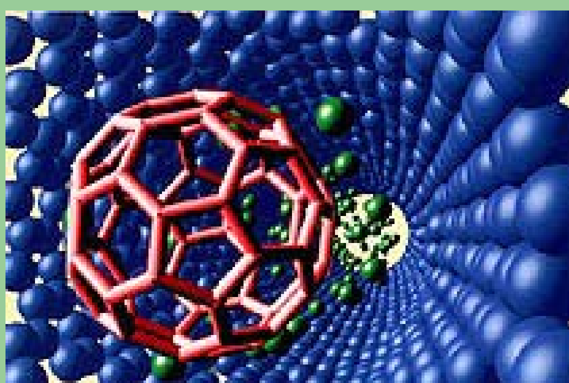
Análisis de materiales unidimensionales para aplicaciones en nanotecnología



Jorge A. Ascencio
ascencio@imp.mx

01 55 30036414
y 30036440

El tamaño si importa …

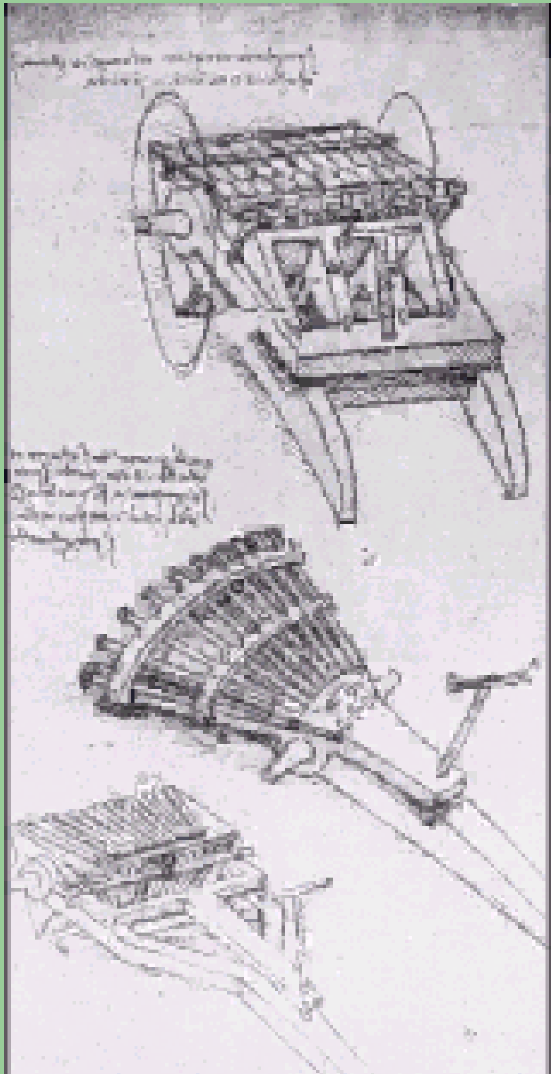
..y la habilidad para usarlo también…

Flint Tools

The Stone Age began about 2 million years ago when prehistoric people started to make stone tools. The use of flint for tools was particularly widespread. Flint has the useful property of producing regular-shaped, sharp flakes when it is chipped. Hand axes, knives, and arrowheads were regularly made from flint.

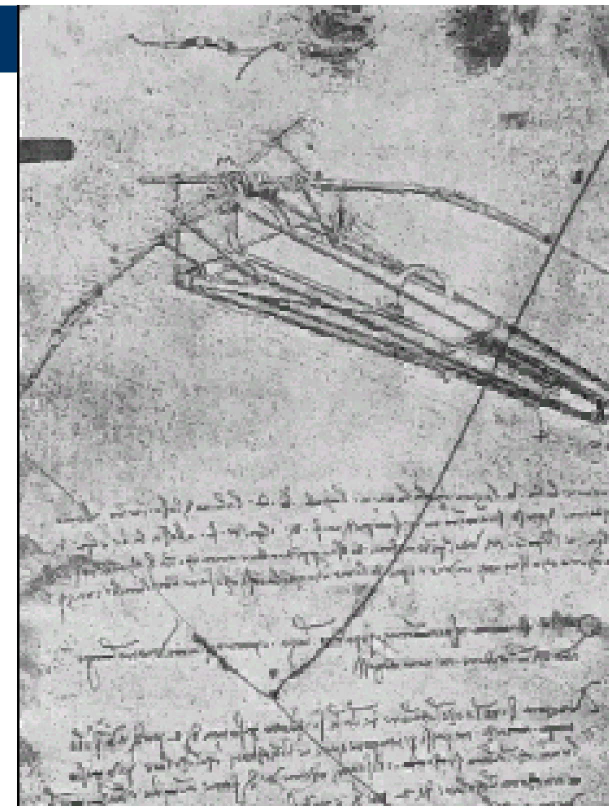




Leonardo da Vinci's Sketches

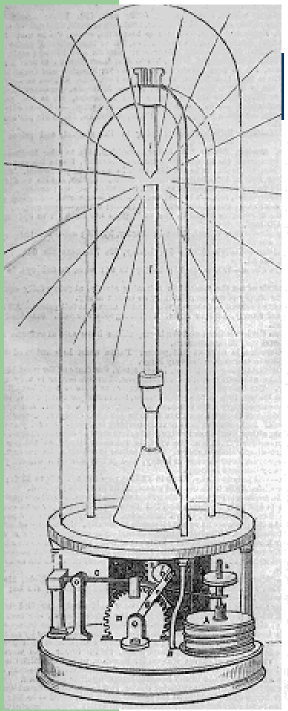
Leonardo da Vinci recorded thousands of pages of ideas about art, science, and engineering in notebooks. He wrote his ideas backward so that they could only be read in a mirror. About 4,200 pages still exist.



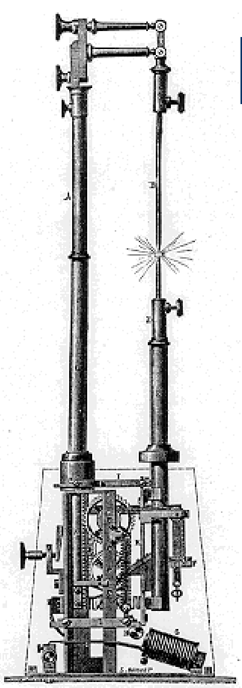
Ornithopter

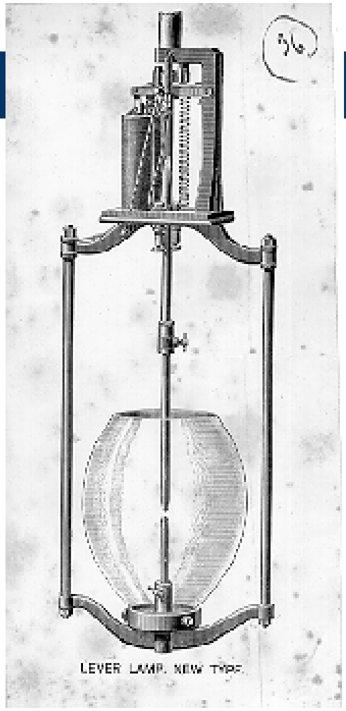
The ornithopter is one of many intriguing ideas created by Leonardo da Vinci. Although these inventions were never carried through to completion, the drawings for them are skillful. The ornithopter was the result of the artist’s interest in the flight of birds; da Vinci could be called the first scientific illustrator.

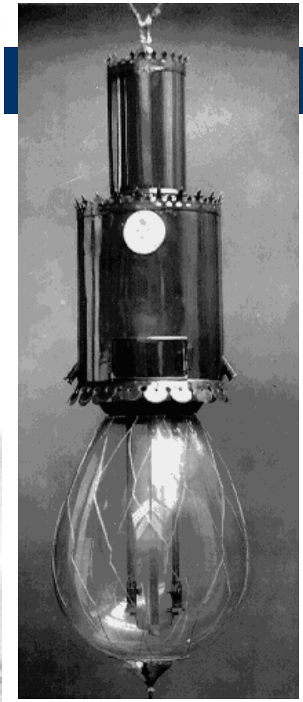
Lamparas de arco desde 1808

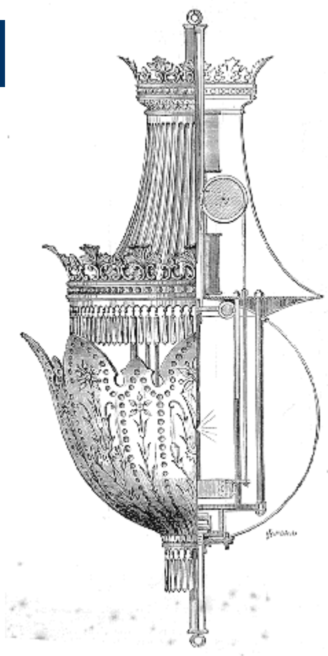


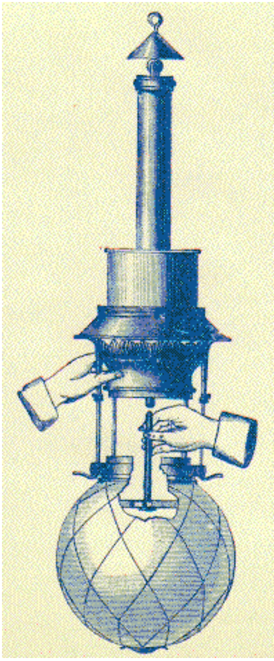
William
Edwards Staite



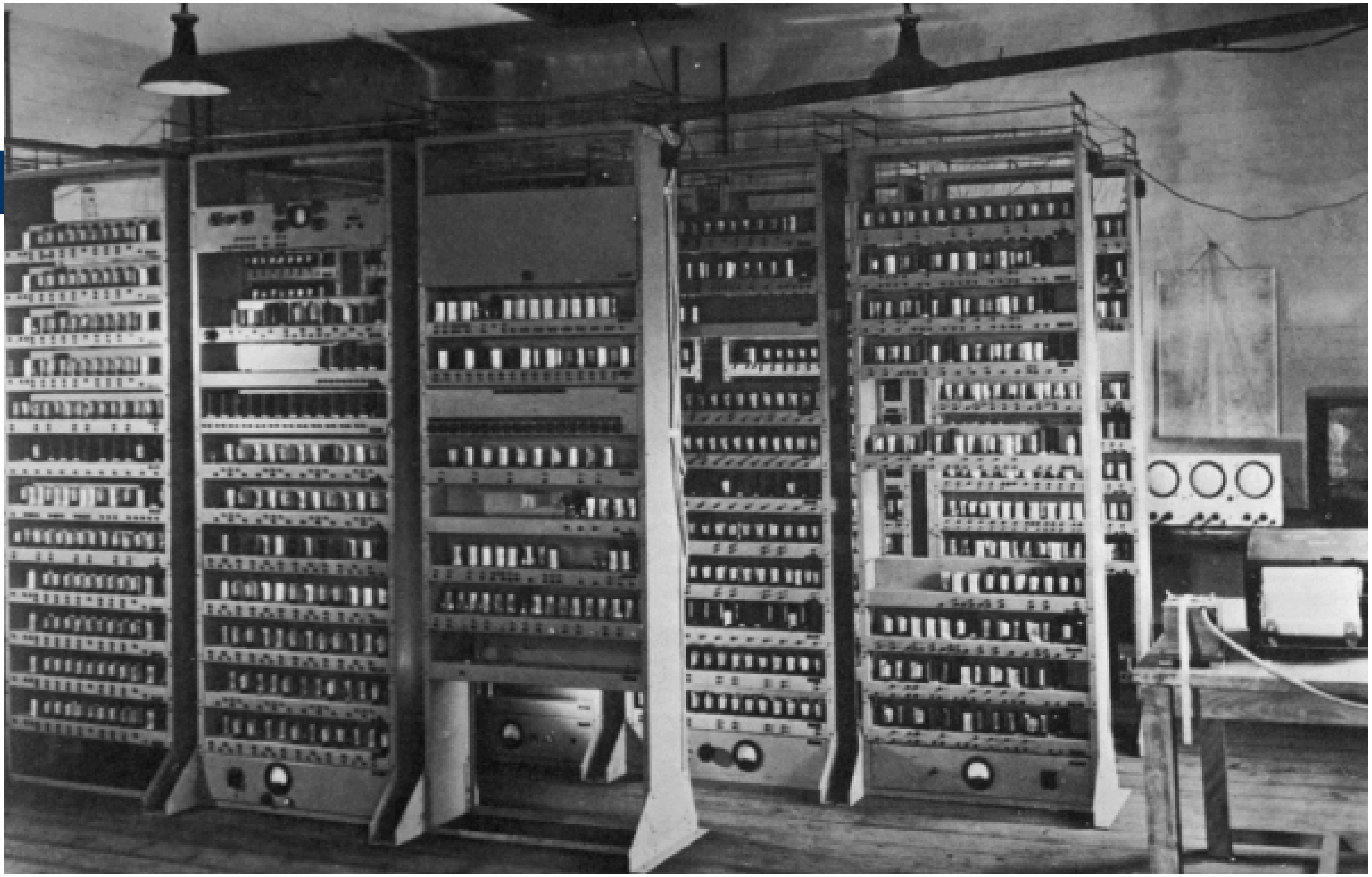








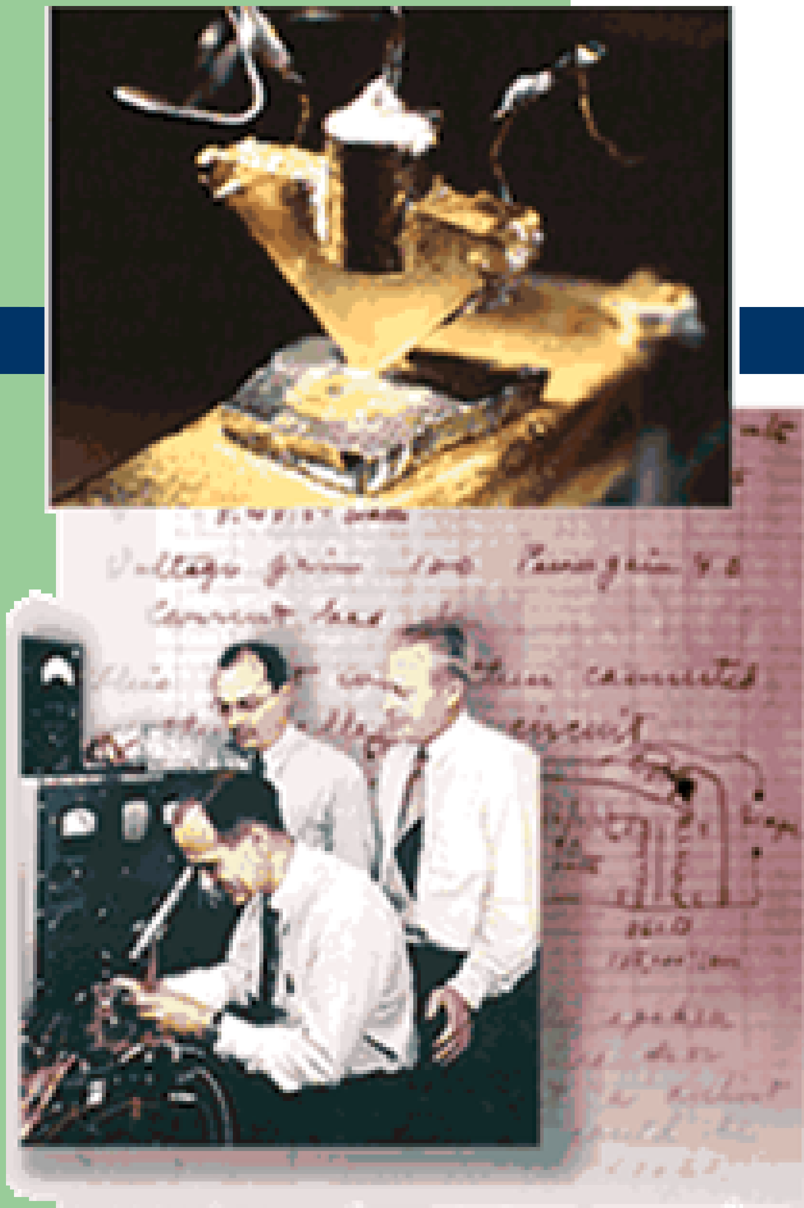
EDSAC under construction, c.1948



The EDSAC, taken shortly after its completion in May 1949

“El Transistor fue probablemente el mas importante invento del pasado siglo 20, y la historia tras del es un conjunto de egos y de secretas investigaciones “

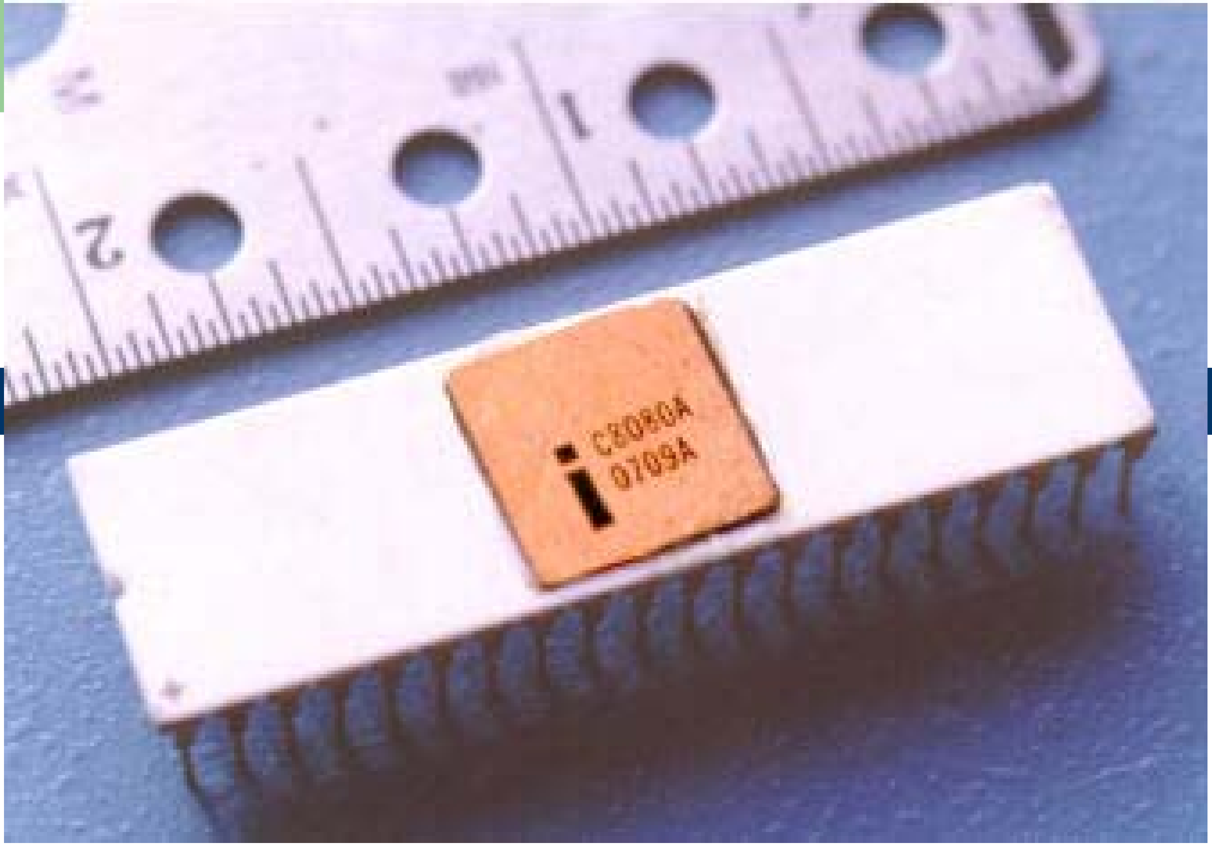
- Ira Flatow, Transistorized!



