# History of the IEEE Electron Devices Society

**Prof. Cor Claeys**

**President EDS**

IEEE Celebrating 125 Years of Engineering the Future

# Outline

**Situation of Field of Interest**

**History of the Society**

**Highlights and Best Practices**

**Future Directions**

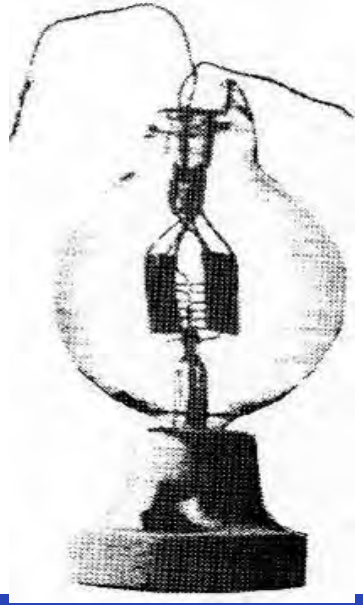
# Integrated Electronic Circuit

**Integrated Circuits or Electronic Circuits**

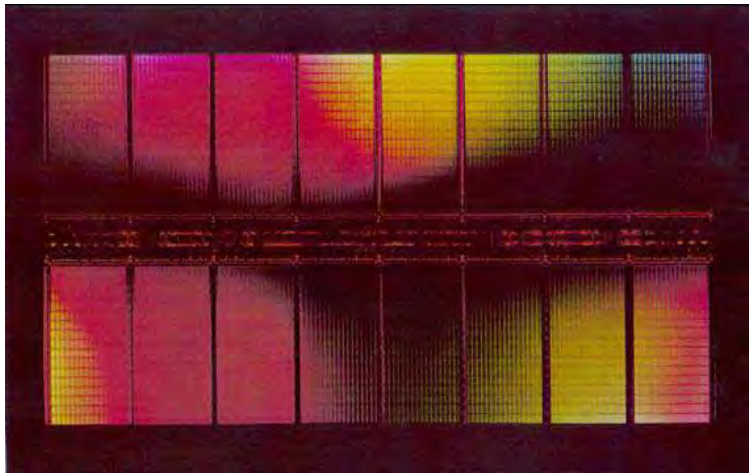
**Most important invention in the 20th century**

