UT-BATTELLE

# Oak Ridge National Laboratory

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OAK RIDGE NATIONAL LABORATORY
U. S. DEPARTMENT OF ENERGY

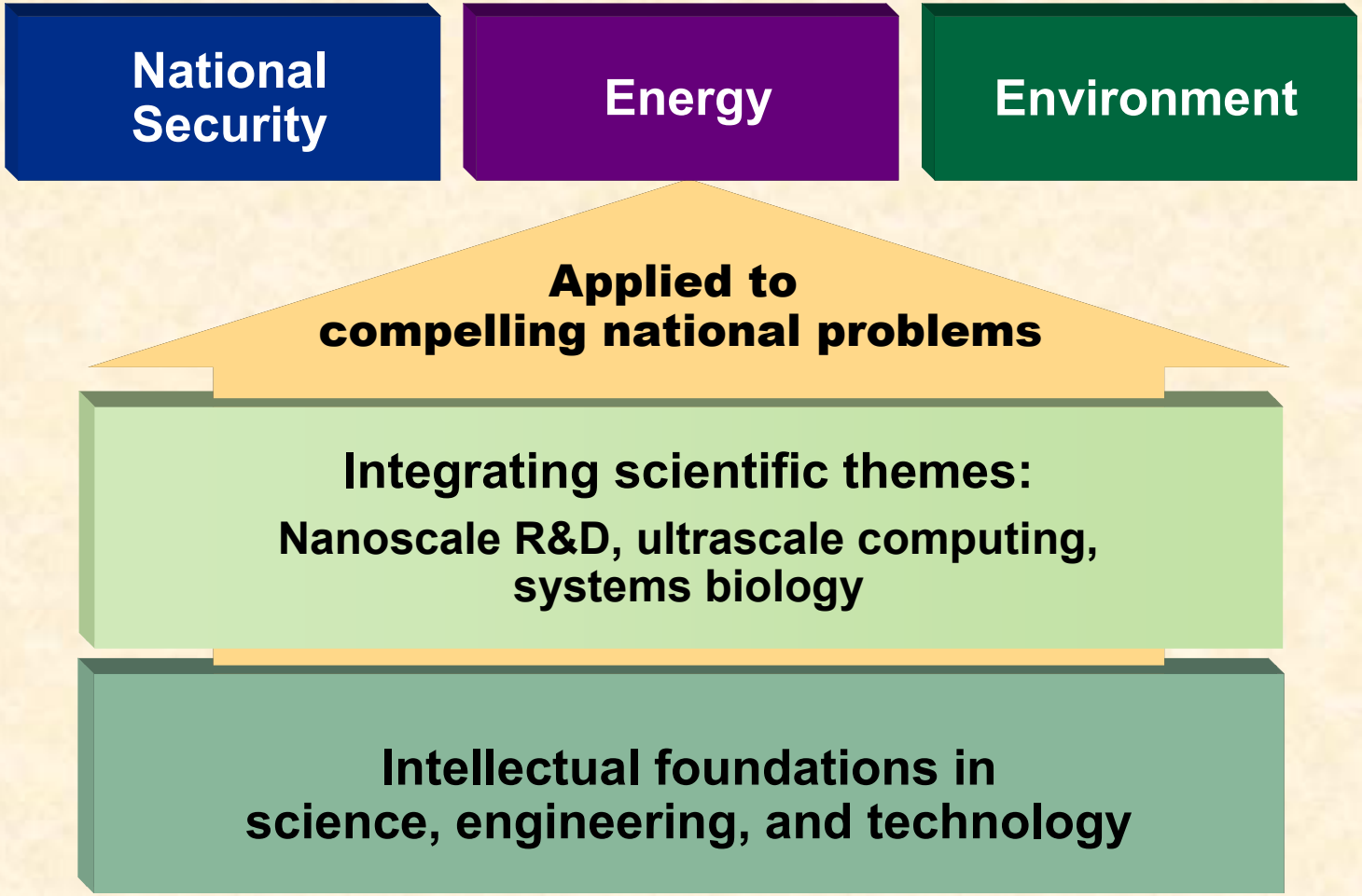
**“Imagination is more important than knowledge …”**