By the beginning of the 1940s it was apparent that the days of the vacuum tube were numbered.

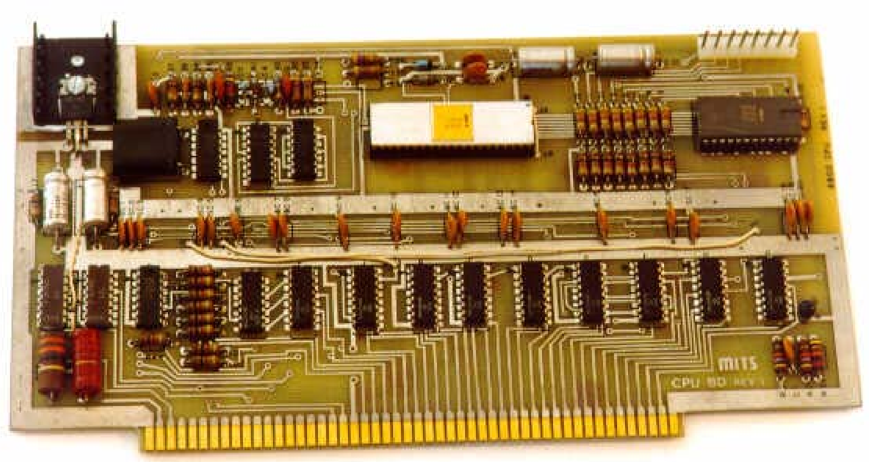
Vacuum tubes were indispensable -without them it was impossible to amplify and switch [redacted]uch power, [redacted]o much space, cost too much to produce, and they burned out. Something better was needed, something "solid-state".

J. Bardeen, W.H. Brattain, and W. Shockley decided to try semiconductors, materials that were neither great nor awful conductors of electric current. They had stumbled onto the "transistor effect" earlier, while investigating the early failure of some radar diodes, and suspected that small current changes within just the right medium would produce active electronic effects. When they trickled current through an N-type germanium crystal, they got what they were looking for. The transistor - and the U.S. multi-billion dollar semiconductor industry - was born.



In 1974 Intel introduced the 8080 microprocessor.

The 8080 was the successor to the 8008. The 8080 had a 16 bit address bus and an 8 bit data bus. Internally it had seven 8 bit registers six which could also be combined as three 16 bit registers), a 16 bit stack pointer and a 16 bit program counter. It Intel updated the design with the 8085, which added two instructions for interrupts, and only required a +5V power supply.



The Altair 8800 made its debut in an article that appeared on the cover of the December 1975 issue of Popular Electronics.

Introduced in 1976 the Pet 2001 featured the then new 6502 microprocessor. Commodore International would later buy the company that produced the 6502, MOS Technology. The pet was one of the first computers to feature a built in display. In it's base configuration it featured 4K of RAM [redacted] BASIC in ROM. Programs could be stored on cassette. The selling price was about $595 with 4K and $795 with 8K. Commodore would later produce two very low priced computers the VIC-20 followed by the Commodore 64.

The Commodore 64 replaced the VIC-20 as Commodore's low priced bargain computer for beginner's. It used a slightly enhanced version of the 6502 microprocessor the 6510. It

included 64k of RAM and could be upgraded to include a disk drive for program and data storage.

Departing from the "kit" concept of the Altair 8800, Radio Shack chose to test the market for a low-cost computer with the TRS-80. It epitomized the "appliance" or "toy" approach to consumer computer marketing, coming [redacted] it still left a lot to be desired: it was limited to an ordinary black and white TV monitor and all upper-case characters.

Osborne 1 (1981) A computer with $2,000 worth of bundled software, small enough to fit under an airline seat, and at a price low enough to be purchased by credit card — this was the vision of Adam Osborne for the world's first portable computer, the Osborne 1.

After observing the success of the Apple II and others, IBM decided to enter the personal computer market. The development of a PC by IBM represented a departure from its normal practices in many [redacted] would [redacted]er industry.

The influence of the IBM PC on the personal computer market was phenomenal and spawned an industry of clones. Machines that were only 95% compatible couldn't run all IBM PC software, and were quickly left behind. Compaq Computer, understanding what the market demanded, positioned itself as the premier player in the IBM PC-compatible arena.

Compaq's first machine, the Transportable, was initially sketched on a restaurant placemat. It was known for its high-quality workmanship, and at 28 pounds, a certain movable capability.

IBM PCjr (1983)

IBM targeted its PCjr at the home and school market, hoping its lower price would lure buyers. It miscalculated on many [redacted] functionality and ability to use third-party upgrades. And the monitor-less $999 price proved too high for the home market and too low for the business market.

DG/One (1984)

The industry's first truly portable IBM-compatible PC, the DG/One weighed 10 pounds and could fit in a standard 3-inch-thick briefcase. The DG/One featured some innovative technologies: a high-speed, low-power CMOS processor, built-in software for text editing and terminal emulation, capacity for two 3.5" floppy disk drives, and a 12-inch flat panel LCD screen — leading-edge technology in 1984.

Sun-3/50 (1986)

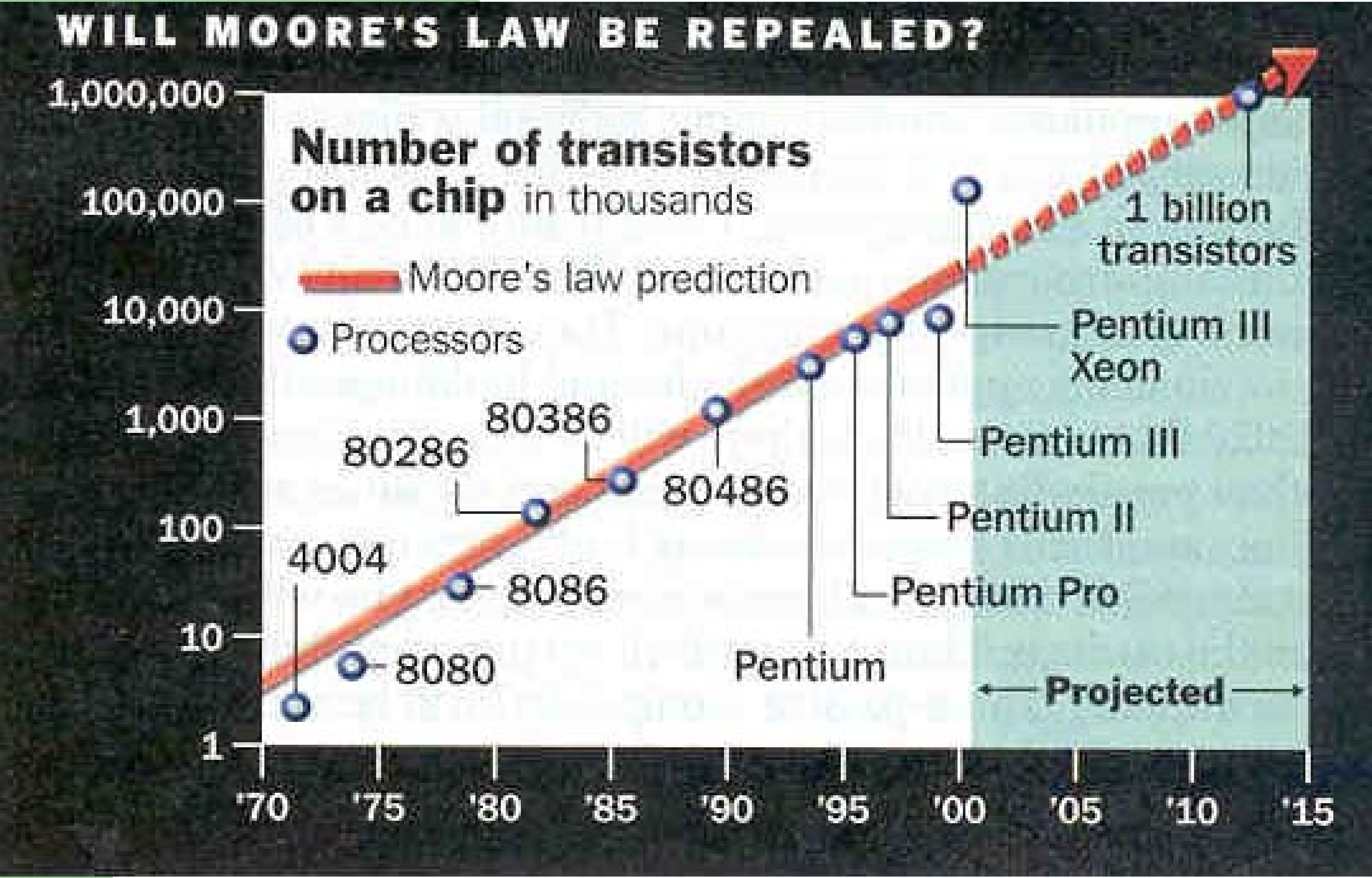
Following the lead of the Sun-2, the Sun-3 workstation bundled hardware and software in an inexpensive package, and was a popular platform for computer-aided design and electronic publishing. Thanks to the [redacted] these "open [redacted]oon dethrone the higher-priced, proprietary architecture-based leaders in engineering and scientific computing.

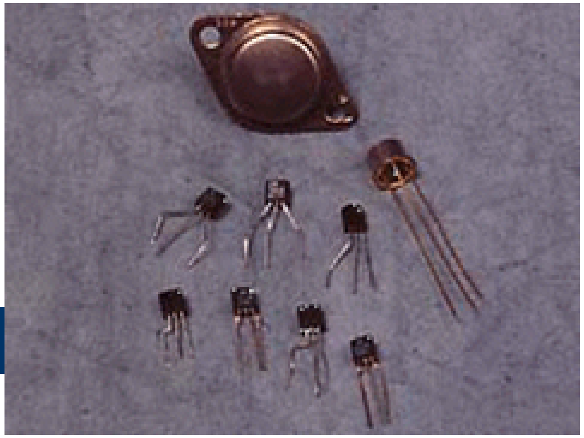
Data General AViiON® (1989)

Symmetric multiprocessing was pioneered in the mid '80s by vendors such as Sequent and Pyramid, creating a market quickly targeted by mainstream Unix server vendors. One of the first second-wave systems was the AViiON, which combined multiple CPUs with redundant array (RAID) disk storage and an industrial-strength muliprocessor-capable Unix.

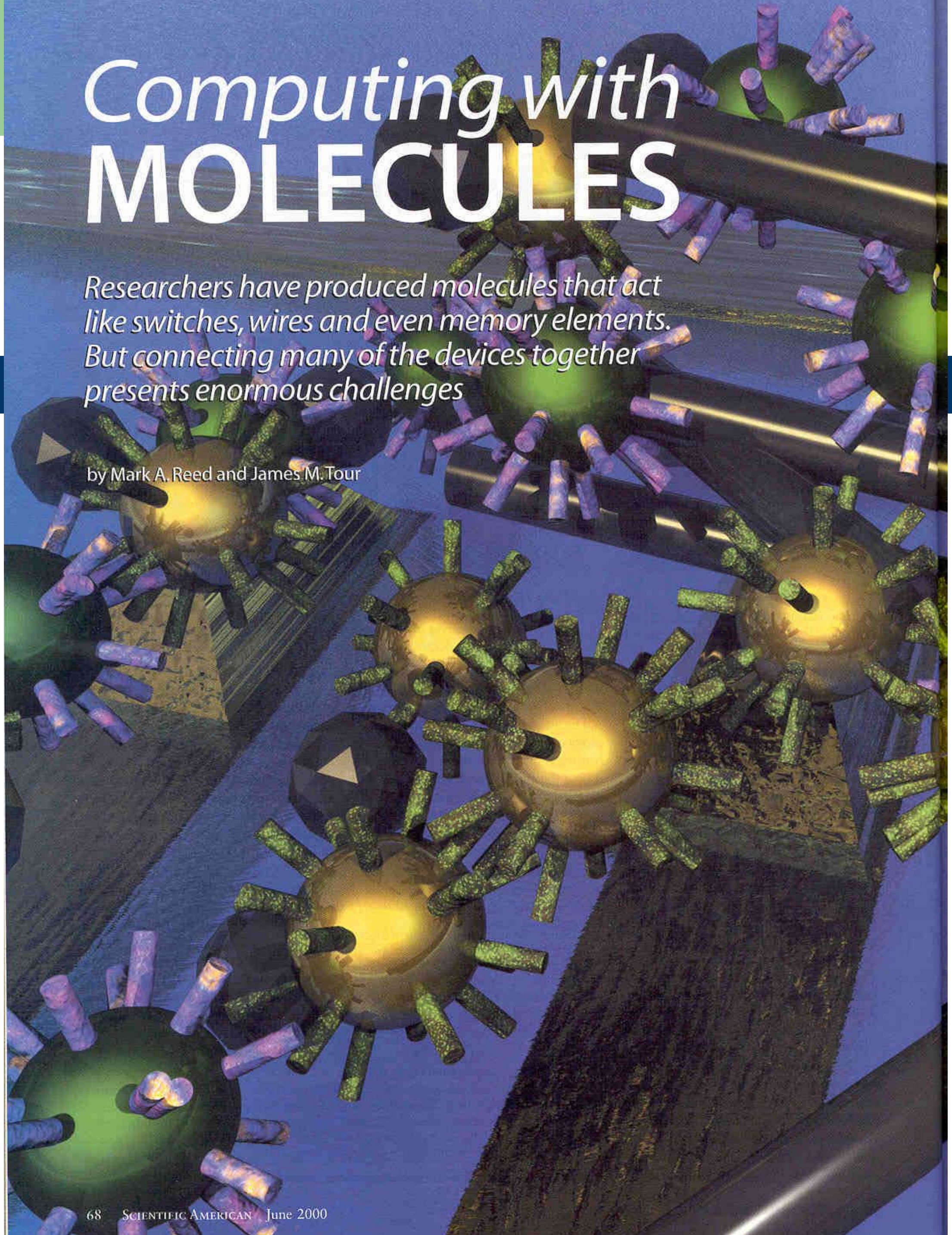
Until my baby said hello!!!

Since 1997, SGI Supercomputers!!!


WILL MOORE'S LAW BE REPEALED?
Number of transistors on a chip in thousands
Moore's law prediction
Processors
1,000,000
100,000
10,000
1,000
100
10
1
'70
'75
'80
'85
'90
'95
'00
'05
'10
'15
4004
8080
8086
80286
80386
80486
Pentium
Pentium Pro
Pentium II
Pentium III
Pentium III Xeon
1 billion transistors
Projected



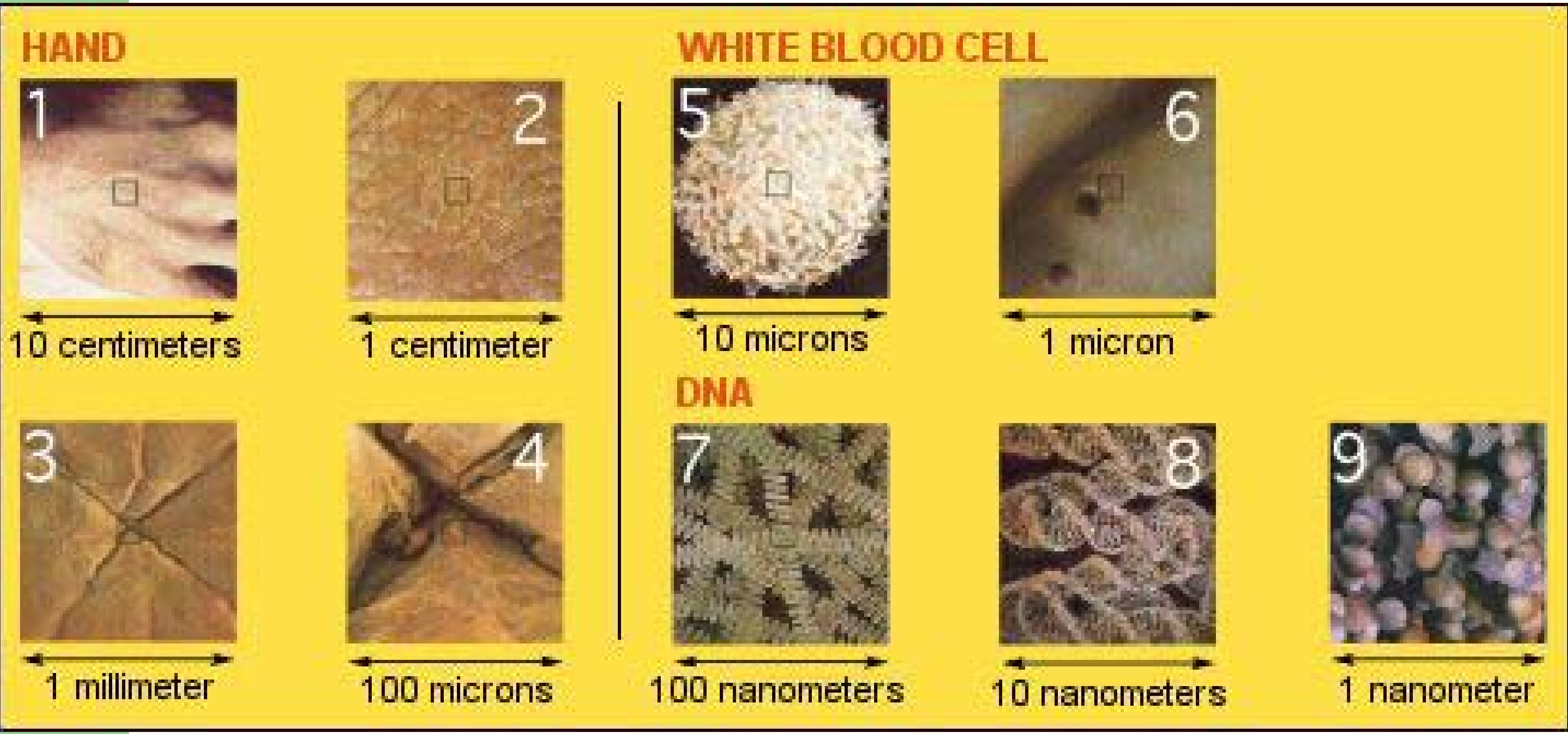
?