**Electronic Circuits in 100 years**

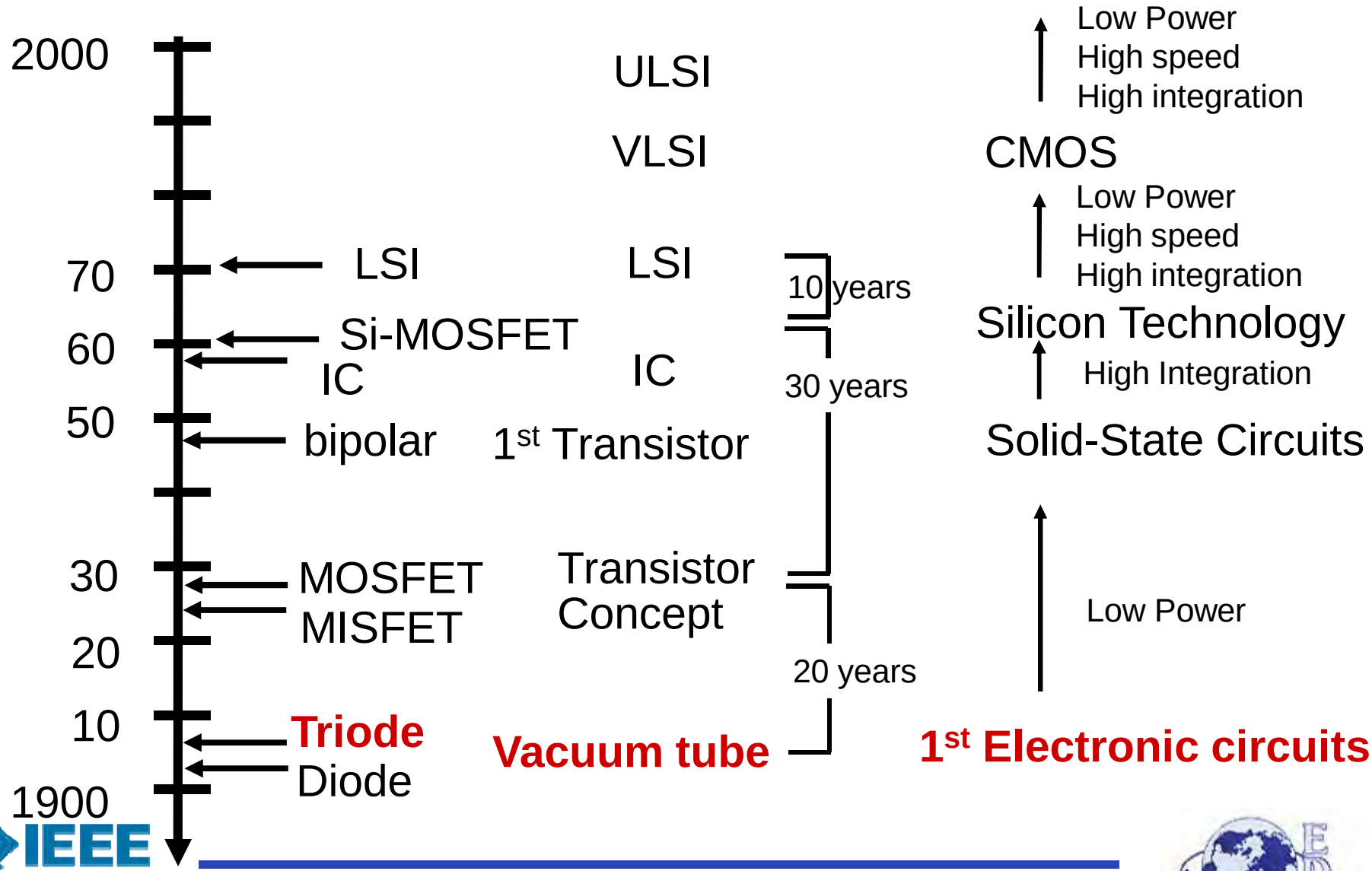
**Vacuum tube**



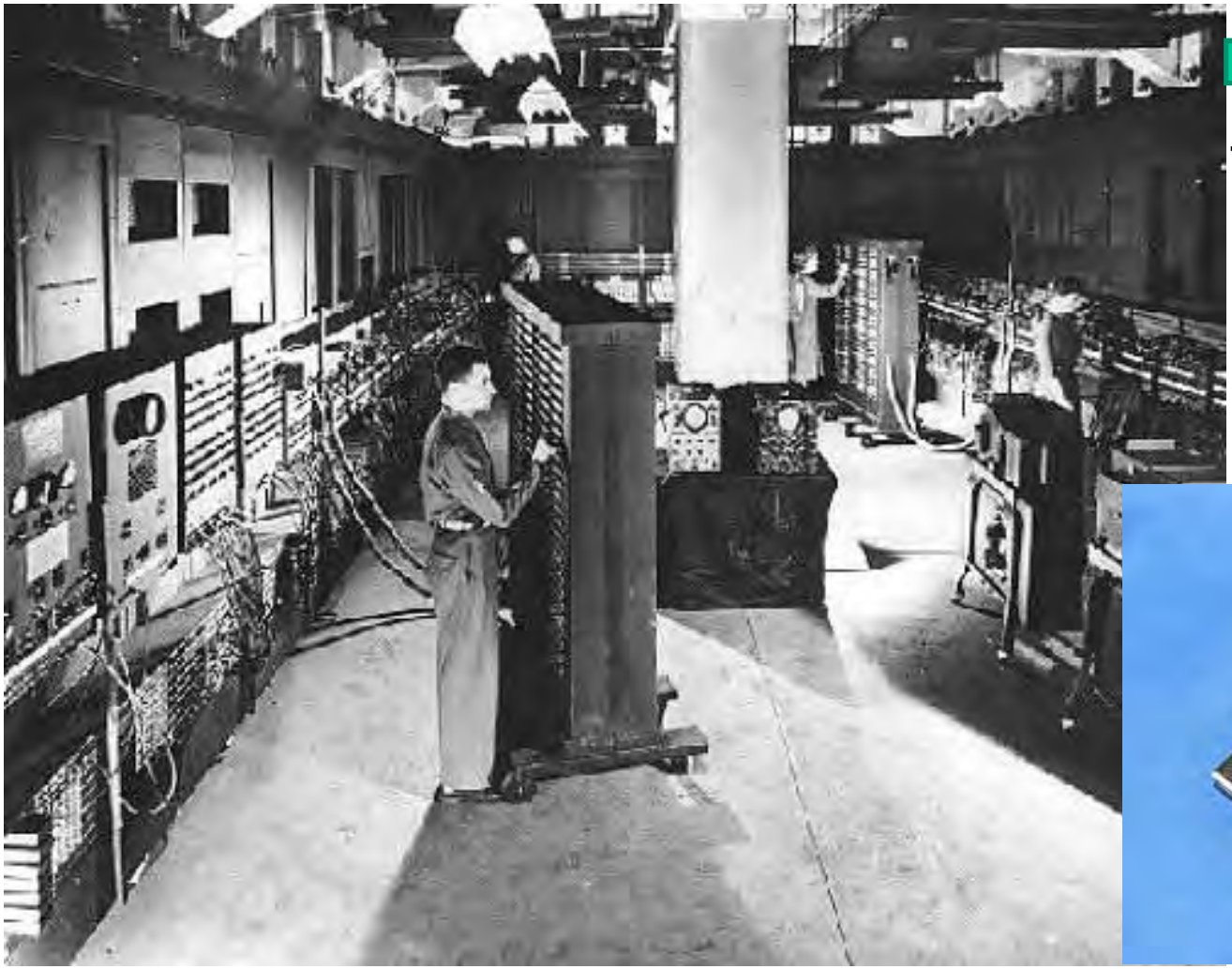
**ULSI**



# History of Electronic Devices



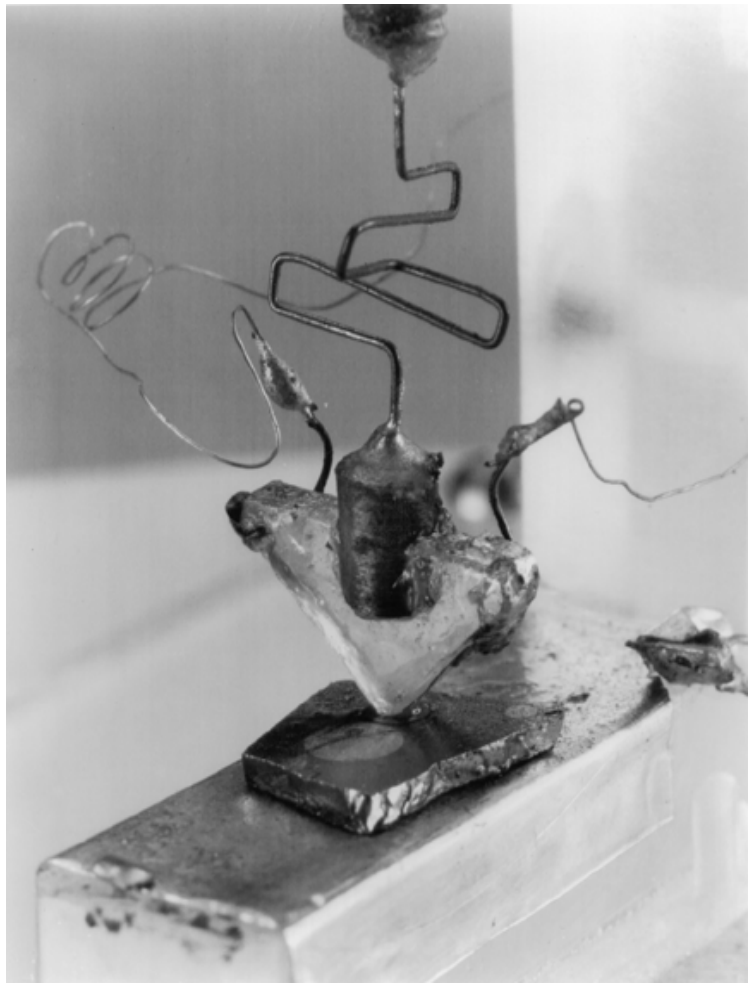
# First Computer Eniac: made of huge number of vacuum tubes 1946
## Big size, huge power, short life time filament



Today's pocket PC has much higher performance with extremely low power consumption

# First Transistor: Bell Labs, December 23, 1947.

- Brattain and Bardeen's pnp point-contact Germanium transistor.
  - Amplifier w/ gain of 18.
  - Shared 1956 Nobel Prize in Physics with William Shockley.
- Germanium transistors dominated industry through 1950s and early 1960s.



# Ge used in first transistor radios

On October 18, 1954, the U.S. company I.D.E.A. announced Regency TR1.

