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Introduction to IOS Core Programs Funding Opportunities



Division of Integrative Organismal Systems Core Programs (IOS)
**Behavioral Systems Cluster
(BSC)**

Program Directors:

Jodie Jawor - jjawor@nsf.gov

Suzy Renn - srenn@nsf.gov

Colette St. Mary - cstmary@nsf.gov

BSC: Integrative Animal Behavior

HOW & WHY individuals and groups of animals do what they do in nature.

Connecting development, mechanisms, adaptive value, and evolutionary history.

Species-specific

OR

Comparative studies

Modeling

OR

Theoretical

NOT human behavior per se (but human comparative)

Research driven by behavioral questions

NOT

Projects that use behavior as an assay

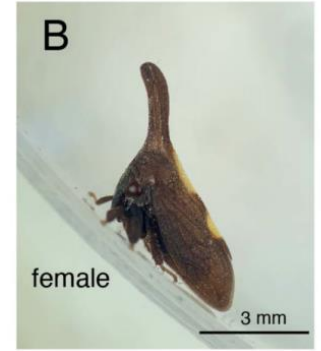
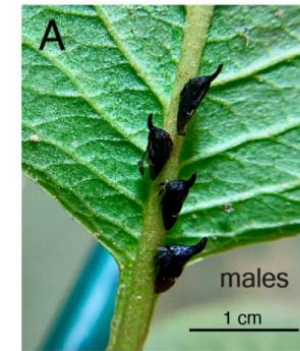
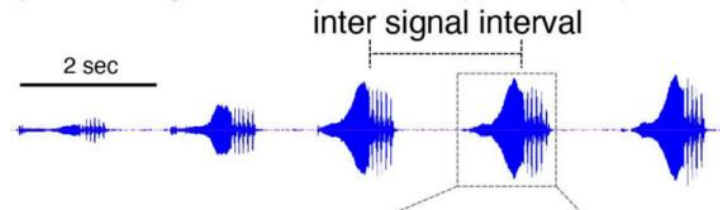


Examples of active BSC Awarded Projects:

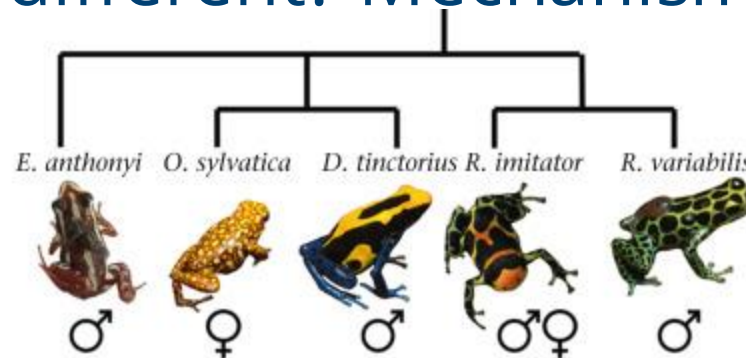
- 2238071: Integrating brain-behavior evolution with real-world science impacts through working dog neuroscience



- 1855962: Speciation and social plasticity: signal-preference phenotypes in social and genetic hybrids.

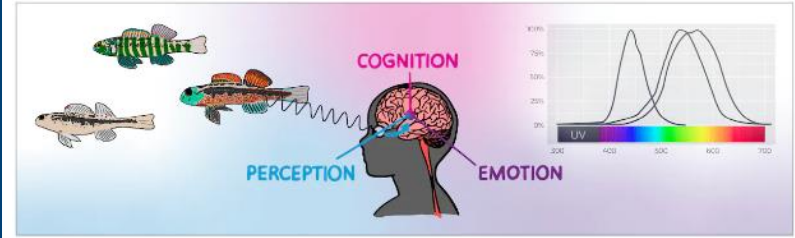


- 2146058: Same, same, or different? Mechanisms of Parental Care Between Sexes:



Examples of BSC Funded Broader Impacts:

2026334: Pattern preferences, information theory, and the evolution of signal design



I Like That!
How perception, emotion, and cognition shape our preferences

Science Grades: 5-9 GALACTIC POLYMATH

The diagram shows three fish on the left, a human head profile in the center with 'PERCEPTION' pointing to the eyes, 'COGNITION' pointing to the brain, and 'EMOTION' pointing to the heart. To the right is a graph with a color spectrum (UV to 700) and two bell curves representing preference distributions.

