



**“Ciencia después del coronavirus.
La sublime utilidad de la ciencia inútil”**

Pedro M. Etxenike
XXVI Reunión SEUP
Pamplona, 16 de junio de 2022

“Muerte terrible, aterradora con su antorcha sepulcral”

John Milton en su *Elegia tertia* para conmemorar la muerte del obispo de Winchester en 1626 a causa de la peste.

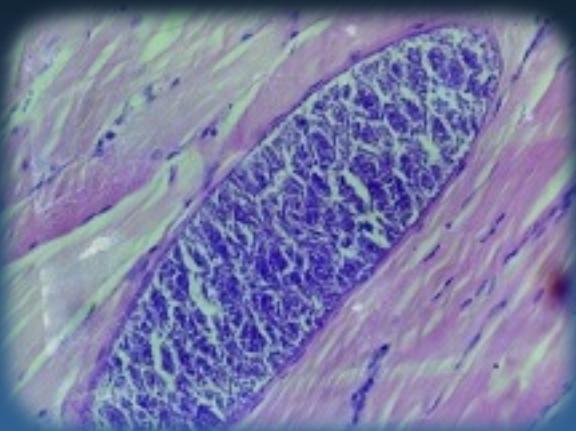
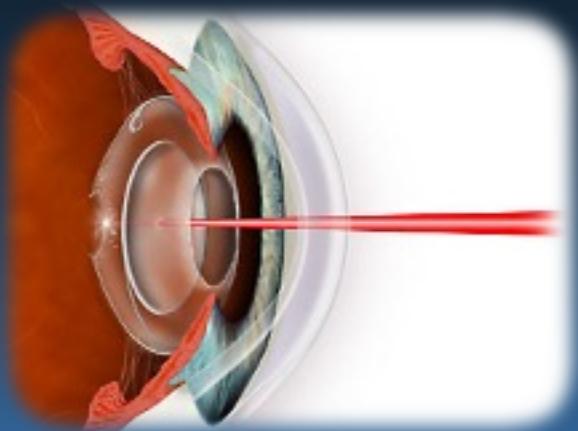
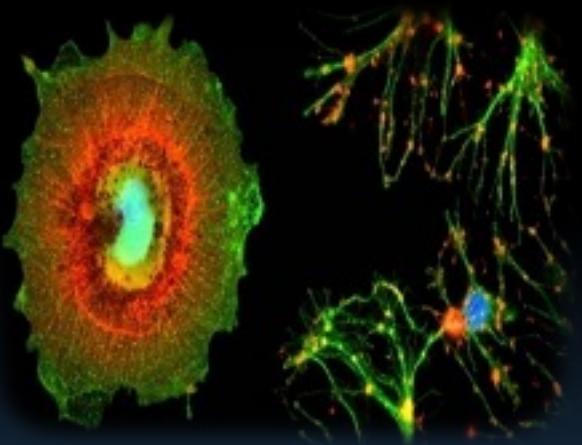
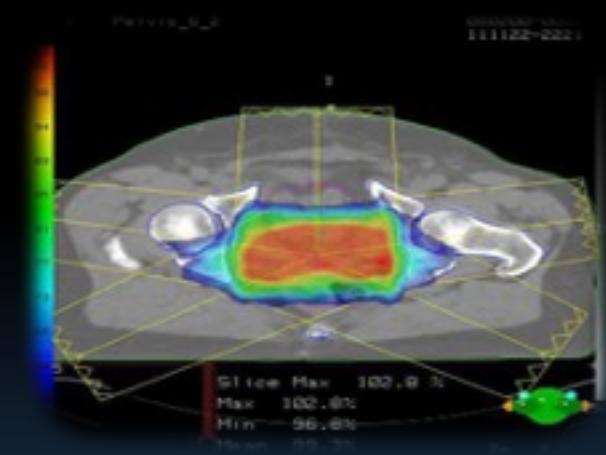
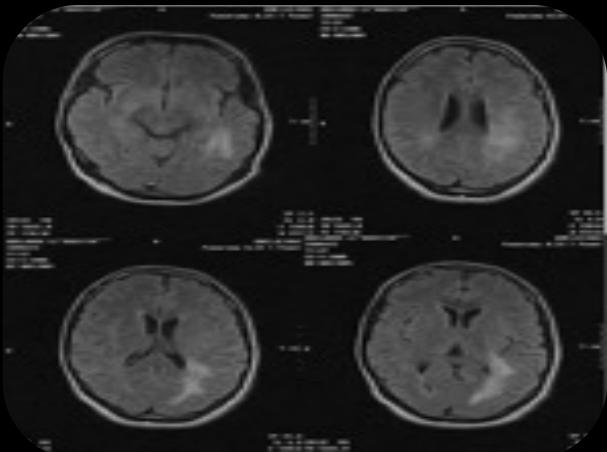
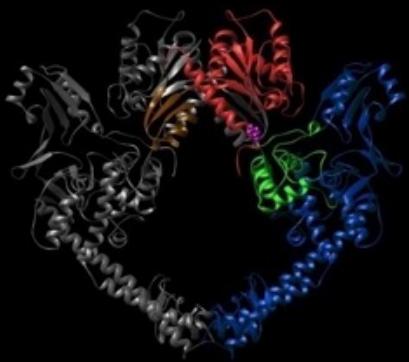


“La respuesta es la
ignorancia. El
remedio es todavía
desconocido”

-1899-

Henry A. Rowland
1^{er} Presidente de la Sociedad
de Física Americana





**“no hay duda, lo más poético,
más poético que las flores y más
que las estrellas,
es no enfermar”**

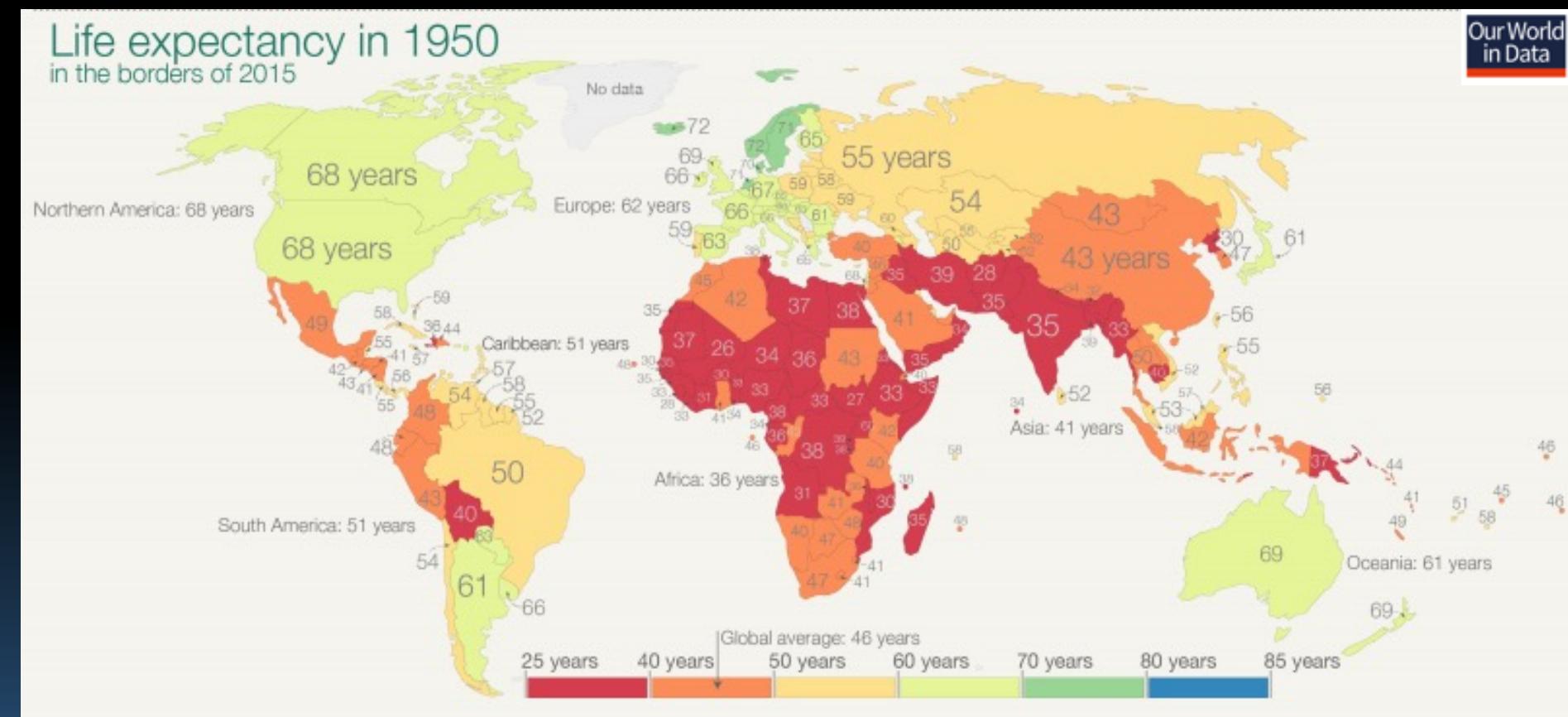
Chesterton

Vivimos más



- Historical estimates suggest that up to at least the year 1800 the life expectancy for people in all countries was less than 40 years.
- These historical estimates come with substantial uncertainty.