Used 4 germanium transistors.

**Regency TR1**


Sony's first radio, TR-55, in 1955

Used 5 germanium transistors.

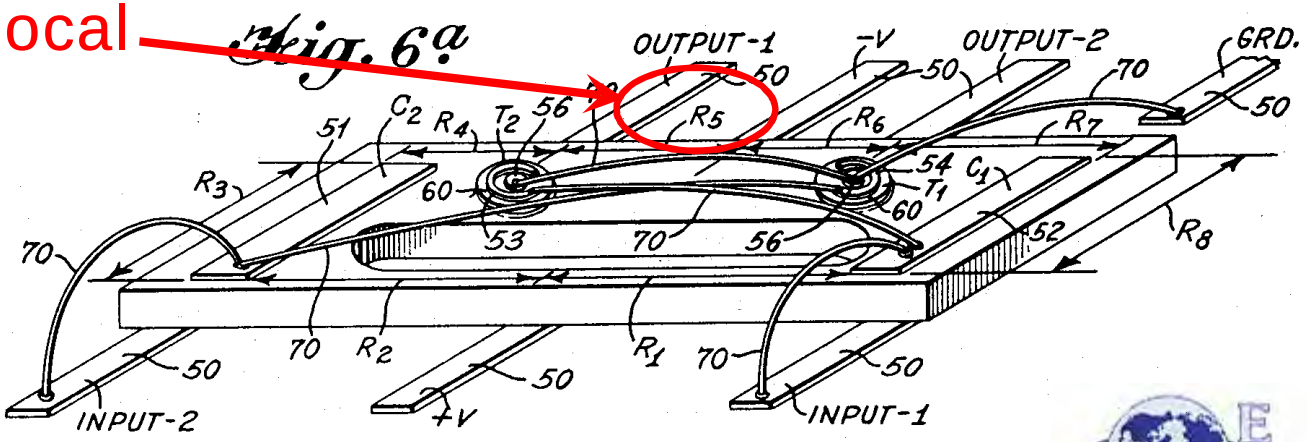
**Sony TR-55**

# Jack S. Kilby, US Patent 3,138,743 "Miniaturized Electronic Circuits"

Filed Feb 6, 1959. Granted June 23, 1964.

ployed. First, a semiconducting wafer, preferably silicon or germanium, of the proper resistivity is lapped and polished on one side. For this design, 3 ohm-cm. p-type germanium was used. The wafer was then subjected to an antimony diffusion process which produced an n-type layer on the surface about 0.7 mil deep. The wafer was then cut to the proper size, 0.200 inch x 0.080 inch and the unpolished surface was lapped to give a wafer thickness of 0.0025 inch.

Wire-bonded local interconnects.

