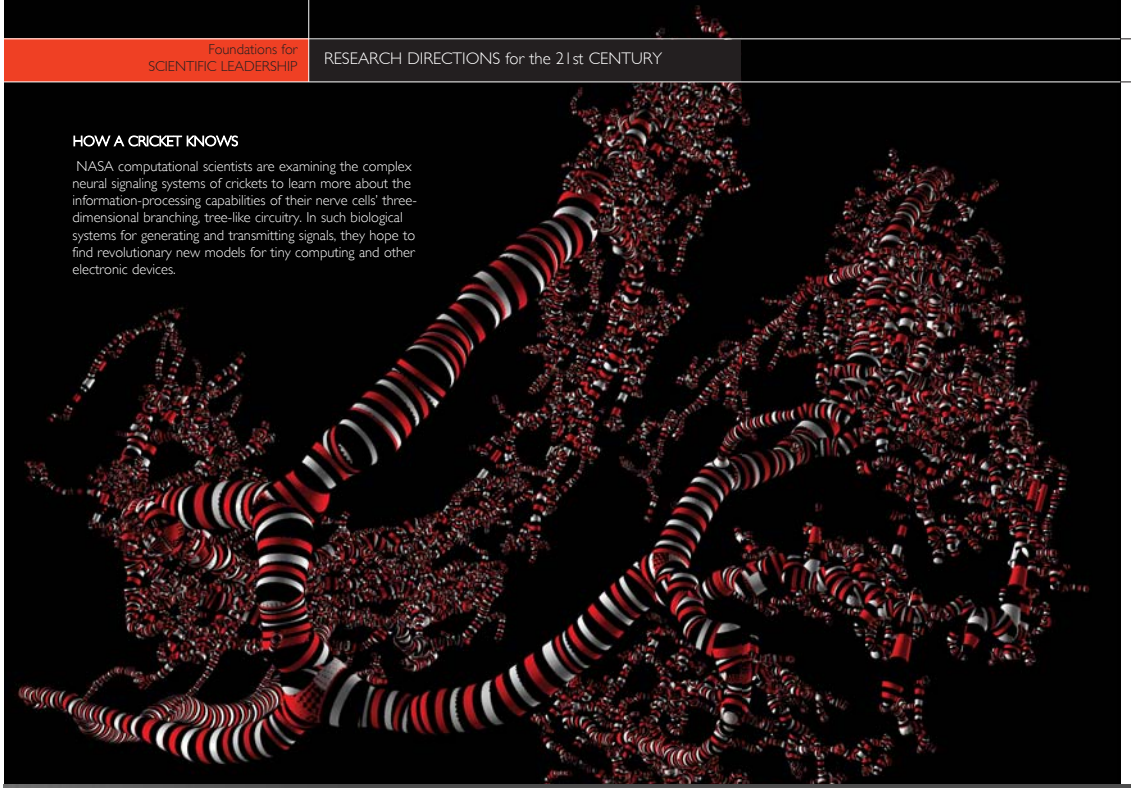
HOW A CRICKET KNOWS

NASA computational scientists are examining the complex neural signaling systems of crickets to learn more about the information-processing capabilities of their nerve cells' three-dimensional branching, tree-like circuitry. In such biological systems for generating and transmitting signals, they hope to find revolutionary new models for tiny computing and other electronic devices.



Visualization by Chris Henze, from data by Gwen Jacobs, of a cricket interneuron, a highly branched nerve cell that "reads" a neural map of input signals transmitted by sensory axons projecting into the insect's abdomen. About 10,000 color bands show precise 3-D geometry of the cell's dendritic branching points and changes in diameter. Details on page 50.

In the Nation's science and engineering research laboratories, high-performance computing, networking, software, and information management capabilities enabled by NITRD work are not only accelerating the pace of discovery but transforming the scientific enterprise, from the way individual scientists work to the relationships among the disciplines. Across the physical and biological sciences, at every scale from the vast to the minute, explorations of the structures, properties, and processes of life and of inanimate matter now converge in the high-end virtual laboratory environment made possible by ongoing NITRD advances.

Fundamental breakthroughs in component technologies, system and storage architectures, systems software, and scientific programming environments provide the U.S. scientific community with the world's most extensive and diversified array of high-end computing capabilities for cutting-edge research. NITRD research and engineering in broadband, optical, and wireless networking technologies provides U.S. researchers with access to high-speed research networks. Moreover, NITRD researchers' invention of grid computing and the Globus Toolkit™ of open-source grid software expands the versatility of this high-end connectivity, making possible networked integration and sharing of state-of-the-art instrumentation, data storage, and computing resources.

NITRD advances in high-performance hardware and software tools equip scientists with new ways to perform experiments and manage and work with massive data sets. The NITRD focus on digital library technologies, information management, foundational information archives, and new forms of human-computer interaction provide the research and education sectors with unprecedented resources for investigation and learning.

From this growing suite of IT capabilities – almost unimaginable just a decade ago – new modes of 21st century inquiry are rapidly taking shape.