National Science Foundation
WHERE DISCOVERIES BEGIN

Integrative Biology and Funding Opportunities

CUNY Workshop

Behavioral Systems Cluster

- Research aimed at understanding the development, function, mechanisms, and evolutionary history of behavior
- Emphasis on vertically integrated understanding of behavioral phenotype

Behavioral Systems Cluster

- Encourages projects that seek to understand:
  - Social and reproductive behavior
  - Behavioral ecology and physiology
  - Neural and hormonal mechanisms from which behavior emerges

Physiological and Structural Systems Cluster

- Research aimed at furthering the understanding of organisms as integrated units of biological organization
- Focused on:
  - interacting physiological and structural systems
  - environmental and evolutionary contexts
  - how these component systems are constrained by integration into the whole organism

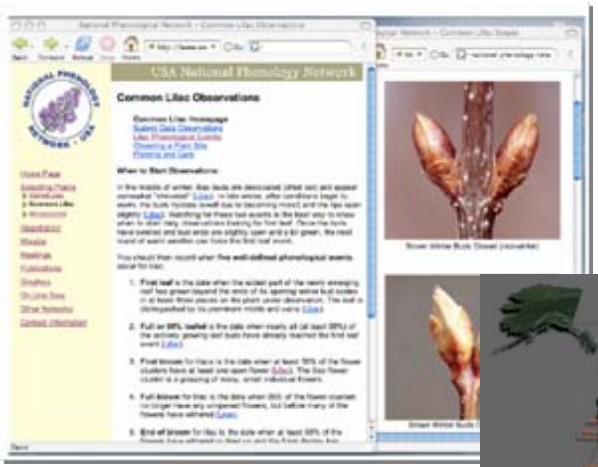
Integrative Graduate Education and Research Traineeship (IGERT)

- Developed to meet the challenges of educating future Ph.D. scientists and engineers
- Emphasizes multidisciplinary training
- Institutional Award (max. $1.4M over 5 years)
- The program is intended to catalyze a cultural change in graduate education

FACULTY EARLY CAREER DEVELOPMENT AWARDS

- Foundation wide – once/yr - July
- Support assistant professors (within 1st 5 years)
- In Bio at least $500,000 for five years
- Combines support of research and education. Must exhibit strong integration of research into education (at any or all levels, formal and informal)
- Nominees for Presidential Early Career Awards for Scientists and Engineers (PECASE) are selected from Career awardees annually.

Cross-Disciplinary or Collaborative Research



Frontiers in Integrative Biological Research (FIBR)

- Support integrative research which addresses major questions in the biological sciences
- FIBR encourages PIs to:
  - Identify major under-studied or unanswered questions in biology
  - Develop innovative approaches to address them
  - Integrate the scientific concepts and research tools of biology, math and the physical sciences, engineering, social sciences and the information sciences.
- Up to $5M for up to 5 years

Research Coordination Networks in Biological Sciences (RCN)

