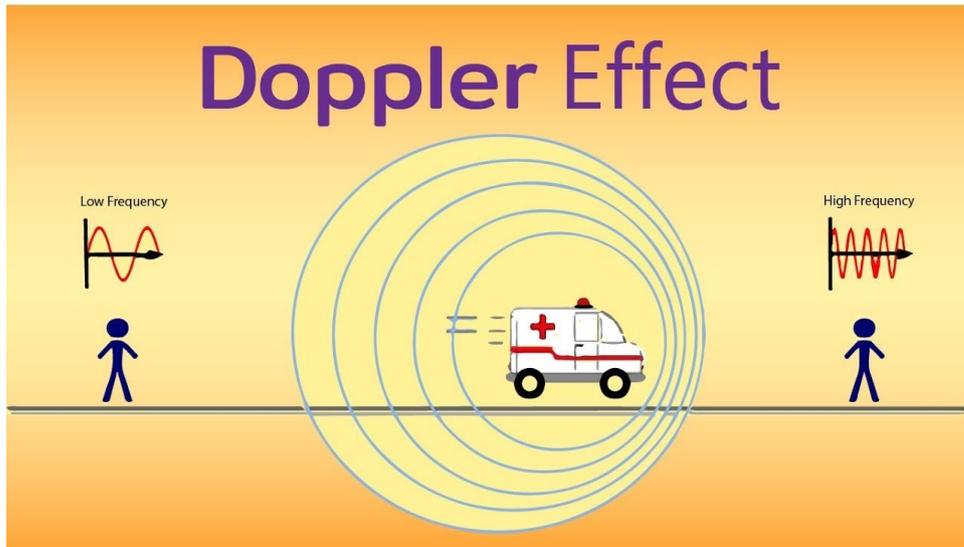


Fig: Emission & Absorption spectrum

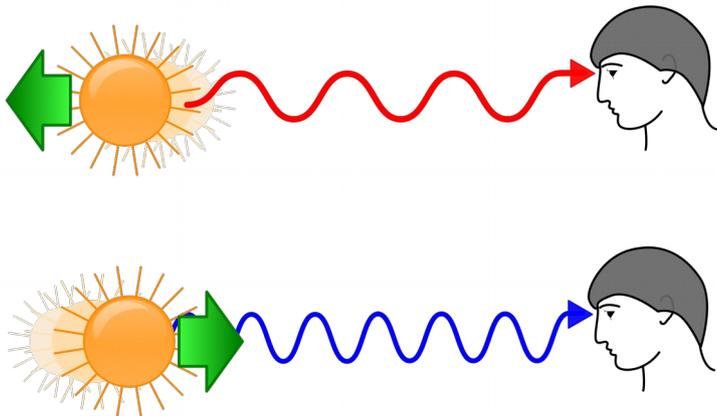
Exact composition of stars are measured by analyzing the light from them

Frequency changes with speed



Shift in frequency of sound depends on the velocity of the moving object.

$$f' = \left(\frac{v \pm v_0}{v \mp v_s} \right) f_0$$



Shift in the frequency of known spectral lines tells about the velocity of the Star.

Distance/velocity = Time , The star started from here 13.8 billion years ago (calculations are more involved)

- <http://hitoshi.berkeley.edu/>
- <https://www.youtube.com/watch?v=TGHqg9HuxkE>

Miller-Urey Experiment: Organic from Inorganic

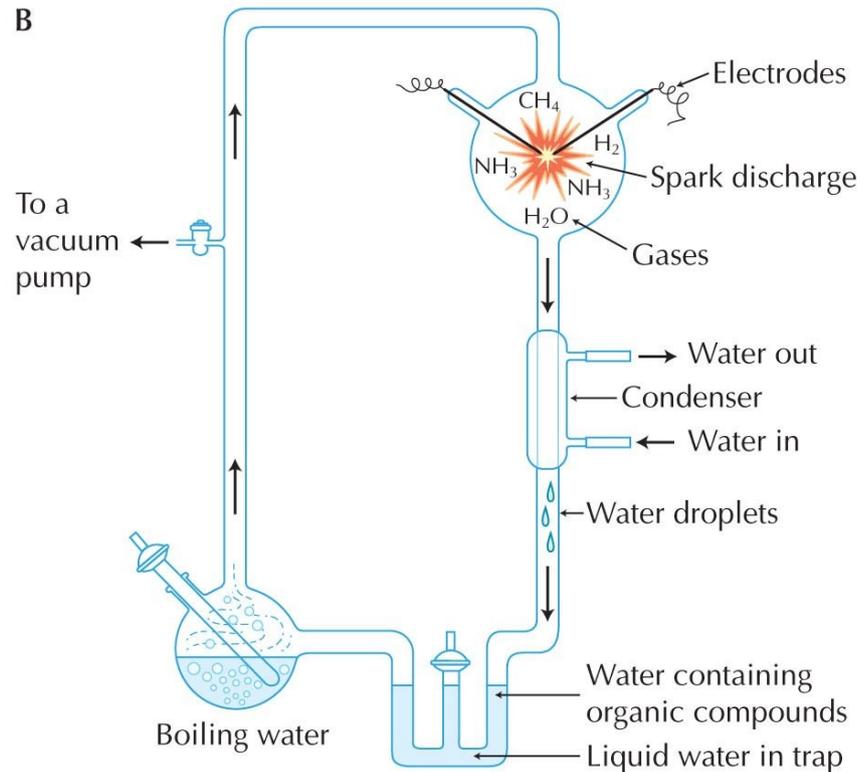


FIGURE 4.6. The apparatus used in the Miller–Urey experiments. (A) Recreation of the original apparatus. (B) Diagram of the apparatus.

4.6A, photo courtesy of NASA

Evolution © 2007 Cold Spring Harbor Laboratory Press

Formation of amino acids (organic) from volcanic gases, 1952.