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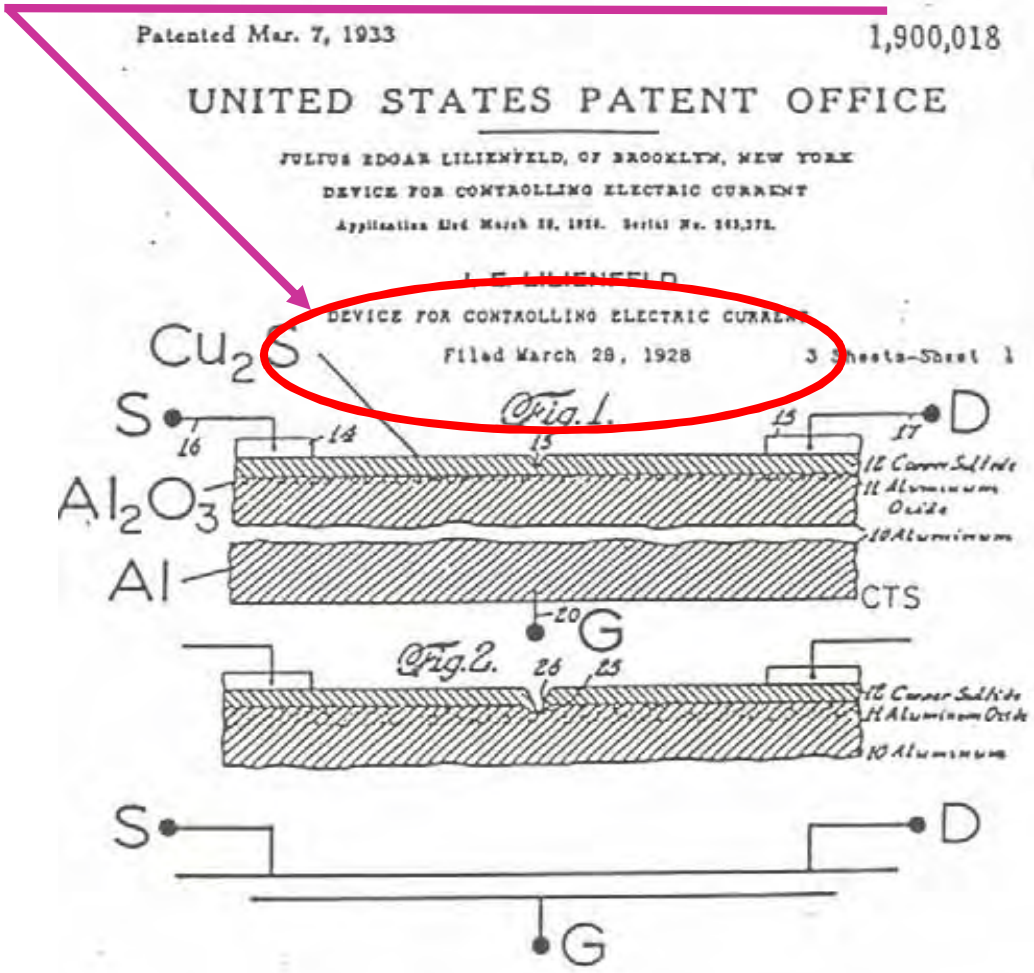
# MOS Principle

## J. E. LILIENFELD

DEVICES FOR CONTROLLED ELECTRIC CURRENT

**Filed March 28, 1928**



Patented Mar. 7, 1933 1,900,018

UNITED STATES PATENT OFFICE

JULIUS EDGAR LILIENFELD, OF BROOKLYN, NEW YORK

DEVICE FOR CONTROLLING ELECTRIC CURRENT

Application filed March 28, 1928. Serial No. 263,378.

DEVICE FOR CONTROLLING ELECTRIC CURRENT

Filed March 28, 1928 3 Sheets-Sheet 1

Fig. 1.

$Cu_2S$

S

D

$Al_2O_3$

Al

G

Fig. 2.