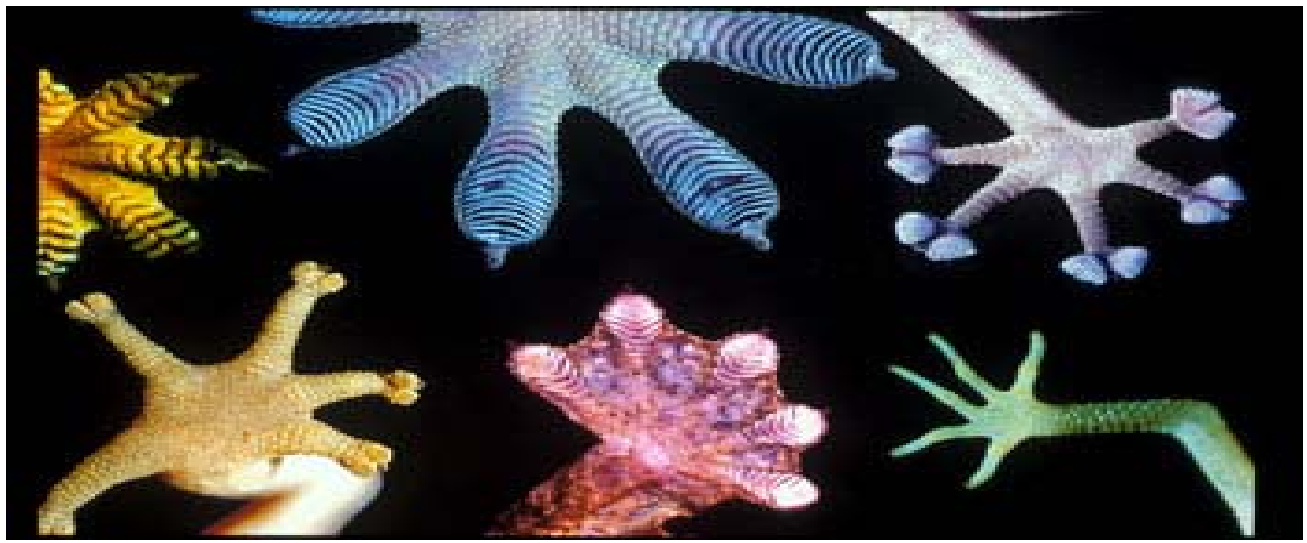
- Encourage interactions among scientists to create new research directions or advance a field; innovative ideas for networking, communicating
- Supports groups of investigators to coordinate their research efforts across disciplinary, organizational, institutional and geographical boundaries
- The proposed networking activities should have a thematic focus on a conceptual question, organisms, technology

Research Coordination Network: Integrating Ecology and Endocrinology in Avian Reproduction – Dr. John Wingfield

- Objective:
  - Coordinate research activities of ecologists, and endocrinologists on reproduction in birds
- Research will cover the full spectrum from field ecology to molecular mechanisms
- Goal:
  - Develop a framework whereby organismal biologists can communicate effectively with cell/molecular biologists (endocrinology)
- Will allow educational revision at K-12, undergraduate and graduate levels and will facilitate a truly integrative, biology curriculum including conservation biology

Environmental Genomics (En-Gen)

- Objective:
  - Enhance the development of fundamental knowledge, and strengthen the capacity to apply genomic-enabled methods in research on the interactions between organisms and their natural environments
- Deadline: January 29, 2007



International Polar Year

International Polar Year (IPY)

- IPY will extend from March 2007 through March 2009
- Envisioned as an intense scientific campaign to:
  - Explore new frontiers in polar science
  - Improve our understanding of the critical role of the polar regions in global processes
  - Educate the public about the polar regions
- Deadline: March 16, 2007

International Polar Year (IPY)

- Emphasis areas:
  - **Understanding Environmental Change in Polar Regions**
    - Research that advances the understanding of the physical, geological, chemical, human, and biological drivers of environmental change at the poles, their relationship to the climate system, their impact on ecosystems, and their linkages to global processes
  - **Human and Biotic Systems in Polar Regions**
    - Opportunities for scientists to address fundamental questions about social, behavioral, and/or natural systems that will increase our understanding of how humans and other organisms function in the extreme environments of the polar regions
    - *Humans in Polar Regions; Environmental Genomics of Polar Organisms*
  - **Education and Outreach**



- THANK YOU

National Centers and Cyberinfrastructure

National Center for Ecological Analysis and Synthesis (NCEAS)