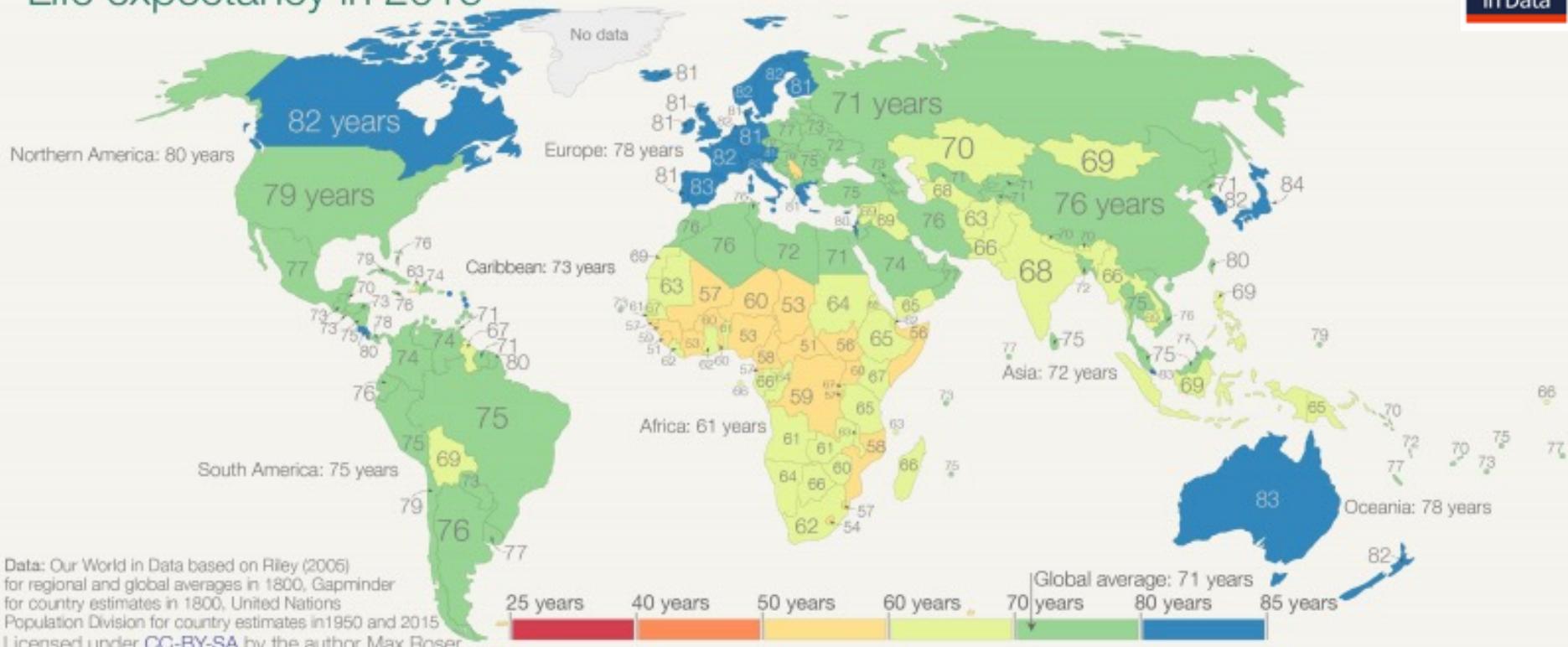
Vivimos más



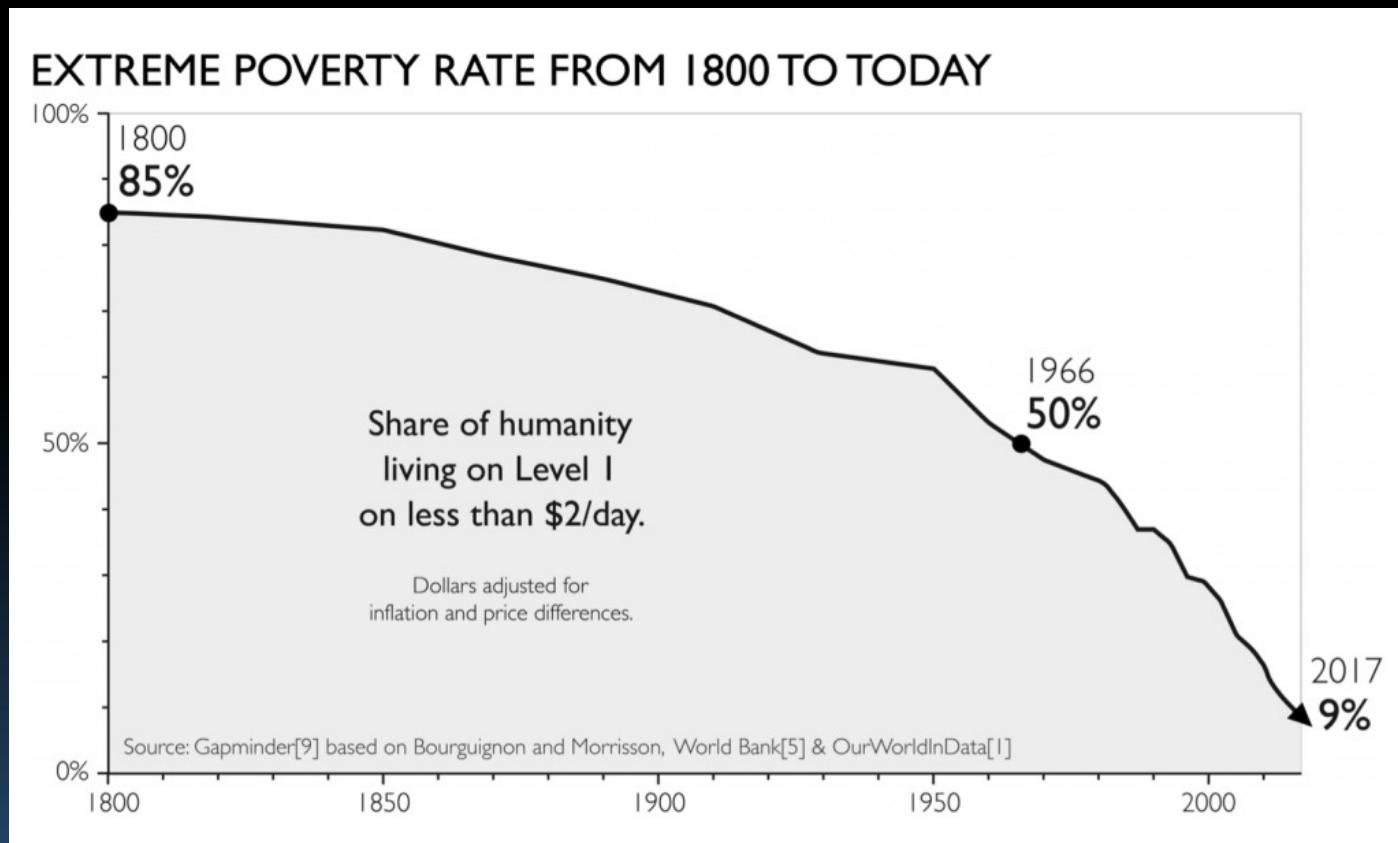
Vivimos más

Life expectancy in 2015

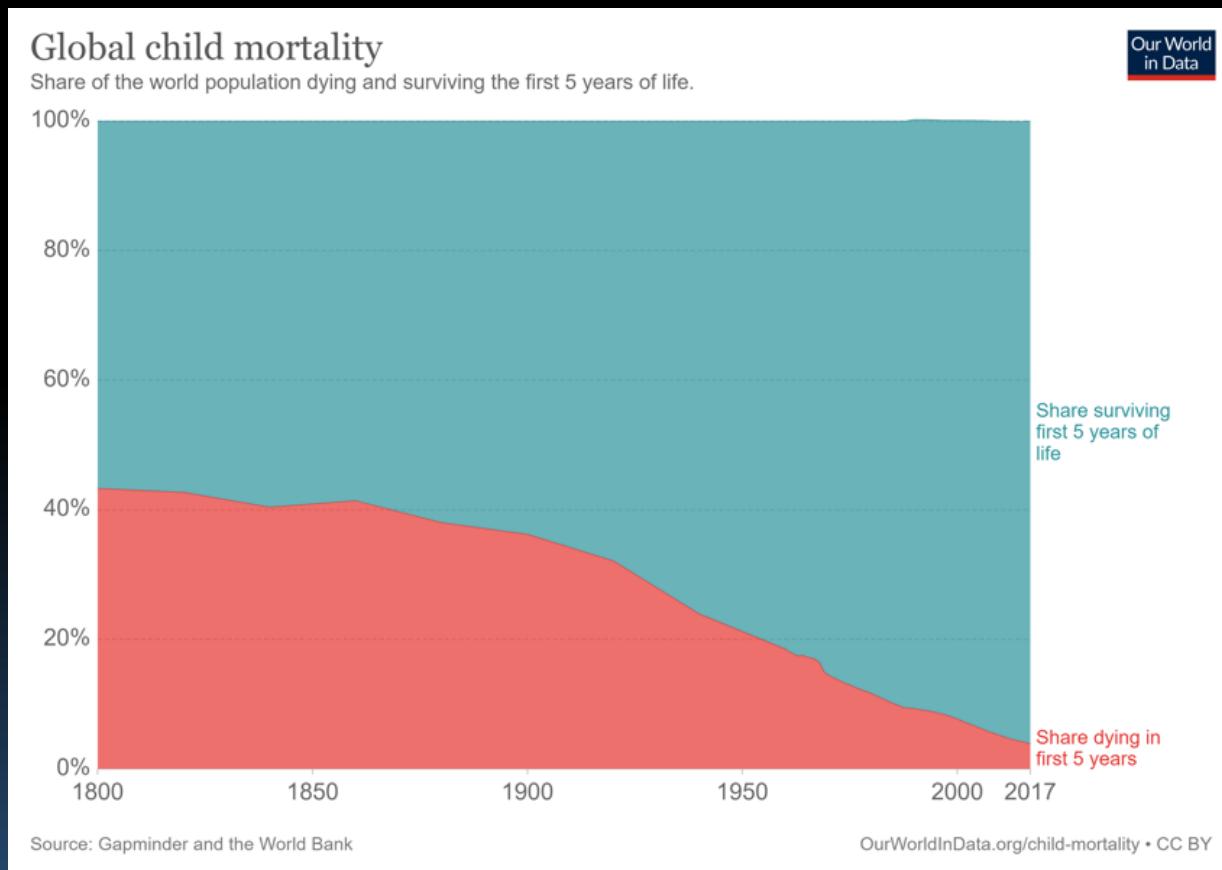
Our World
in Data



Vivimos mejor



Vivimos más



CIENCIA



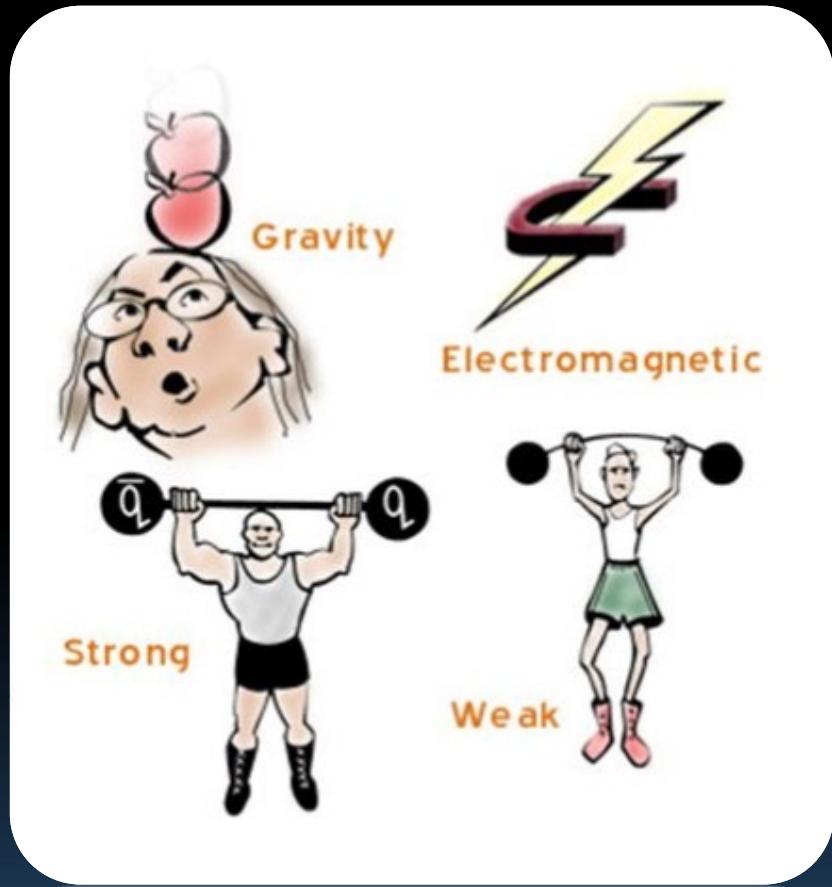
La ciencia es cultura

The conceptual structure of
Science is the most important
collective cultural work of mankind,

the most beautiful collective work
of art of mankind

CULTURE

Ciencia



**Los constituyentes
últimos de la materia son
muy pocos y obedecen a
leyes de gran simetría.**



El mundo de las cosas es vasto, inmenso e infinitamente variado. Es inexhaustible. Porque son inexhaustibles las posibilidades, tanto en el mundo inanimado de copos de nieve y galaxias, como en el animado de felinos y flores.