S

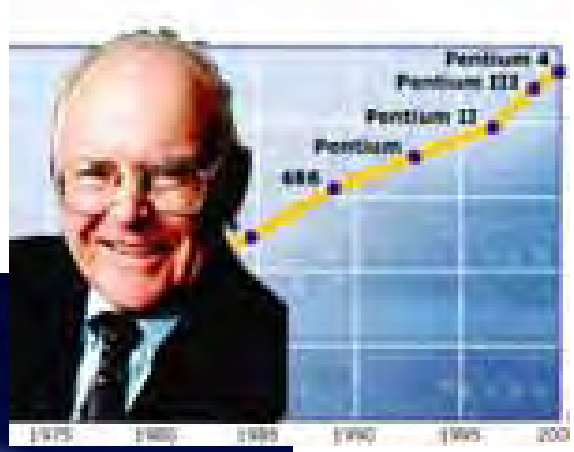
D

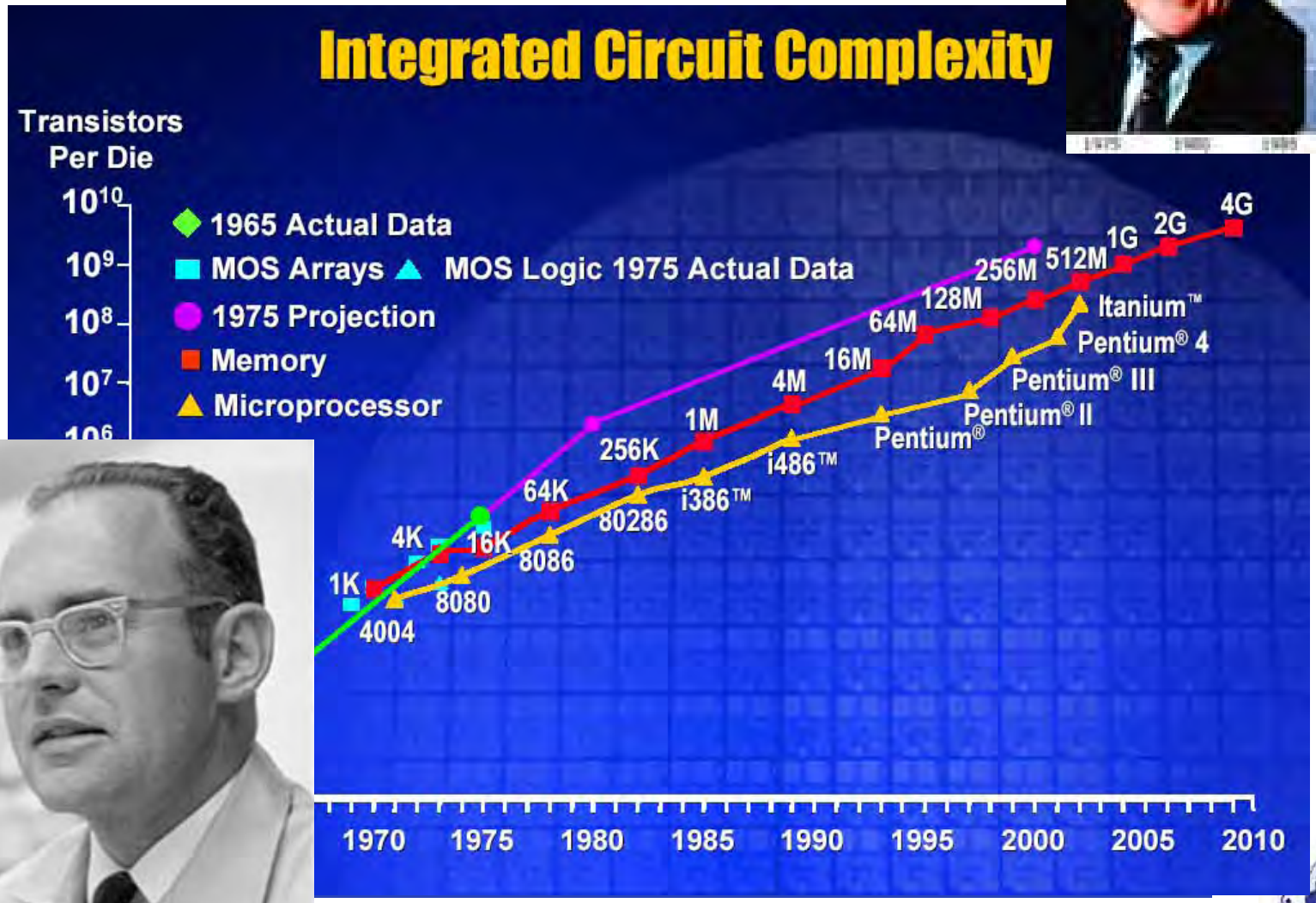
G

## J.E.LILIENFELD

# Transistor count in ICs

*(Source: Intel)*

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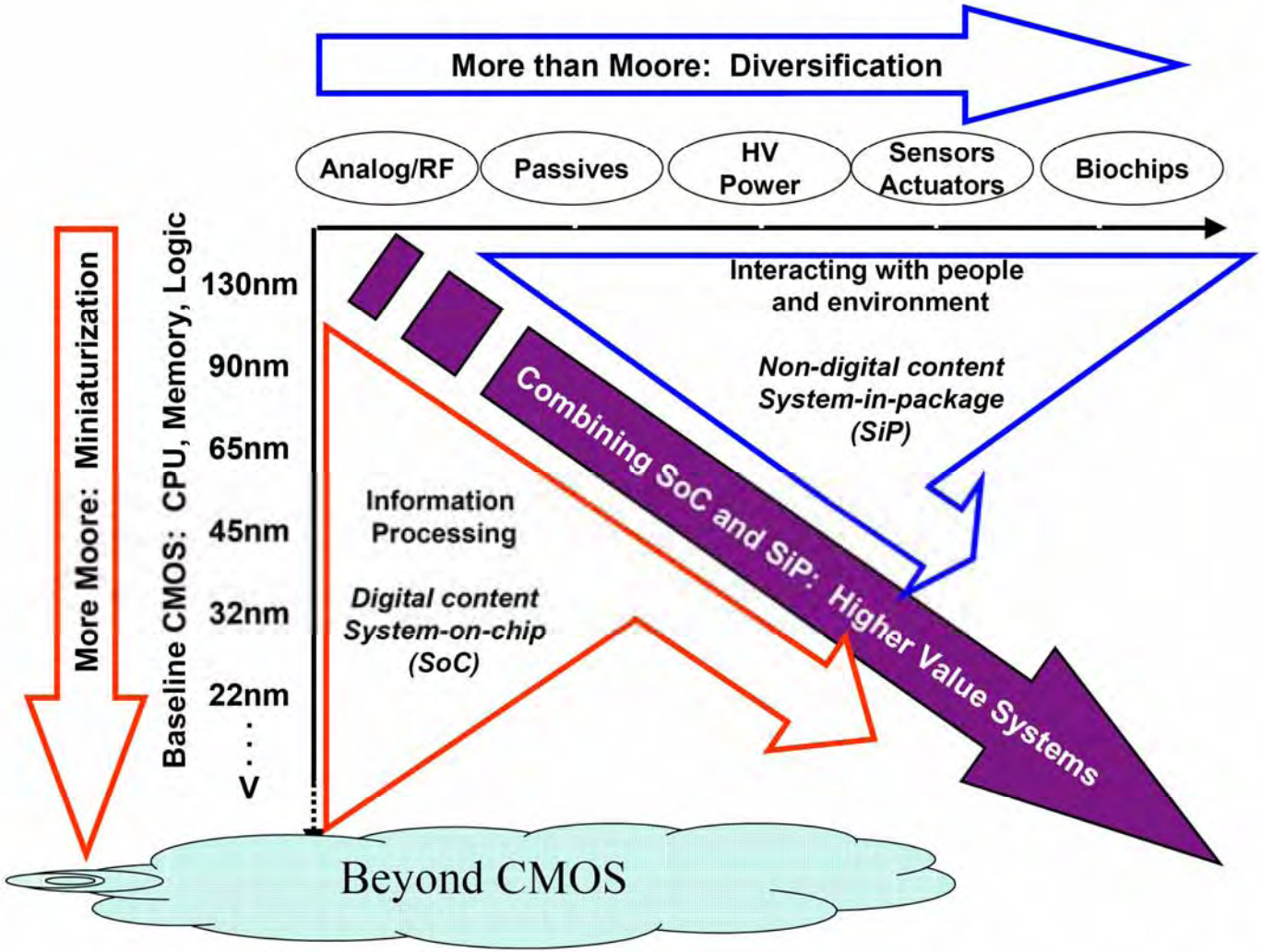
# Technology Roadmap: Strategic Agenda



# Society Needs Micro-Nanoelectronics