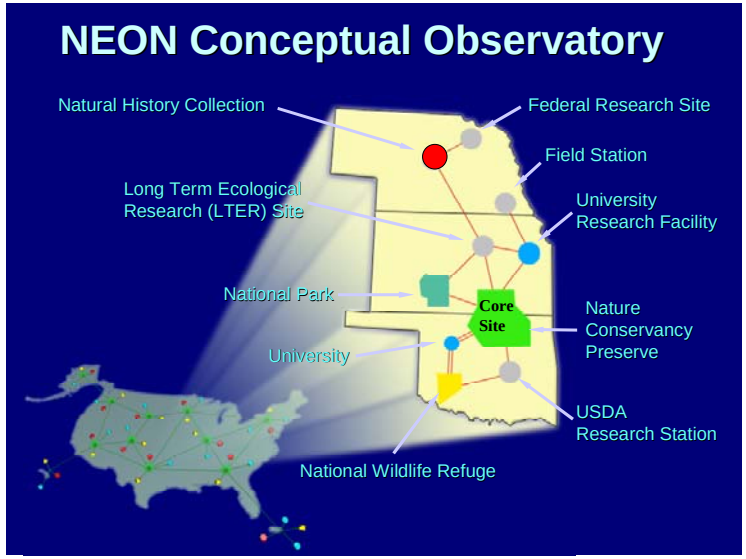
- Core activities include the development and testing of important ecological ideas and theories using existing data
  - Cutting-edge analysis of ecological information
  - Research on data access and use
  - Promoting the use of sound science in policy and management decisions
  - Investigating sociological issues that pertain to the science of ecology
  - Projects involving the state of California
  - Education and outreach

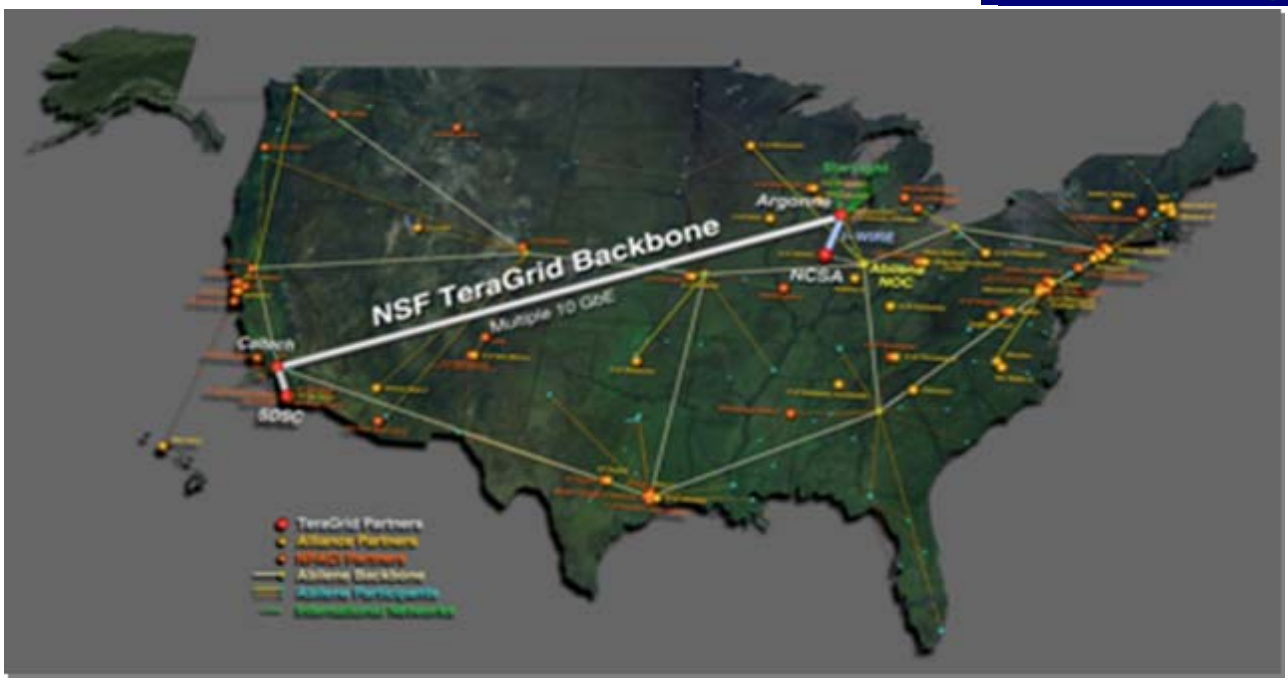
National Evolutionary Synthesis Center (NESCent)