Computing with MOLECULES

Researchers have produced molecules that act like switches, wires and even memory elements. But connecting many of the devices together presents enormous challenges

by Mark A. Reed and James M. Tour

68 SCIENTIFIC AMERICAN June 2000



HAND
1
2
10 centimeters
1 centimeter
3
4
1 millimeter
100 microns
WHITE BLOOD CELL
5
6
10 microns
1 micron
DNA
7
8
9
100 nanometers
10 nanometers
1 nanometer

Lineal

$$1\text{m} = 1'000{,}000\mu\text{m} = 1{,}000'000{,}000\text{nm}$$

área

$$1\text{m}^2 = 10^{12}\mu\text{m}^2 = 10^{18}\text{nm}^2$$

volumen

$$1\text{m}^3 = 10^{18}\mu\text{m}^3 = 10^{27}\text{nm}^3$$

$1\mu\text{m}=1{,}000\text{nm}$

$1\mu\text{m}^3=1{,}000'000{,}000\text{nm}^3$

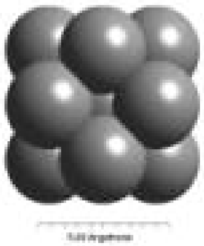
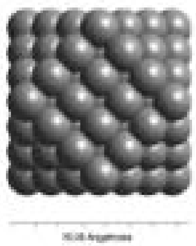
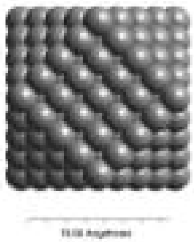
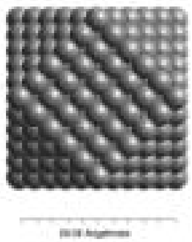
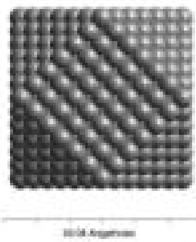
INTEL
Pentium IV

IMPTEL
Nanium I

~ 10^6 transistores por chip

~10^{18} transistores por chip

¿Qué son las nanopartículas?

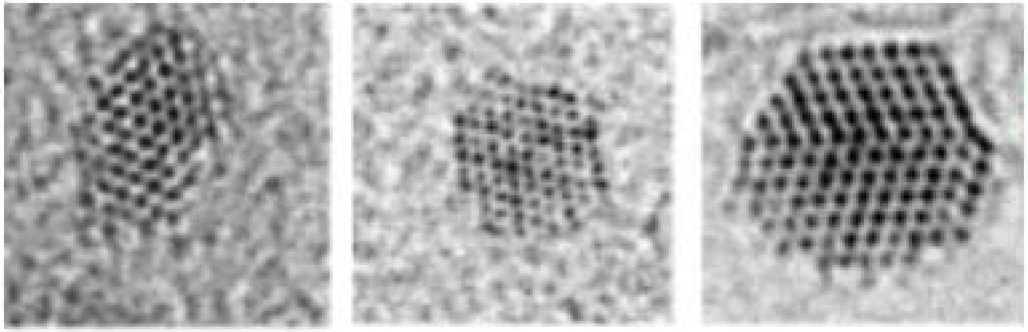
13 átomos	55 átomos	147 átomos	309 átomos	561 átomos	923 átomos
4.078 Å	8.157 Å	12.235 Å	16.313 Å	20.391 Å	24.470 Å
					

Aplicaciones actuales de las nanoestructuras.

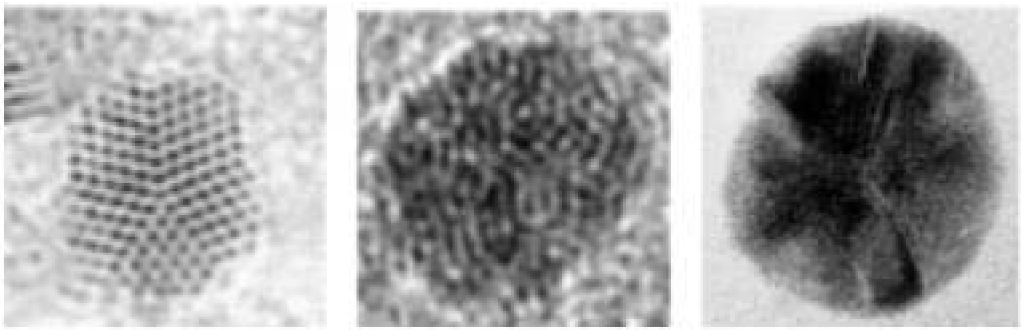
Campo	Ejemplos de aplicación
Catálisis heterogénea	Partículas de Pt-Ru/A_2O_3 reformadoras de derivados de nafta.
Fotografía	Emulsiones fotográficas basadas en nanocristales de AgBr.
Medicina	Tratamiento de cáncer mediante agregados de organometálicos de Pt.
Instrumentación Industrial	Herramientas de corte producidas por películas delgadas de materiales metálicos nanoestructurados.
Almacenamiento magnético	Cintas magnéticas basadas en nanopartículas de Fe
Ciencia de coloides	Pinturas, colorantes, productos médicos y cosméticos

Nanoparticles characterization

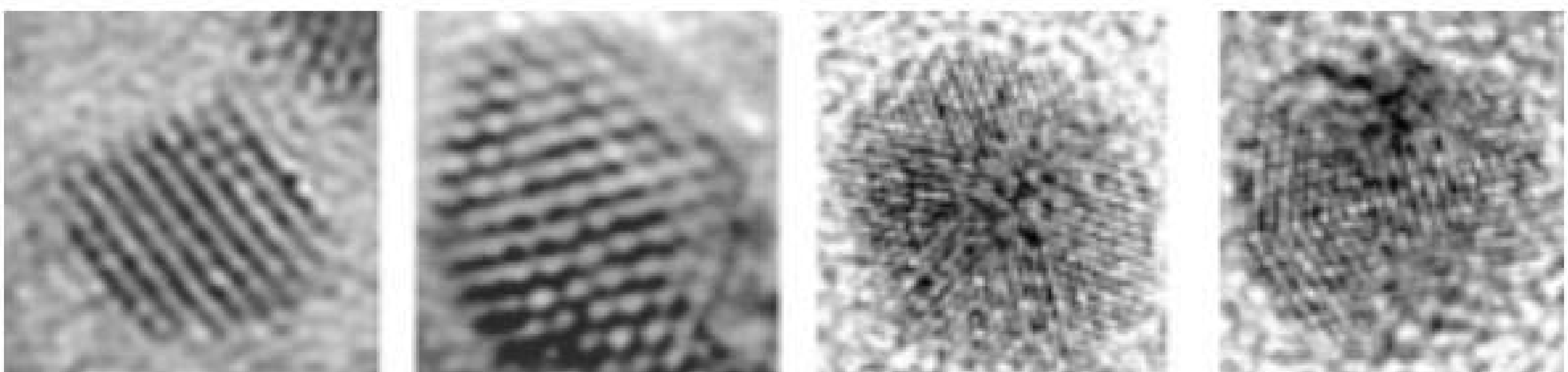
(Experimental images)