# No innovation without micro-nano electronics

Health & wellness | Transport & mobility | Security & safety


Energy & environment | Communication | Infotainment

# Cell Phone as Powerful Nomadic Tool







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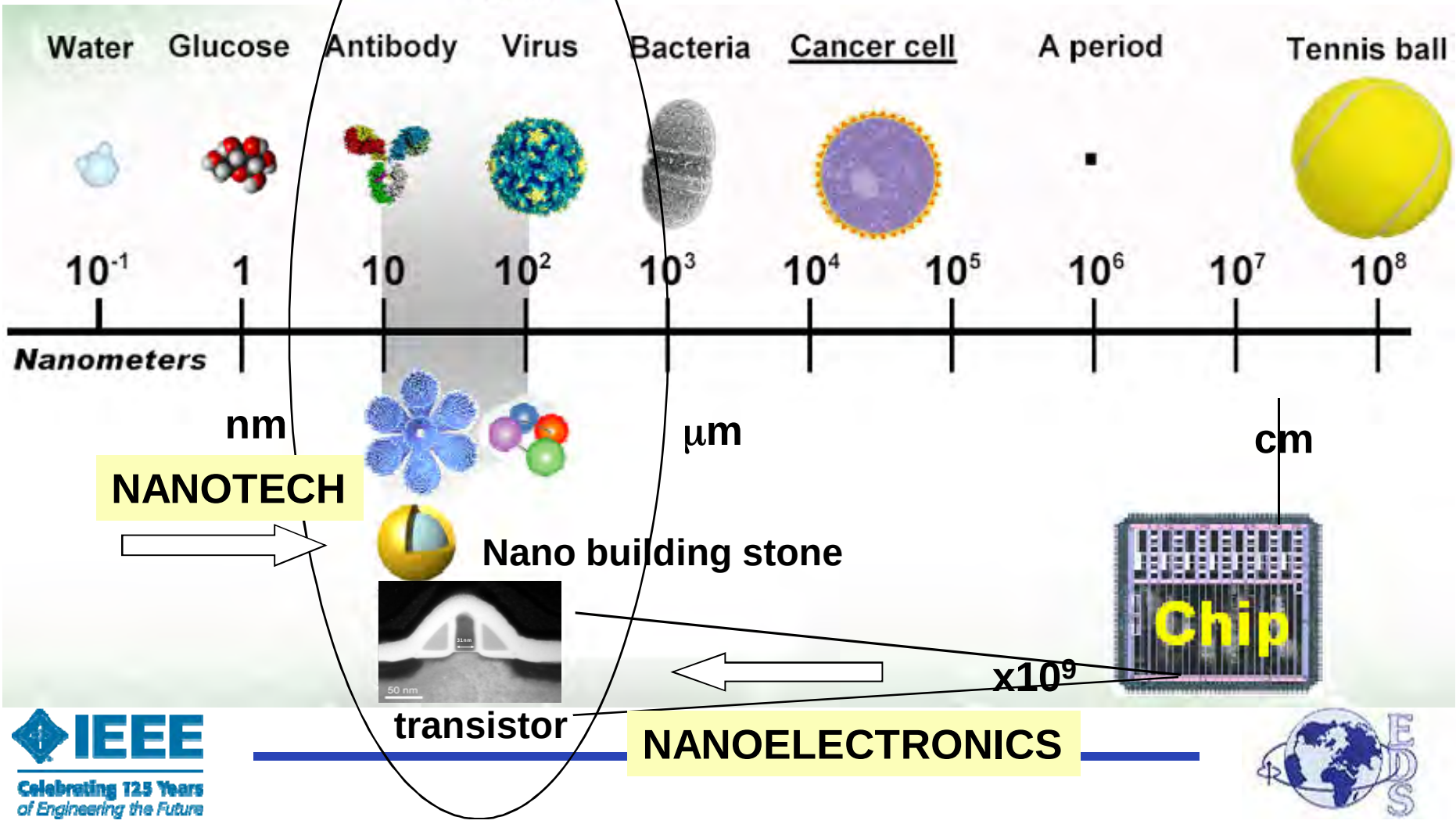
Source: Dr. T. Makimoto

