

Bio-Nano-Information Fusion

Chih-Ming Ho 何志明

*Institute for Cell Mimetic Space Exploration
University of California, Los Angeles
Los Angeles California, 90095-1597*

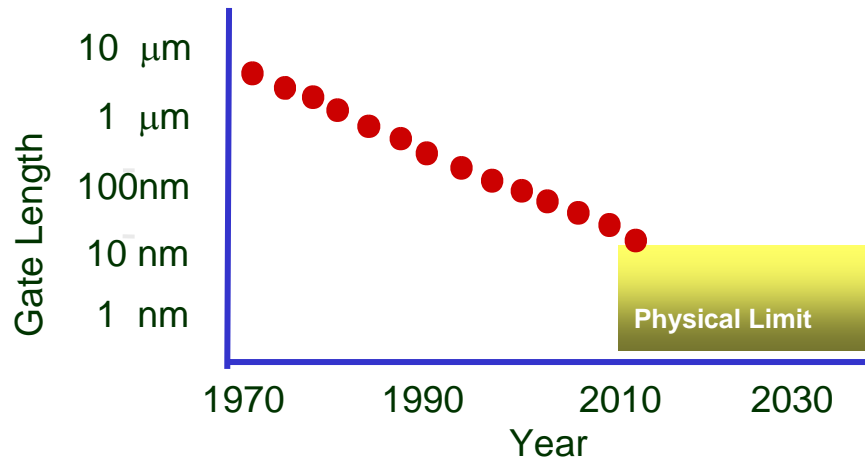
*<http://ho.seas.ucla.edu>
<http://www.cmise.ucla.edu>*

CMISE

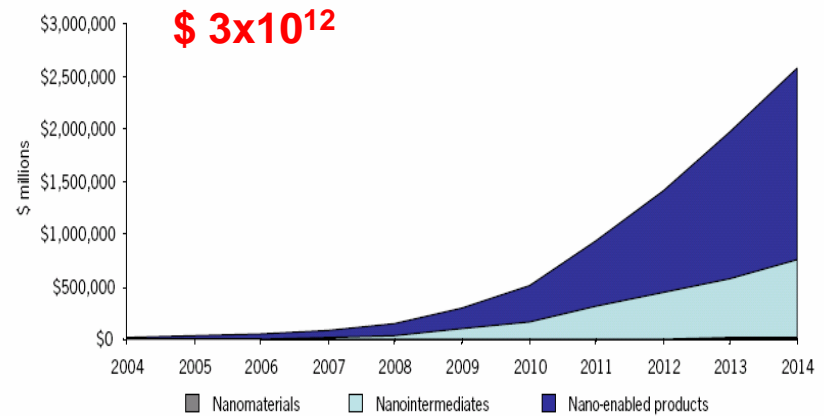
INSTITUTE FOR CELL MIMETIC SPACE EXPLORATION