DNA, Chromosomes, Genes

The survival
machine of Genes

Survival of the most
Evolutionary Stable

Book of Life uses
only four letters

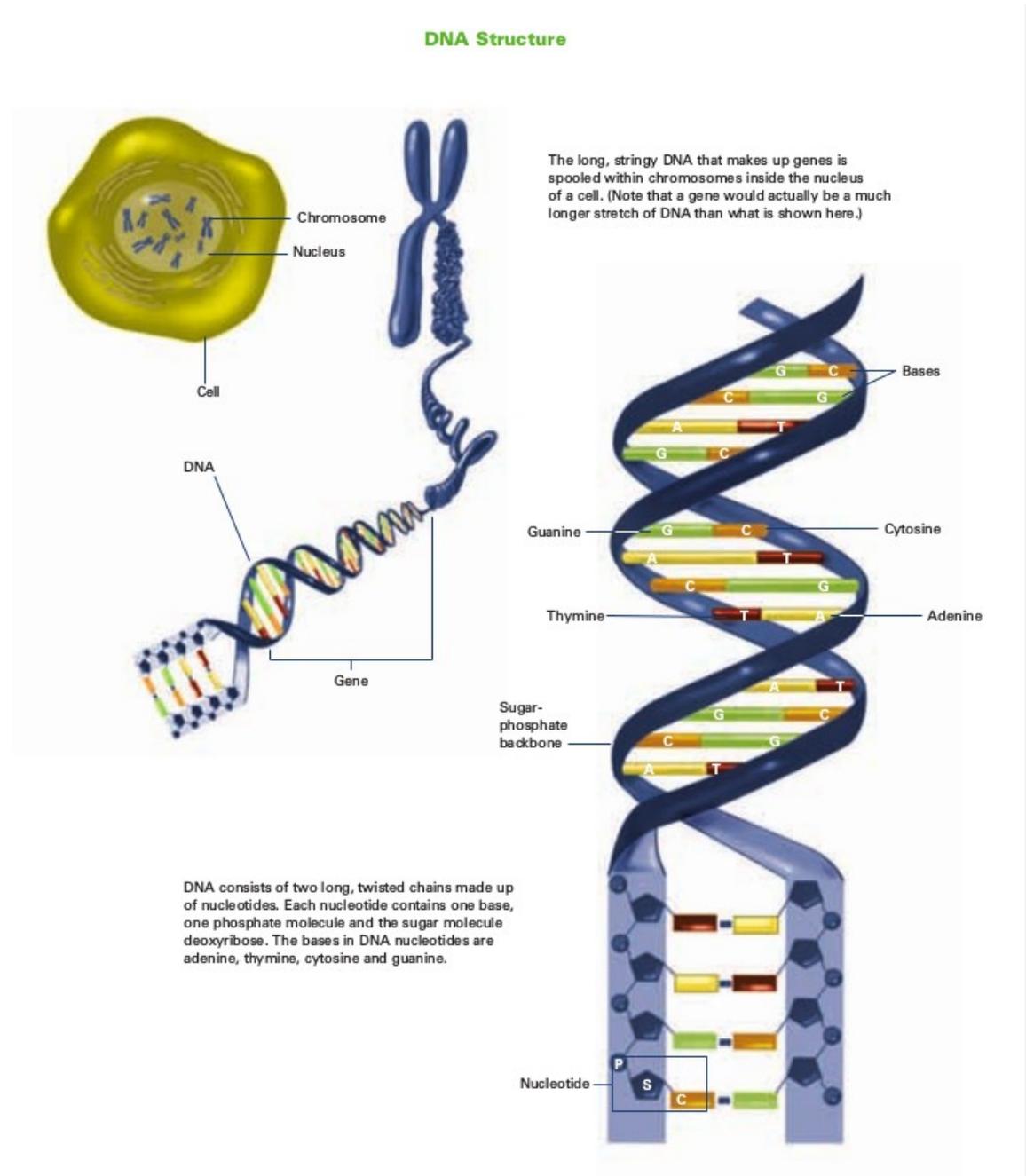
Adenine

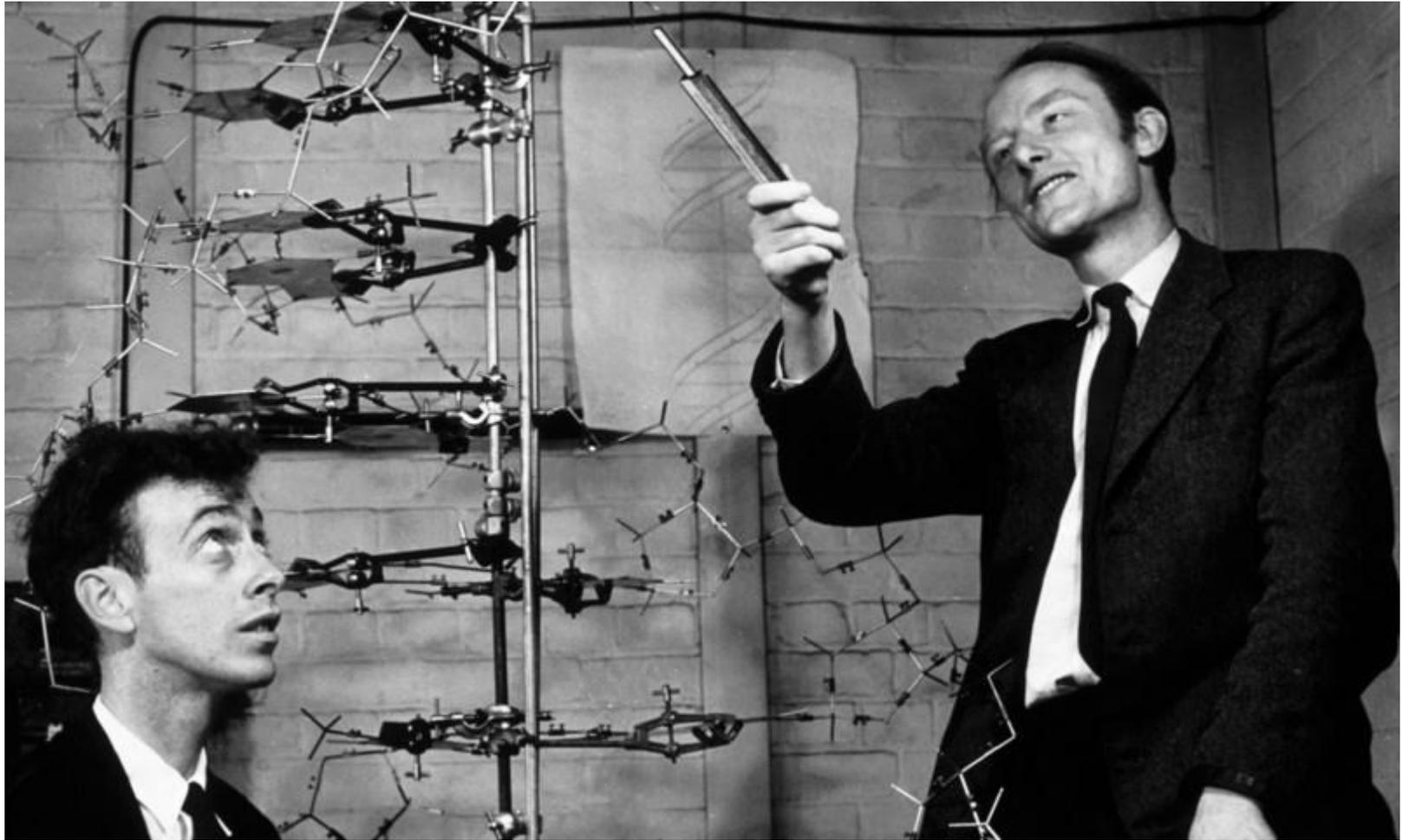
Thymine

Cytosine

Guanine

in three letter
sequences.