- NSF-funded Cooperative Agreement: Duke Univ., NC State Univ. and UNC-Chapel Hill
- Foster a greater conceptual synthesis in biological evolution by bringing together researchers and educators, extant data and information technology resources
- Working groups: making progress on significant issues in evolutionary biology where opportunities for synthesis have been identified

http://www.nescent.org/index.html

neon


NEON Conceptual Observatory
Natural History Collection
Federal Research Site
Field Station
Long Term Ecological Research (LTER) Site
University Research Facility
National Park
Core Site
Nature Conservancy Preserve
University
USDA Research Station
National Wildlife Refuge


NSF TeraGrid Backbone
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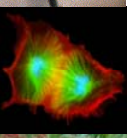
Argonne
NCSA
Caltech
SDSC
TeraGrid Partners
Abilene Backbone





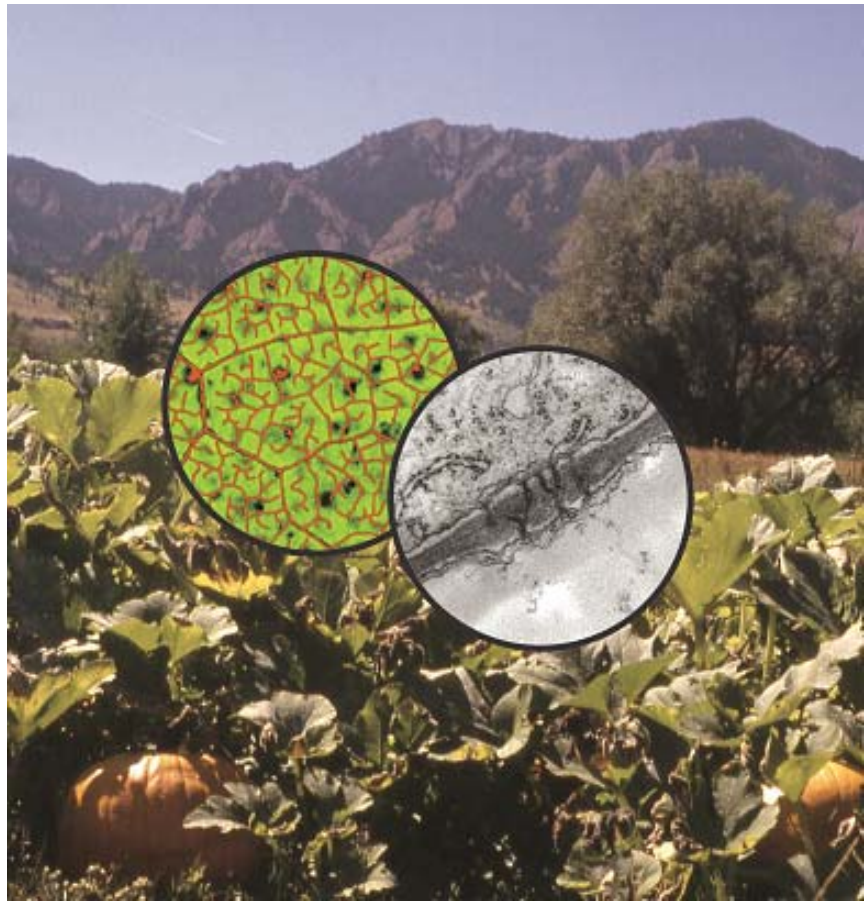

- **NEON is a continental scale infrastructure platform designed to investigate the ecological effects of climate and land-use change:**
  - **Geographically distributed sites, networked with state-of-the-art cyberinfrastructure and communications; use of emerging technologies (sensor, analytical, information)**
  - National scale observations of ecological drivers and response variables
  - Manipulative experiments to test mechanistic relationships between those variables
  - Mobile observational infrastructure to capture gradients and ecological variability
- **Will transform the field of ecology by testing ecological theory and enabling ecological forecasting at regional to continental scales**

•Develop new collaborative environments (simulation, computation, visualization, and knowledge systems) to facilitate the integration of research, education, and dialog across a wide range of biological, geophysical, and social sciences.