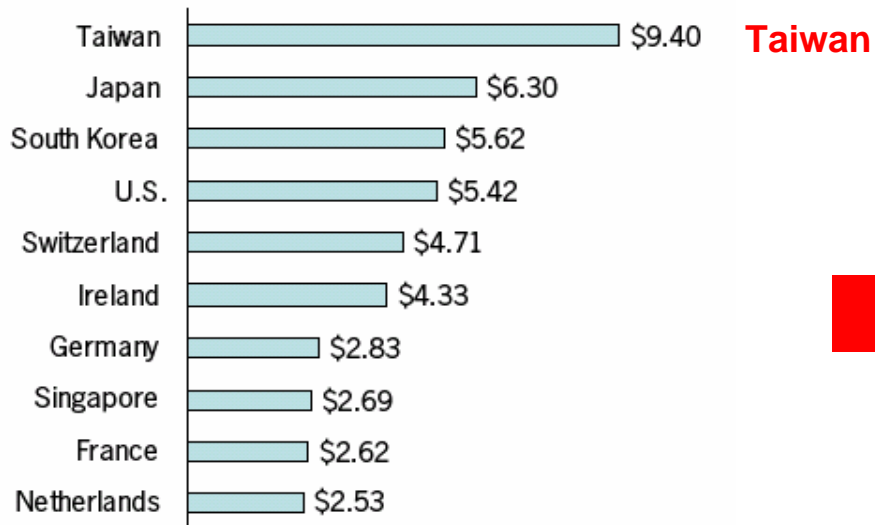
End of Roadmap



Global Sales



Government funding per capita



Public Awareness



Length Scales

100 μm



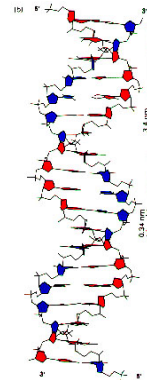
Hair

1 μm



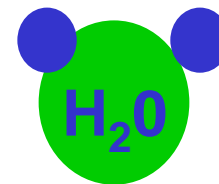
Cell

3 nm



DNA

1 \AA



water

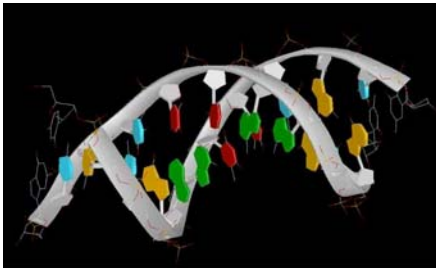
functional molecules



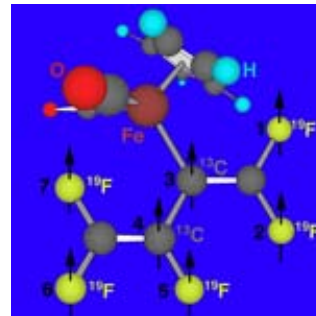
Nano Sciences and Technologies

Synthesize, Characterize, **apply** and **control** of macro functional molecules

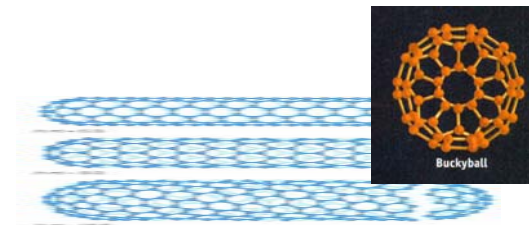
Bio-nano Tech



Nano electronics

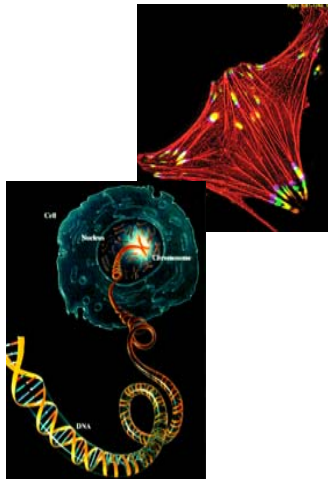
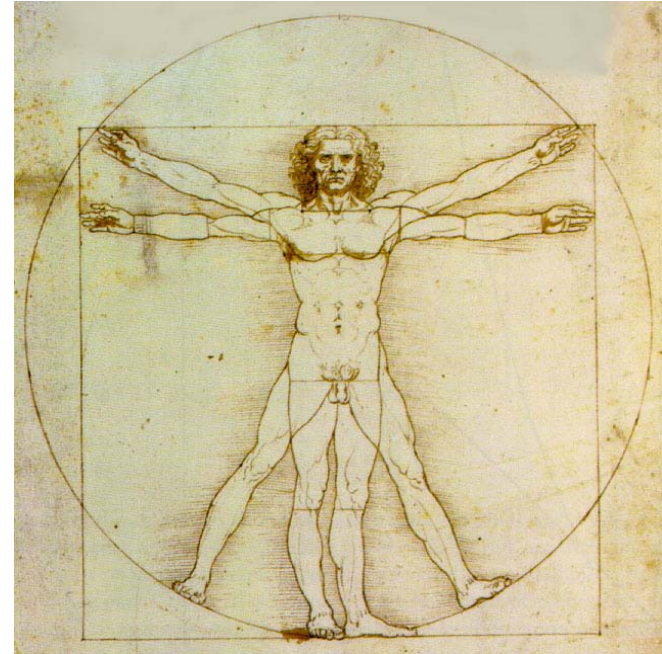