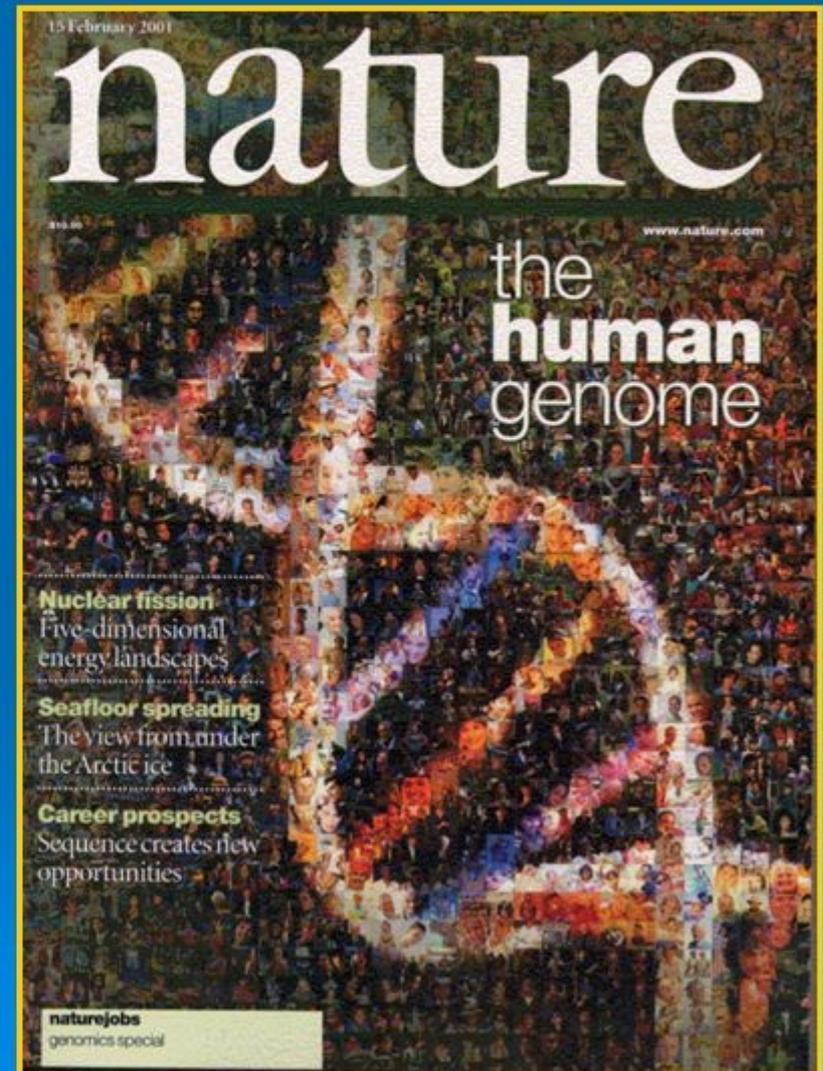




James Watson and Francis Crick, with the Double Helix DNA model

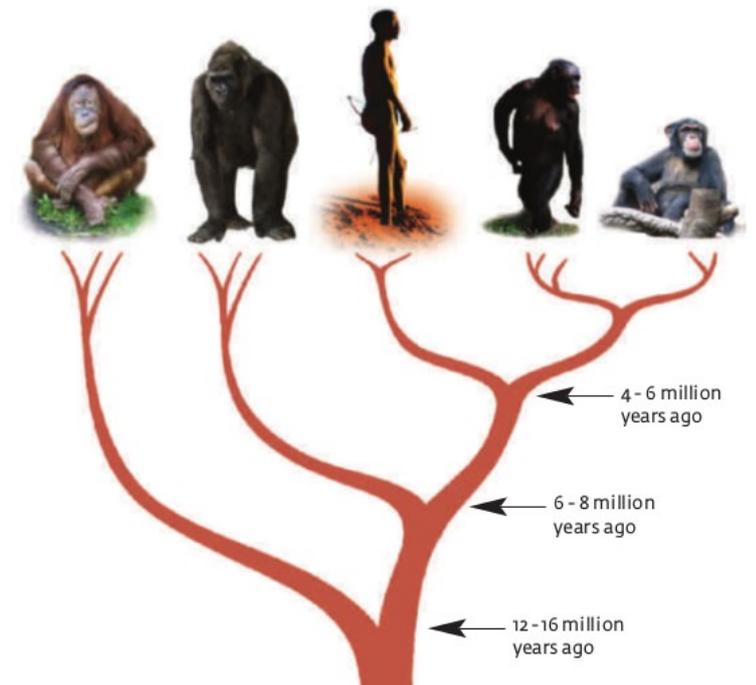
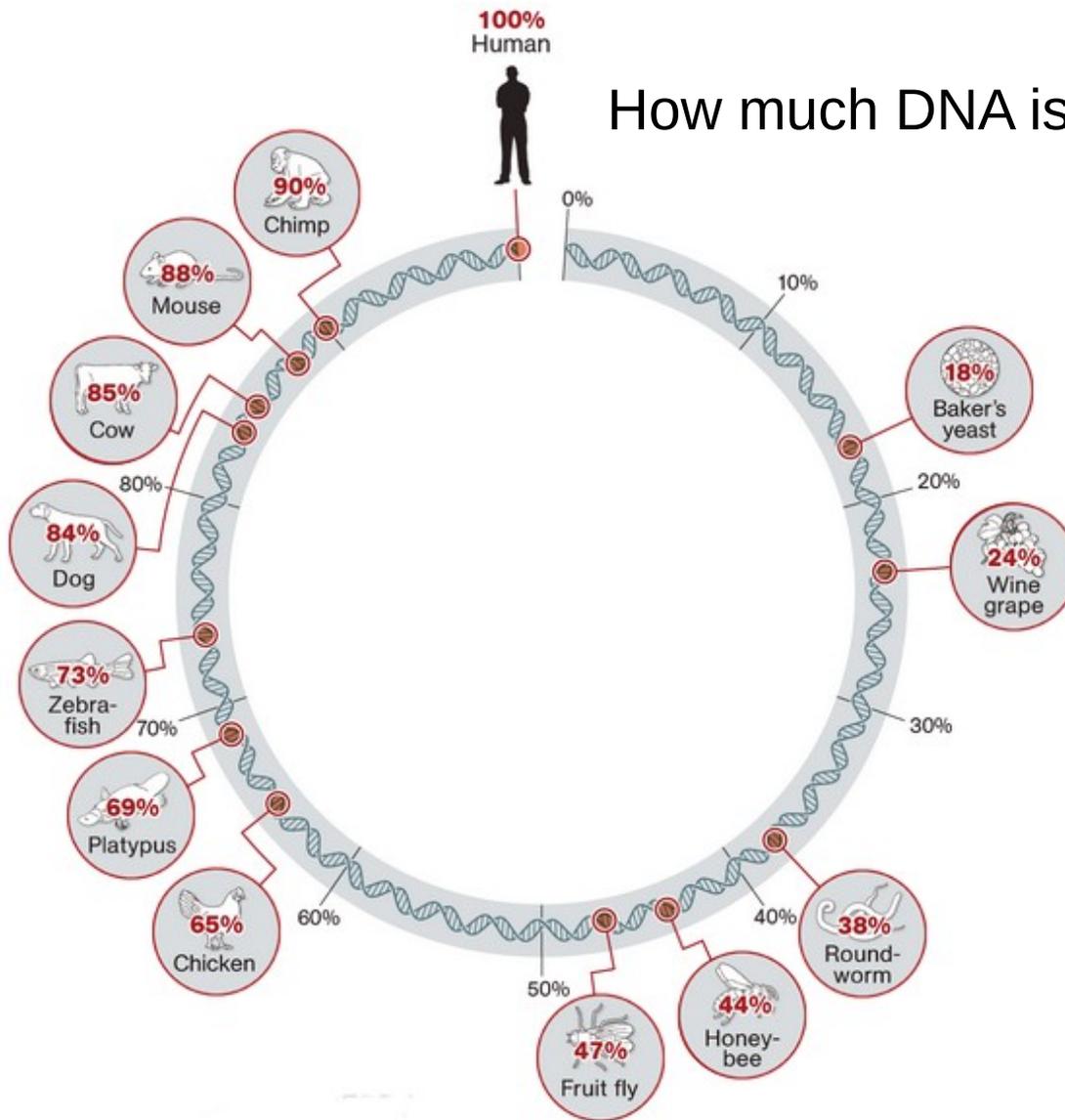
The Completion of the Human Genome Sequence

- June 2000 White House announcement that the majority of the human genome (80%) had been sequenced (working draft).
- Working draft made available on the web July 2000 at genome.ucsc.edu.
- Publication of 90 percent of the sequence in the February 2001 issue of the journal *Nature*.
- Completion of 99.99% of the genome as finished sequence on July 2003.



Theory of evolution at molecular level

How much DNA is common



Our Holy Book says

