MOLECULAR AND CELLULAR BIOSCIENCES $124,980,000

The FY 2005 Request for the Molecular and Cellular Biosciences (MCB) Subactivity is $124.98 million, an increase of $3.21 million, or 2.6 percent, above the FY 2004 Estimate of $121.77 million.

Molecular and Cellular Biosciences Funding
(Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004 Amount	Change over FY 2004 Percent
Molecular & Cellular Biosciences Research Projects	121.89	121.77	124.98	3.21	2.6%
Total, Molecular & Cellular Biosciences	$121.89	$121.77	$124.98	$3.21	2.6%

The overarching goal of **21st Century Biology** is to understand life at both its most fundamental level and in all its complexity. MCB supports research on the fundamental properties and dynamics of living cells and their components and how those components work together to carry out the complex processes of life. The research supported by MCB addresses questions about how living cells are organized, communicate, and respond to internal and environmental signals, and explores subjects ranging from the diversity of microbes that populate every imaginable habitat on Earth, to the cells that make up the specialized tissues of multi-cellular plants and animals.

Exciting advances in genomics, informatics, computer science, mathematics, physics, chemistry, and engineering offer the tools that make it possible to realize these ambitious goals. MCB is forging partnerships across disciplines to introduce new analytical and conceptual tools, especially cyberinfrastructure tools, to the biological scientist, as well as to provide unique training environments for the scientists of the future.

Research and education at the interface of biology and the physical sciences: MCB core activities support research on the structure, mechanisms of action, and control of the molecules that represent the machinery of the living cell. Partnerships generated among the core activities of MCB and Mathematical and Physical Sciences (MPS) subactivities will emphasize support for beginning investigators whose integrated research and teaching activities bridge this interface.

Living Networks: Theoretical, computational, and mathematical modeling approaches are playing increasingly critical roles in all areas of the molecular and cellular biosciences - in formulating and testing physical and mathematical models of the structure and function of complex molecules and cellular processes; in analysis of genome data; and in addressing one of the greatest computational challenges facing 21st Century Biology, creating multi-scale models that can integrate our understanding of biological structure, function, and interactions at all levels into a predictive whole. MCB is partnering with programs in the Engineering Directorate to promote research and training in this area.

In FY 2005, core activities in the MCB Subactivity are increased by $3.21 million, or 2.6 percent. Within the constraints of this increase current emphases will be maintained.

Highlights of areas supported:

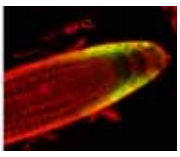
Research and education at the interface of molecular and environmental biology: Originally imported from Europe, the spotted knapweed has now become widely distributed over millions of acres of rangeland. Its advance is threatening ranches in the Midwest and the West. A plant biochemist and two ecologists worked together to unlock the secret of the mechanism behind the successful invasion of this weed. They found that this plant with beautiful purple flowers has a deadly effect on its neighbors by secreting a chemical, catechin, from its roots. Catechin is deadly to most plants, but not to the knapweed itself. The researchers found that the mechanism of catechin's toxicity is that in susceptible plants it activates a signaling pathway that produces toxic "reactive oxygen" that kills their roots. Turning to the tools of genomics the researchers found in the genome of the model plant, Arabidopsis, a gene that determines sensitivity to catechin. This work offers clues to strategies for interfering with the spread of this invasive species.

Spotted Knapweed

Microbial Biology: Core activities and the Microbial Observatories program encourage research on microbes at all levels of biological organization. Genome-enabled and biochemical approaches are being used to identify and characterize attributes of microbes, most of which have never before been described. Analysis of microbial genomes is leading to discovery of new organisms and to appreciation of the diversity of their metabolic functions that enable them to occupy diverse habitats and to interact in complex communities. These efforts are consistent with priorities of the interagency effort, "The Microbe Project."

It has long been assumed that in winter when the tundra is covered with snow the microbes living in the soil are dormant. Research from one of the Microbial Observatories has shown that the opposite is true. Populations of fungi covered by snow in the Colorado mountains are more active in winter. The metabolism of snow-covered microbes serves as an important "sink" for nitrogen. Release of nitrogen from the microbial sink in the spring may serve as ready fertilizer for the tundra-dwelling plants, which have a short growing season. In addition, the fungi discovered in this study belong to totally new groups, thus our appreciation for the diversity of fungi has been expanded by this project.

"2010 Project:" Unsolicited research led to the discovery of the value of *Arabidopsis thaliana* as a model flowering plant. Recently published research has provided a gene expression map of the Arabidopsis root. This map shows where and when about 22,000 of the estimated 28,000 total genes of Arabidopsis are active within the root. This level of resolution of gene expression on a global basis has not thus far been achieved for any other organism. The MCB Subactivity will continue to support research enabled by the availability of the complete genome sequence of *Arabidopsis* to determine the functions of all the genes of this model flowering plant by the year 2010.



Arabidopsis root tip