ÁTOMO

Nanotecnología

XX.MENDEA

The periodic table of the elements

	IA	IIA	IIIA	IVA	VIA	VIIA	VIII A	IB	IIB	IIIB	IVB	VIB	VIB	VIB	O
1	H														He
2	Li	Be													Ne
3	Na	Mg													Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn			Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Xe
6	Cs	Ba	L	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	At
7	Fr	Ra	A												Rn
			L	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er
			A	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Tm
															Yb
															Lu

- Metallic
- Metalloid
- Non metallic
- Trans.metallc
- Rare gas

Copyright(C) 1997 CCIMS

Uranium

Silicon



BIT

Información

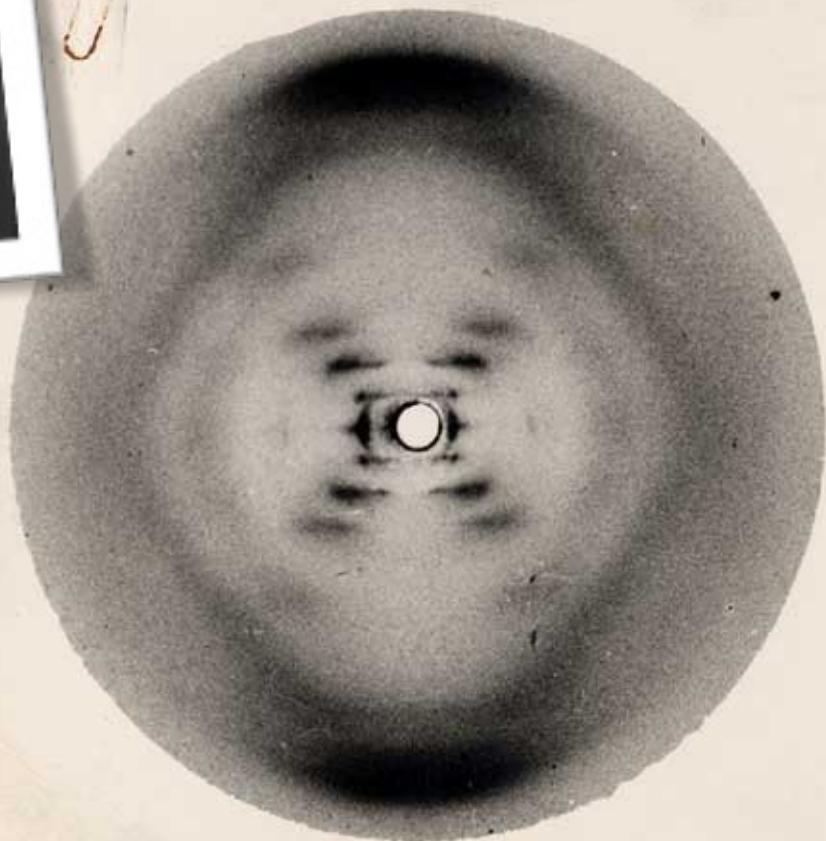




GEN

Biotecnología

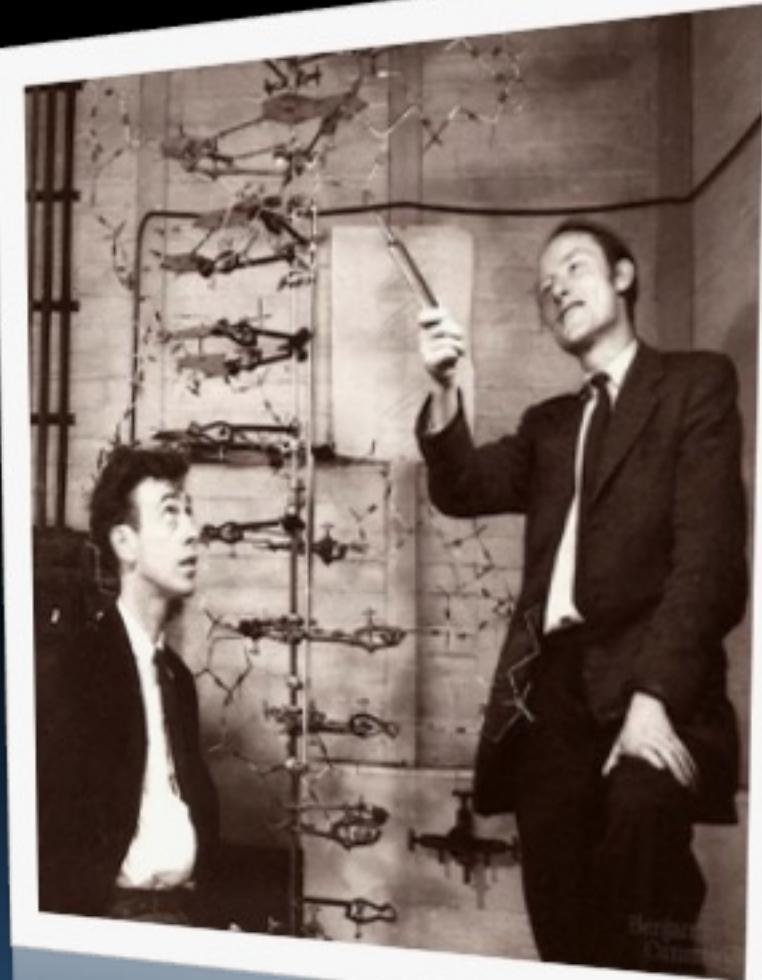
Una modesta foto ...