- The blade of grass you step on while walking is your distant cousin.
- It's atoms could be from those who walked on it yesterday.

Miracles ...

- Landing on the Moon, organ transplantation etc. are small miracles
- Appearance of Space, Time, Energy and Mass, formation of atoms and molecules, highly **complex assembly of molecules developing consciousness and searching for their own origin** can be considered as a first rate miracle.

Morals and Ethics

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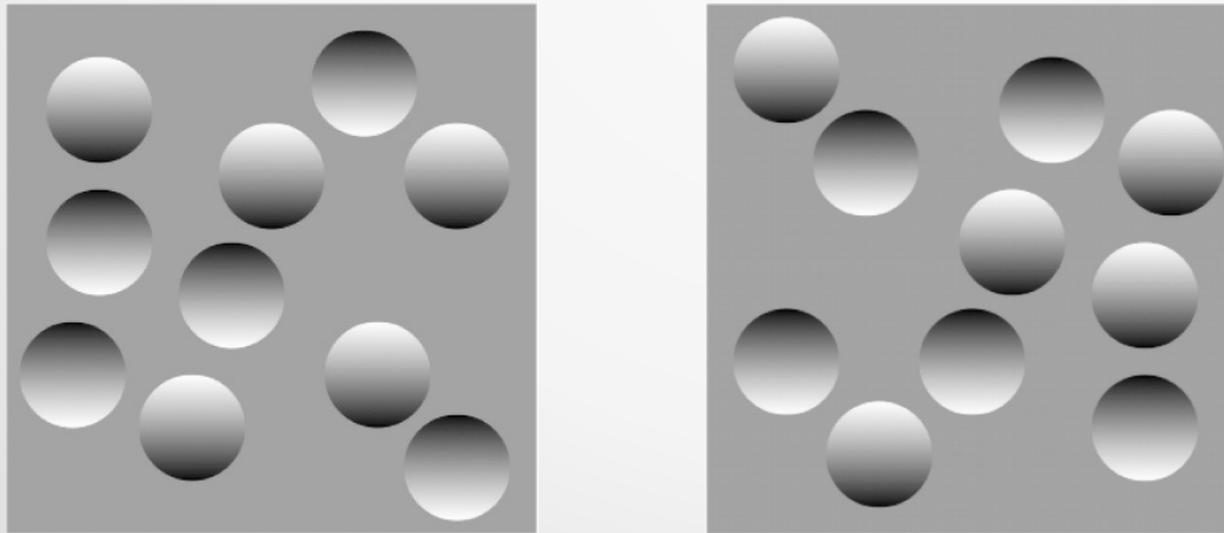
Scientists have mapped the interconnected brain regions involved in a mouse's empathetic response to seeing a companion in distress. Credit: Alamy