Nano Material applications New materials



Enriching Human Life

- Improved living standard
- Better health conditions
- Longer lives



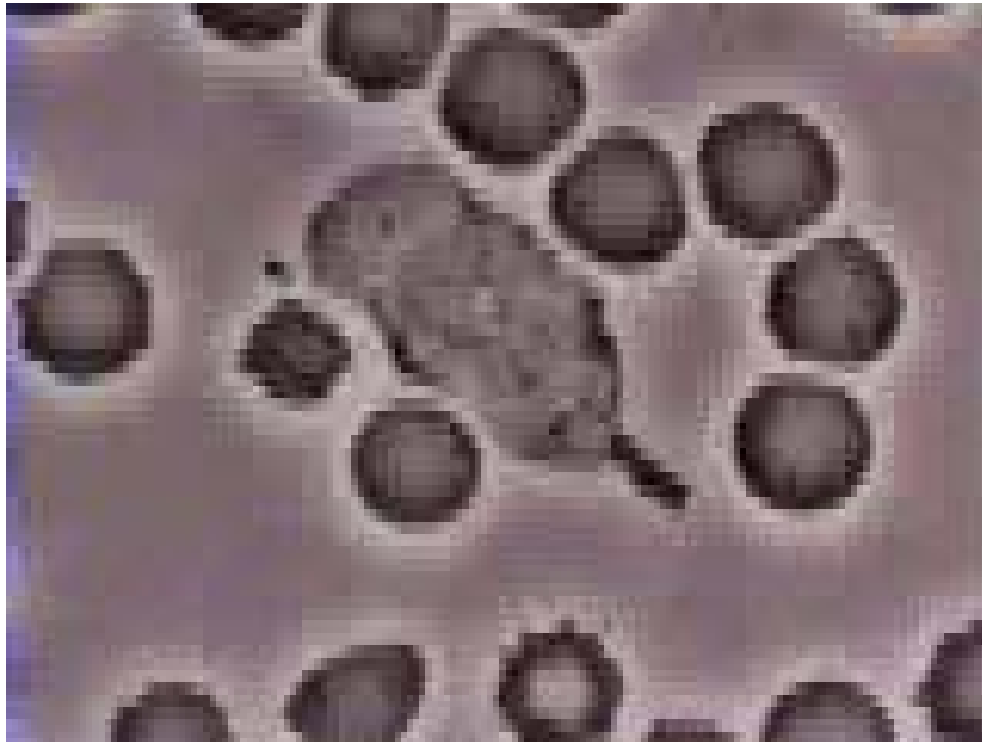
Length Scale – 10^9 apart

- Biomolecules – cell – organ – system
- Networks of signaling pathways
- Fused system