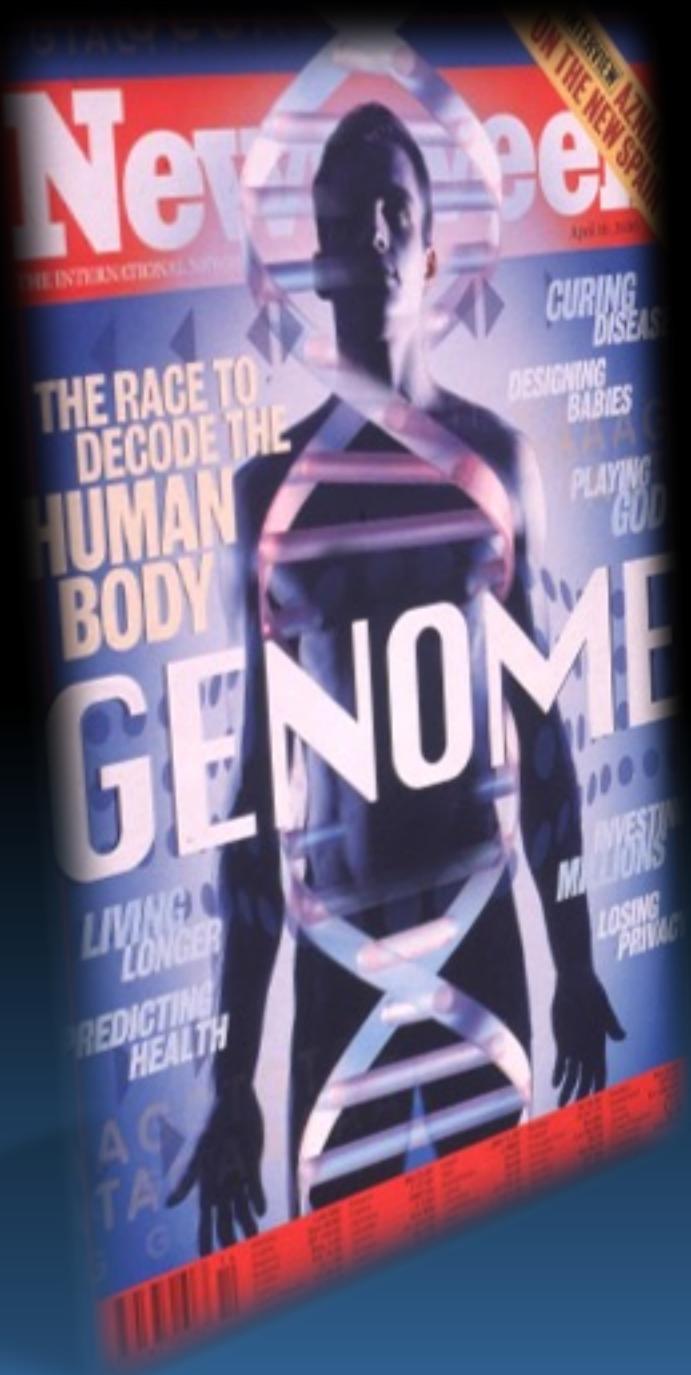


Franklin &
Rosalind
Rabbit pox
Type I

Plate 1

... da paso a
una gran
revolución





PROYECTO GENOMA

Terapia génica
Genómica artificial
\$\$\$\$\$\$\$



Largo plazo

Colectivo

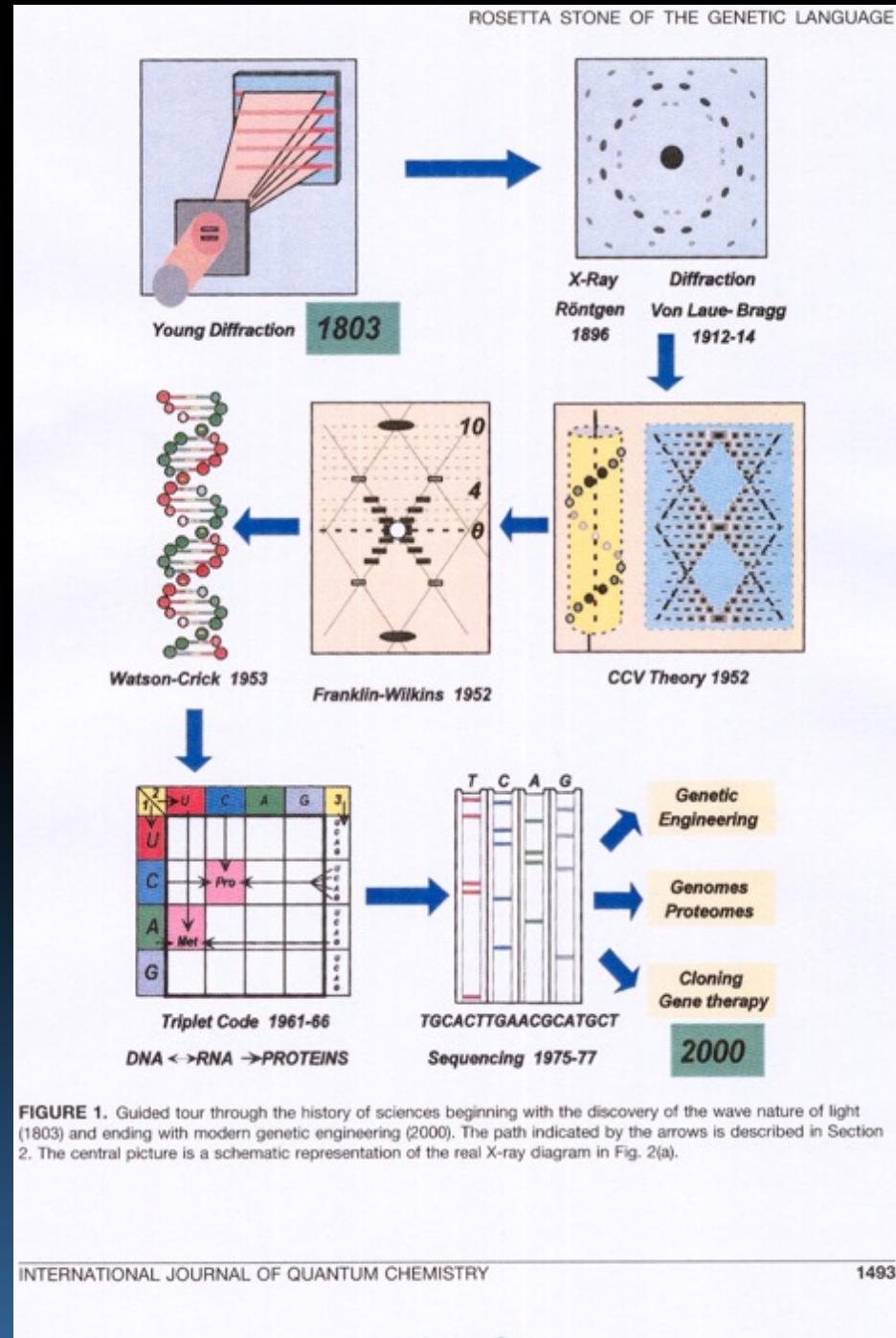
Progreso

an example...

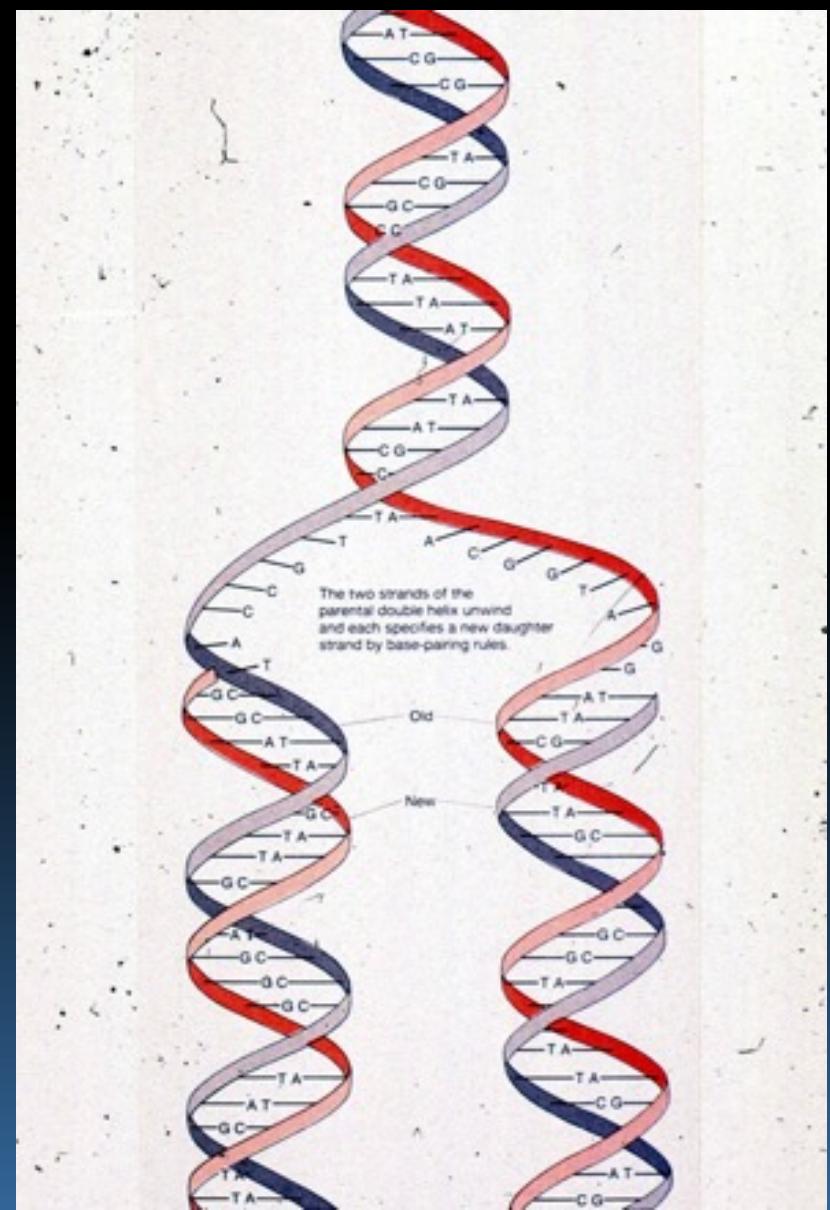
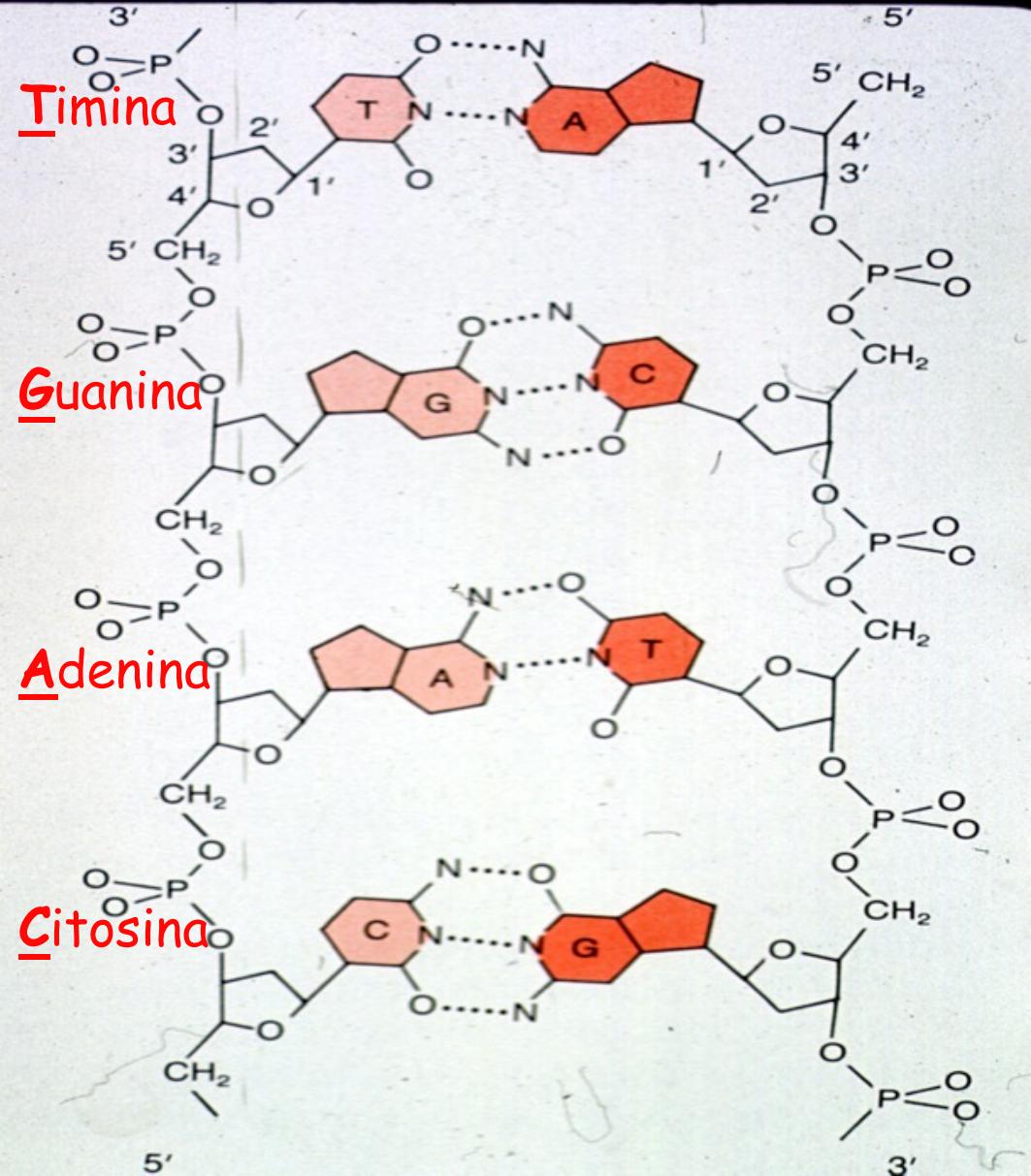
... From what is
light to what is life

*“Scribbles that change
the course of human
affairs”*

Amand A. Lucas,
Classe des Sciences –
Académie royale de Belgique



La estructura del ADN explica la naturaleza y la replicación del material genético

