

Getting an Angle on the Nano World: Texas Research, Texas Policy, and Texas Ventures

Larry R. Faulkner

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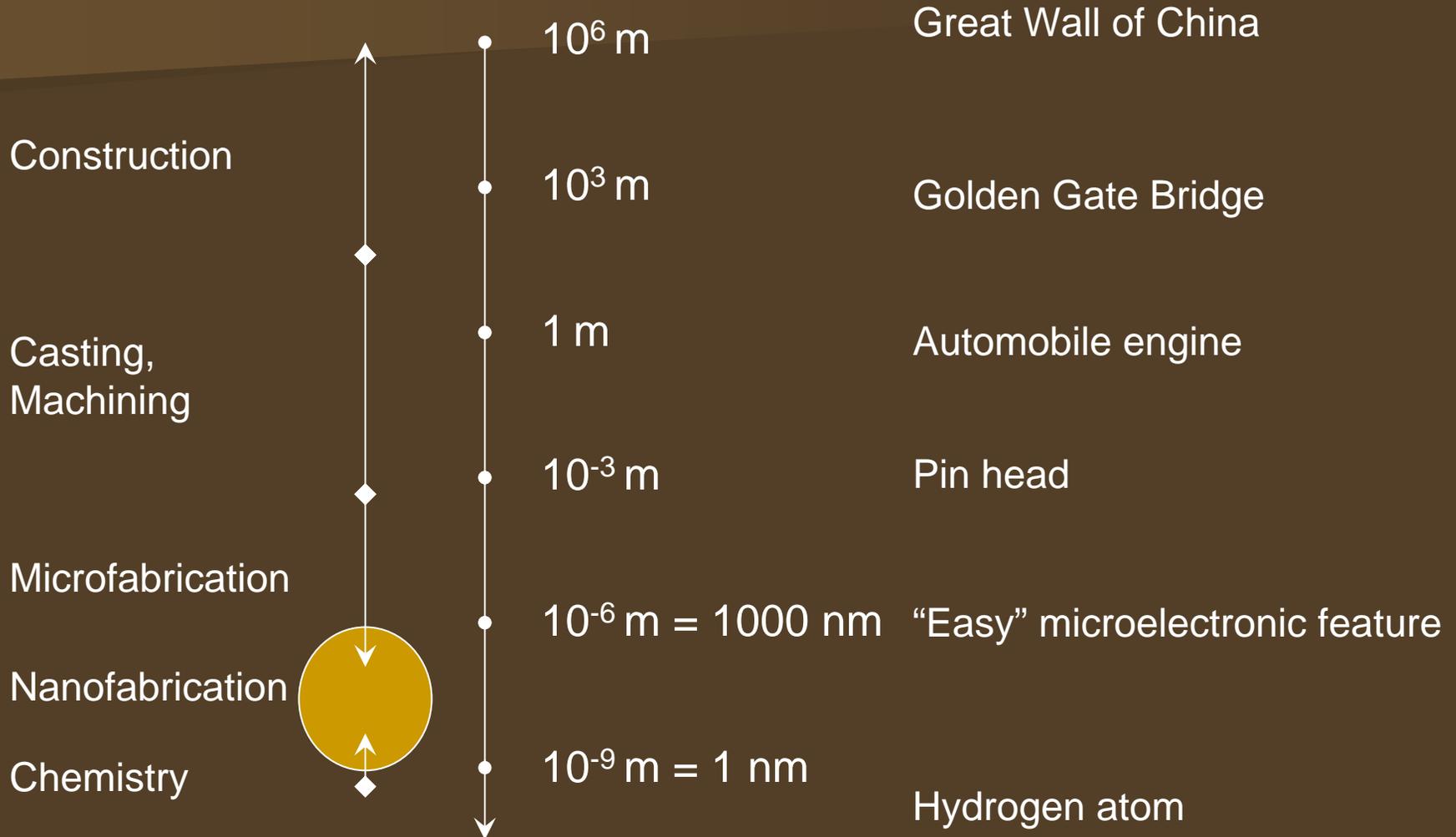
Natural Next Chapter in the Science and Technology of Materials

- Chemistry
- Physics
- Materials science
- Molecular biology and biochemistry
- Electrical engineering
- Mechanical engineering
- Chemical engineering
- Materials engineering
- Biomedical engineering