TO TKD St

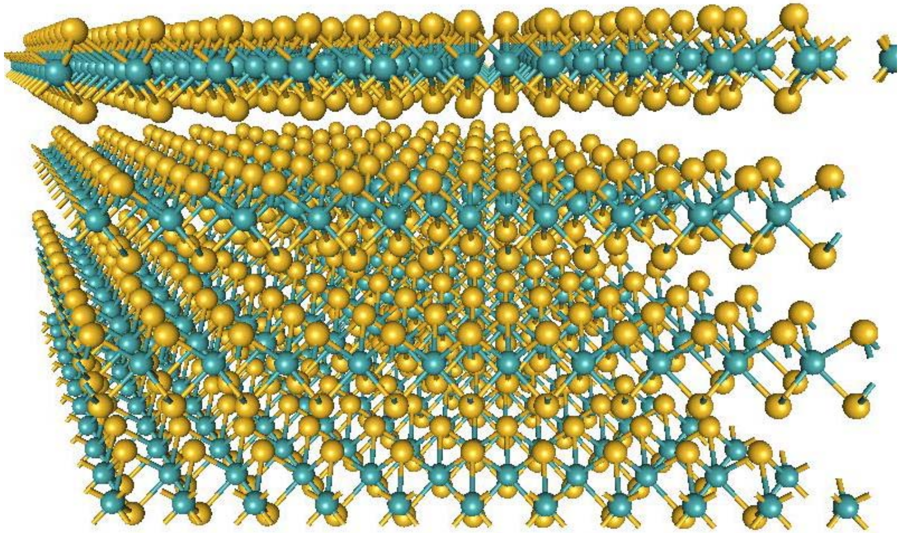


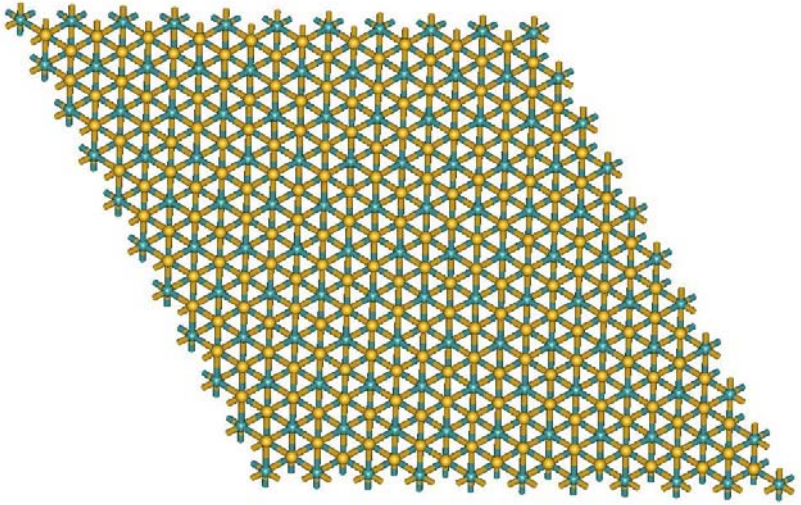
TDh Ih TIh

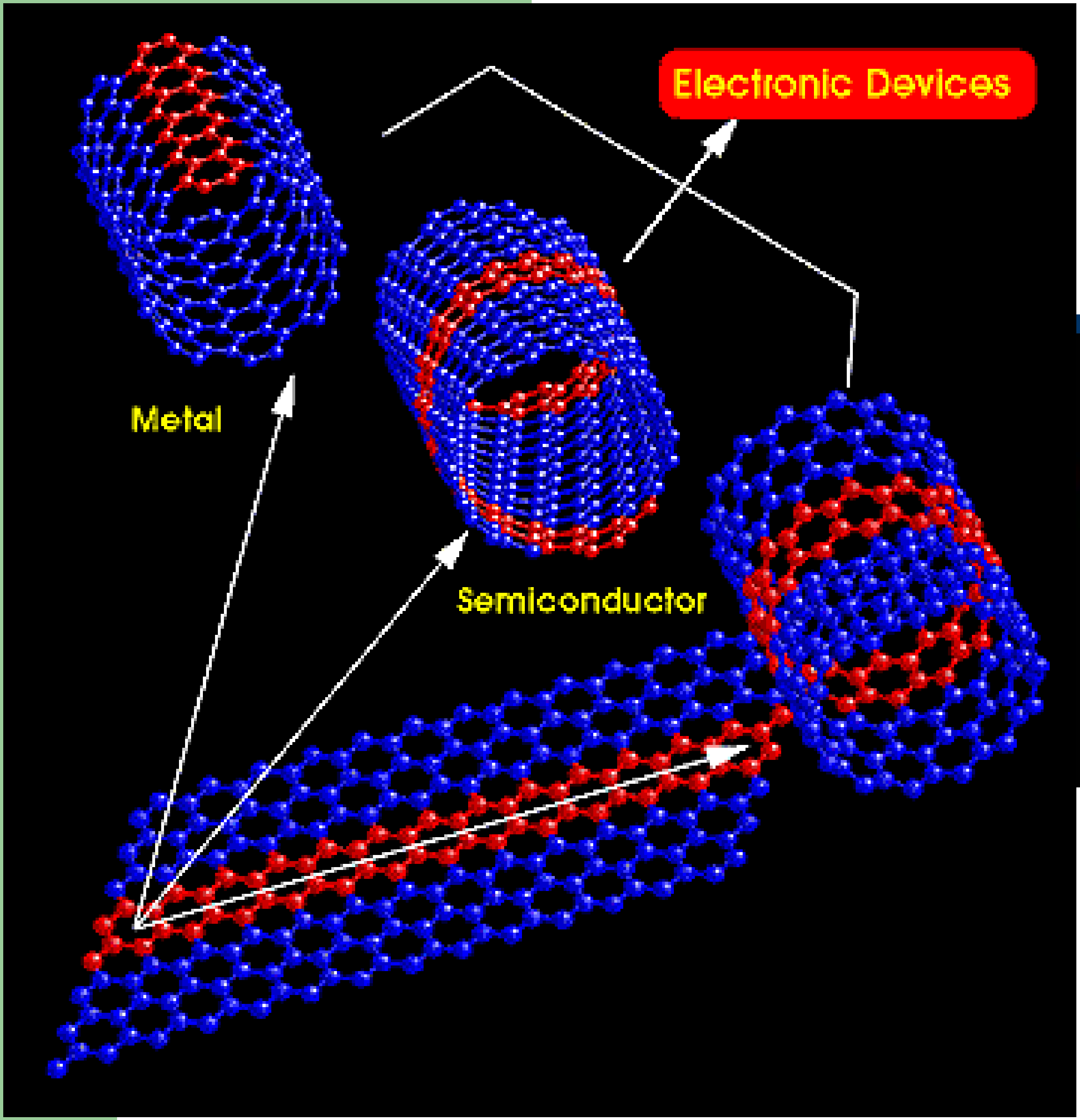


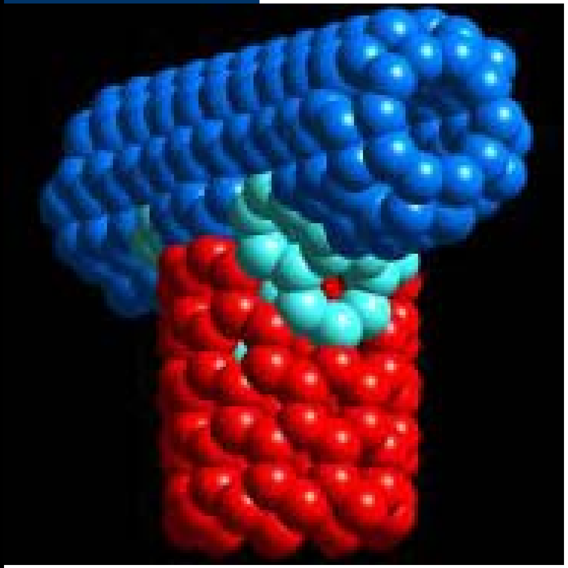
fcc TDh TIh TIh

Layered Materials MoS_2

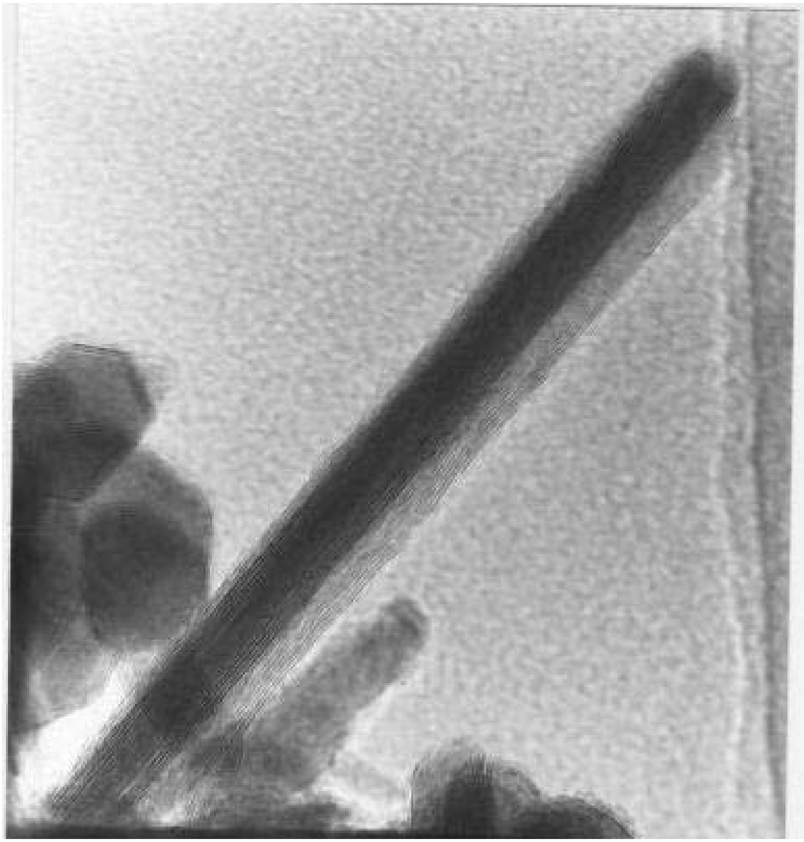


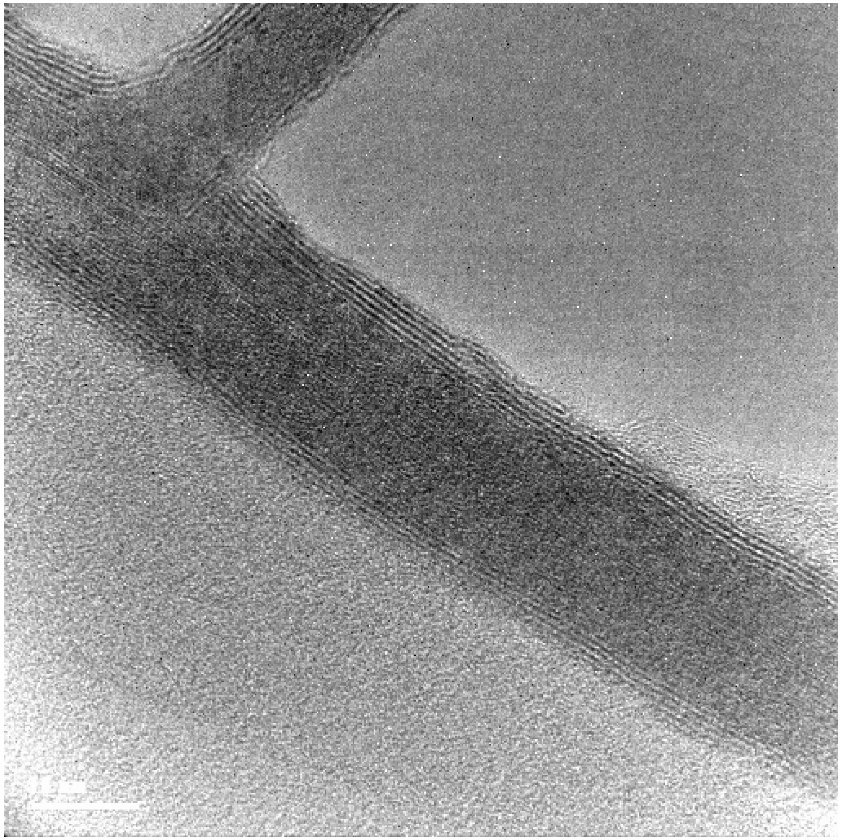



Electronic Devices
Metal
Semiconductor

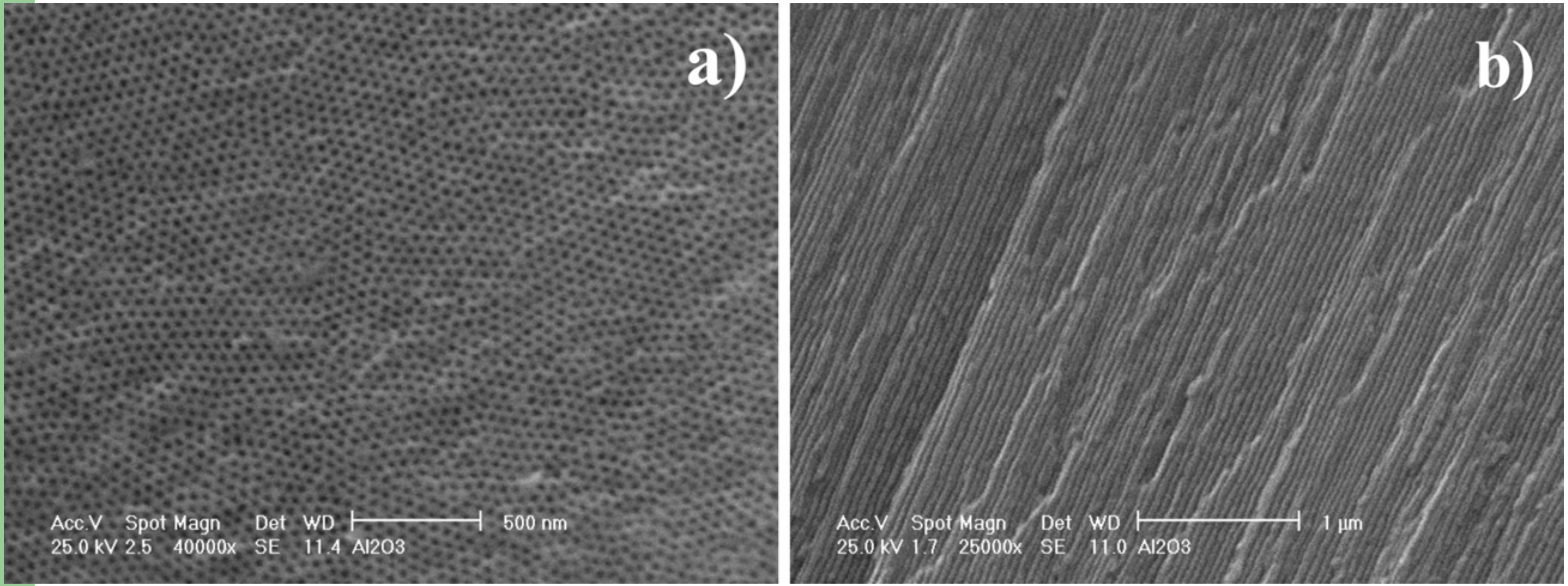


Layered Materials Nanotubes

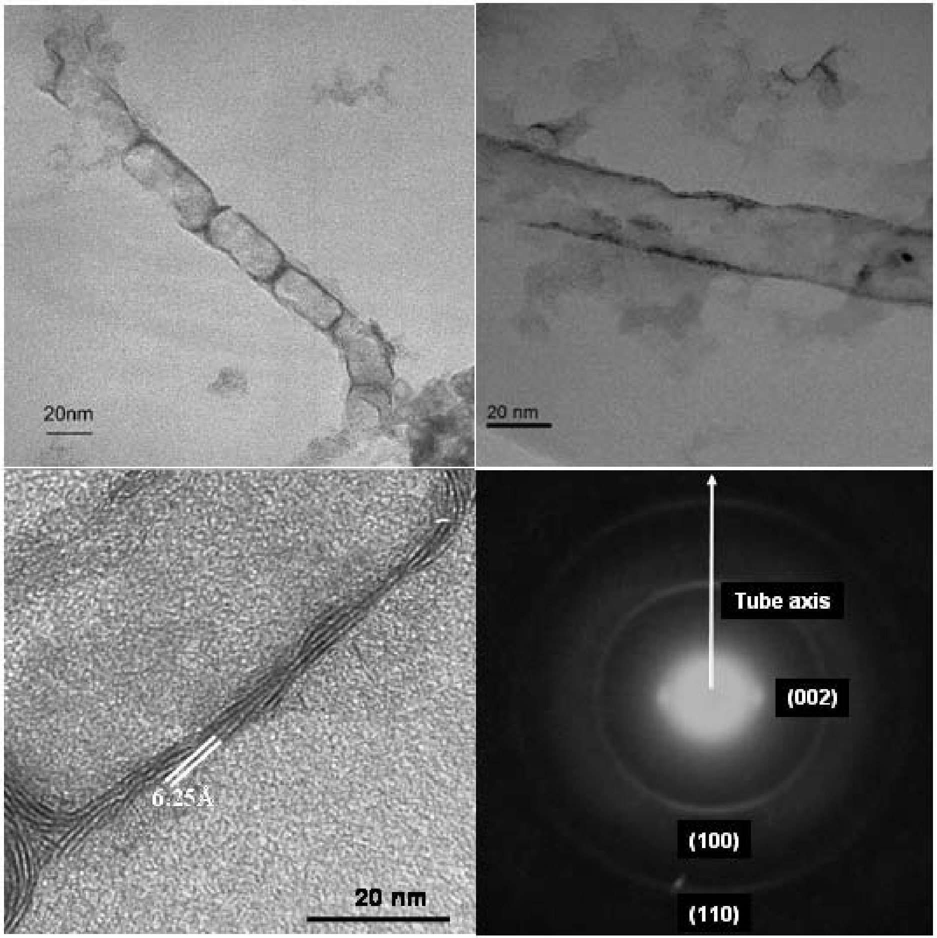




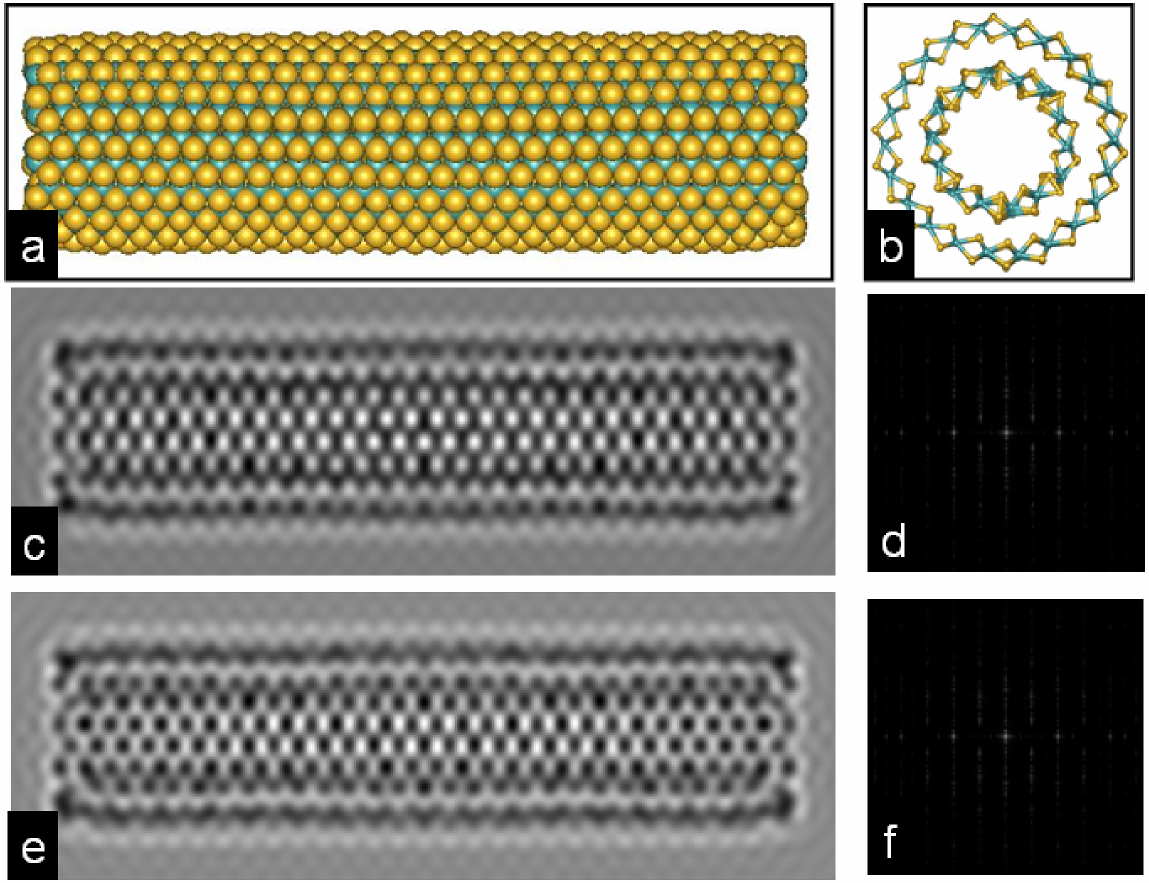
Layered Materials Nanotubes



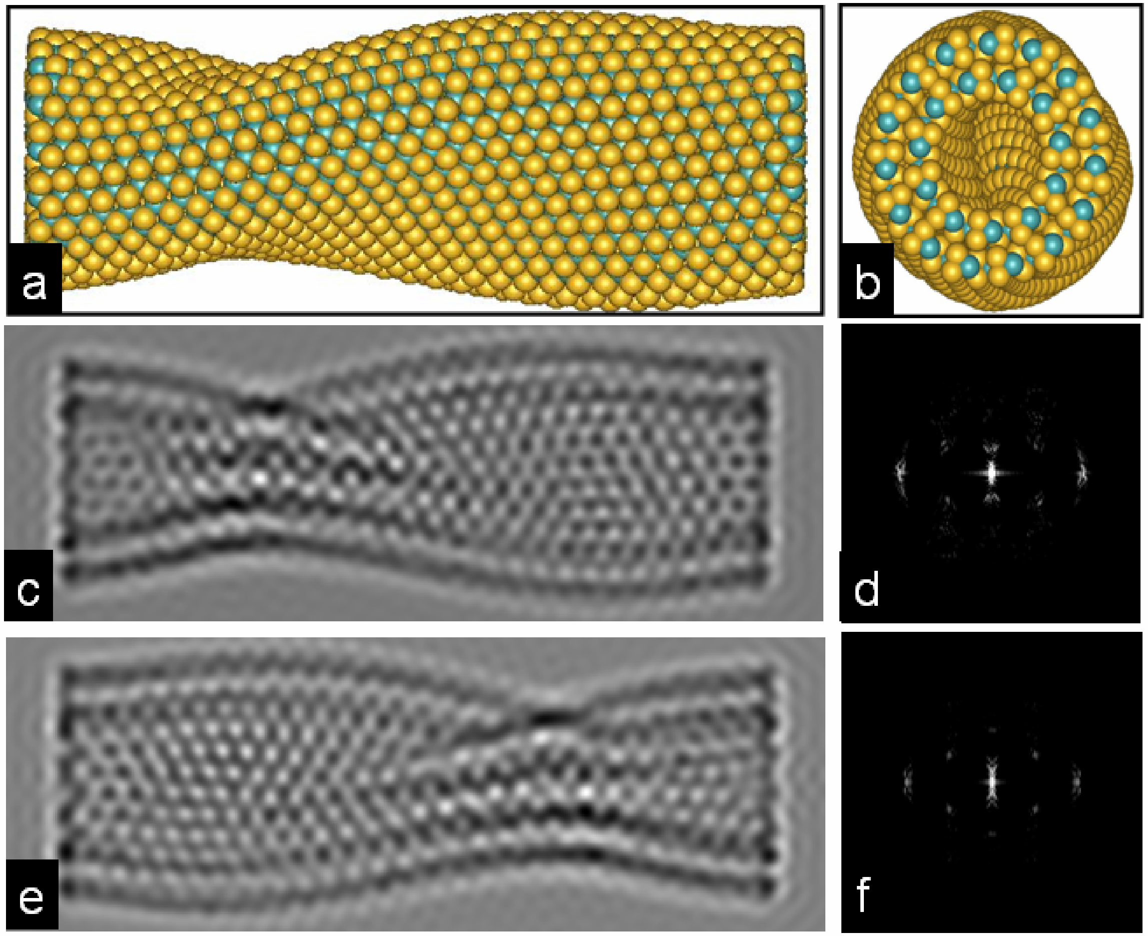
Layered Materials Nanotubes



Layered Materials Nanotubes



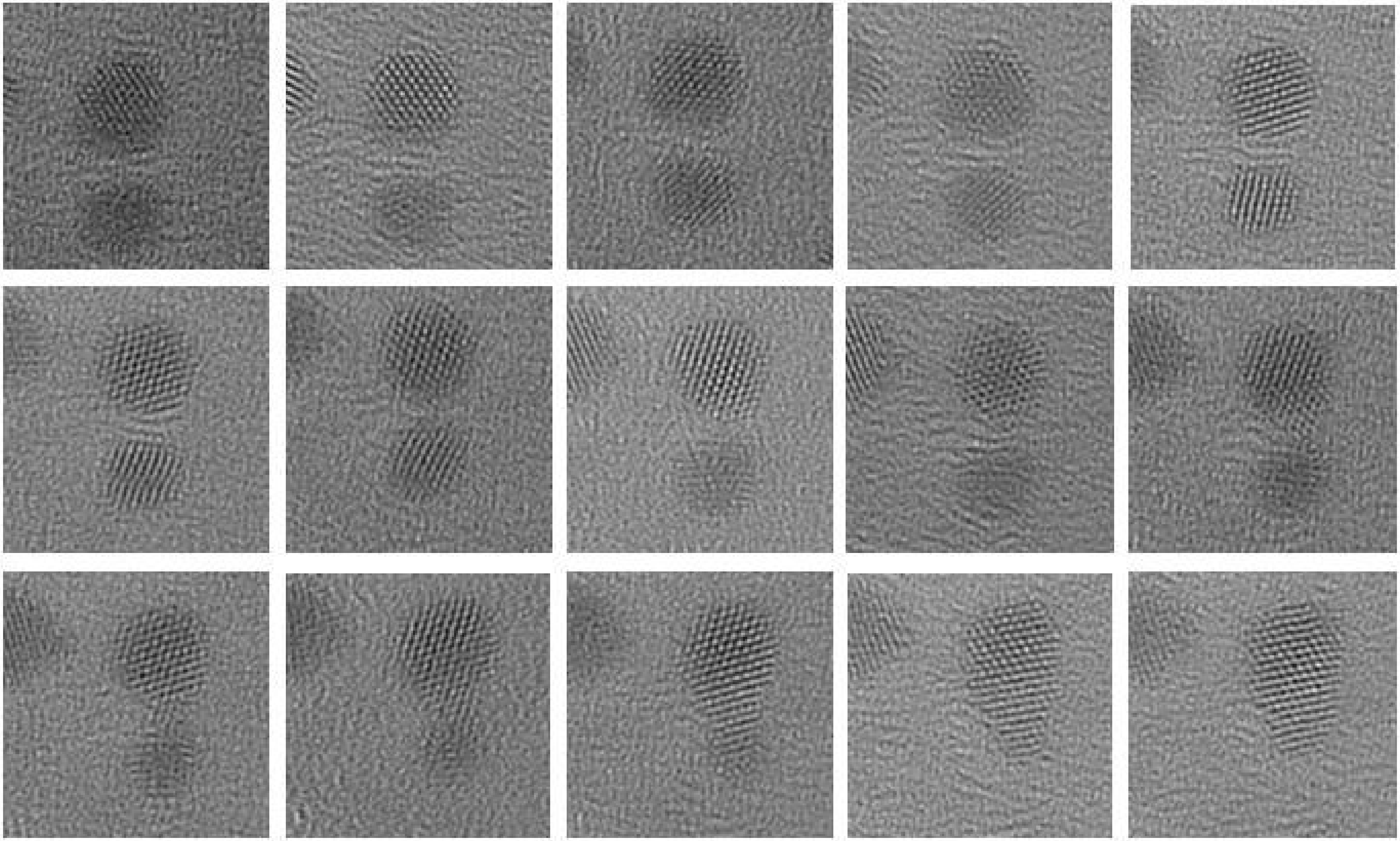
Layered Materials Nanotubes



Nanorods

- Size
- Shape
- Well defined facets
- Connectivity possibilities
- Possibility to produce arrays

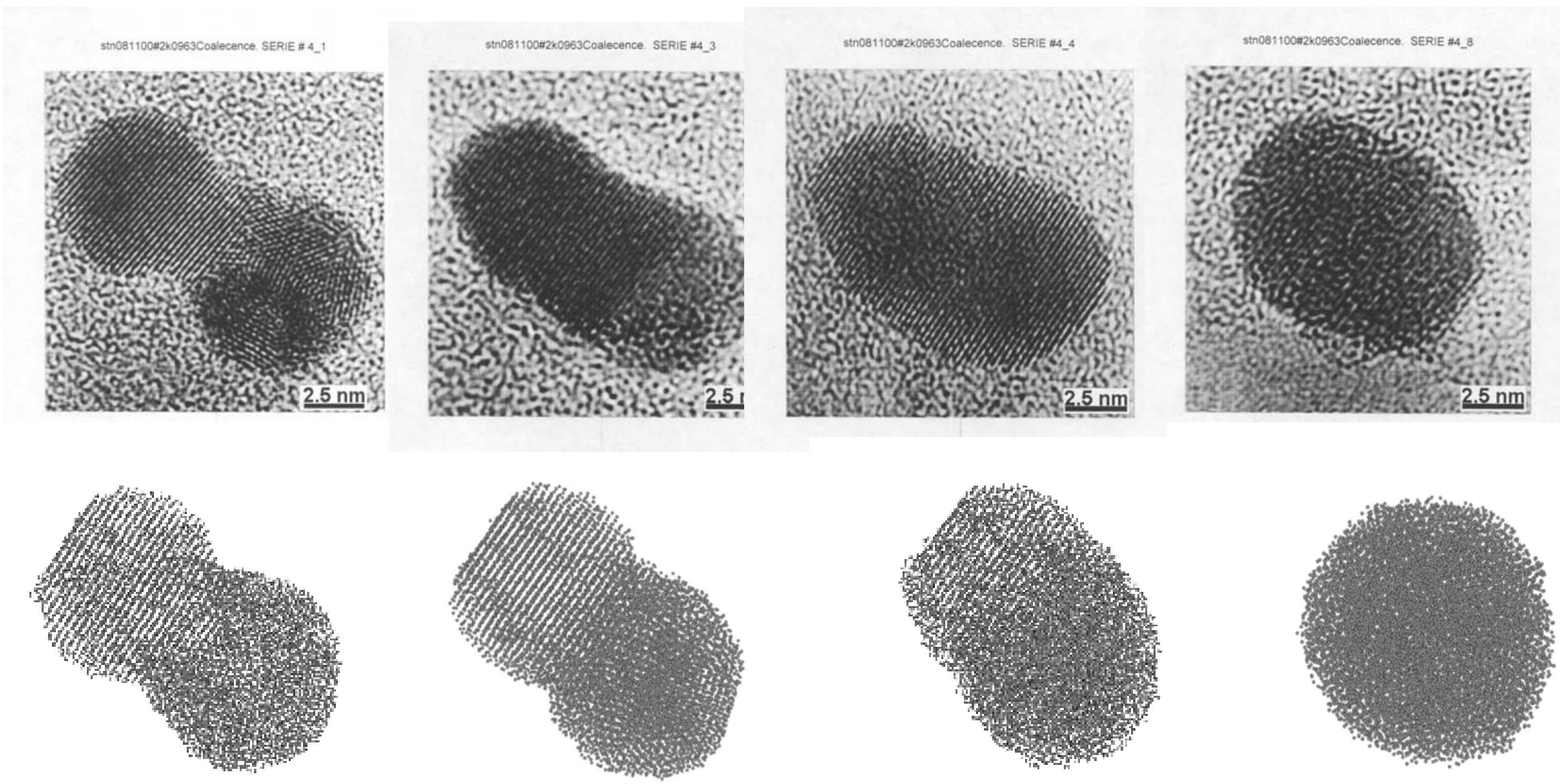
Coalescence evidences in HREM analysis of nanoparticles