Cell : an ultimate micro system

Neutrophil chasing a *S. aureus*

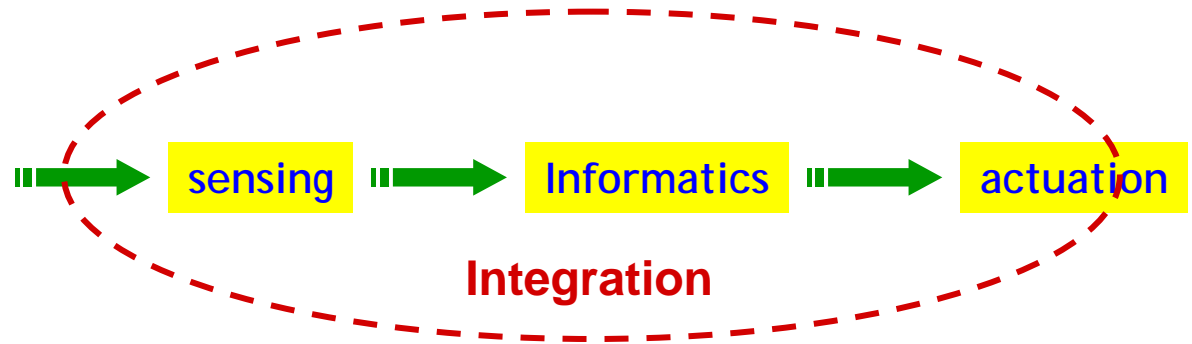


Control

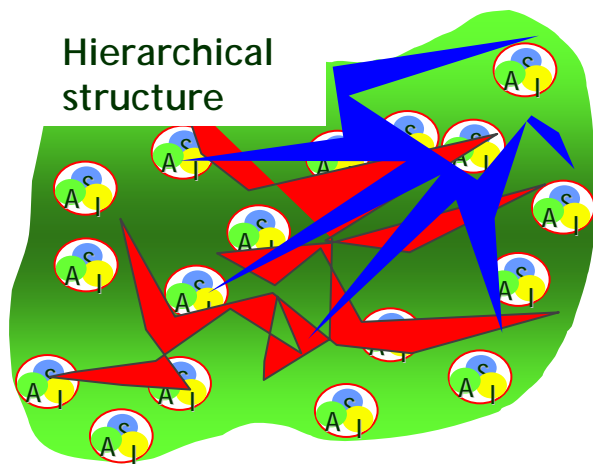
Understand

Fusion vs Integration

Artificial System



Natural System

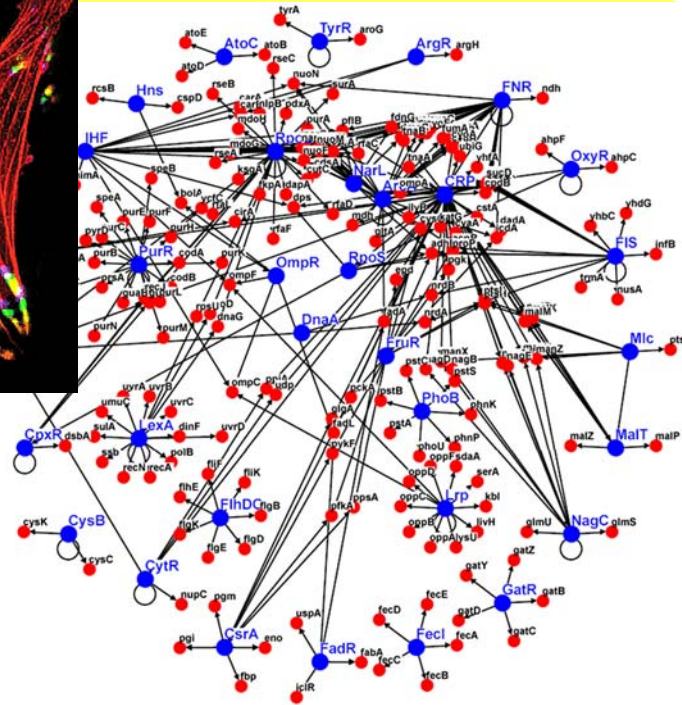
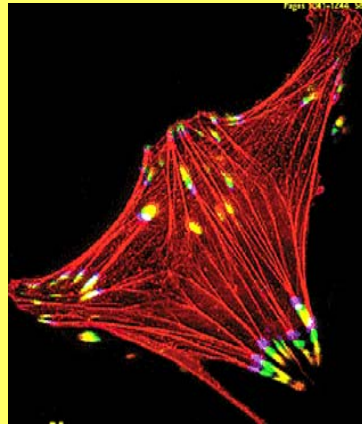
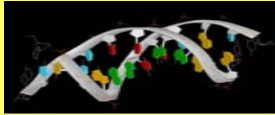