NEUROSCIENCE · 07 JANUARY 2021

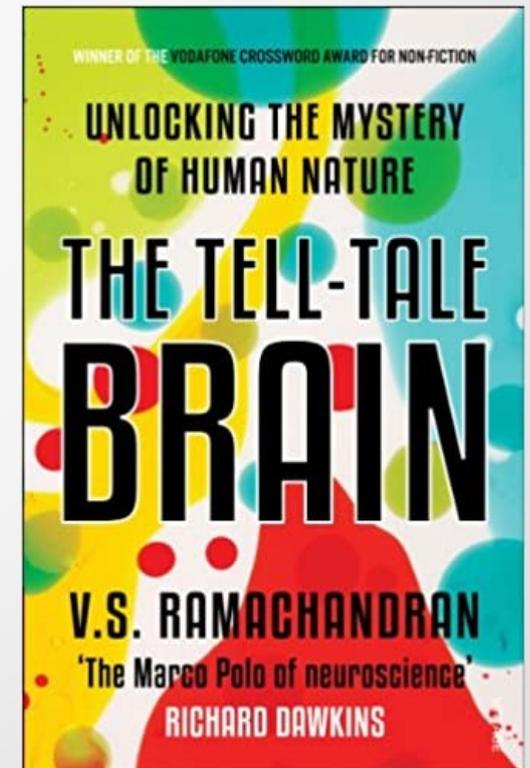
Brain maps show how empathetic mice feel each other's pain

Empathy is built-in

- Animal brains, including human, are wired for competition as well as collaboration. We should not spoil it by divisive ideologies and fear.
- Work of Jaak Panksepp
- <https://www.frontiersin.org/articles/10.3389/fnins.2018.01025/full>
- The Telltale Brain by V S Ramachandran



Same picture, rotated by 180°



3. Efforts to undermine Science

- Outright Rejection
 - Campaigns against vaccination, birth control etc.
- Opposition against certain theories about the physical universe
 - flat earth theory
 - creationism
- Misinterpret science to prove it is wrong. Entropy and Life.
- “Science Does Not Know All” argument by quoting science itself.
- Mixing science with ideologies to create fake science
- Trivialize science by ancient science propaganda
- Sabotaging by scientific progress by diverting it to irrelevant areas

Life is precious. But the views of Humans and Nature are different. To preserve the phenomenon of life nature is willing to sacrifice millions of lives. The humanist way is to prevent unwanted birth that may result in a premature death.

Trump administration can allow employers to deny birth control, Supreme Court rules

Challenge to Affordable Care Act rule exempts religious groups from mandate that guarantees access to women's healthcare

Alex Woodward New York | Wednesday 08 July 2020 13:04 | [comments](#)



The **US Supreme Court** has sided with a policy under **Donald Trump's** administration that allows employers with religious or moral objections to limit access to birth control, a blow to an **Affordable Care Act** mandate to expand women's access to preventative healthcare.

Rule changes could impact as many as 126,000 people, according to government estimates.

Justices **Ruth Bader Ginsburg** and **Sonya Sotomayor** dissented in the high court's 7-2 decision.

In her dissent, Justice Ginsburg wrote: "In accommodating claims of religious freedom, this Court has taken a balanced approach, one that does not allow the religious beliefs of some to overwhelm the rights and interests of others who do not share those beliefs. Today, for the first time, the Court casts totally aside countervailing rights and interests in its zeal to secure religious rights to the nth degree."

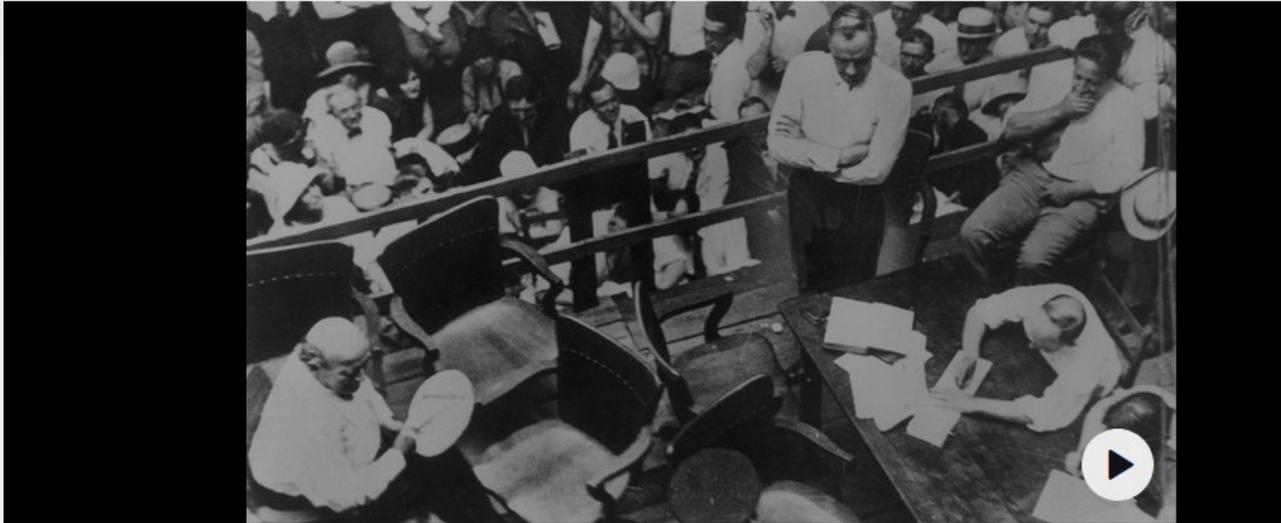
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“..teach any theory that denies the story of the Divine Creation of man as taught in the Bible, and to teach instead that man has descended from a lower order of animals.” from a Tennessee law