Comparison between experiment and simulation

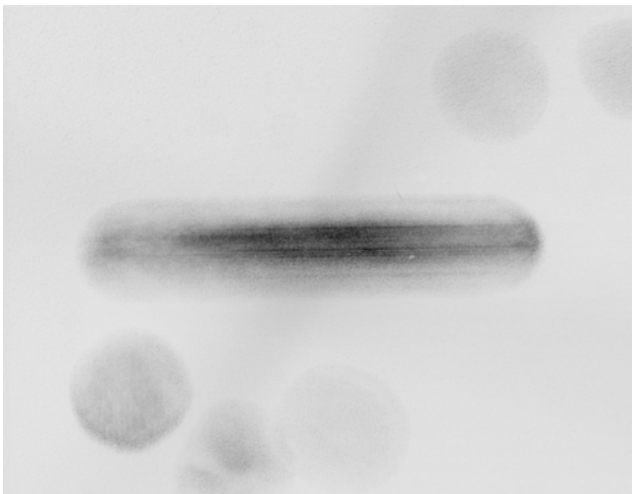
Experiment

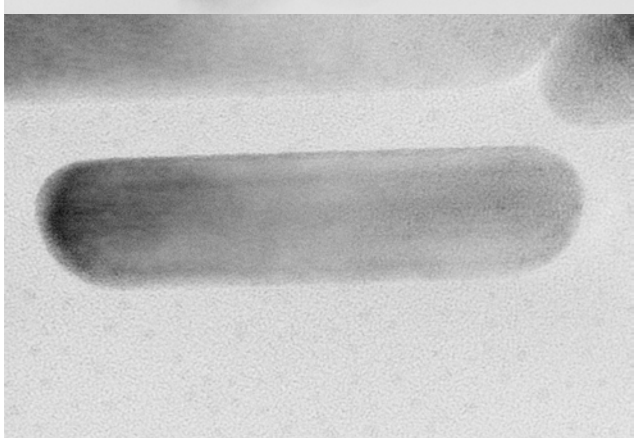
Simulation

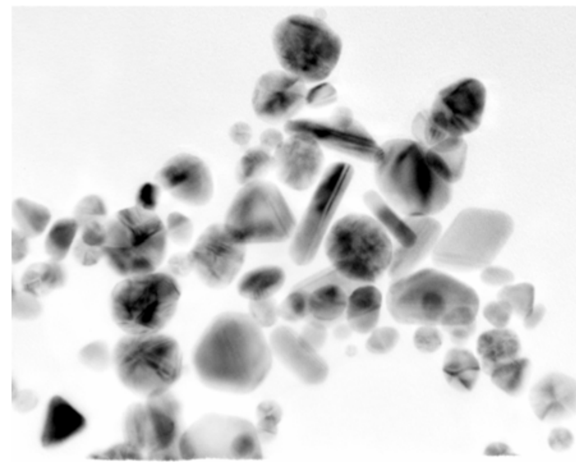


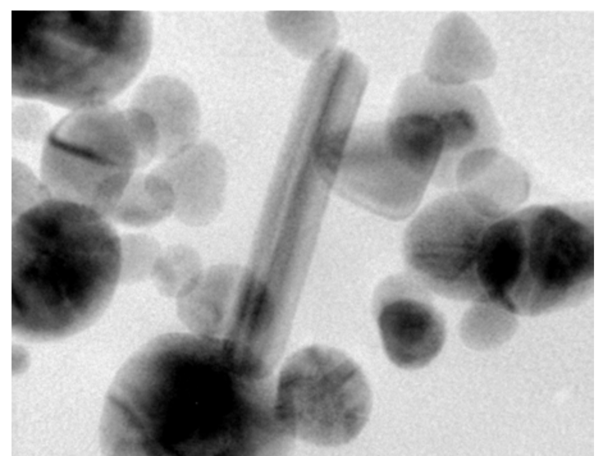
825 K | 850 K | 875 K | 900 K

Nanorods

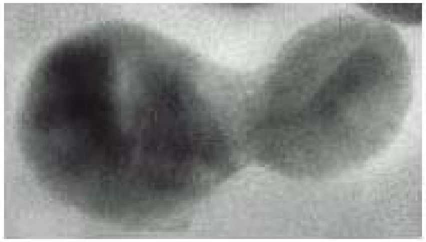


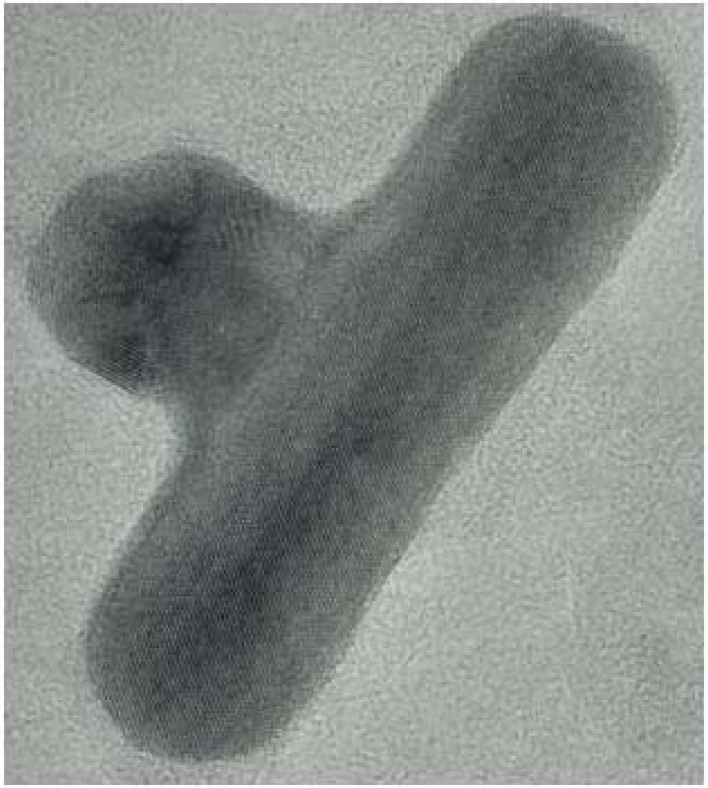


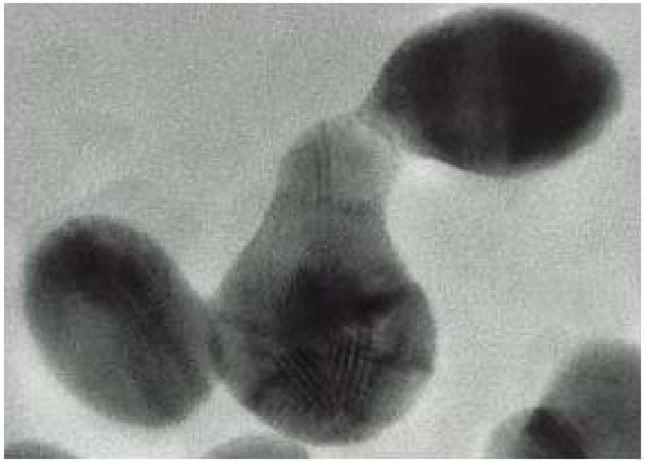




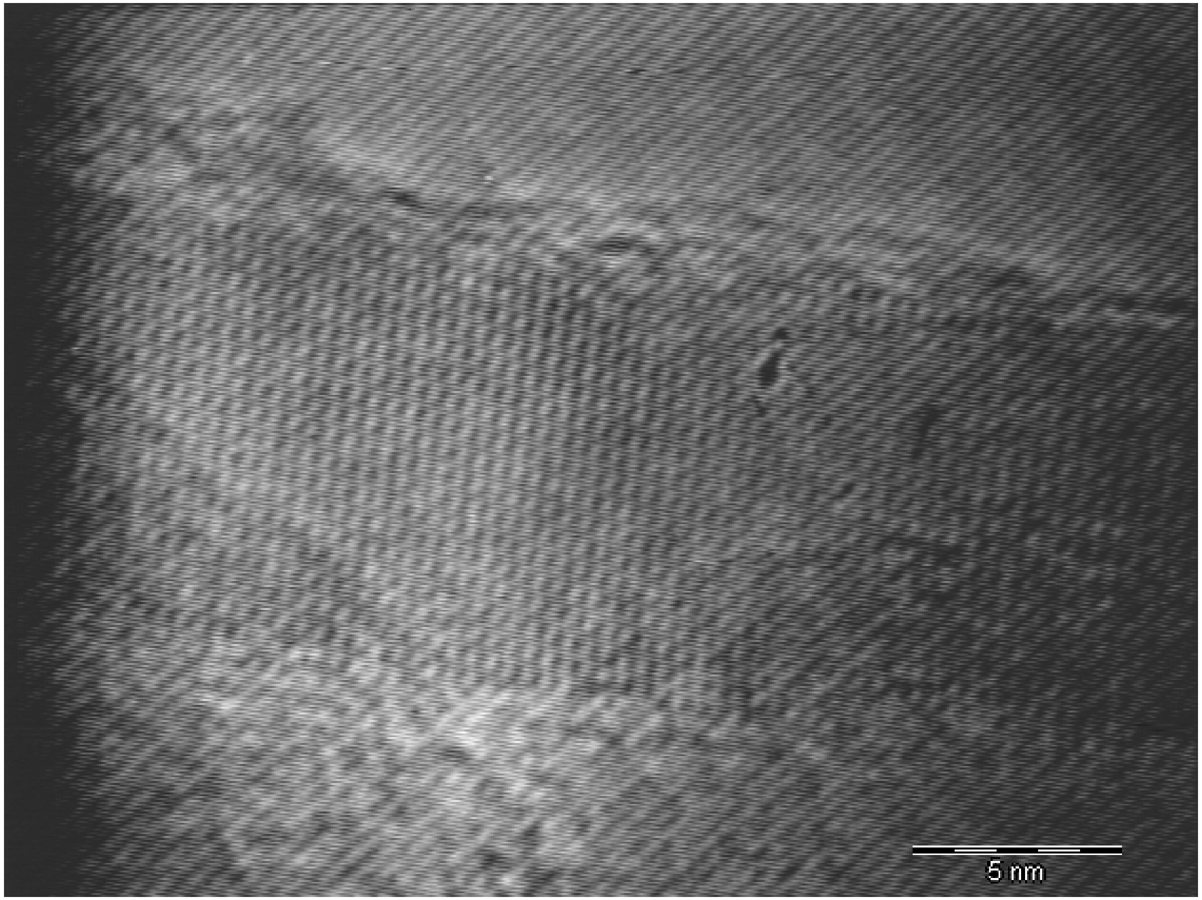
Nanorods



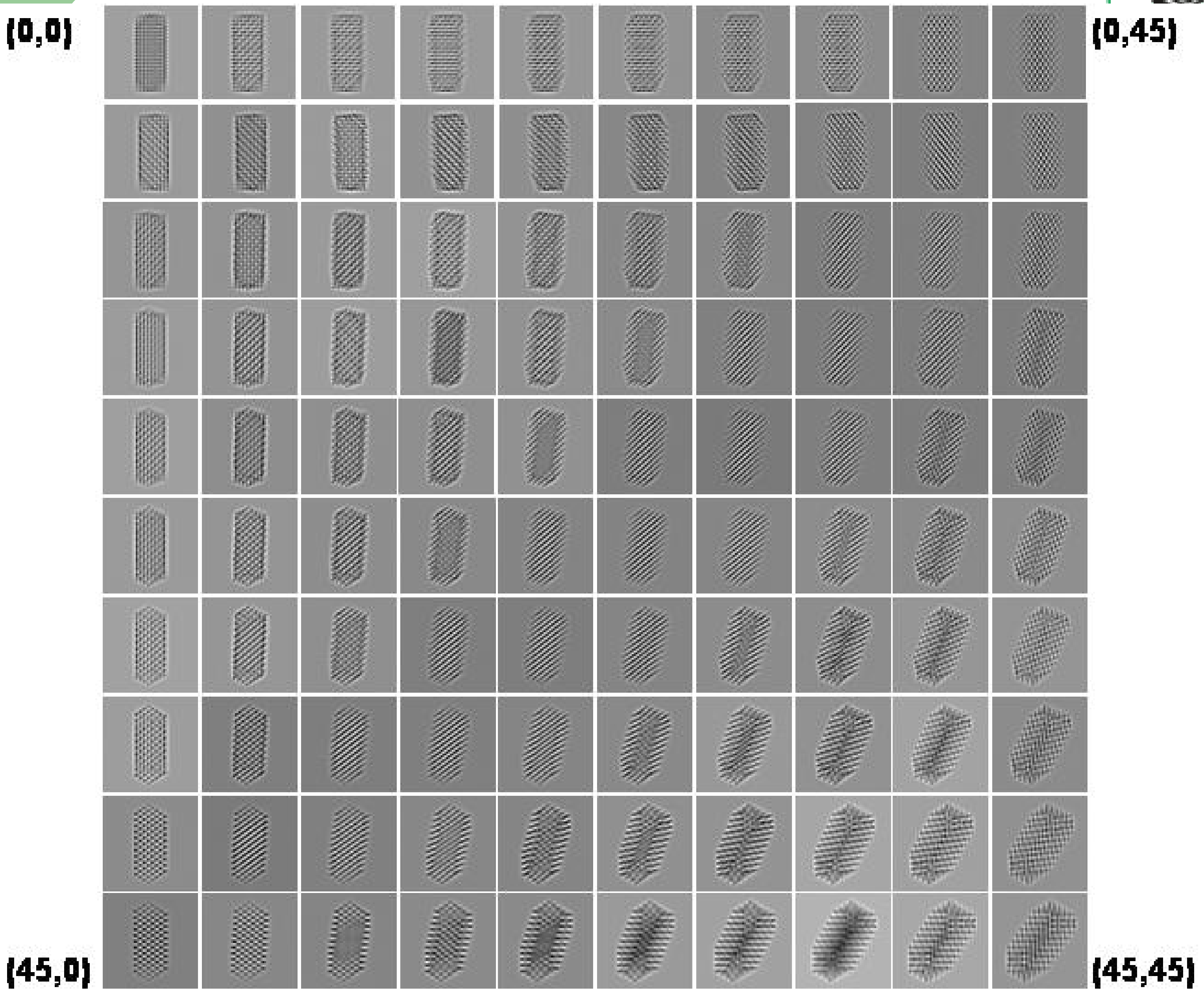




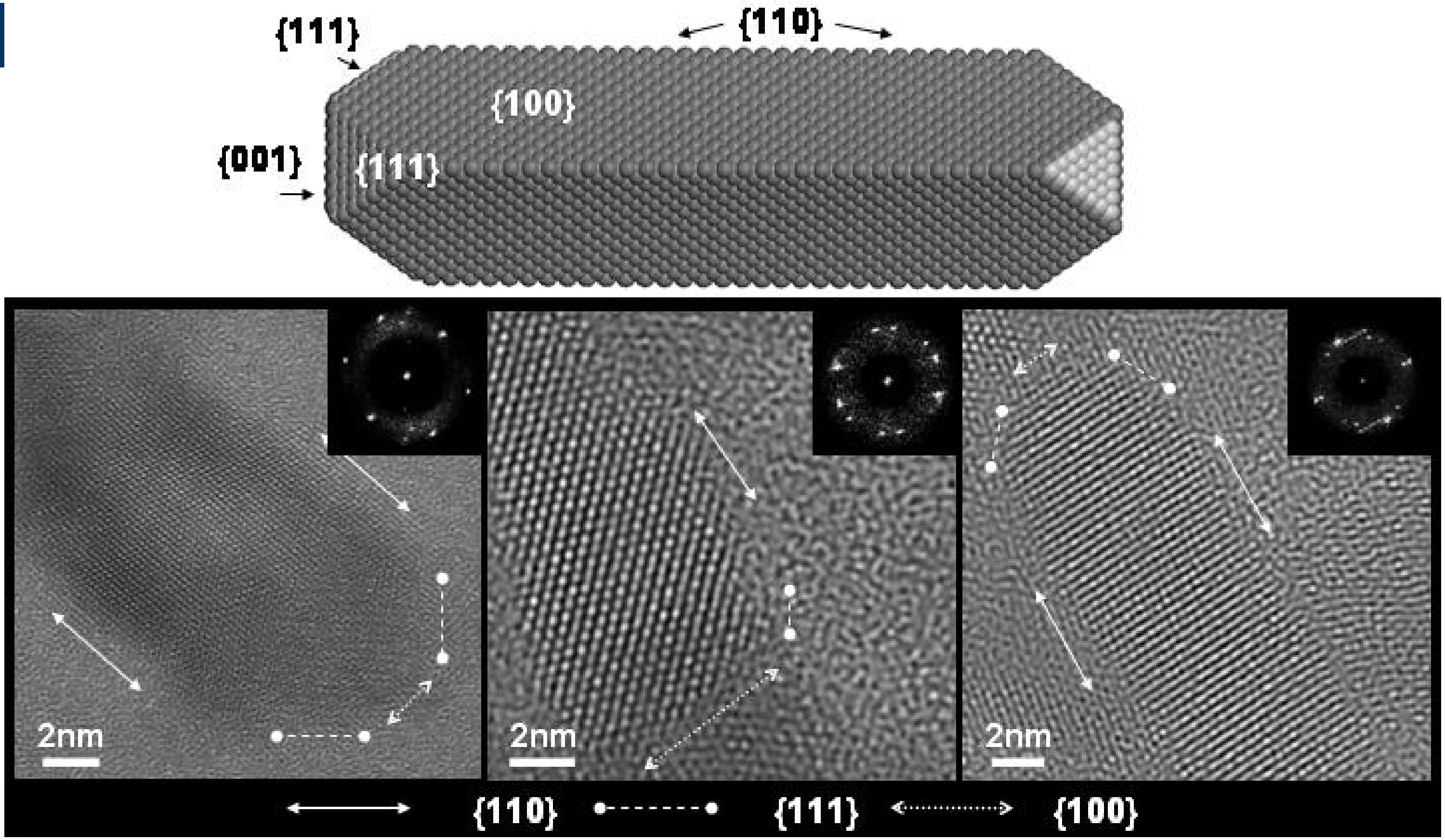
CdS Nanorods



CdS Nanorods

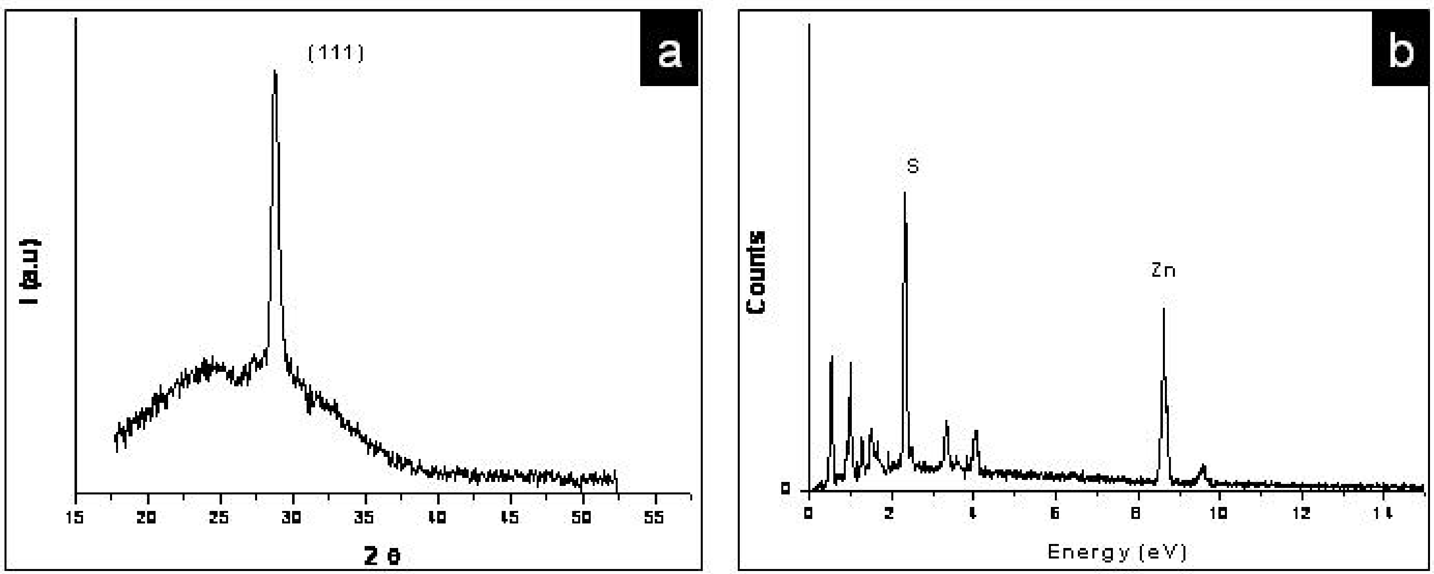


CdS Nanorods



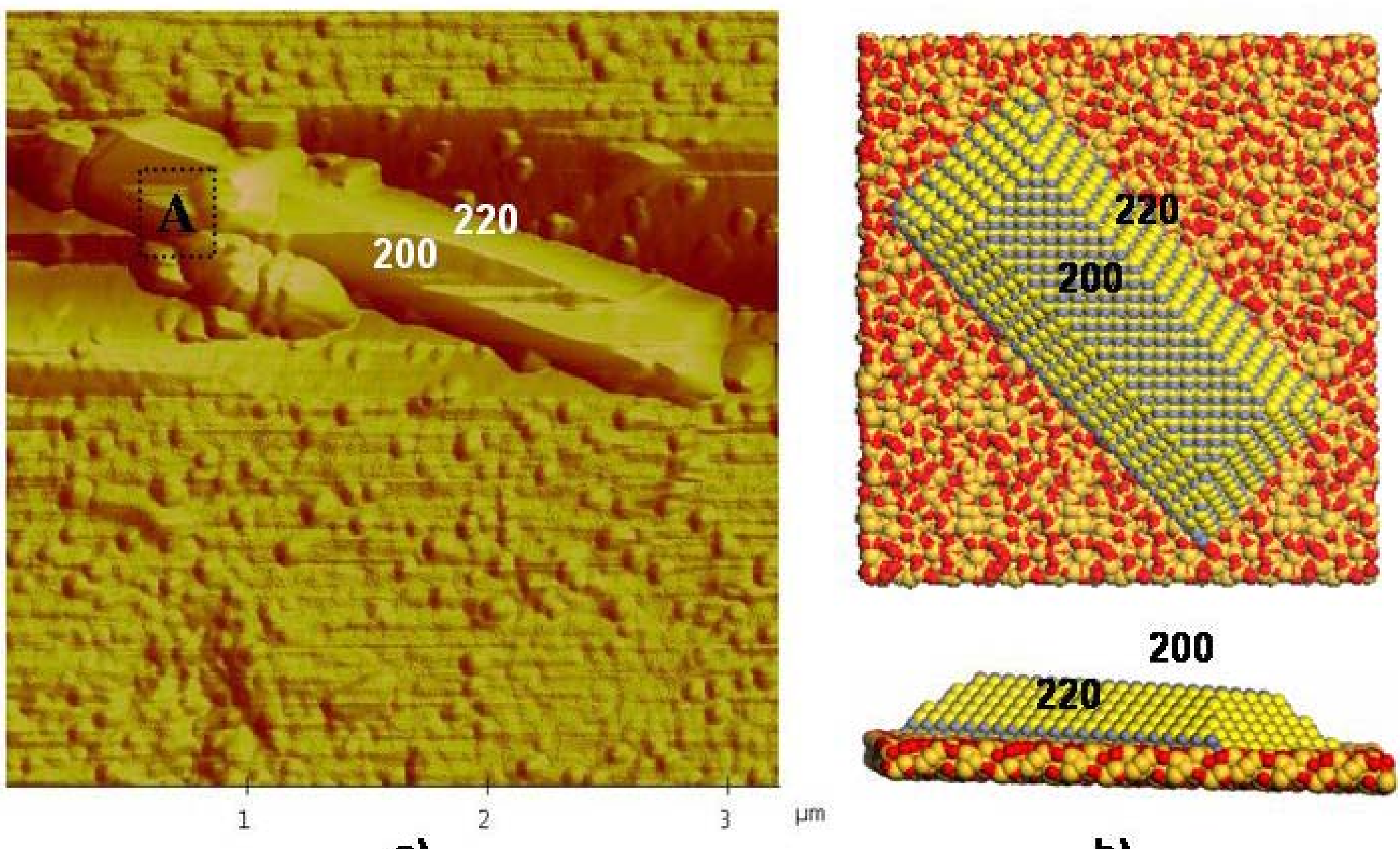
J. A. Ascencio, P. Santiago, L. Rendon and U. Pal. *Structural basis for homogenous CdS nanorods: Synthesis and HREM characterization.* **Enviado a J. of Nanostructured Materials.**

ZnS Nanorods



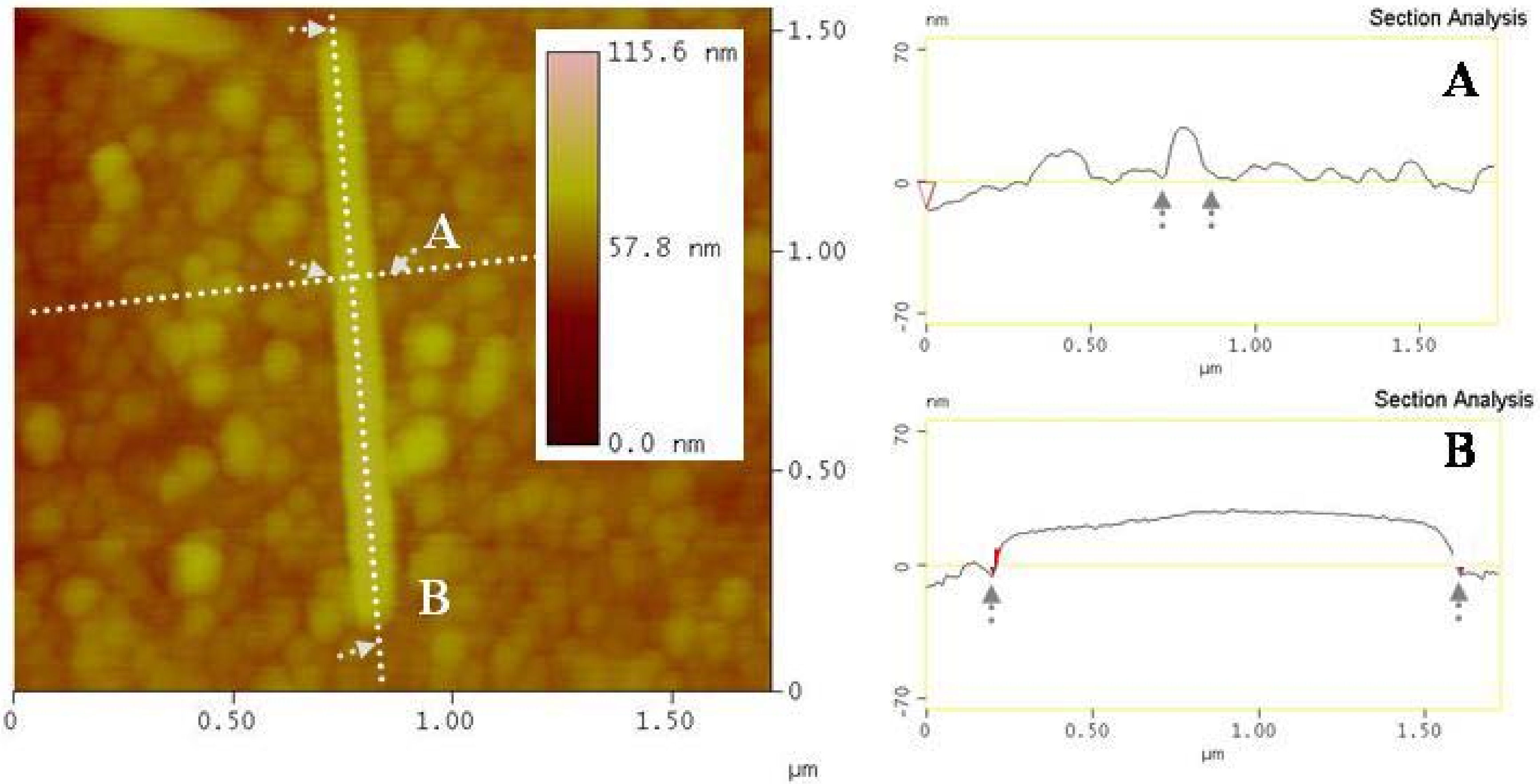
J. A. Ascencio, M. Perez-Alvarez, L.M. Molina, P. Santiago and M. José-Yacaman. *Structural Models Of Inorganic Fullerene-Like Structures.* **Surface Science.** 526, 243-247 (Febrero del 2003).

ZnS Nanorods



S.Velumani and J.A.Ascencio, *Formation of ZnS nanorods by simple evaporation technique*, enviado a **Applied Physics A.**

ZnS Nanorods



S.Velumani and J.A.Ascencio, *Formation of ZnS nanorods by simple evaporation technique*, enviado a **Applied Physics A.**

CoMeNaSA

Consorcion Mexicano de Nanotectologia y Soluciones Avanzadas

Nanomedicina


Science
8 February 2002
Vol. 295 No. 5557
Pages 917–1180 $9
BODYBUILDING:
The Bionic Human
AMERICAN ASSOCIATION
ADVANCEMENT OF SCIENCE

If I only had a heart…

Science

Historical Highlights

in Bionics and Related Medicine

Bionics has had a rich and fascinating history. In the development of arm and leg prostheses, progress has come as a slow and gradual process. In other fields, such as organ transplantation, there have been decades between the first attempts at a new procedure and the routine achievement of success. This punctuated progress has frequently been contingent on accumulating new insights from other disciplines, such as the role of the immune system in tissue rejection, or on serendipitous discovery, as was the case for several anti-rejection drugs. Rather than attempting to be comprehensive, we have portrayed in this timeline, highlights from different areas of medical research. Similarly the images, although not always connected to specific dates or events, are intended to portray both interesting artifacts from the past, and today's high-tech advances, which provocatively hint at developments yet to come.

1504 Iron prosthetic hand with flexible finger joints.

1597 Reconstruction of the nose by tissue grafting.

1628 Early theory on the circulatory system developed.

1666 Blood transfusion between two dogs.

1667 Blood transfusion between sheep and human.

1682 Repair of human skull with dog skull bone.

1807 Development of an endoscope for minimally invasive surgery.

1822 First successful fresh skin autograft.

1842–1847 Anesthetic properties of a number of compounds first discovered and demonstrated.

1847 Introduction of silver amalgam for dental fillings.

1858 Publication of the first edition of *Gray's Anatomy*.

1863 Introduction of antiseptic surgical techniques.

1881 First temporary skin graft.

1883 Development of Ringer's solution for keeping tissues alive outside the body.

1888 First reports on use of contact lenses to correct vision.

1901 Identification of different blood groups.

1905 & 1906 First reports of corneal transplants.

1905 Discovery of technique for growing tissue cells in vitro.

1905 Successful direct blood transfusion between humans.

1905 Early attempt at an artificial hip replacement.

1908 Early attempt at knee replacement surgery (using a cadaver for the replacement part).

1911 Paraffin injection to treat vocal fold paralysis.

1914 Citrate identified as a blood anti-coagulant, allowing for blood storage.