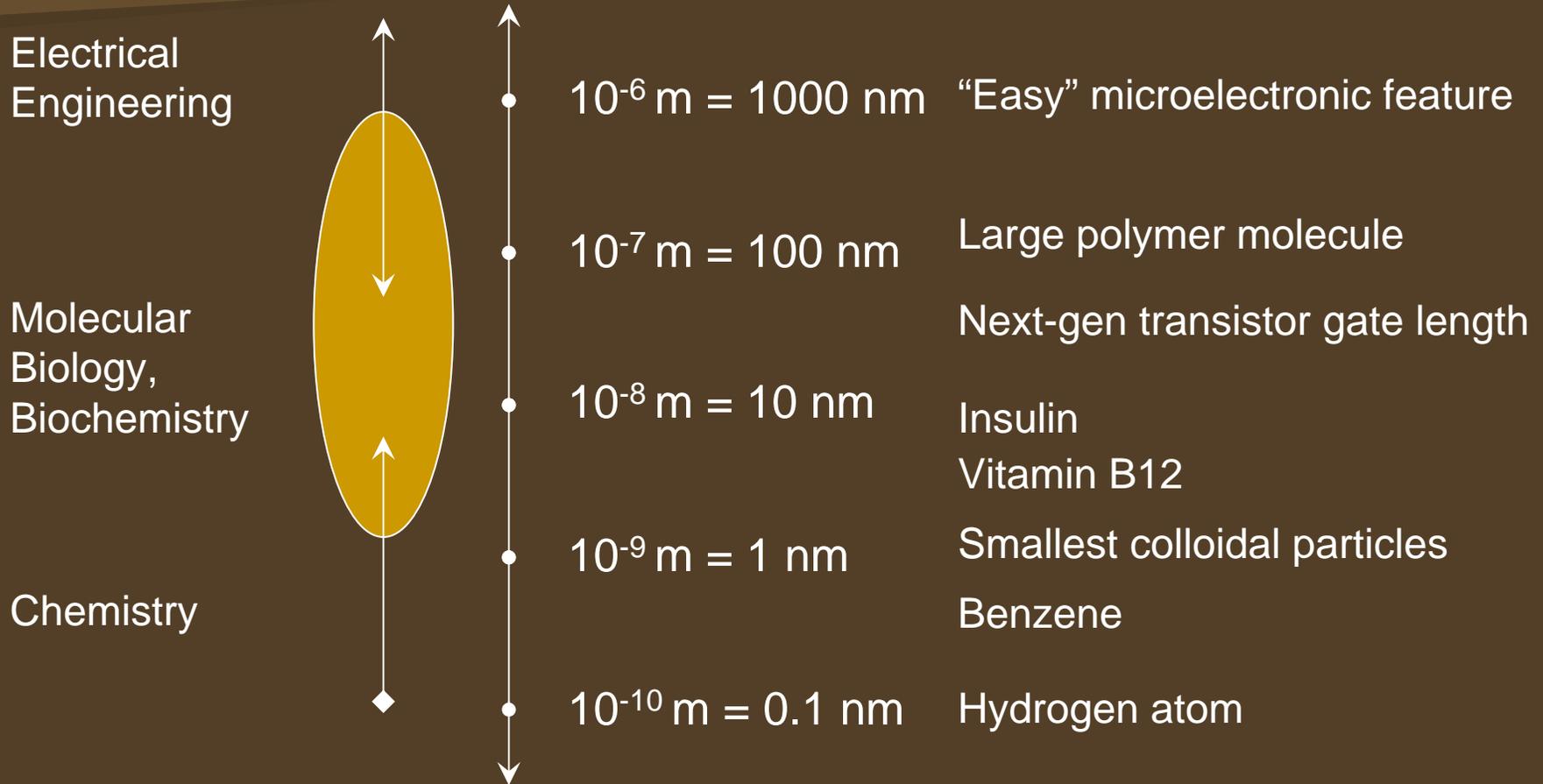
Unexplored, Undefined Gap in Spatial Scale

- Lower boundary defined by molecular scale.
- Upper boundary defined by the technology of device fabrication [“easy” lithographic feature sizes].