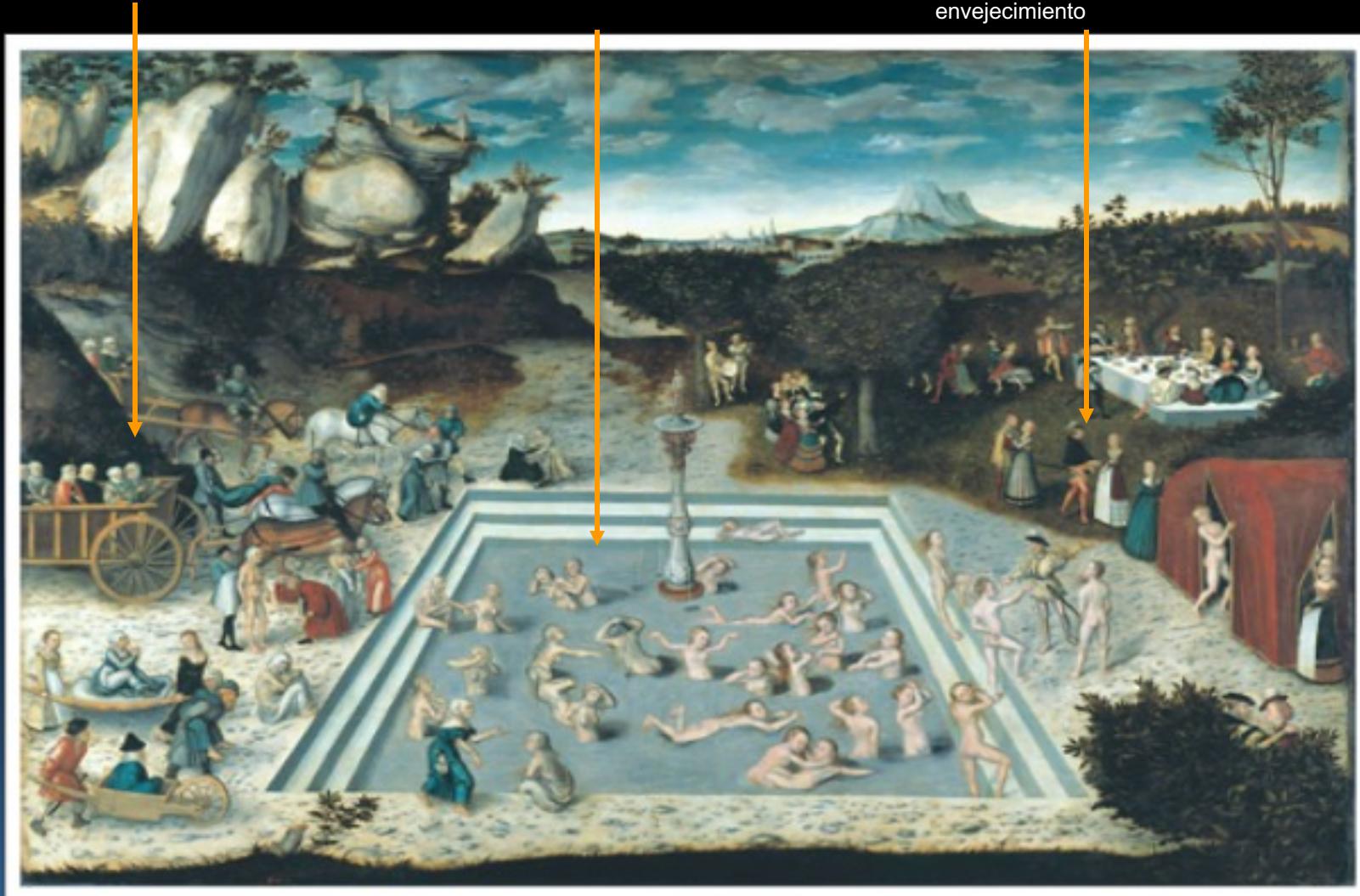


La actividad de foxo se puede modificar con facilidad mediante manipulación genética por al método CRISPR/Cas, lo cual permitiría aumentar la longevidad sin necesidad de comer poco, pasar frio y eliminar la sexualidad

1- individuos envejecidos con bajo nivel de actividad foxo

2 - Baño en una solución que contiene un vector infectivo que contiene la maquinaria genética para aumentar la actividad de foxo

3 - la actividad de daf-16 confiere resistencia al daño en el ADN, incrementa la capacidad proliferativa e induce actividad de genes de la línea germinal que impiden el envejecimiento

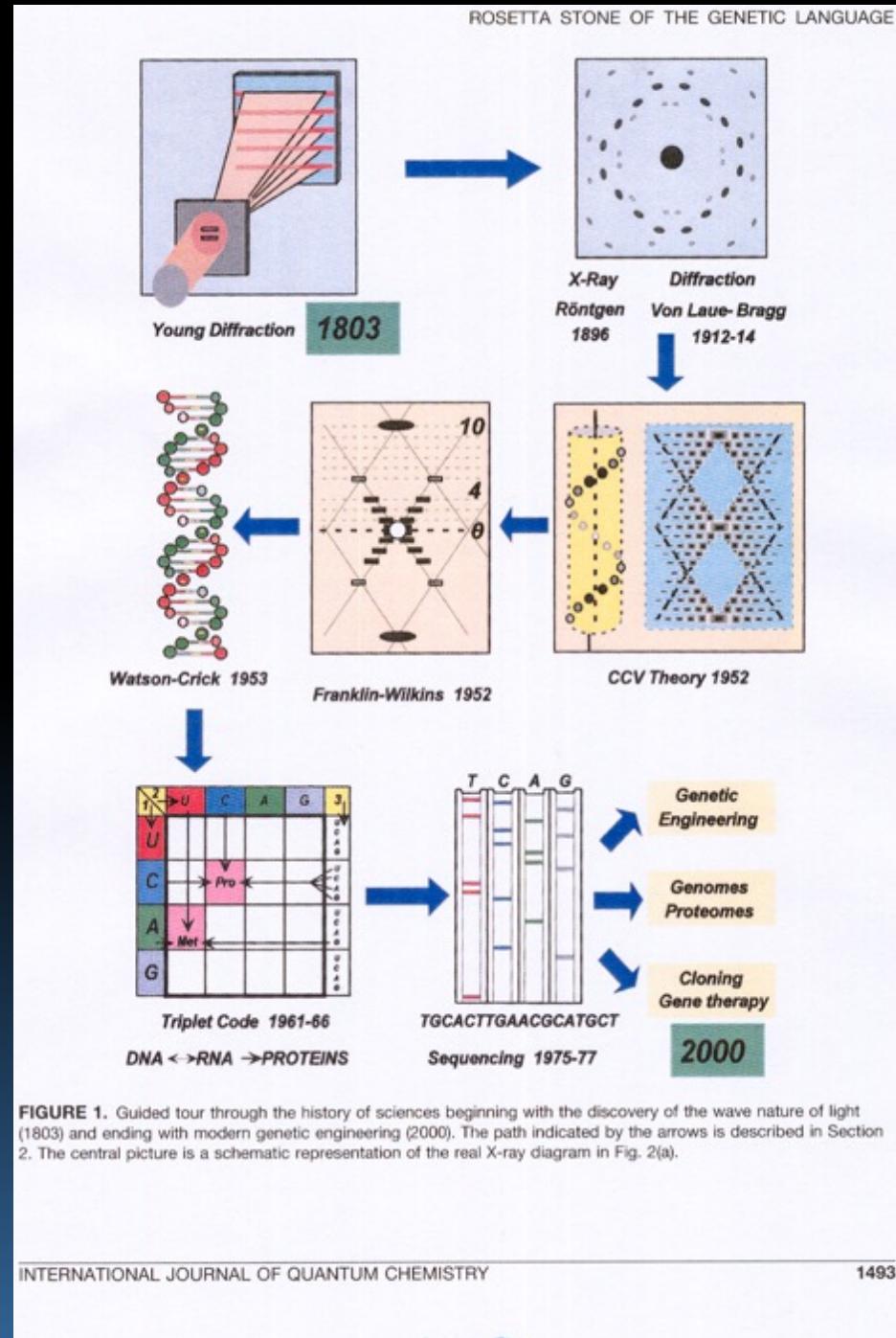


an example...

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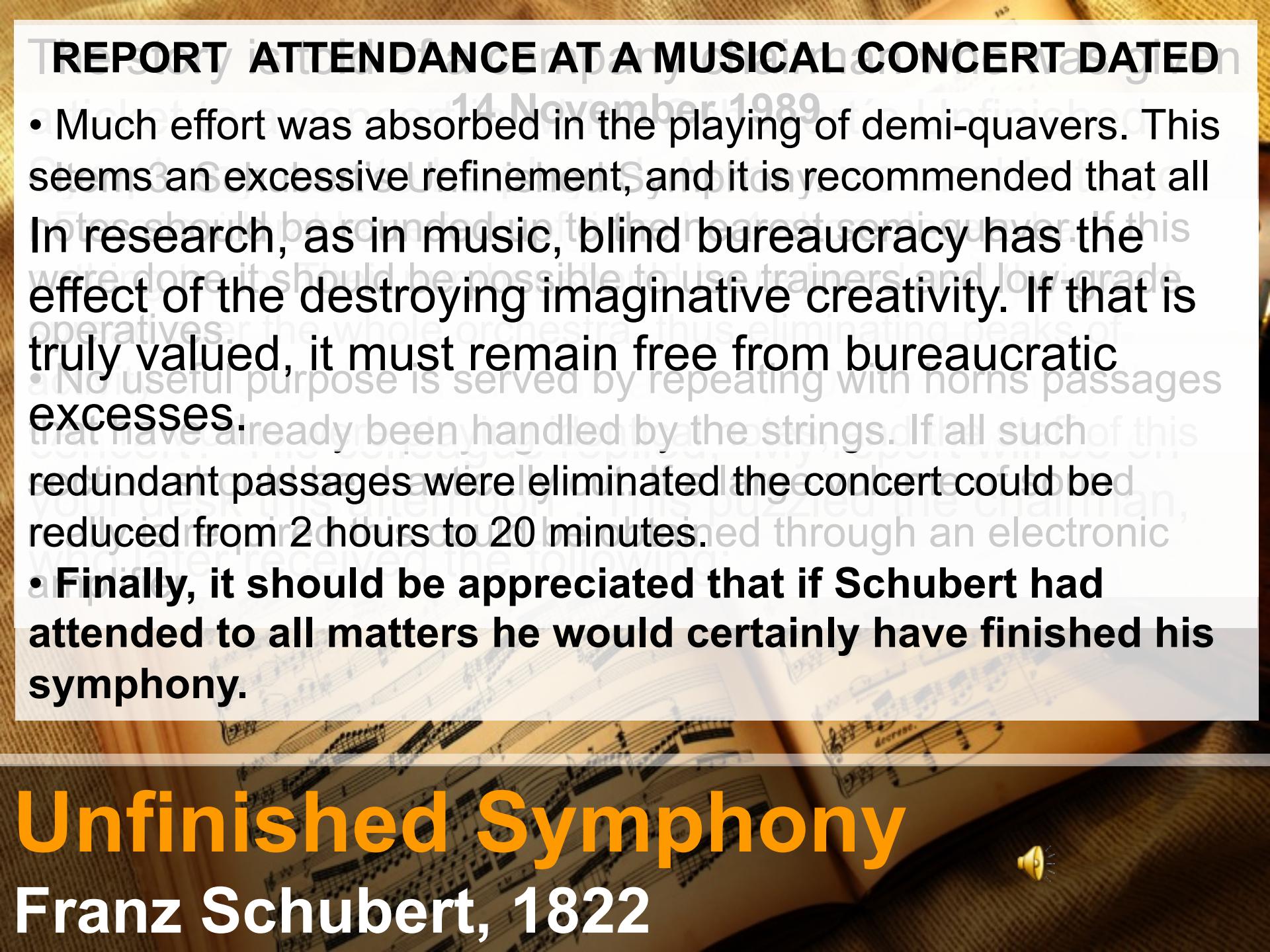
Todas las olas del mar deben la belleza de
su perfil a las que las preceden y se retiran

André Gide



REPORT ATTENDANCE AT A MUSICAL CONCERT DATED

- Much effort was absorbed in the playing of demi-quavers. This seems an excessive refinement, and it is recommended that all In research, as in music, blind bureaucracy has the effect of the destroying imaginative creativity. If that is truly valued, it must remain free from bureaucratic excesses.
- redundant passages were eliminated the concert could be reduced from 2 hours to 20 minutes.
- Finally, it should be appreciated that if Schubert had attended to all matters he would certainly have finished his symphony.

