INTEGRATIVE BIOLOGY AND NEUROSCIENCE $110,630,000

The FY 2005 Budget Request for the Integrative Biology and Neuroscience (IBN) Subactivity is $110.63 million, an increase of $3.22 million, or 3.0 percent, above the FY 2004 Estimate of $107.41 million.

Integrative Biology and Neuroscience Funding
(Dollars in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Request	Change over FY 2004 Amount	Change over FY 2004 Percent
Integrative Biology & Neuroscience Research Projects	107.47	107.41	110.63	3.22	3.0%
Total, Integrative Biology & Neuroscience	$107.47	$107.41	$110.63	$3.22	3.0%

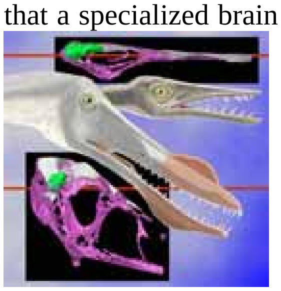
Totals may not add due to rounding.

Research supported by the Integrative Biology and Neuroscience Subactivity focuses on organisms, with particular emphasis on the mechanisms by which organisms develop, grow, reproduce, regulate their physiological activity, respond to their environment, and evolve. Understanding organisms requires integration of molecular, subcellular, cellular, and functional genomics information gathered in both laboratory and natural settings. It can also require advanced computational techniques and interdisciplinary perspectives from other areas of biology, the physical sciences, mathematics, engineering, and computer science. The development and use of a wide diversity of organisms contributes to both identifying unifying principles common to all organisms and documenting the variety of mechanisms that have evolved in specific organisms.

In FY 2005, core activities in the IBN Subactivity are increased by $3.22 million. IBN will emphasize 21st Century Biology projects that are multidimensional, multidisciplinary, and integrative, to understand the development, physiology, neurobiology, behavior, and evolution of living organisms. Because these projects will be data-driven, IBN will increase support for new ways to manage and analyze data.

Highlights of areas supported:

Brain scans of extinct reptiles. Pterosaurs, which emerged as the first flying vertebrates during the age of dinosaurs, could grow as large as an airplane but soared through the skies with ease. Research suggests that a specialized brain and inner ear structure helped these ancient reptiles to fly and target their prey, a finding that could give scientists insight into the evolution of the brain and visual system. Fossils of pterosaurs, which lived during the Mesozoic Era, are being examined by running fossil skulls through a high-resolution CT scanner and using sophisticated computer graphics software to reconstruct the brain cavity and inner ear canals. These scans can be compared with skulls of alligators and birds, which are the closest living relatives of pterosaurs, to test hypotheses on how evolutionarily similar, but still quite distinct, animals adapted to live in the air.

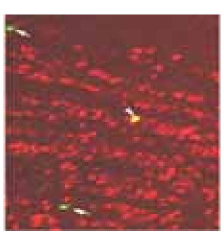


Paternal care as an ancient trait in primates: Behavior plays a pivotal role in survival and reproduction. Baboons in east Africa are providing a comprehensive picture of how behavior shapes fitness outcomes and population processes. Adult males and females do not form permanent bonds, and males have no easy way to tell which infants in the group are their own offspring. When biologists and anthropologists, jointly supported by BIO and SBE, performed DNA paternity tests, they surprisingly found that males provided far more care to their own offspring than to non relatives. This project also provides research and educational opportunities for American and Kenyan students and supports active collaborations between researchers in both countries.

Plants make their own aspirin to fight disease: Plant disease causes an estimated loss worldwide of $100 billion annually. A variety of strategies are being developed to protect plants against disease, including induction of the plant's own defense. Gaining an understanding of the mechanisms of acquired immunity against pathogens could reduce the effects of disease in agricultural systems and in managed forests. Research has established that acetylsalicylic acid (aspirin) is made inside Arabidopsis cells in response to viral attack and that it plays a critical role in providing immunity to the entire plant. This research breakthrough shows that plant immuno-response systems share traits with animal immuno-response systems. From a practical perspective, plant immunity has tremendous implications for the resistance of plants to pathogens. To control these pathogens we currently apply chemicals on our fields. Insight into how the immunity process works suggests ways to amplify this immune response, so that chemical use may be decreased.

Identifying the signal from mother to embryo that initiates pregnancy: Failure to implant is a major cause of doomed pregnancies in mammals. Research on basic reproductive physiology will improve our knowledge of embryo implantation. One characteristic of many carnivorous species is tight control of the timing of implantation. In the black bear and spotted skunk, for example, embryo implantation occurs months after fertilization, with the blastocyst in an inactive state in the interim, a phenomenon called delayed implantation. Because of their domestication and relative abundance, domestic ferrets provide an excellent model to study implantation in carnivores. Researchers have identified a protein called GPI, produced by the female, that triggers the implantation of the embryo into her uterus. In addition, this research is helping to train students in new methodologies by combining whole-organism and molecular approaches to answer important questions in reproductive endocrinology.

New cells in adult mammalian brain can make functional connections: Previously, researchers had made the startling discovery that the adult brain can produce new cells and that cells made in particular regions of the brain migrated within the forebrain and differentiated into neurons. But did the new cells make functional connections and respond to environmental factors? Using adult male hamsters, researchers recently discovered that new brain cells made functional connections and were activated when females were placed near the males. Apparently, testosterone produced in response to the proximity of the females was important for activation and survival of the new cells. These discoveries significantly enhance our understanding of neuron production, migration and death.



Arrows indicate new cells in adult hamster brain