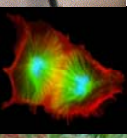
•Use legacy data repositories and facilities

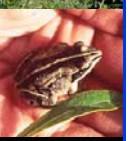
Emergent Properties

- Over-riding objective: supporting research to understand the fundamental nature of life by understanding the emergent properties of organisms
- Emergent Properties:
  - Complexity
  - Robustness
  - Communication
  - Adaptability
  - Cooperation







Emergent Properties

- **Complexity** - how interwoven organismal components or processes produce more than a sum of their parts
- **Robustness** -
  - Resiliance - the ability to recover from perturbation or stress
  - Resistance - the degree to which an organism resists perturbation or stressful influences
- **Communication** - the processes that enable individual components in a system to instruct one another or alter one another's behavior
- **Adaptability** – the capacity of organisms to change in in ways that maintain overall organismal integrity and fitness.
- **Cooperation** – the behaviors of cells or organisms that benefit more than an individual

Overview

- Part I: Division of Integrative Organismal Systems
  - Programs to which you may submit unsolicited proposals
- Part II: Additional Funding Opportunities in the Biological Sciences

Integrative Organismal Systems

Supports Research that:

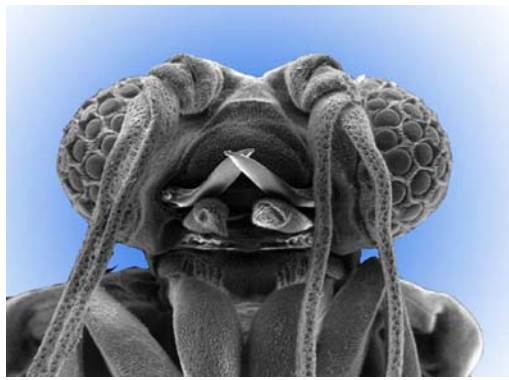
- Develops a comprehensive understanding of organisms
- Predicts why organisms are structured the way they are and function as they do
- Employs innovative applications of systems biology approaches, i.e. that combine experimentation, computation, and modeling
- Leads to new conceptual and theoretical insights and predictions about integrated organismal properties that may be experimentally verified

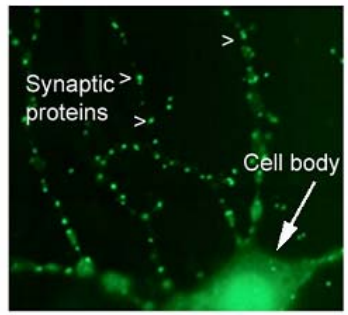
Approaches

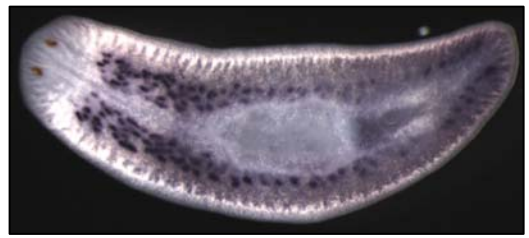
- Integrative - analyses across multiple levels of biological organization - Molecular to ecological, theoretical, computational
- Interdisciplinary - collaborations across all areas of biology, behavioral sciences, physical sciences, mathematics, engineering, and computer science

Organization - Clusters

- Behavioral Systems
- Developmental Systems
- Neural Systems
- Physiological and Structural Systems







The Developmental Systems Cluster

Three Programs:

Animal Developmental Systems

Evolution of Developmental Systems

Plant, Fungal and Microbial Developmental Systems

NSF

Animal Developmental Systems Program

- Focuses on research that seeks to understand the processes that result in the complex phenotypes of animals
- Encourages analyses of development in a wide range of different species