A background image showing a close-up of musical notation on a page of sheet music.

Unfinished Symphony

Franz Schubert, 1822



**INVESTIGACIÓN FUTURA.
NO CONCENTRARNOS SOLAMENTE
EN LO BIOMÉDICO**

The Many Virtues of Basic Science: I. Clinical Medicine

- 1894 X-Rays
- 1932 Antimatter
- 1950 Nuclear Magnetism
- 1912 Radioactive Isotopes
- 1934 Cyclotron
- 1957 Lasers
- 1986 Polymerase Chn Rctn
- 1928 Penicillin (by chance!)
- 1953 DNA Structure
- CAT Scanners
- PET Scanners
- MRI Scanners
- Brachytherapy
- Particle Beam Therapy
- Microsurgery
- Forensic Medicine
- Disease Control
- Gene Therapy

Each of these discoveries earned a Nobel Prize!

II. Basic Science and Information Technology

- 1888 Radio Waves
- 1947 Holography
- 1947 Transistors
- 1951 Integrated Circuits
- 1966 Optical Fibers
- 1976 PK Cryptography
- 1988 Giant Magnetoresistance
- 1986 High T Superconductors
- 2012 Quantum Manipulation
- Wireless Transmission
- Secure Credit Cards
- 1st Computer Revolution
- 2nd Computer Revolution
- Rapid Data Transmission
- Secure Data Transmission
- Disk Readout
- Energy Storage (?)
- Quantum Computers (?)

All but two of these discoveries earned Nobel Prizes!

**La salud de las naciones
depende de la salud de las
naciones**

JCDecaux

VIVE
QUAND TOUT
SERA PRIVÉ,
ON SERA PRIVÉ
DE TOUT
LE
SERVICE
PUBLIC

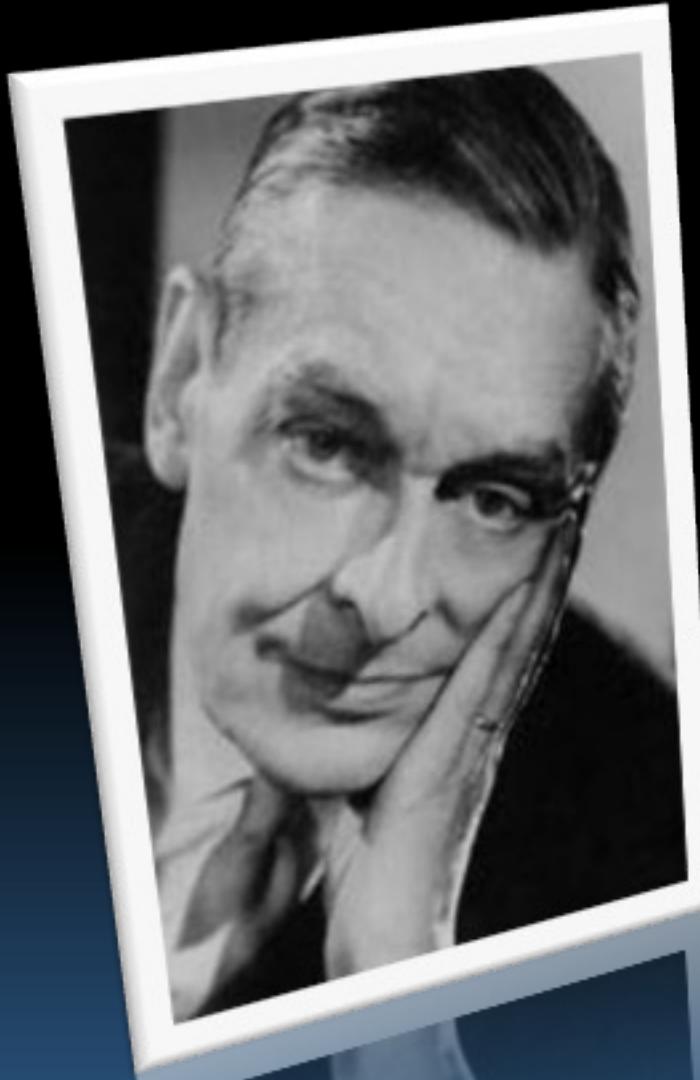




The big challenges of mankind, energy, health, food, water, balance with the natural environment, inequality and increase of intolerance and fundamentalism ... will not be solved with less science and less education, but with more Science and more Education.

“He, that will not apply new remedies, must accept new evils, for time is the greatest innovator”

F. Bacon



“Where is the **wisdom**
we have lost in **knowledge**?

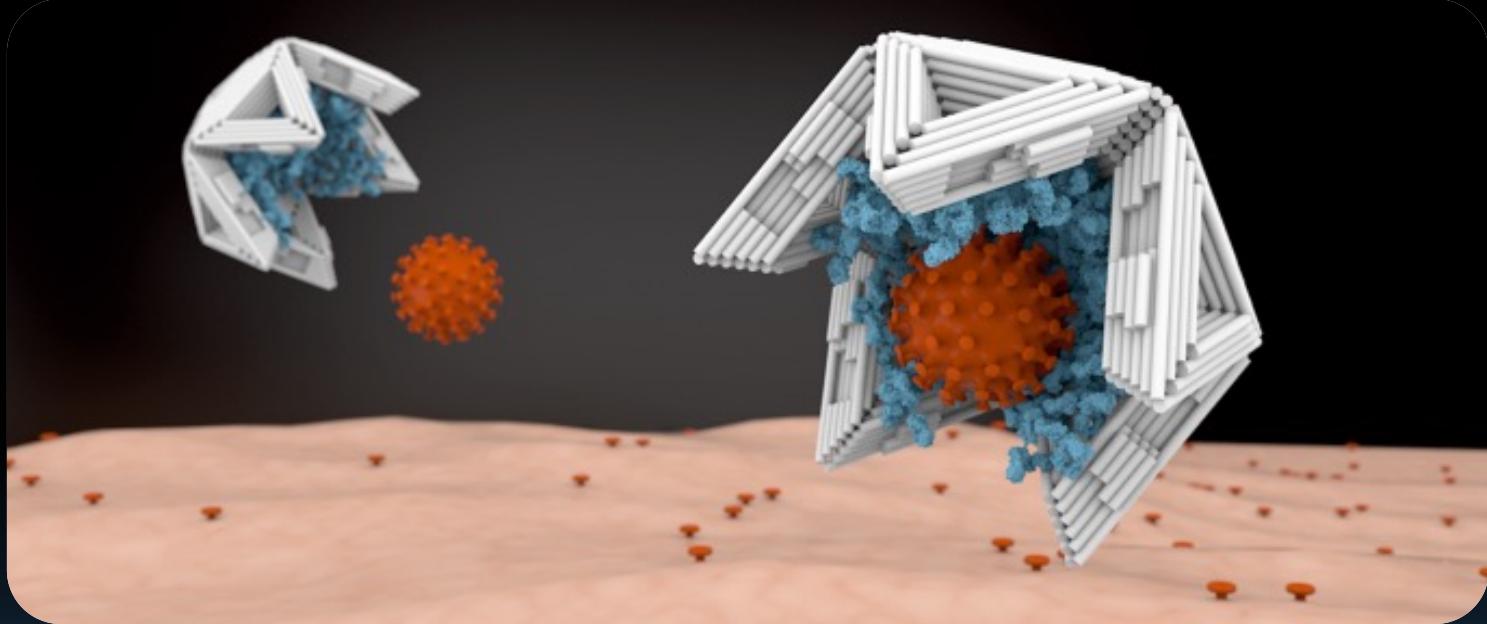
Where is the **knowledge**
we have lost in **information**?”

T. S. Eliot

“Choruses from the Rock”



Mila esker!