1928 Iron lung developed for treatment of polio victims.

1939 Hard (plastic) contact lenses introduced.

1943 Kidney dialysis machine developed.

1949 Role of immune system in tissue rejection identified.

1951 First artificial heart valve implanted.

1953 Development of the heart-lung machine.

1953 Demonstration of acquired immune tolerance to foreign grafts.

1954 Kidney transplant between identical twins.

1956 First successful bone marrow transplant.

1957 First cochlear implant developed.

1958 Early attempts at developing an implantable pacemaker.

1958 Identification of the importance of the histocompatibility system for tissue matching.

1963 First liver transplant.

1966 First successful pancreas transplant.

1967 First successful heart transplant. Patient survived 18 days.

1969 First biocompatible ceramic that could bond to collagen and bone developed.

1969 Total artificial heart implanted in a human as a temporary measure.

1972 Testing of modern design steel/polymer hip joint.

1973 Successful unrelated bone marrow transplant.

1978 The immunosuppressant cyclosporine is introduced.

1979 First auditory brainstem implant.

1980 First successful single-channel cochlear implant in a child.

1981 A peripheral nerve bridge is implanted into the injured spinal cord of an adult rat.

1982 Genetically engineered insulin becomes commercially available (the first genetically engineered drug).

1982 Implantation of the Jarvik-7, a permanent total artificial heart.

1983 First successful single lung transplant.

1984 Baby Fae receives heart from baboon and survives 20 days.

1986 First successful double lung transplant.

1987 First clinical use of a bioartificial liver device.

1990 FK506 immunosuppressant becomes available.

1990 First living donor lung transplant.

1993 FDA approval of left ventricular assist device as a bridge to heart transplantation.

1995 Jeff Getty receives a baboon bone marrow transplant.

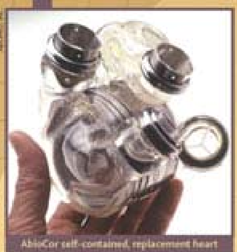
1997 Transplant of pig neurons in patients with Parkinson's disease.

1998 Human hand transplant.

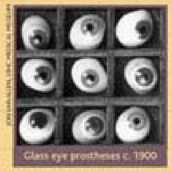
1998 Total larynx transplant.

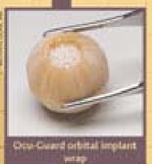
2000 Implantation of a prototype artificial pancreas.

2001 Implantation of the AbioCor, a permanent self contained total heart replacement.

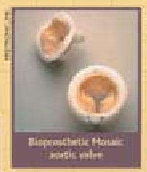

AbioCor self-contained, replacement heart

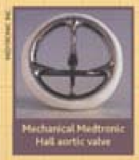

Subretinal chip in a cat eye

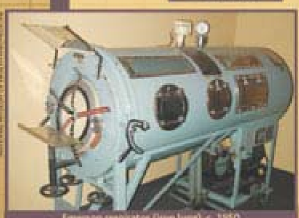

Glass eye prostheses c. 1900

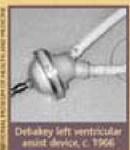

Oco-Guard orbital implant wrap

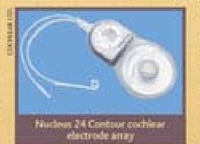

AlloDerm® processed human dermis

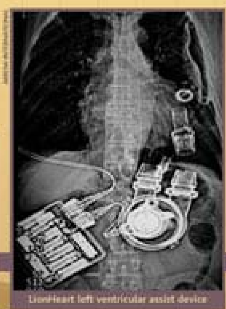

Bioprosthetic Mosaic aortic valve

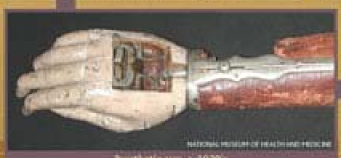

Mechanical Medtronic Hall aortic valve

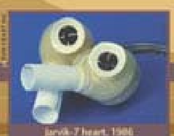

Emerson respirator (iron lung), c. 1950


Debakey left ventricular assist device, c. 1966


Nucleus 24 Contour cochlear electrode array


LionHeart left ventricular assist device


Prosthetic arm, c. 1920's

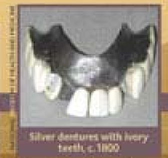

Jarvik-7 heart, 1986


Responsive prosthetic SensorHand


Porcelain denture, c. 1850


Howmedica Sphero-centric knee implant c. 1970's


Mechanical knee joint


Silver dentures with ivory teeth, c. 1800

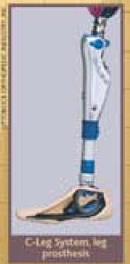

Kolff-Brigham dialysis unit (artificial kidney), c. 1950


Tendon-controlled artificial hand


An engineered human bladder


Artificial leg, c. 1937


Biomet hip implant, late 20th century


C-Leg System, leg prosthesis

Main sources:
National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, D.C.

M. Facklam, H. Facklam, *Spare Parts for People* (Harcourt Brace Jovanovich New York, NY, 1987).

W. R. Murphy, *Spare Parts: From Peg Legs to Gene Splices* (Twenty-First Century Books, Brookfield, CT, 2001).

International Encyclopedia of Science and Technology (Oxford University Press, Oxford, UK, 1999).