NSF

Evolution of Developmental Systems Program

- Focuses on understanding developmental processes that are shared by all organisms
- And, those singular ones that produce diversity
- Encourages inter-disciplinary & collaborative approaches using a wide range of model organisms

NSF

Plant, Fungal and Microbial Developmental Systems Program

- Supports research that addresses developmental processes in:

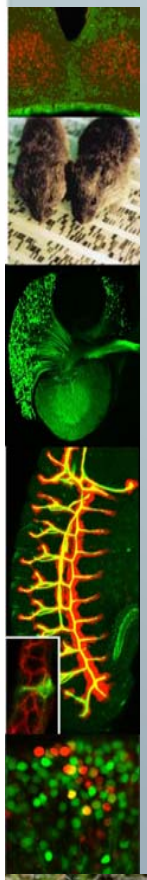
  plants, from algae to angiosperms

  microbes

  fungi

NSF

Neural Systems Cluster

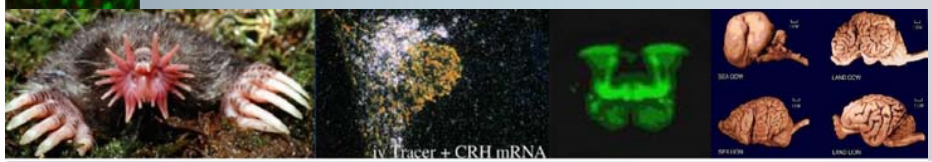


- Focuses on:

  How complex functions emerge from the interactions of the cellular elements of the nervous system

- Encourages:

  A systems biology approach to understand how the nervous system adapts and regulates its function and structure in response to the internal or external environment



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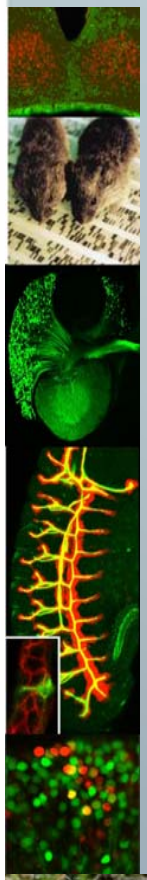
Neural Systems Cluster

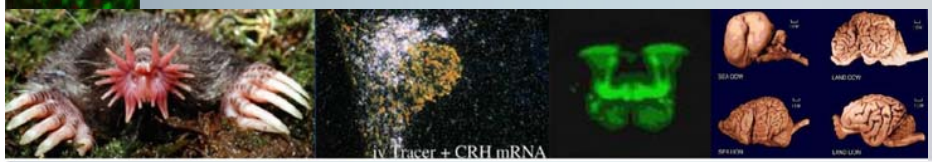


Focuses on:

- Questions that span time scales from the physiological to the evolutionary and
- Levels of complexity from the molecular biology of the cell to complex behavior

Encourages:

- Development and use of new theoretical approaches
- And, computational models to guide and instruct experimental design



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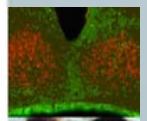
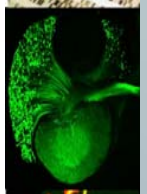
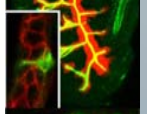
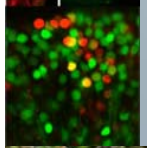
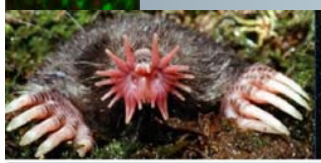
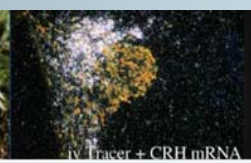
Neural Systems Cluster Programs

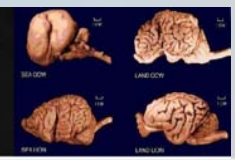




- Behavioral Neuroscience
- Cellular and Developmental Neuroscience
- Computational Neuroscience
- Neuroendocrinology
- Sensory Systems

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