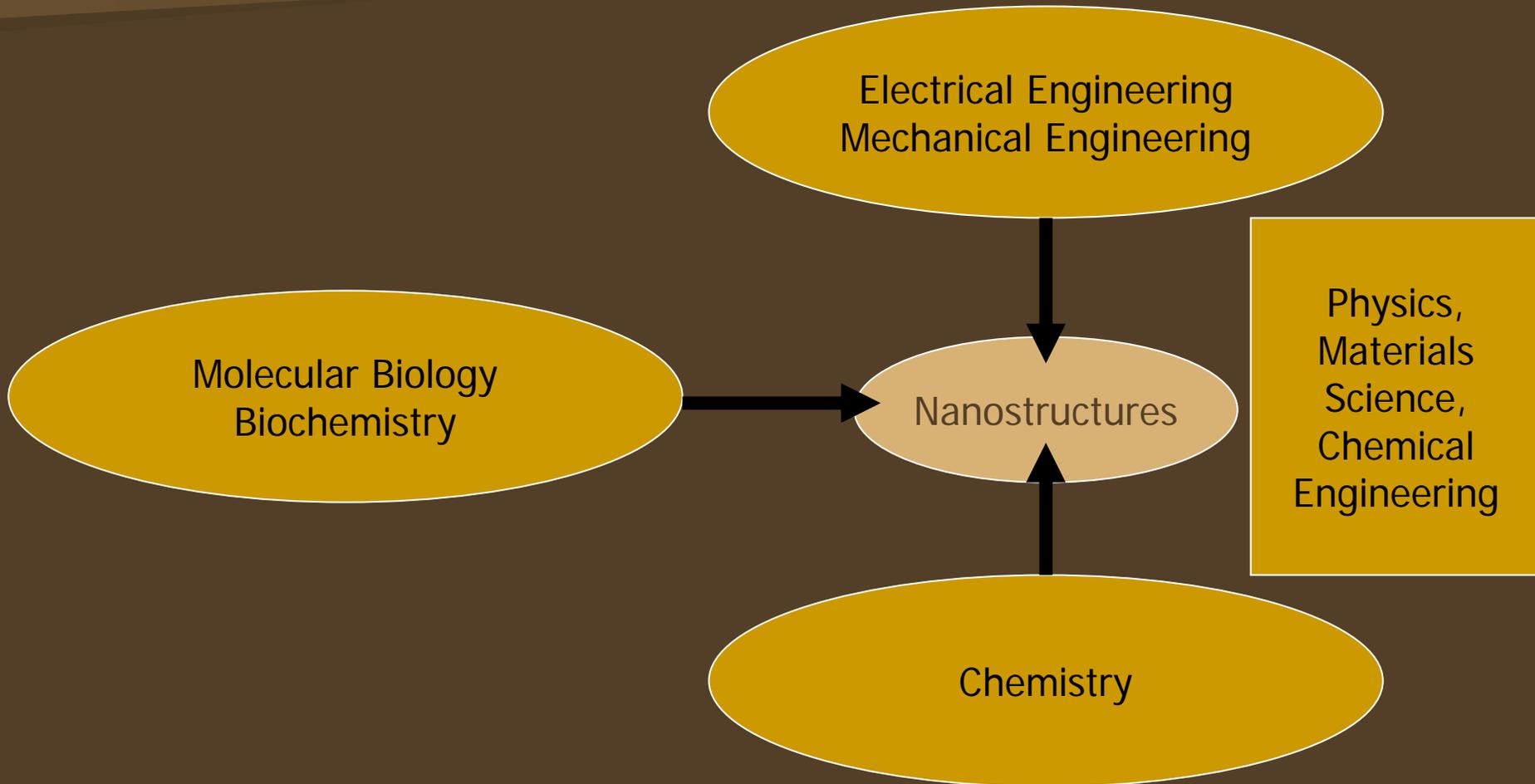
Fabricated Devices and Structures



The Nano Range



Synthesis of Nanostructures

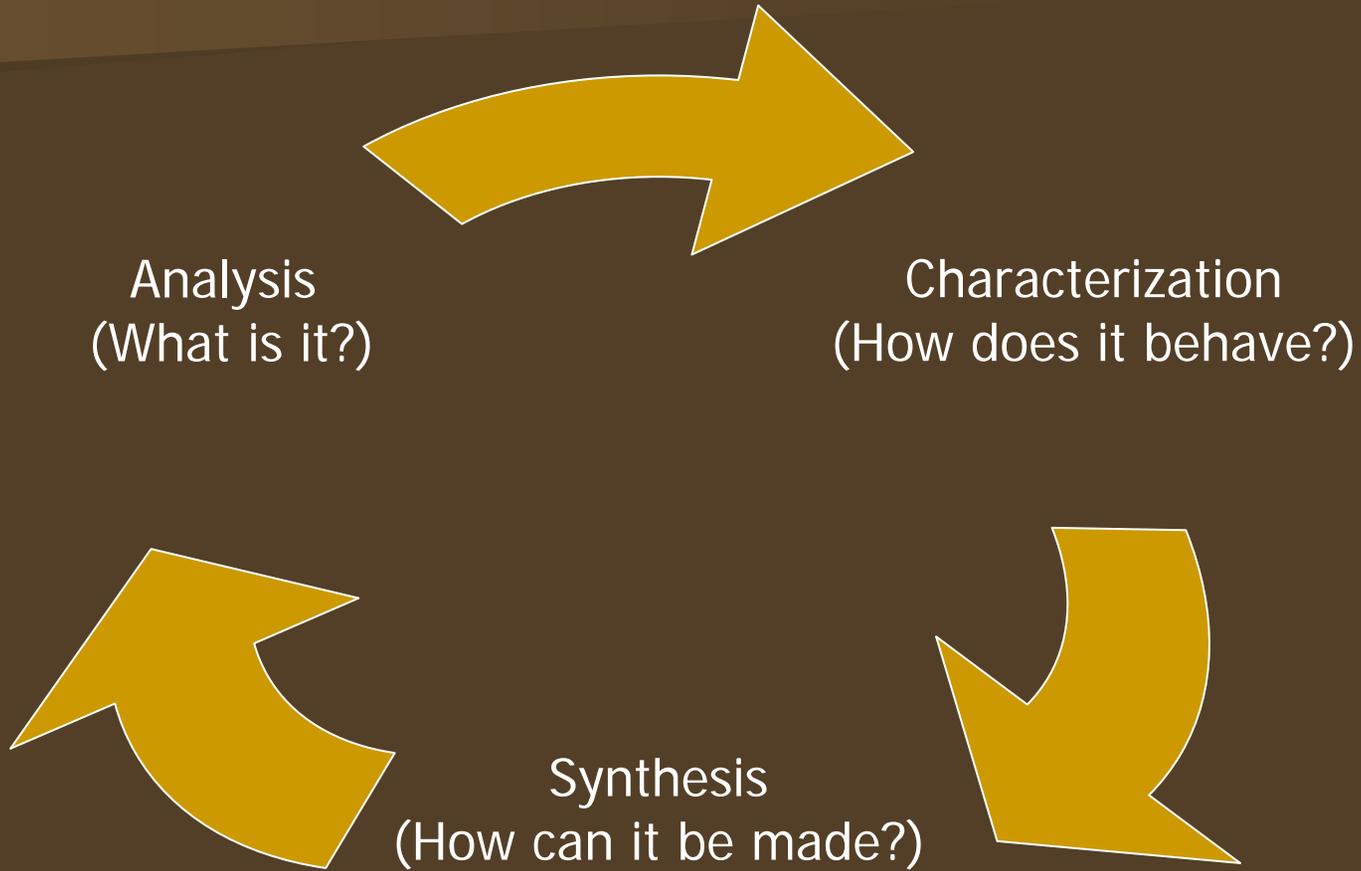


Why should new things arise?

- Distance scale for structural control of basic processes.
 - Selective reaction
 - Catalysis
 - Vectoring of charge, energy
- New properties.
 - Quantization
 - Statistical mechanics

- Distance scale for intimately linking biological structures with physical and chemical ones.
 - Wholly new entities
 - Wide range of potential applications: medical, agricultural, non-biological

What limits progress?



Significant Developmental Issues

- Analyze with spatial sensitivity on the right distance scale.
- Exploit self-assembly more consistently.
- Understand and exploit self-healing.
- Predict and control the folding of macrostructures.
- Understand and control the chemical behavior of surfaces.

Academic Policy

- Nanoscience and nanotechnology comprise a large new frontier for all main-line disciplines of the material world.
- A central concern to strongly related units in any university.
- Not appropriate for “assignment” to any single institution or small group.
- A few may, of course, develop special, noteworthy expertise.

Best Early Prospects

- Tailored nanoparticles.
- Fabrication and characterization tools that can help microelectronics manufacturing to deal with wavelength limitations.
- Devices and materials for drug delivery.

The Texas Scene

- Strong industrial base in microfabrication.
 - Texas Instruments, Samsung, AMD, Freescale, ...
 - Applied Materials
 - Sematech
 - Foundries
- Strong university leadership in engineering, chemistry, physics, materials.
- Strong medical and agricultural research base that could connect to nanotechnology.
- Little industrial base in pharmaceuticals, biotechnology.

Wise Policies for Texas Leadership

- Keep a strong focus on the industrial base concerned with microfabrication, tools, and materials.
- Encourage entrepreneurship in this sector.
- Give priority in universities to synthesis, analysis, and characterization. (Hire people who make new things and find out what they do.)
- Foster communication and collaboration across material-related disciplines within and across universities.
- Find ways to bring the health institutions more actively into the picture.

Advice to Investors

- Ask a lot of questions:
 - How consistently can the product be made?
 - Does anyone really understand how it works?
 - Can something that can accomplish the same function be harvested practically from the natural world?
- Don't forget the sword's second edge:
 - Safety, environmental, occupational health issues are bound to arise in this area.