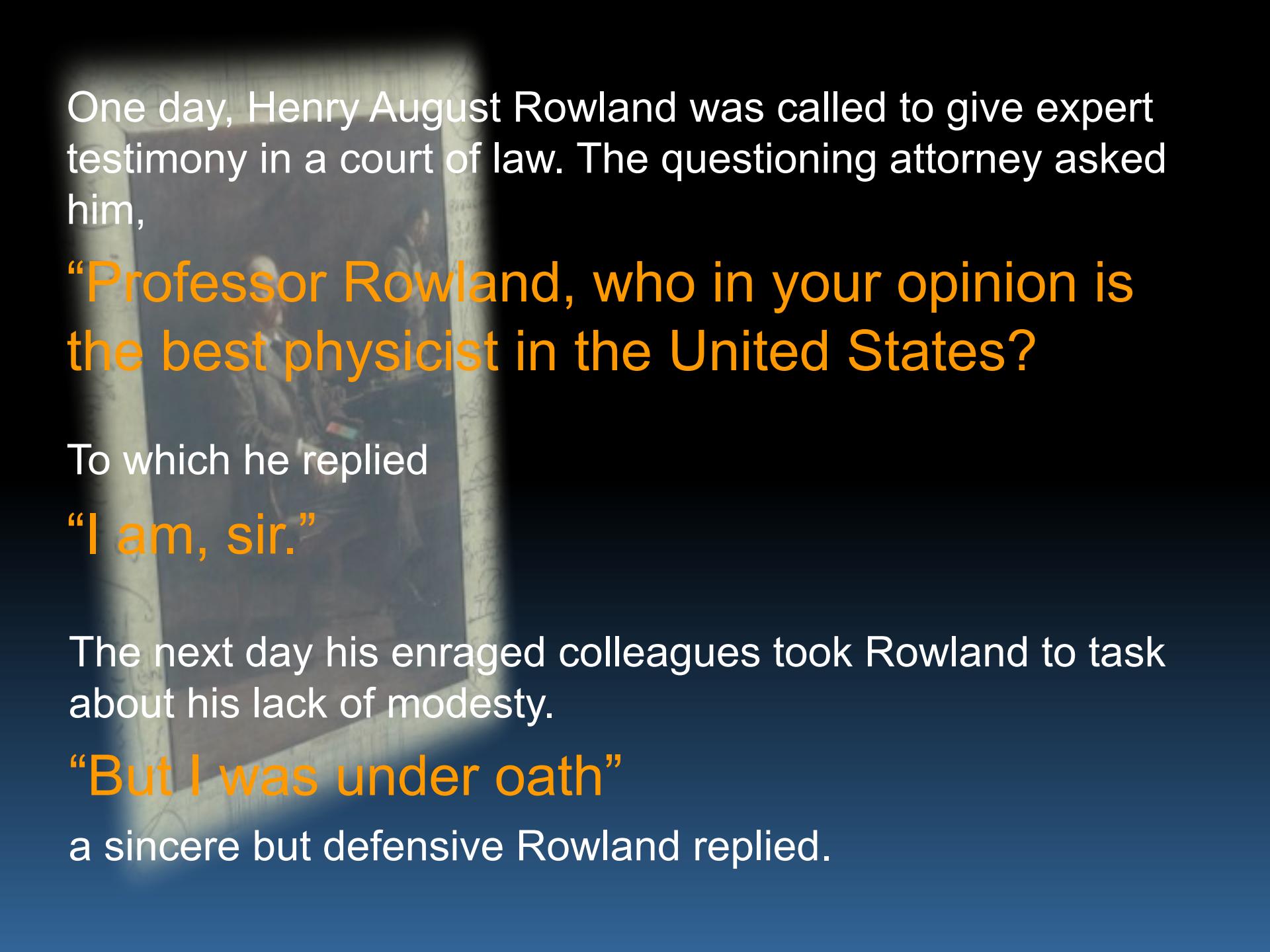
Credit: Elena-Marie Willner / Dietz Lab / TUM



Science is a quest for understanding.

Scientists should never claim that something is absolutely true. You should never claim perfect, or total, or 100% because you never ever get there.

Dame Jocelyn Bell Burnell



One day, Henry August Rowland was called to give expert testimony in a court of law. The questioning attorney asked him,

“Professor Rowland, who in your opinion is the best physicist in the United States?

To which he replied

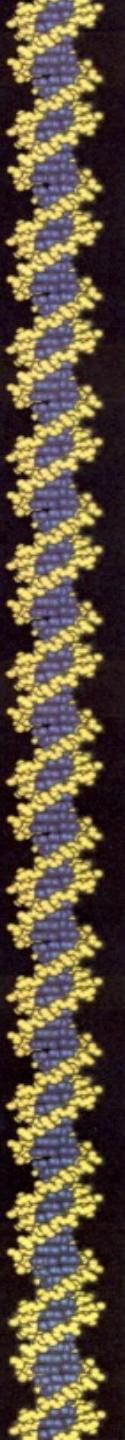
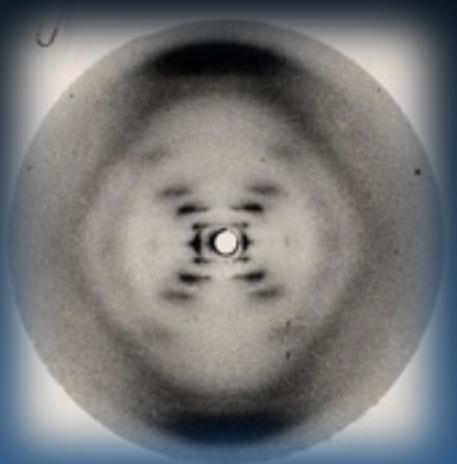
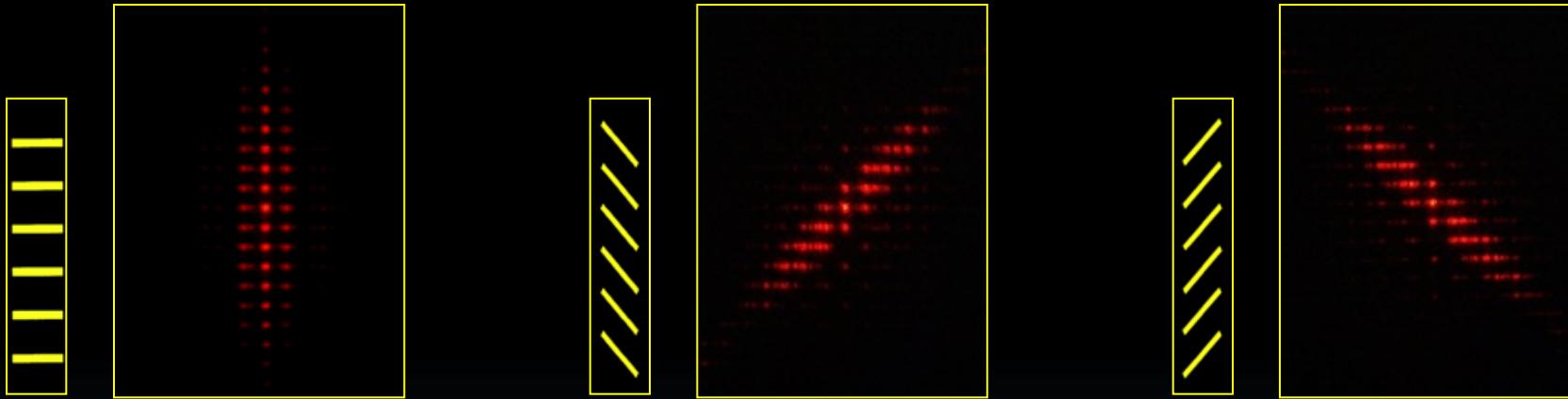
“I am, sir.”

The next day his enraged colleagues took Rowland to task about his lack of modesty.

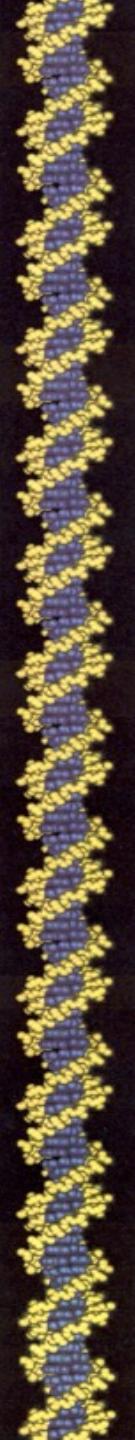
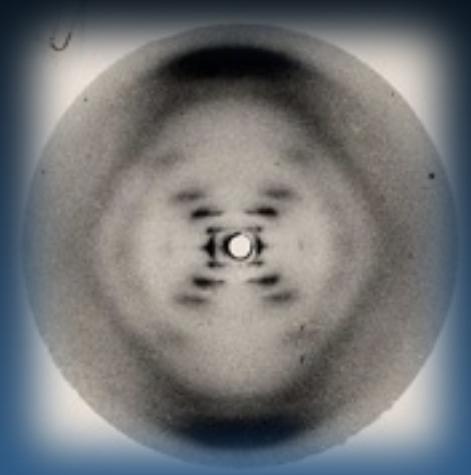
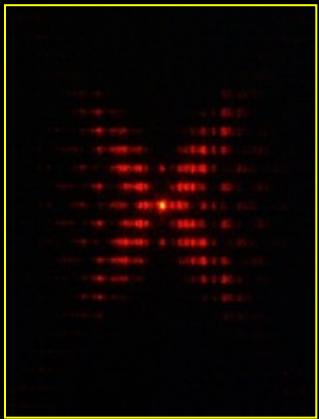
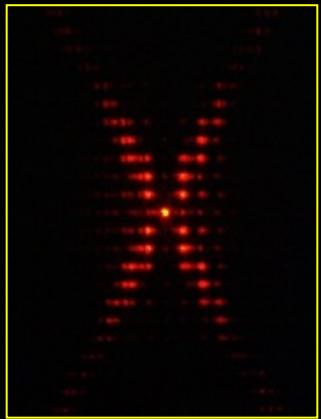
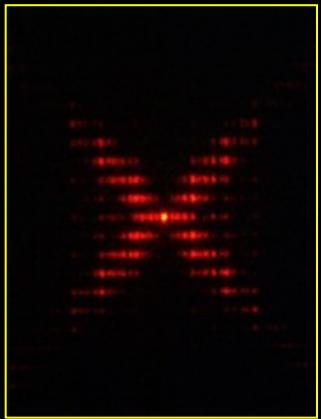
“But I was under oath”

a sincere but defensive Rowland replied.

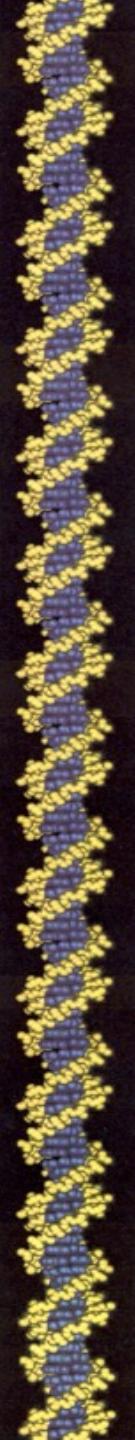
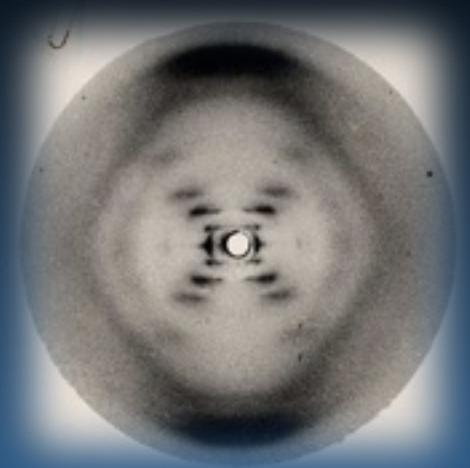
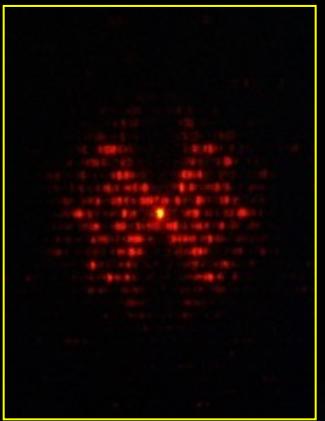
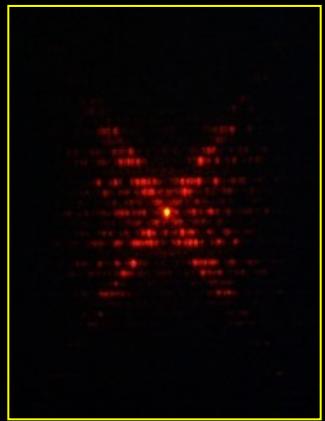
THE STRUCTURE OF B-DNA