THIS DAY IN **HISTORY** | JULY 10 ▾



1925

July 10

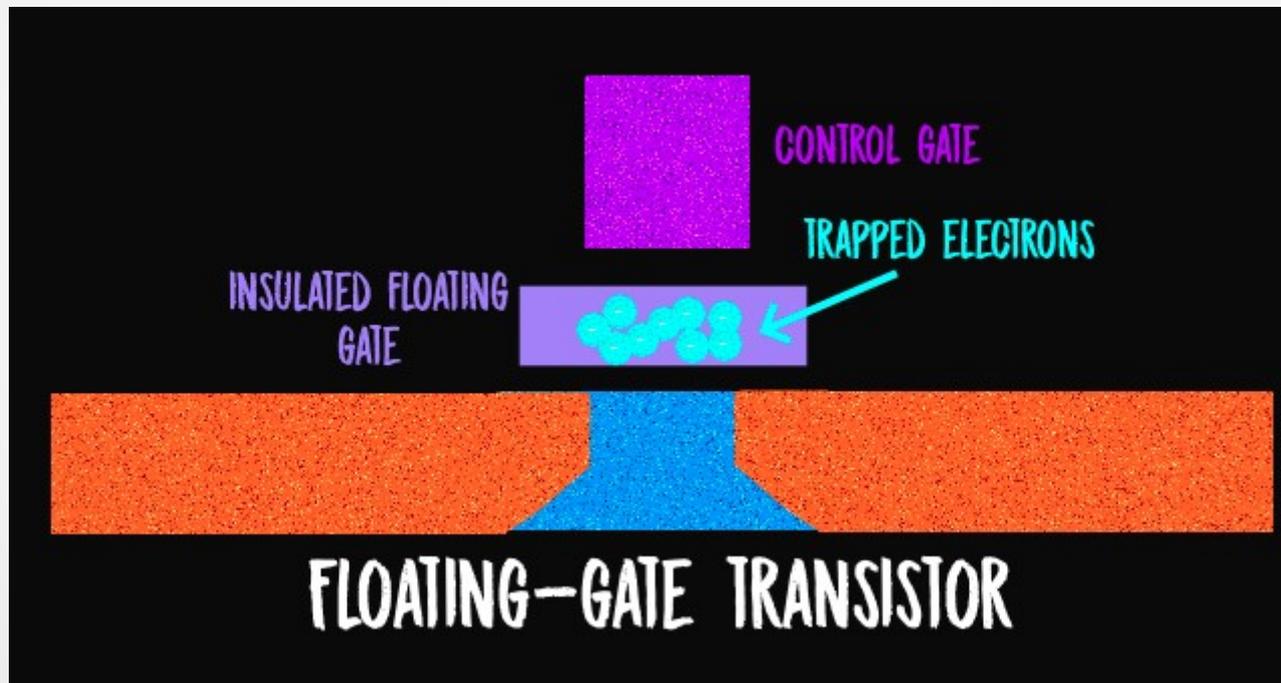
Scopes Monkey Trial begins



In Dayton, [Tennessee](#), the so-called [Scopes Monkey Trial](#) begins with John Thomas Scopes, a young high school science teacher, accused of teaching [evolution](#) in violation of a Tennessee state law.

Science doesn't know the ultimate...

- Wave or particle ?
- Atom is only an assumption.
- Uncertainty is Quantum Mechanics.



Precise calculations decide the amount of trapped electrons. The USB pen drive in your pocket has billions of such junctions, performing exactly as predicted by Quantum Mechanics.

Mixing political ideologies with science...

SCIENCE

The Soviet Era's Deadliest Scientist Is Regaining Popularity in Russia

Trofim Lysenko's spurious research prolonged famines that killed millions. So why is a fringe movement praising his legacy?

SAM KEAN DECEMBER 20, 2017



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Why this ad? ⓘ

Lysenko promoted the Marxist idea that the environment alone shapes plants and animals. Put them in the proper setting and expose them to the right stimuli, he declared, and you can remake them to an almost infinite degree.



NATIONAL

Coronavirus: Group hosts 'cow urine party', says COVID-19 due to meat-eaters



NEW DELHI, MARCH 14, 2020 22:39 IST
UPDATED: MARCH 15, 2020 09:50 IST

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'Miracle' liquid: A member of the Akhil Bharat Hindu Mahasabha drinking cow urine at the event in New Delhi on Saturday. | Photo Credit: Getty Images

'Global leaders should import the liquid from India'

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Trending in National

National Nanda Devi glacier burst updates | Seven bodies recovered so far, Dhauliganga water level rises again

National India has transgressed LAC more often than China: V.K. Singh

Other States Uttarakhand glacier burst | Experts point to climate change impact

National Uttarakhand flood: 2019 study warned Himalayan glaciers melting at alarming speed

Other States Uttarakhand glacier disaster: State govt. releases ₹20 crore

Dividing science in space and time ...

“The ancient formulations like Kayakapa and Chyavanprash astonish modern drug formulators.

Blending of noble metals like gold, silver, and mercury with certain herbs and their administration has sound basis in modern medicine too.”



The screenshot shows a web browser displaying the Vedic Heritage website. The address bar shows the URL vedicheritage.gov.in/science/. The website header includes the logo and name "vedic heritage" and "Indira Gandhi National Centre for the Arts, Ministry of Culture, Government of India". A navigation menu lists categories: HOME, INTRODUCTION, SAMHITAS, BRAHMANAS, ARANYAKAS, UPANISHADS, VEDANGAS, RITUALS, UPAVEDA, and PRESENT CONTEXT. The "PRESENT CONTEXT" section is active, showing a list of topics: Agriculture, Astronomy, and Cosmology. The "SCIENCE - VEDAS-INDIA'S SCIENCE BASE" section is also visible, with an "INTRODUCTION" paragraph stating: "The basis for any scientific discoveries and inventions is to explore, observe, experiment and interpret. For this, one needs to bank on prior knowledge, facts that are documented, so that the results lead to new or improved status in the given realm."

http://vedicheritage.gov.in/Vijnana_Bharati_1/VB_02_15.pdf

<https://www.who.int/news-room/fact-sheets/detail/mercury-and-health>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3764874/>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2755247/>

Unscientific 'science'

THIS STORY IS FROM OCTOBER 13, 2020

Cow dung chip reduces radiation from mobiles, safeguard against diseases: Rashtriya Kamdhenu Aayog chief