**“The important thing Is not to stop questioning …”**

**“If we knew what it was we were doing, it wouldn’t be called research, would it?”**

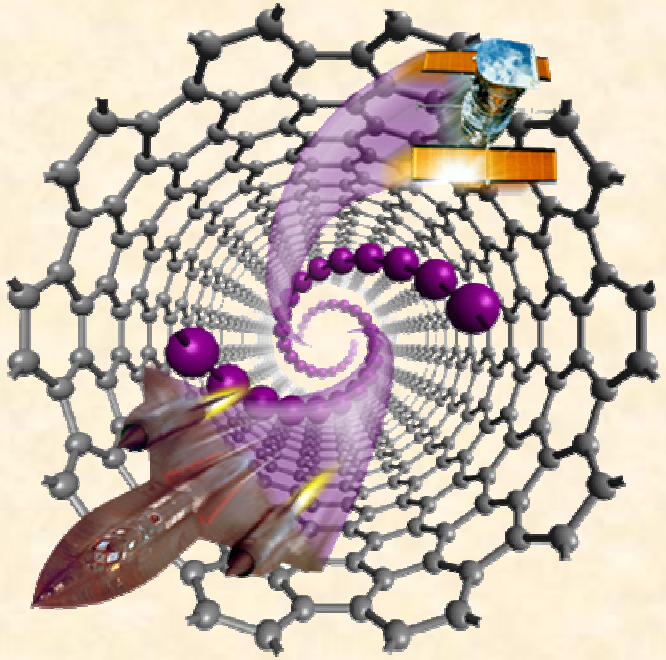
*Albert Einstein*

# Oak Ridge National Laboratory's research framework



## Our aspiration:
# Best lab in the world at what we do

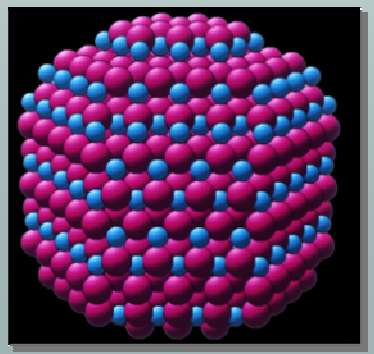
- Control of functionality at the nanoscale
- Leadership-class computing for the frontiers of science
- Integration of biology and ecology, based on the foundation of understanding molecular-level interactions
- Integration of science, technology, and thought leadership for energy
- Innovative solutions that improve national, homeland, and global security



# The Nano-Info-Bio Nexus

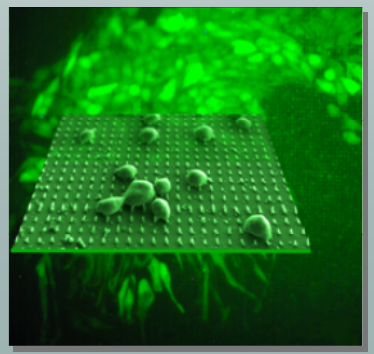
**We can expect revolutionary solutions to compelling problems in national security, energy, the environment, and medicine as we begin to**

**Develop a detailed understanding of the processes by which molecules organize and assemble themselves**



**Apply the principles of physics and chemistry to the modeling of biological systems at the atomic and molecular level**

**Model and simulate the behavior of complex systems**



# We are applying our S&T resources to national and homeland security

- Deploying integrated systems for incident awareness, detection, and response
- Creating tools for information management, synthesis and analysis
- Expanding modeling and simulation for threat analysis and response planning
- Delivering enhanced protection and new capabilities to warfighters
- Applying advanced materials to security applications
- Detecting, preventing, and reversing the proliferation of weapons of mass destruction


# We have significant strengths in key areas

**Radiological and nuclear weapons countermeasures**

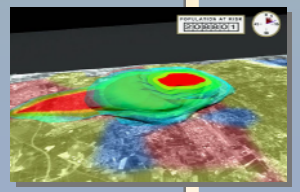
- RDD attribution studies, forensics program development, and decontamination of the aftermath
- Active interrogation technologies
- Radiation detection technologies and new materials