Embedded and distributed
sense, think and act **locally**
achieve **global effect**

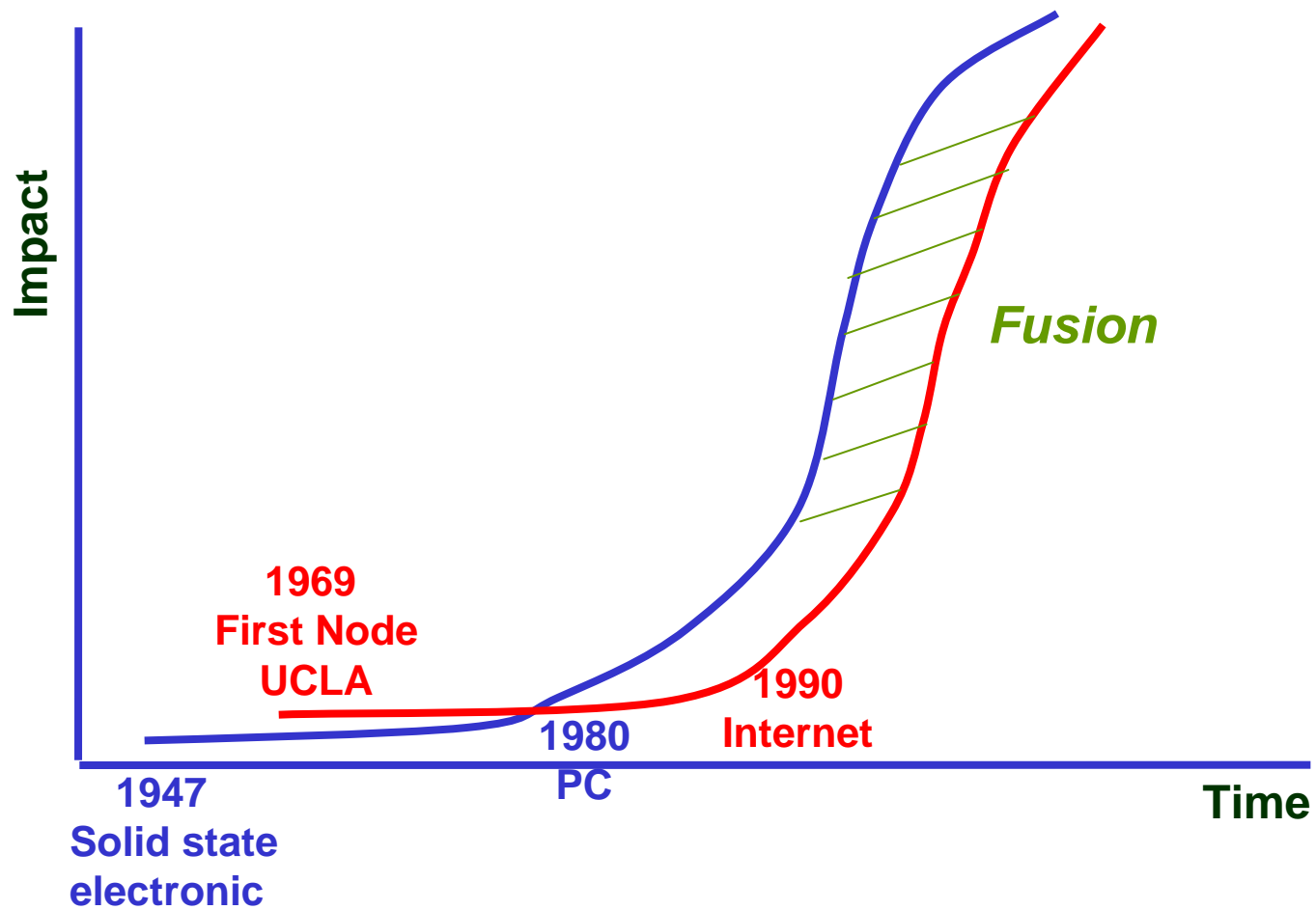
Fusion



Bio-Nano-Information Fusion



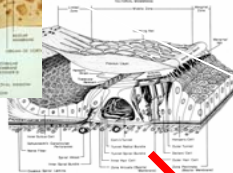
Fusion of Technologies and Industries



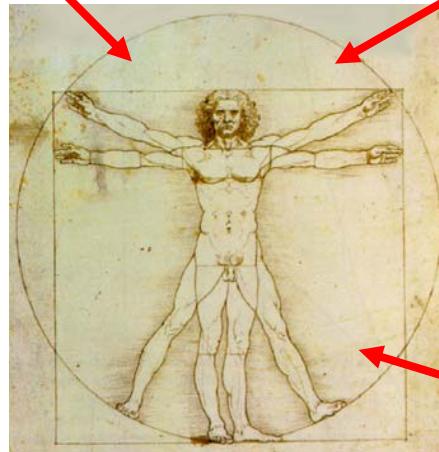
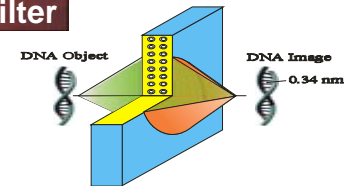
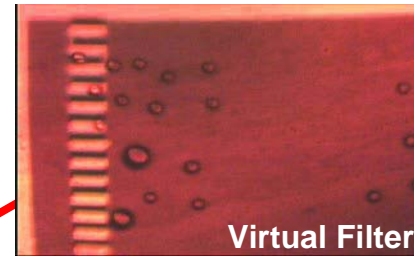
Core Technologies - Systems



Bio-science



Nano technologies
(Optical, Electrical, Fluidic, Chemical
Enabling Technologies)



Intelligent system control



20 test vs. 1,000,000 trials
for drug screening

Opportunities for Fused Bio-nano-Information technologies

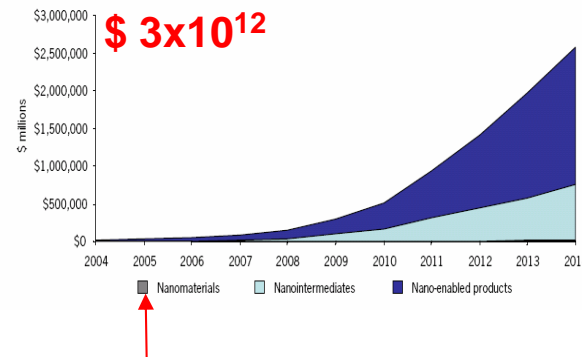
Bio-molecular based medical diagnosis

- Existing market by traditional techniques : 23 billion dollars
- Bio-markers ??? : bio-informatics
- Sensor and **Sample Preparation Chips** : nanotechnology

Personalized Drugs

- Rapid sequencing techniques : nano tech & informatics
- Rapid drug screening techniques : nano tech & informatics

Challenges for Fused Bio-nano-Information technologies



Intellectual Properties – acquiring the leading position

- Not the number of patents
- Patents controlling the **fundamental technologies**
- Locally developed – can not be imported
- At early stage – **develop enabling technology**
e.g. If study biology without microscope ???
If we have **nanoscope** to visualize
a drug molecule inside a **living cell**

People

People

People

Talents

- Education - Interdisciplinary education facilitate technology fusion
- Education - **Creativity** not only knowledge
- Education - Broad view

Leader

- Identify people with vision
- Attract people with leadership
- **Recognize local talents**
- Provide growing potential

We do have social responsibilities

Environmental Impact

Toxicity

New Drug Tests

Lifespan – 150 years ?

Global Impacts

- human, society and earth -

Enrich human life in general and life at “old” age in specific

Social structure

promoted to full professor at age of 100 ?

Earth resources utilization and distribution