ANI | Oct 13, 2020, 17:14 IST

✉️ 🖨️ A- A+



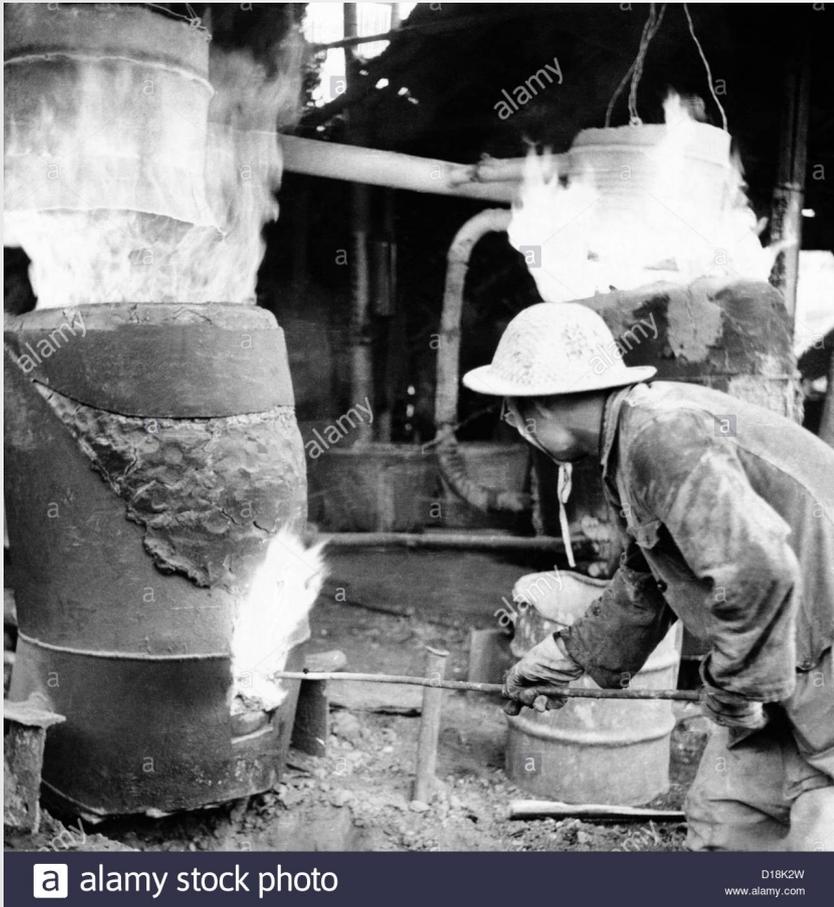
Vallabh bhai Kathiria, Chairman, Rashtriya Kamdhenu Aayog, shows cow- dung based Diwali articles during a news ... [Read More](#)

NEW DELH: [Rashtriya Kamdhenu Aayog](#) (RKA) chairman [Vallabh bhai Kathiria](#) unveiled a 'chip' made of [cow dung](#) and claimed that it reduces radiation from mobile handsets and it will be a safeguard against diseases.

Speaking at the launch of a nationwide campaign 'Kamdhenu [Deepawali Abhiyan](#)', which is aimed at promoting cow dung products,

Kathiria said: "Cow dung will protect everyone, it is anti-radiation... It is scientifically proven...This is a radiation chip that can be used in mobile phones to reduce

The Great Leap Forward (China, 1958 to 1962)



Backyard Furnace

Autocratic rulers ignoring established science could result in tremendous damage.

The Great Chinese Famine is widely regarded as the deadliest famine and one of the greatest man-made disasters in human history, with an estimated death toll due to starvation that ranges in the tens of millions (15-55 millions+)

Chinese movies on YouTube

“To Live” life during the revolution

<https://www.youtube.com/watch?v=wNTd0dydfE4>

“Red Sorgham” , story during Japanese invasion

<https://www.youtube.com/watch?v=-E31v5HJsCI>

Claims of Ancient Technology

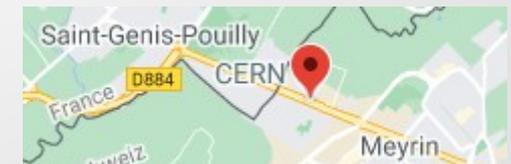
Did we have nuclear weapons during Mahabharata war ?

You need to look for evidence only in that book.

Look for any evidence of electricity.

Should we divide Science in Space and Time ??

- By knowing what you will learn about all the things in this world ?
 - Aryabhata
 - Kepler
 - Newton
 - Einstein
 - Chandrasekhar
-
- It is curious to imagine what will happen if the Rishis who asked the profound questions appear here today.



Which is a better world ? The ancient one or the modern

Greeks claim an ancient democracy, but slaves and women had no say in it.

One can learn about India's ancient past from the epics like Mahabharatha.

Do we like to hear the question that was asked to Karna ?

Concepts like equality and liberty are very new, but should we accept ideas based on their place of origin ?

Should we accept the epics as history ?

Points to ponder

- Philosophy gave rise to both Religion and Science
- Is Science becoming a better “Religion” than all other ones
- All religions preach against individual ego but survives on collective ego of groups.
- Does Nationalism differ from religion in its nature
- False Pride is a key factor in both
- Science punctures the false pride of Human race, should we like it.