**Chemical and biological**

- Mass spectrometry
- Bioinformatics
- Host-pathogen interactions

**Threat vulnerability testing and assessment**

- Geospatial science
- Plume/effect modeling
- Cybersecurity technology



**Infrastructure protection**

- Vulnerability assessment and mitigation

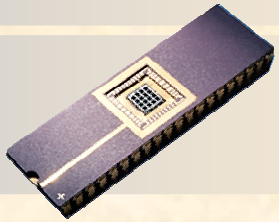
**Crosscutting**

- Sensor technologies
- Knowledge discovery

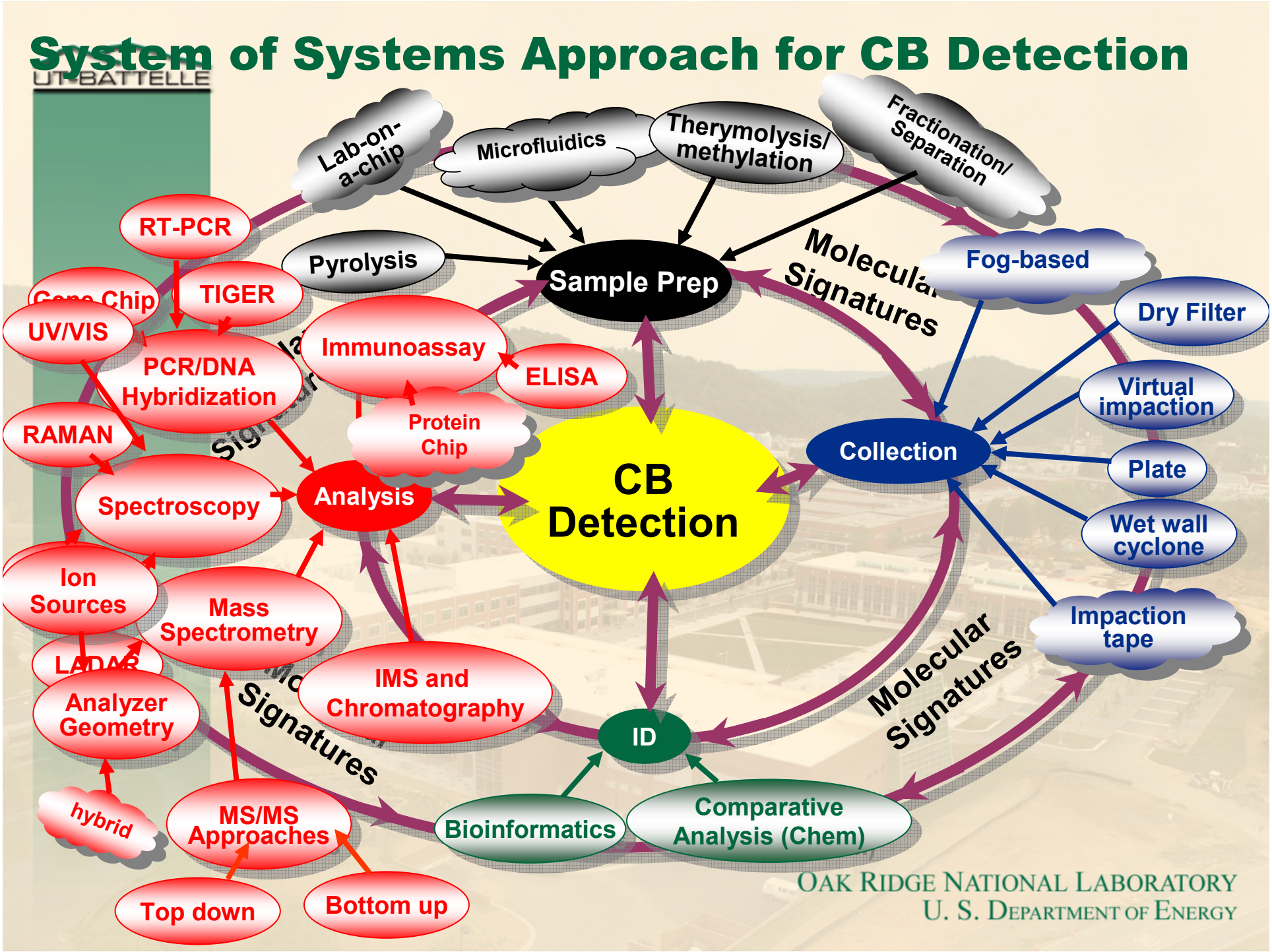
# Significant advances in sensors and detectors

- Block II Chemical-Biological mass Spectrometer Detector
- Microcantilever sensors for detection of explosives and chemicals
- AquaSentinel for water supply protection
- RAMiTS for detection of chemical agents and other hazardous chemicals
- Biochip for detection of bacteria, viruses, and toxins





# System of Systems Approach for CB Detection

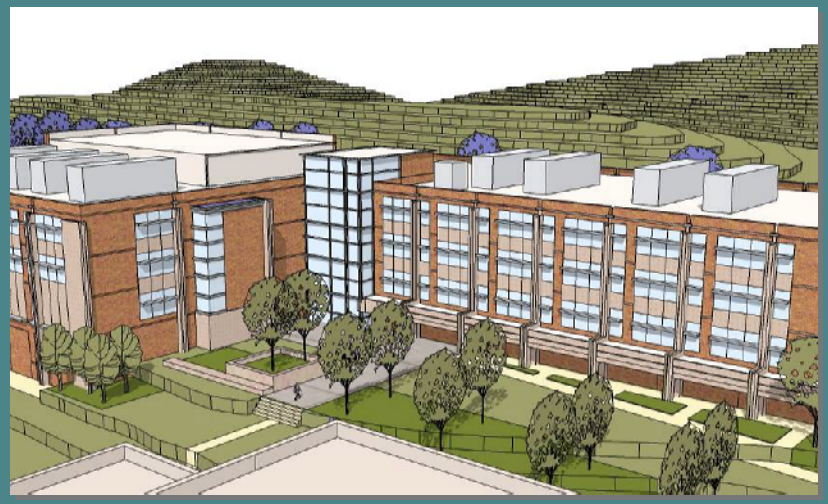


# Infrastructure protection

- **Modeling, simulation, and analyses used to assess vulnerabilities, consequences, and risks**
  - **Vulnerability Interactive Site Analysis Code (VISAC)**
  - **HYTRAS**
  - **LandScan**
  - **TRAGIS**
- **Real-time support to decision makers during crises and emergencies**
  - **HPAC**
  - **OREMS**
  - **SensorNet**