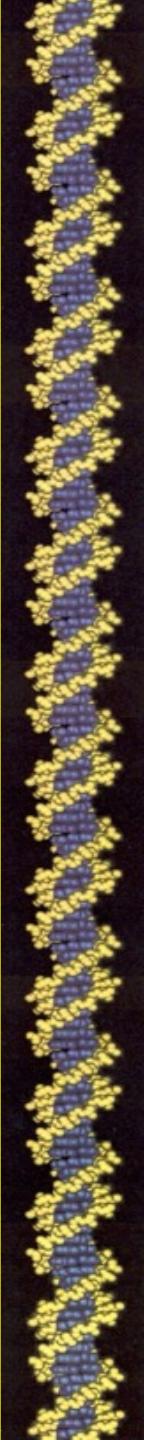
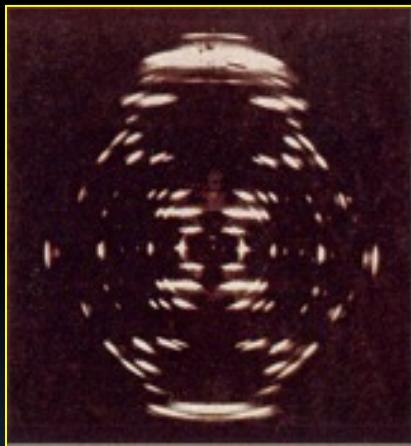
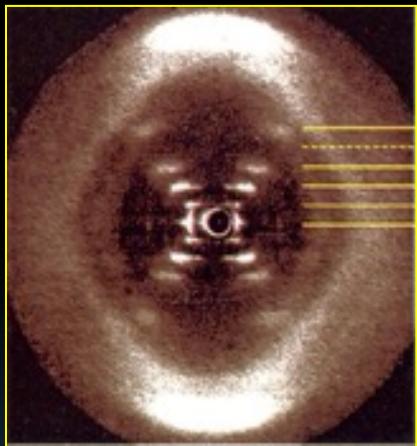
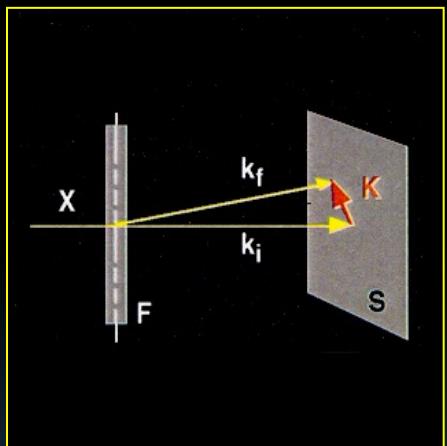
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THE STRUCTURE OF B-DNA

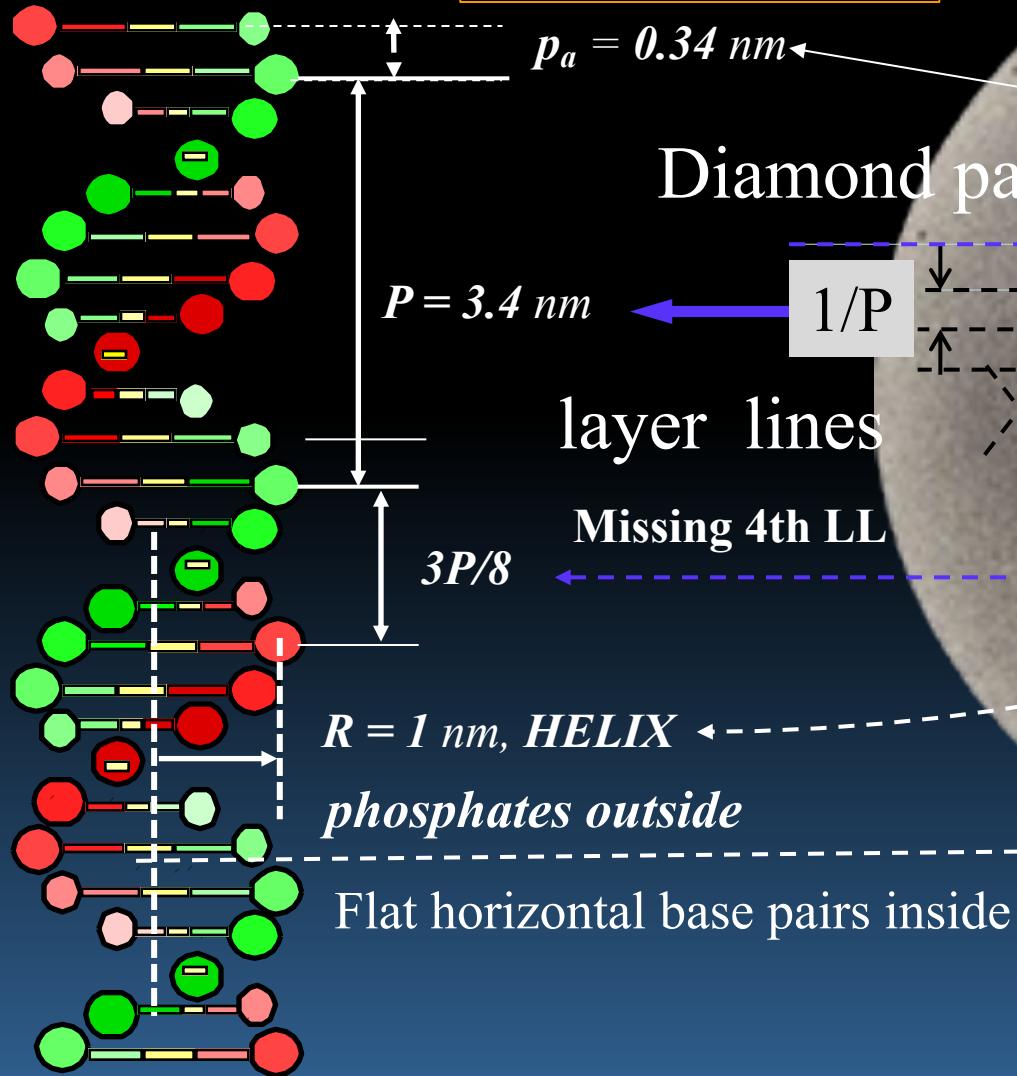


THE STRUCTURE OF B-DNA

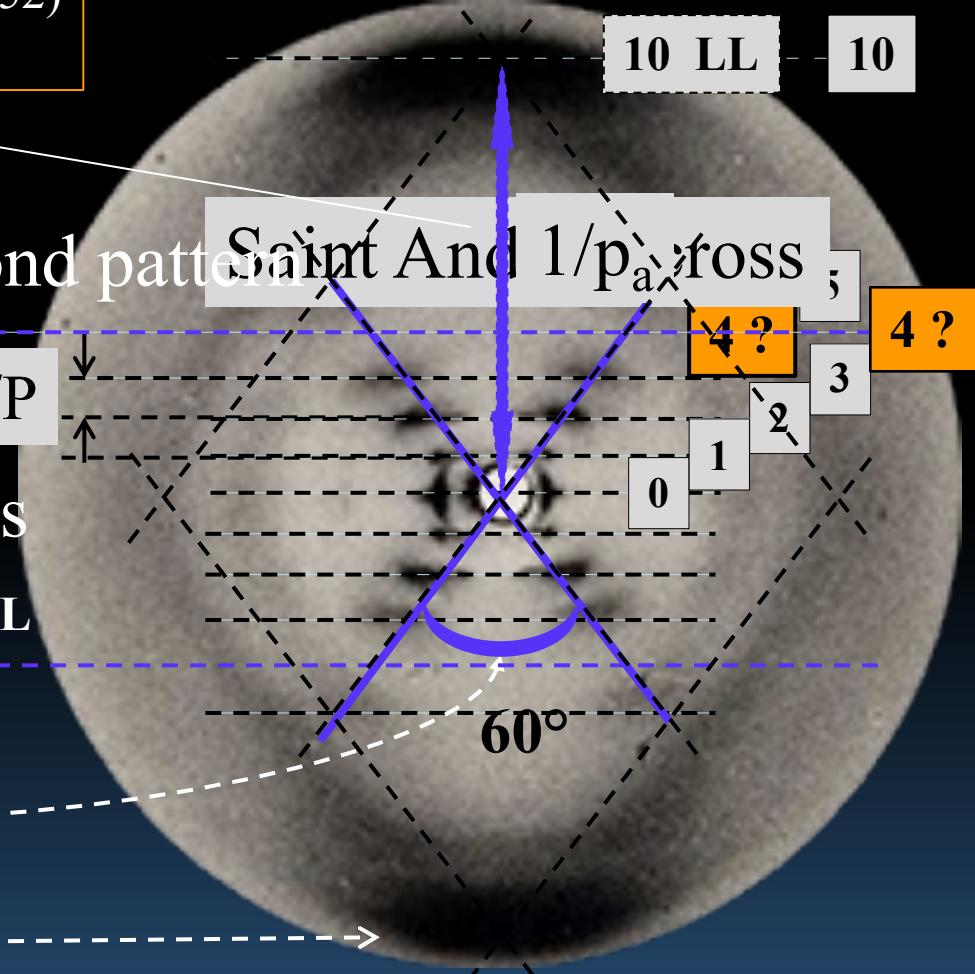


Watson-Crick B-DNA model

Crick *et al*'s theory
X-ray diffraction by
an atomic helix (1952)
Pauling α -helix



B-DNA fiber
Franklin « photo 51 »



PROGRESO

SALUD

III. Even More Fruits of Basic Science

- 1839 Photovoltaic Effect
- 1905 Photoelectric Effect
- 1912 X-Ray Diffraction
- 1916 General Relativity
- 1923 Matter Waves
- 1938 Nuclear Fission
- 1949 Carbon Dating
- 1969 Charged Coupled Device
- 1985 Bucky-Balls (Fullerenes)
- 2004 Graphene
- Solar Panels
- Charged Coupled Device
- DNA Structure
- Global Positioning
- Electron Microscope
- Nuclear Power
- Climate Research
- Digital Cameras
- ?
- ?

**All but two of these discoveries earned Nobel Prizes!
(Einstein's prize was for something other than relativity.)**