असतो मा सद्गमय ।
तमसो मा ज्योतिर्गमय ।
मृत्योर्मा अमृतं गमय ।

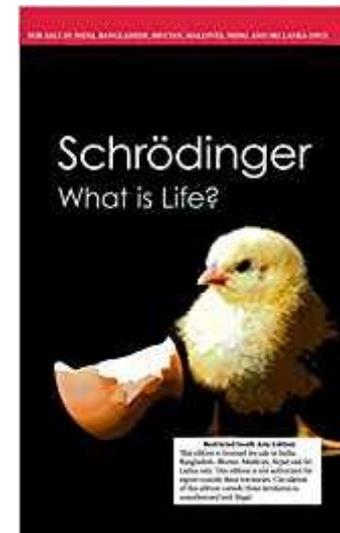
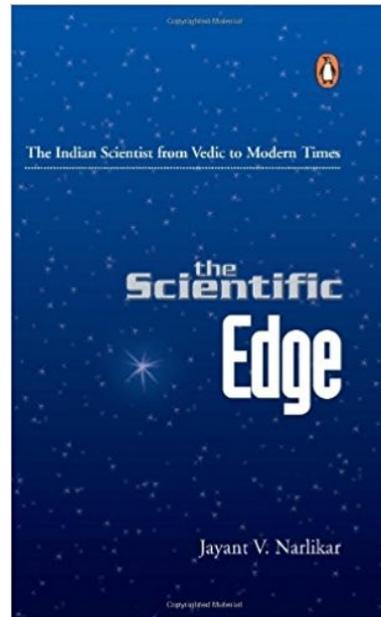
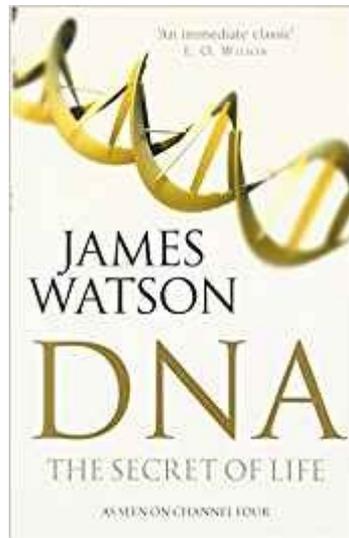
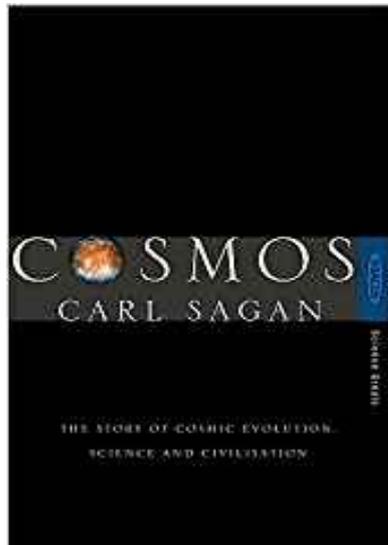
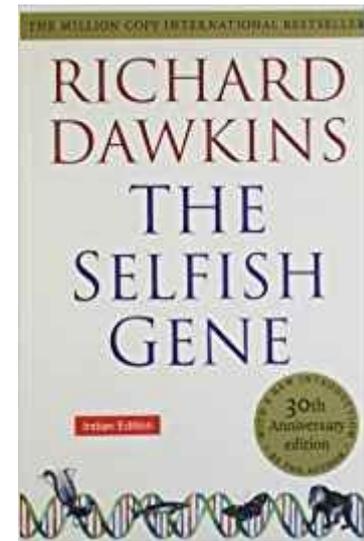
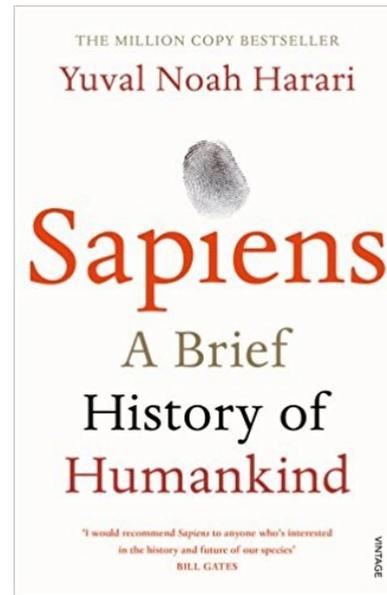
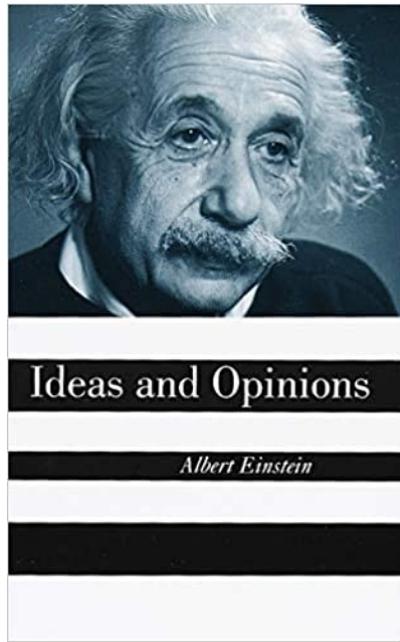
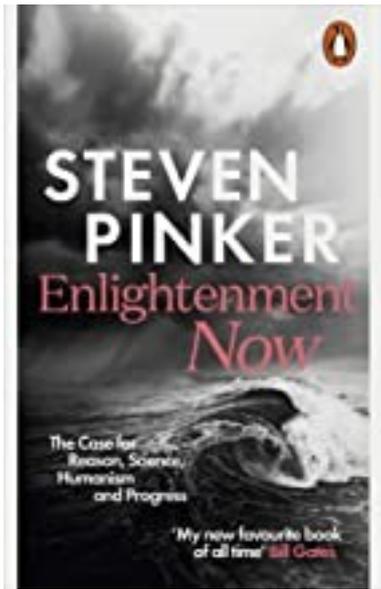
Brihadaranyaka upanishad

From falsehood lead me to truth,
From darkness lead me to light,
From death lead me to immortality.

The legacy of this lines belongs to science and not to those who
just chant it.

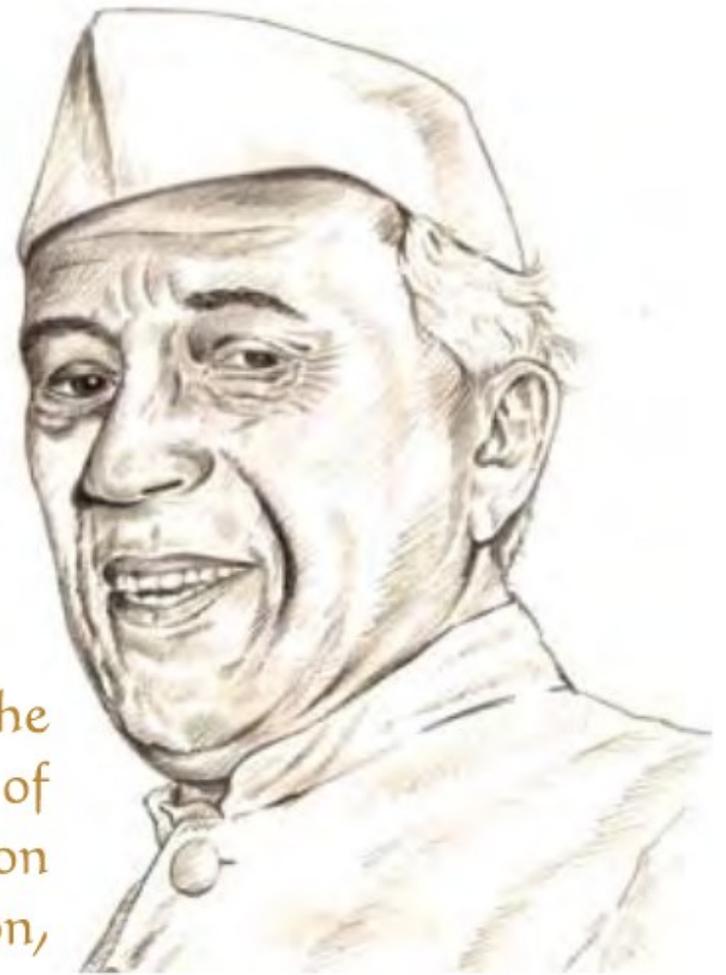
Science does not respect the narrow boundaries created by
humans.

Join and strengthen it for a better world.



“It is science alone that can solve the problems of hunger and poverty, of insanitation and illiteracy, of superstition and deadening of custom and tradition, of vast resources running to waste, or a rich country inhabited by starving poor... Who indeed could afford to ignore science today? At every turn we have to seek its aid... The future belongs to science and those who make friends with science.”

— Jawaharlal Nehru



Thank You for your Attention