# Infrastructure revitalization at ORNL is expanding our capabilities

State-of-the-art vivarium housing ORNL's genetically distinctive mouse colony

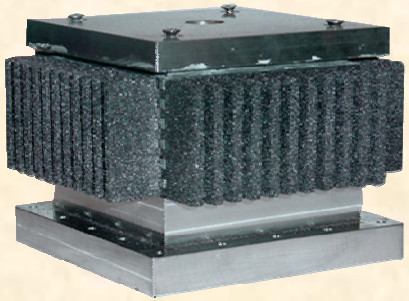


Multiprogram Research Facility

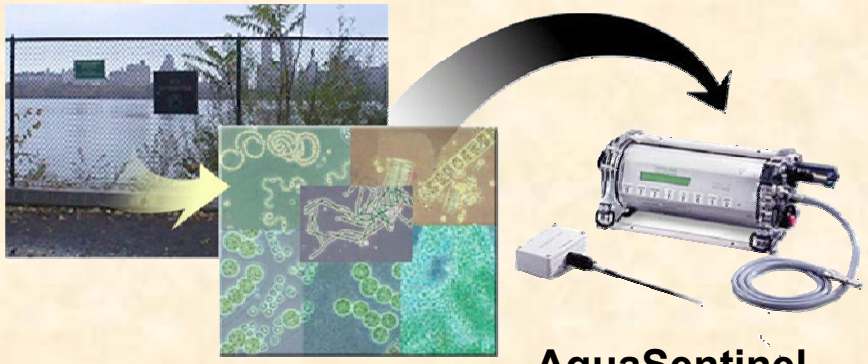
- 200,000 ft$^2$
- Light labs, computing space, and offices
- Capable of handling the full range of national and homeland security work

# Partnerships are essential to our success

- Other national laboratories
- Universities
  - UT-Battelle/ORNL core universities
  - UT-ORNL Center for Homeland Security and Counterproliferation
- Other government agencies
- Education/Training With Industry Program (U.S. Air Force and U.S. Army)
- ORAU post-docs
- Industry
  - National Security Technology Consortium
  - United Defense
  - National Safe Skies Alliance
  - NucSafe

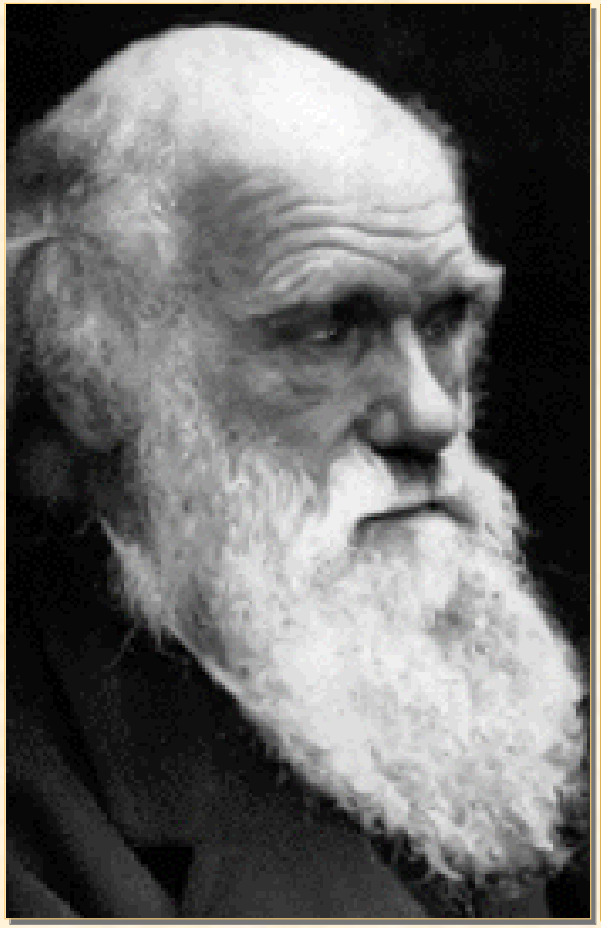


Carbon foam



AquaSentinel

# Oak Ridge National Laboratory:
## Ready for the next generation of great science



"It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change."

– Charles Darwin