EDS

# Nano-bio vision :Bio & ICT meet at the nanoscale



# Electron Devices Society

**Origin in both AIEE and IRE**

**1884: First article in Trans. AIEE – Notes on Phenomena in Incandescent Lamps**

**1938: First IRE sponsored Conference on Electron Tubes, New York**

**1949: IRE Committee on Electron Tubes and Solid State Devices**

**1951: IRE Professional Group on Electron Devices**

**1952: Special issue of Proc. of the IRE on Transistors**

# Electron Devices Society

**1960: First International Electron Devices Meeting (IEDM), previously Washington Meetings**

**Foundation of IEEE by merging AIEE and IRE**

**1963: IEEE Professional Technical Group on Electron Device**

**IEEE Transactions on Electron Devices**

**1965: IEEE Electron Devices Group**

**1966: Newsletter of the Electron Devices**

# Electron Devices Society

**1971: J.J. Ebers Award for 'outstanding technical contributions to electron devices"**

**1974: Jack A Morton Award – Andrew S. Grove award in 2000 (IEEE Level technical award for electron device contributions)**

**1976: IEEE Electron Devices Society**

**1980: IEEE Electron Device Letters**

**1981: First Symposium on VLSI Technology**

# Electron Devices Society

**1988: IEEE Transactions on Semiconductor Manufacturing Science**

**1990: First European member to EDS Adcom**

**Start of a strong globalization action**

**2004: First EDS President from R10 (Hiroshi Iwai)**

**2008: First EDS President from R8**

# Electron Devices Society Today

**About 11,000 members**

**28 AdCom members – 2 meetings/year ( 1 outside USA)** **Total : 647 volunteers**

**Strong EDS Distinguished Lecture program with 129 DLs. In 2008 about 200 presentations were given**

**Increasing interest in Mini-Colloquia to support the Chapters: 16 MQ's organized in 2008**

**166 EDS supported conferences, of which 26 financially sponsored ones, in 2008**

# EDS Distinguished Lecturers 2008

| IEEE Regions | Total Numbers of Lecturers |
|---|---|
| Regions 1-6 | 60 |
| Region 7 | 2 |
| Region 8 | 23 |
| Region 9 | 9 |
| Region 10 | 35 |
| Total | 129 |

# EDS Membership Statistics

| | As of 12/31/07 | | As of 12/31/08 | |
|---|---|---|---|---|
| **Region** | **Count** | **%** | **Count** | **%** |
| 1-6 | 5,721 | 54.0% | 5,693 | 52.5% |
| 7 | 191 | 1.8% | 213 | 2.0% |
| 8 | 1,914 | 18.0% | 1,964 | 18.1% |
| 9 | 176 | 1.7% | 242 | 2.2% |
| 10 | 2,604 | 24.5% | 2,733 | 25.2% |
| **Total** | 10,640* | 100% | 10,845 | 100% |

* The 2007 membership count of 10,640 was calculated from the new IEEE Business Management System which counts memberships differently then the previous IEEE system. Based on the previous system rules, the 2007 membership count was actually about 10,420. Also the sum of the regional statistics does not correctly total to the 2007 year end count of 10,640.

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# EDS Chapters

| REGION | COUNT | | | |
|---|---|---|---|---|
| | ED ONLY | JOINT | TOTAL | STUDENT |
| 1 – Northeastern USA | 4 | 8 | 12 | 1 |
| 2 – Eastern USA | 2 | 4 | 6 | 0 |
| 3 – Southeastern USA | 1 | 4 | 5 | 0 |
| 4 – Central USA | 1 | 3 | 4 | 1 |
| 5 – Southwestern USA | 3 | 2 | 5 | 0 |
| 6 – Western USA | 4 | 9 | 13 | 2 |
| 7 – Canada | 2 | 3 | 5 | 0 |
| 8 – Europe, Middle East & Africa | 9 | 34 | 43 | 5 |
| 9 – Latin America | 10 | 4 | 14 | 5 |
| 10 – Asia and Pacific | 26 | 11 | 37 | 6 |
| Total | 62 | 82 | *144 | 20 |