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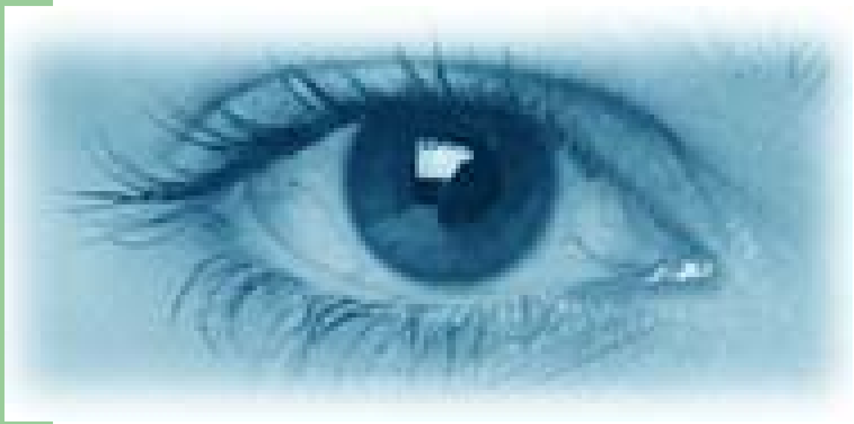
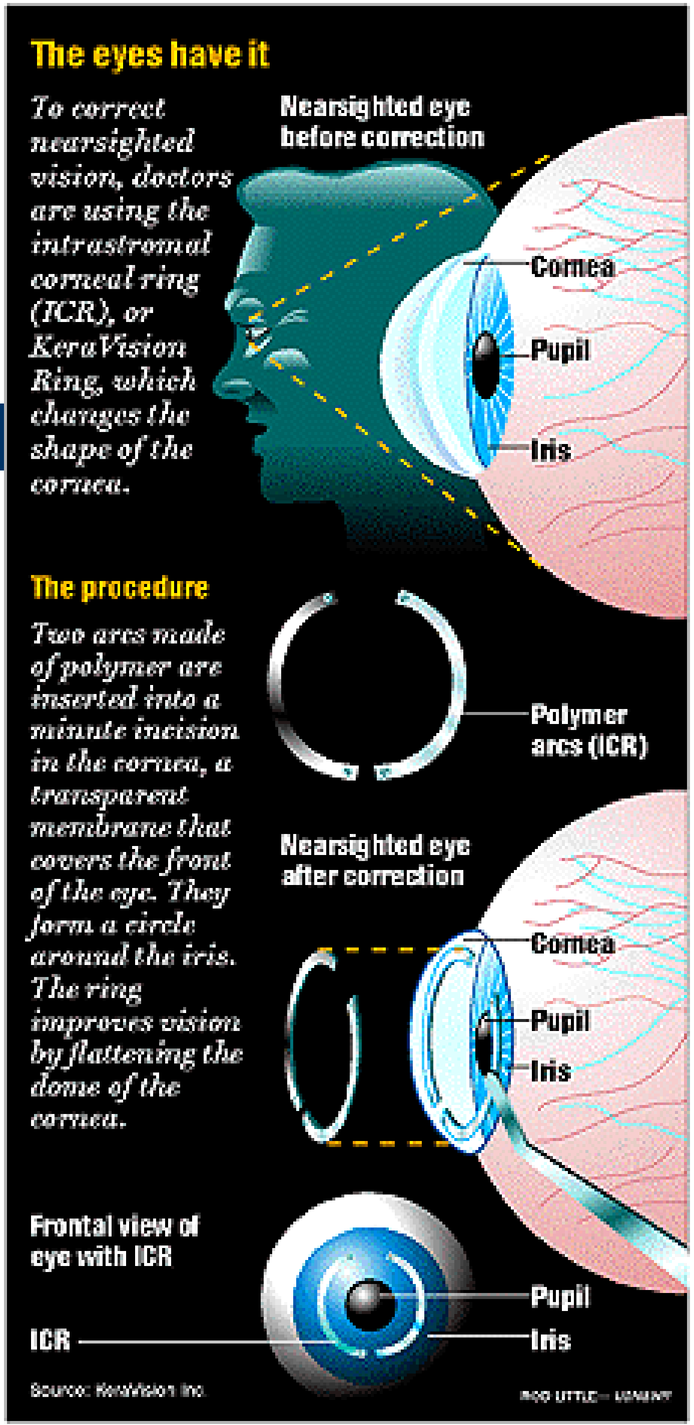
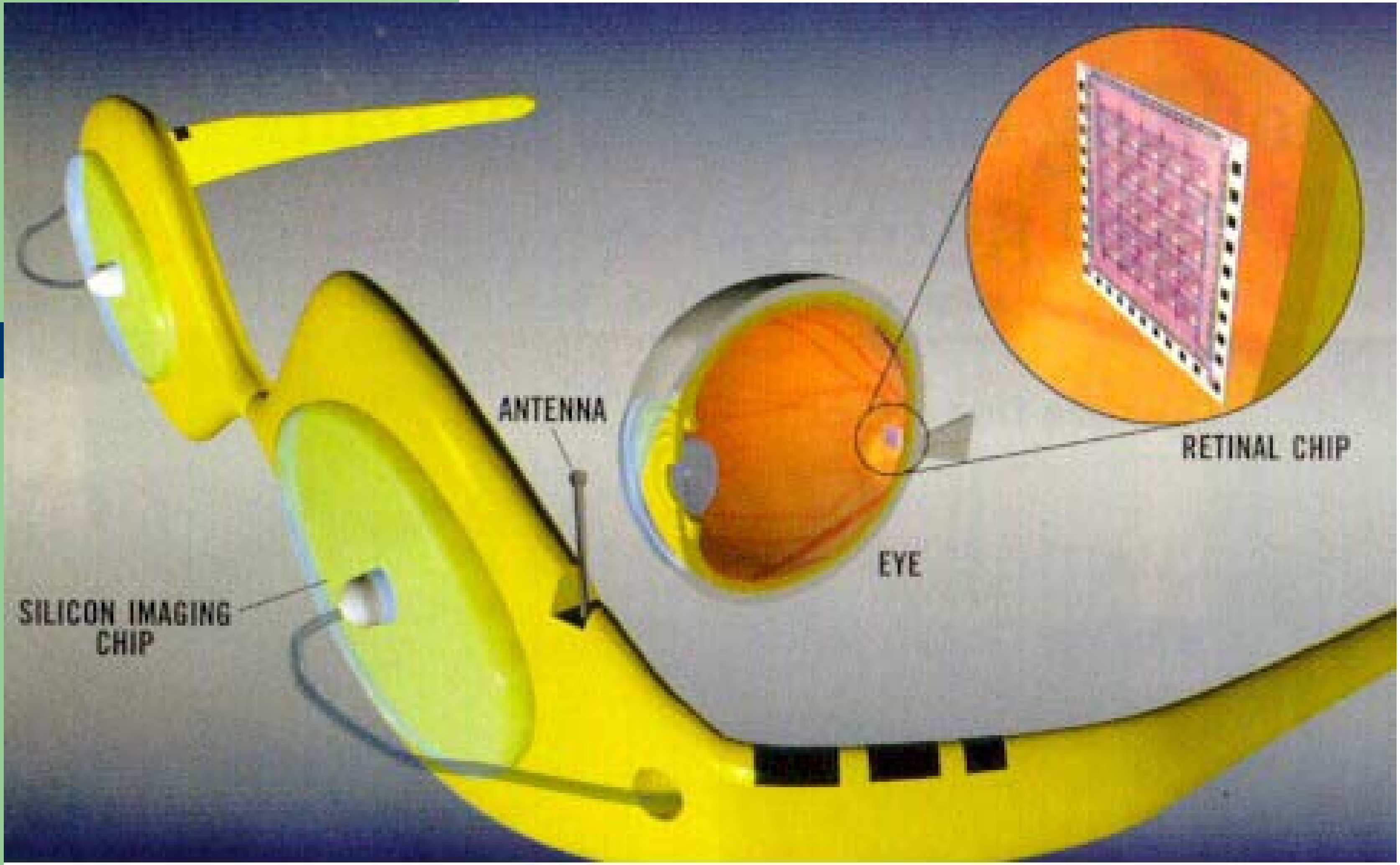
Improving our vision

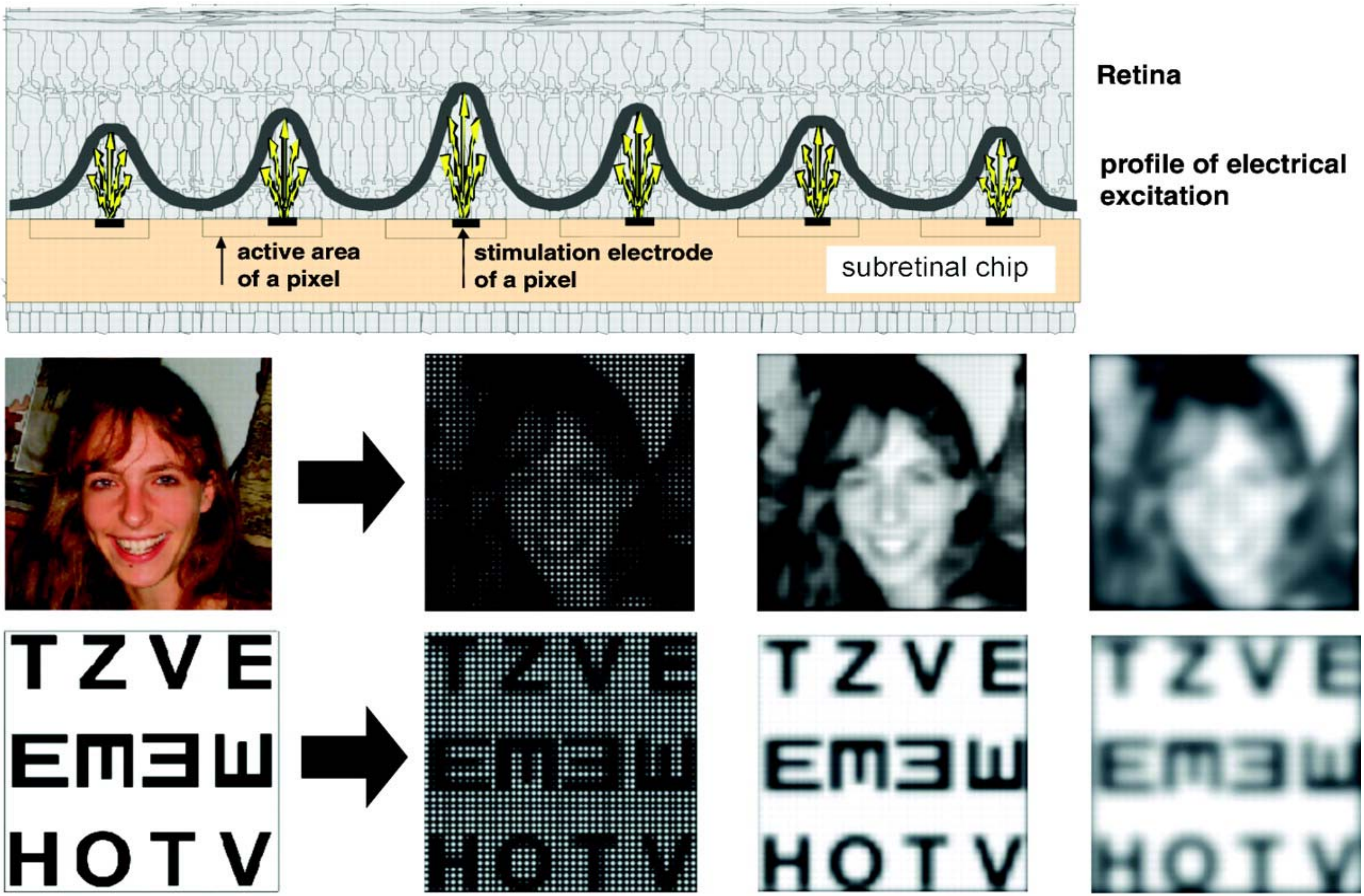


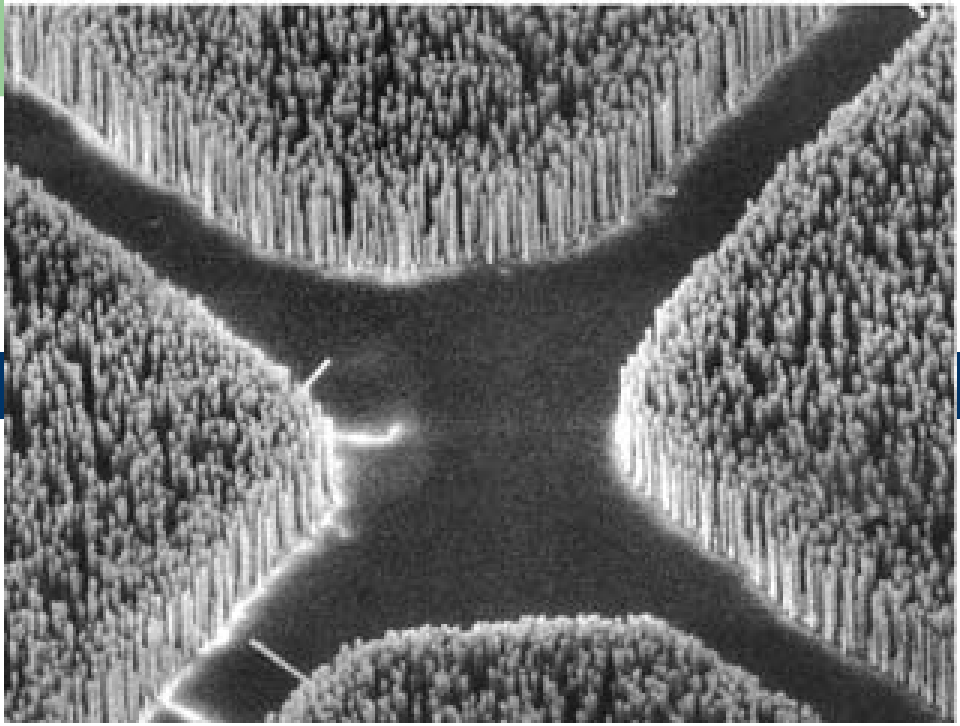


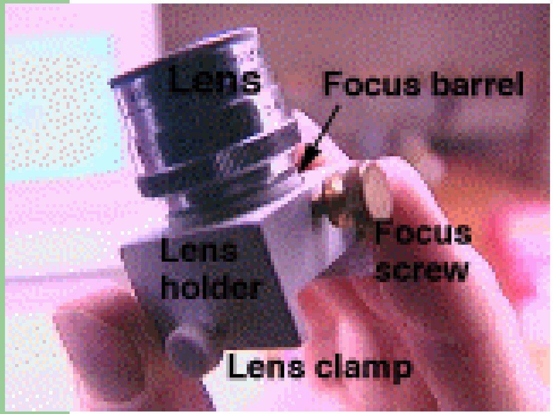


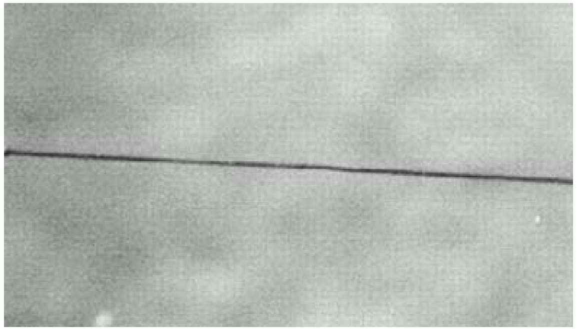
Retinal Prosthesis Project

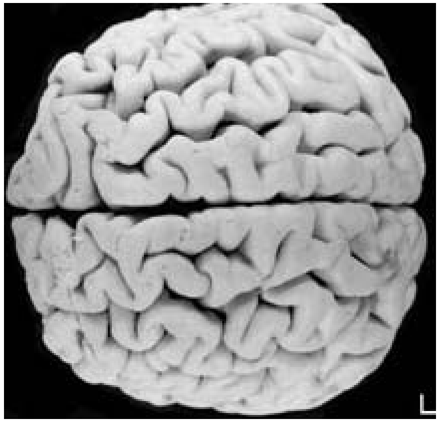
Johns Hopkins University
North Carolina State University

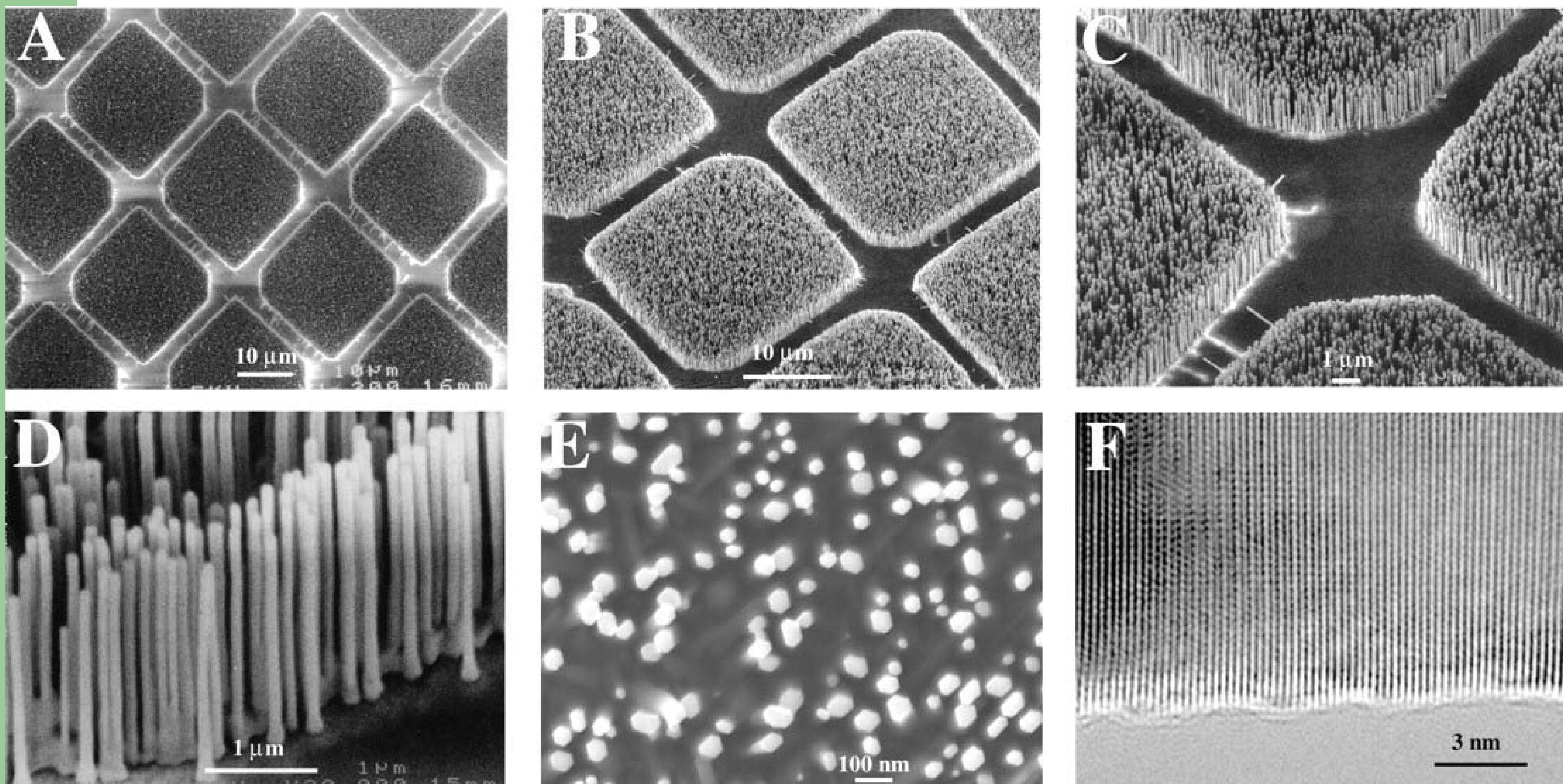

Retina
profile of electrical excitation
active area of a pixel
stimulation electrode of a pixel
subretinal chip