**76,464 k$ subsidy to Chapters in 2009 (+ DL + MQ)**

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# Technical Meetings

**EDS is the principal 100% financial sponsor (some on an alternating basis) for the following meetings: 17 in 2009**

* Bipolar/BiCMOS Circuits and Technology Meeting
*Compound Semiconductor IC Symposium
* Electron Devices Meeting
* Interconnect Technology Conference
* Microelectronic Test Structures Conference
* Non-Volatile Semiconductor Memory Workshop
* Photovoltaic Energy Conversion World Conference
* Photovoltaic Specialists Conference
* Power Semiconductor Devices and ICs Symposium
* Semiconductor Interface Specialists Conference
* Silicon Nanoelectronics Workshop
* SOI Conference
* TRANSDUCERS- Solid-State Sensors & Actuators Conference
* Vacuum Electron Sources Conference
* Vacuum Electronics Conference
* Vacuum Nanoelectronics Conference
* VLSI Technology Symposium

# Electron Devices Society Today

**Fellowship Program for both Master and PhD students**

**Dedicated actions towards GOLD**

- **Elected AdCom Position**
- **GOLD representatives in all society committees**
- **GOLD committee (20 members)**
- **GOLD Lecture linked to a key conference**
- **GOLD Ambassadors Program**
- **GOLD Early Career Award**

# Electron Devices Society Today

**Increased Membership Benefits**

**- EDS Archival collection on DVD and annual EDS DVD update package**

**- QuestEDS**

**- IEDM short-course DVD**

# EDS ARCHIVAL COLLECTION ON DVD AND ANNUAL EDS DVD UPDATE PACKAGE

**The Archival Collection includes:**

**IEDM Tech. Digests (1955 to 2004)**

**Transactions on Electron Devices (1954 to Aug. 2004)**

**Electron Device Letters (1980 to 2004)**

**Only IEEE EDS members are eligible to purchase the EDS Archival Collection on DVD. Available at the low price of $30 and only $9.95 for student members.**

**A fully compatible EDS DVD Update Package is now available to EDS members for $30 ($15 for students) which includes 2004 - 2008 T-ED, EDL and the IEDM.**

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# got a question?

IEEE

ELECTRON DEVICES SOCIETY

**www.ieee.org/go/questeds**

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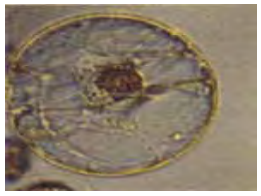

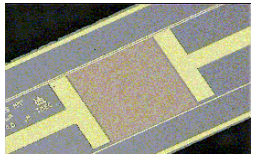

# Exciting challenges on the horizon

**Increased functionality through scaling:**

approaching physical, technological and financial limits: the pendulum of Moore's clock will slow down, ***innovative solutions needed!***

**Technology in the human sphere:**

man-machine interactions, enhancement & replacement of senses – ***engineering for the body***

**Converging technologies:**

Nanotechnology, biotechnology, information and cognitive sciences – ***engineering for the mind …***

***Entering a transdisciplinary world …***

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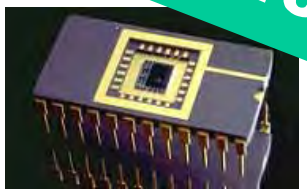
# Micro-Nano convergence



Microelectronics

Nanotechnology

Nano-electronics

Magneto-electronics

Polymer electronics

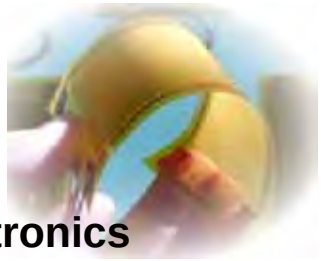
Opto-electronics

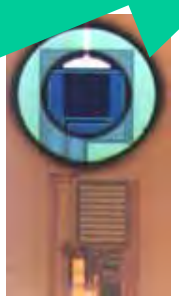
Nano-electronics

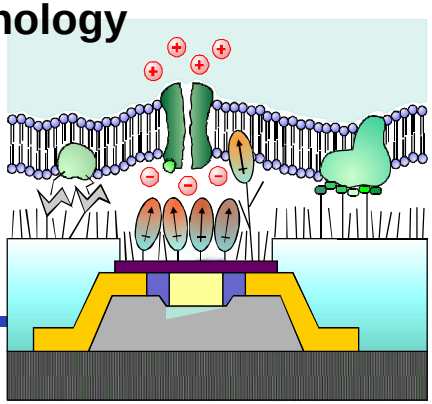
Biosensors

Molecular nano-technology

Micro (nano) electro-Mechanical systems







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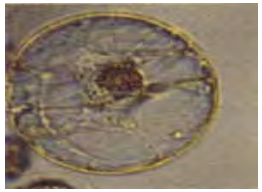
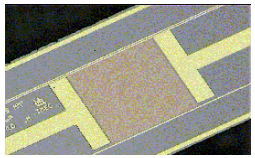
1950 1960 1970 1980 1990 2000 2010 2020 2030

# Needed: Renaissance Engineers, Scientists…



Converging Technologies require:
Wo(men) driven by socio-eco challenges
Teamplayers, system architects
tech nerds
With cross-disciplinary communication skills
Trained in creative thinking at system level

Co-architects of society
Putting a societal vision into a solution
With economic value: entrepreneurial spirit

Hence need for:
"Sociology for Future Engineers"

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# Conclusions

Society will have to take into account the fast changing Field of Interest of the multi-disciplinary trained engineer

Continued effort for globalization is a must

New Unique Membership Benefits needed

Student members and GOLD are important assets