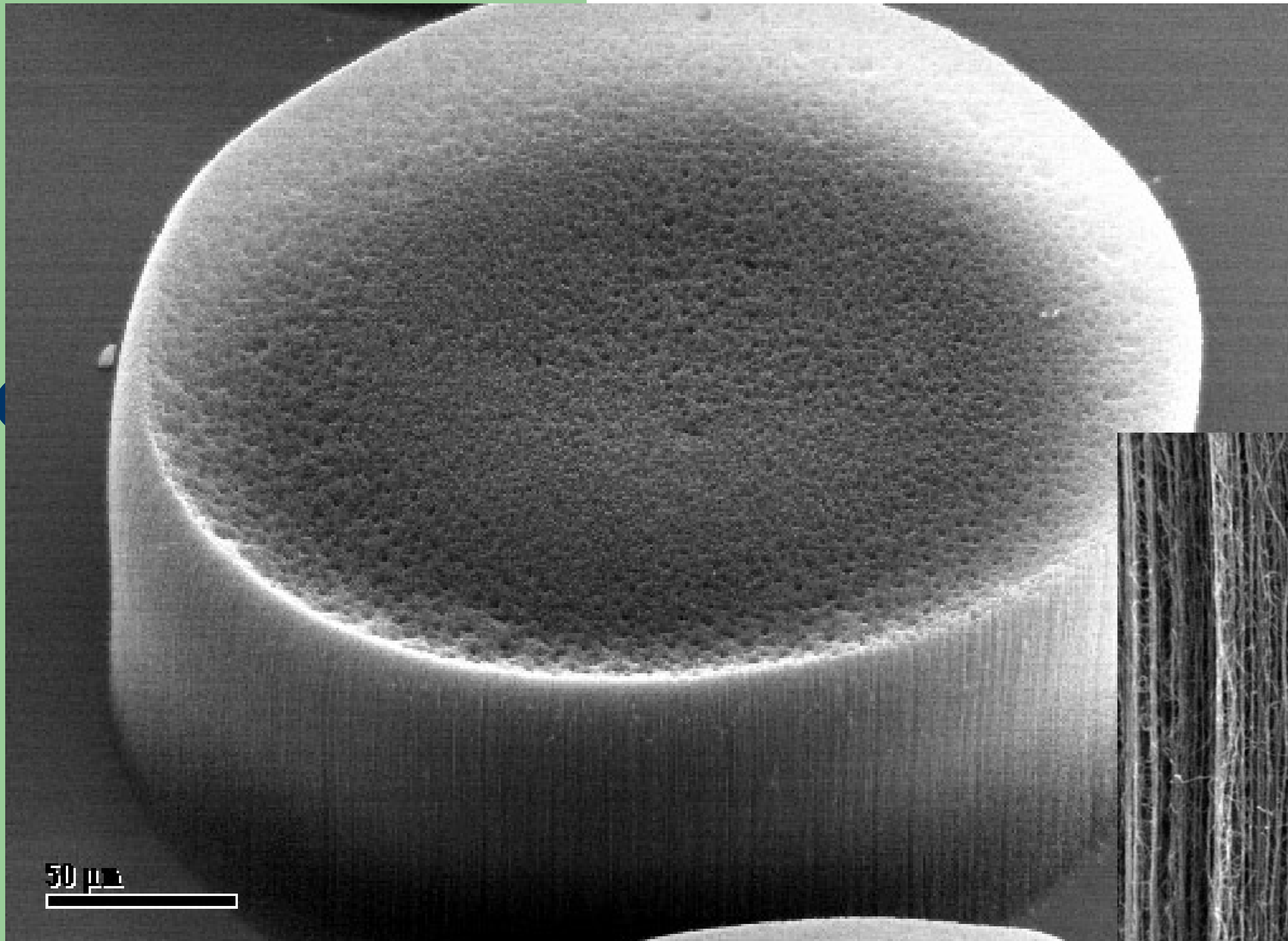


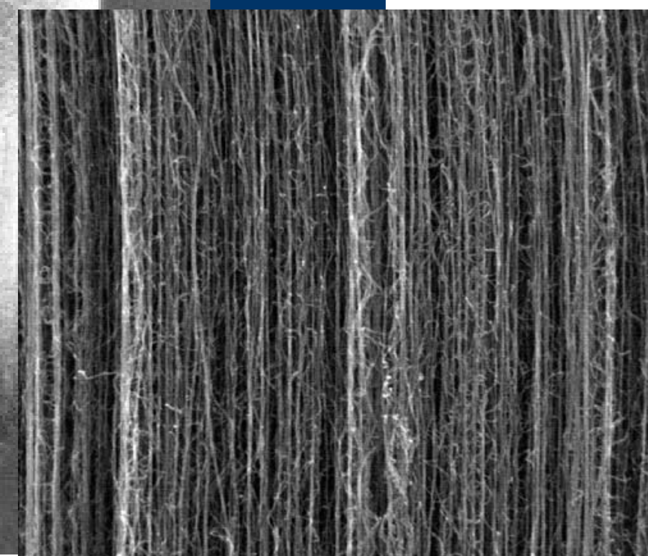

Lens
Focus barrel
Focus
screw
Lens
holder
Lens clamp

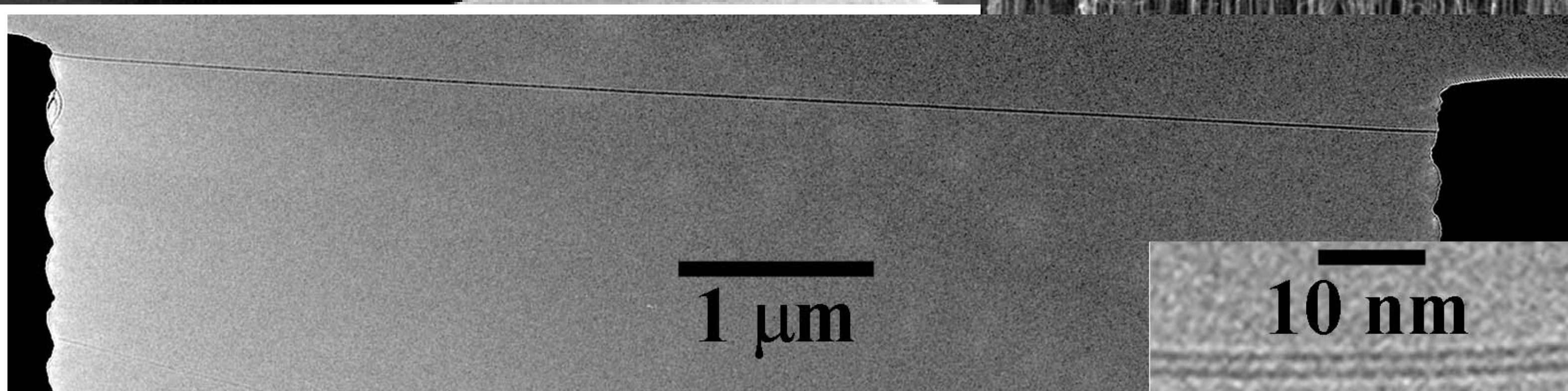


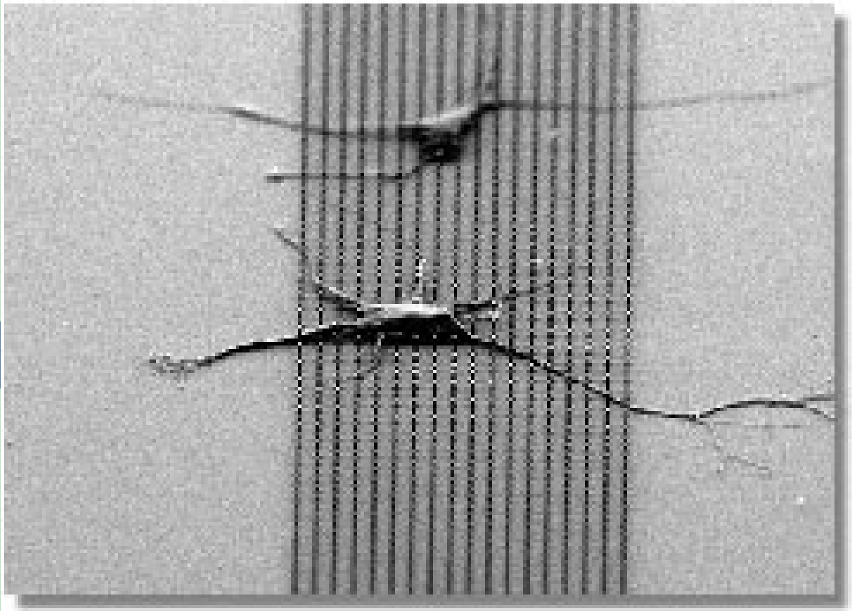


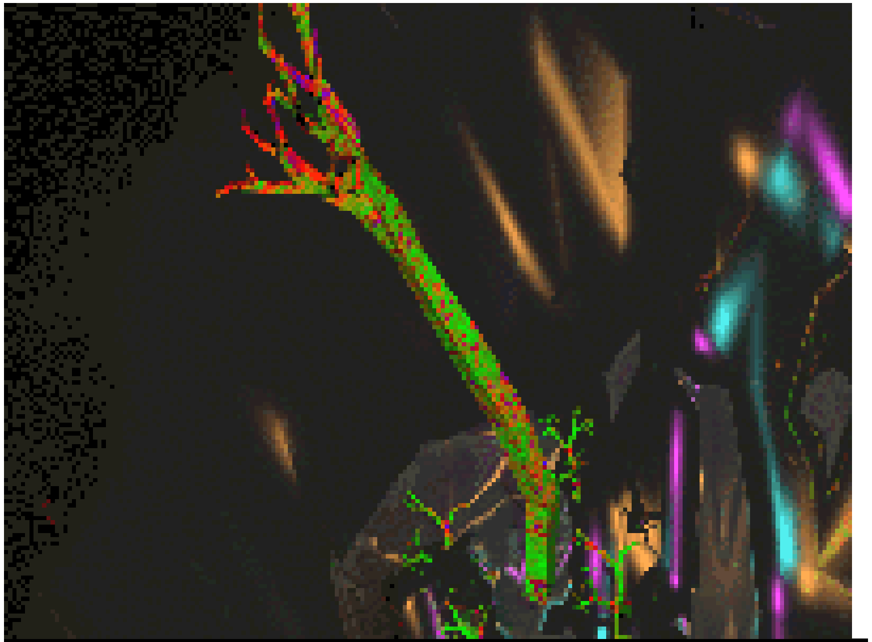

A
10 µm
B
10 µm
C
1 µm
D
1 µm
E
100 nm
F
3 nm

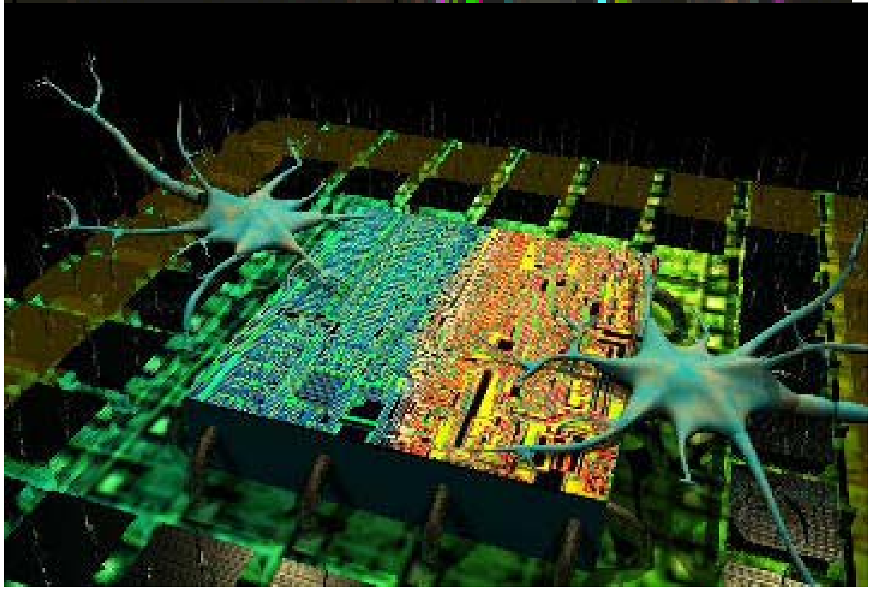

50 µm



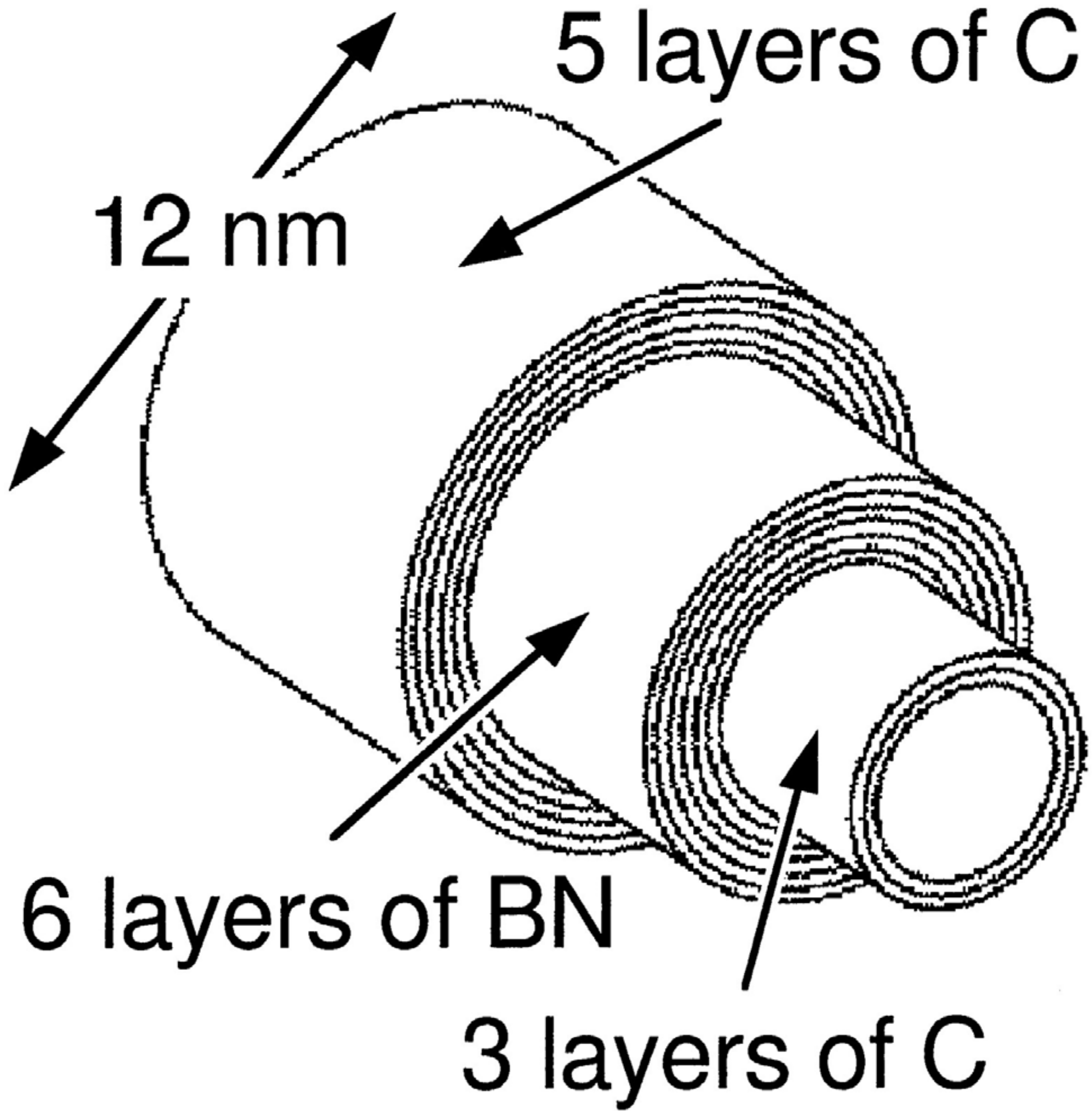

1 µm
10 nm

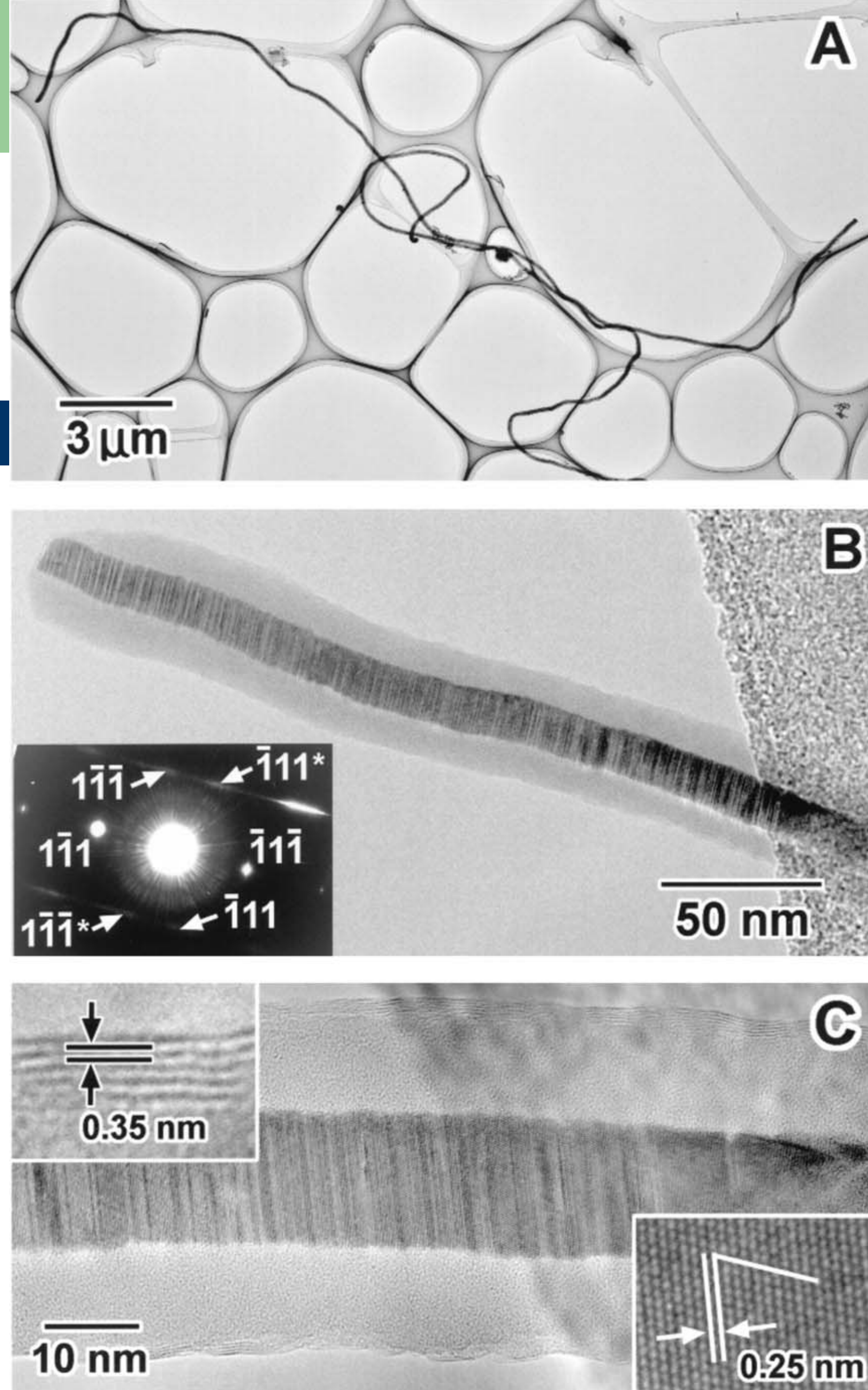






D





A
3 µm
B
$1\bar{1}\bar{1}$
$\bar{1}11$*
$1\bar{1}1$
$\bar{1}1\bar{1}$
$1\bar{1}\bar{1}$*
$\bar{1}11$
50 nm
C
0.35 nm
10 nm
0.25 nm

Entonces…

Un científico no es el que se dedica a la ciencia para vivir…

…es quien se dedica y vive la ciencia viendo y preguntándose …

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-

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