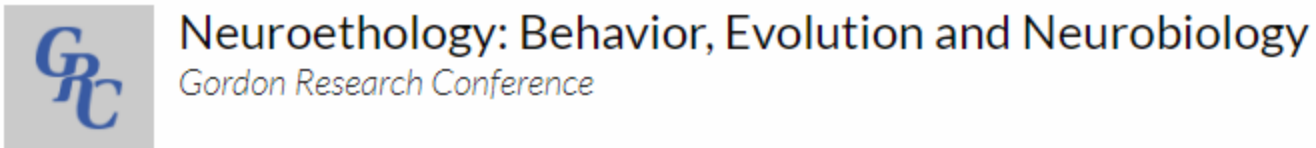
1856266: Linking process to pattern through an experimental network approach to identify the behavioral mechanisms of reproductive isolation



Scientific Conferences BSC often Attends:



SOCIETY for the STUDY of EVOLUTION



Tips from our program about transitioning from a Postdoc to a Principal Investigator

- Volunteer to do ad hoc reviews
- Volunteer to be on a proposal review panel
- The Postdoc Research Fellowship Program (PRFB) is a good place to get reviewing experience while you are also submitting your own proposals.



Learn More



Volunteer

Become a Reviewer







Division of Integrative Organismal Systems Core Programs (IOS)
Developmental Systems
Cluster

Program Directors:

Anna Allen - akallen@nsf.gov

Kimberly Gallagher - kgallagh@nsf.gov

Description of Research Scope

supports research aimed at understanding how interacting developmental processes give rise to the emergent properties of organisms

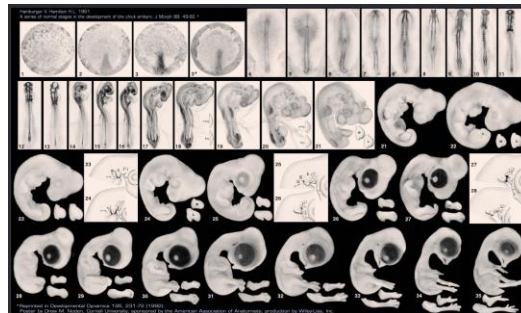
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**Plant, Fungal, and
Microbial
Developmental
Mechanisms**



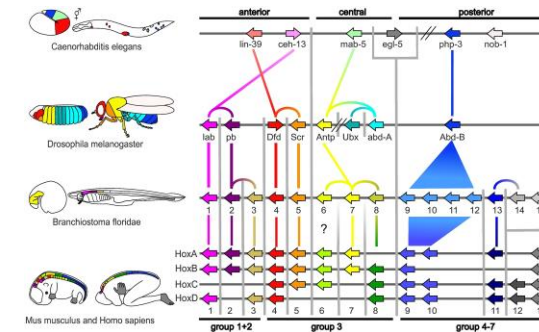
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**Animal
Developmental
Mechanisms**



1080

**Evolution of
Developmental
Mechanisms**

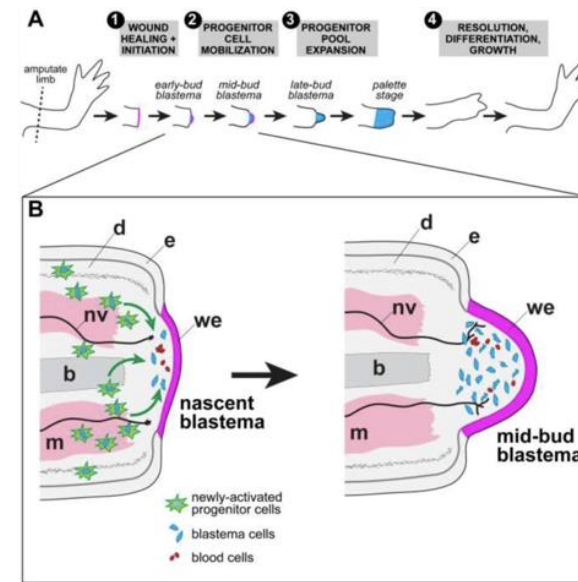


Examples of Awarded Projects to Give a Better Understanding of the Program

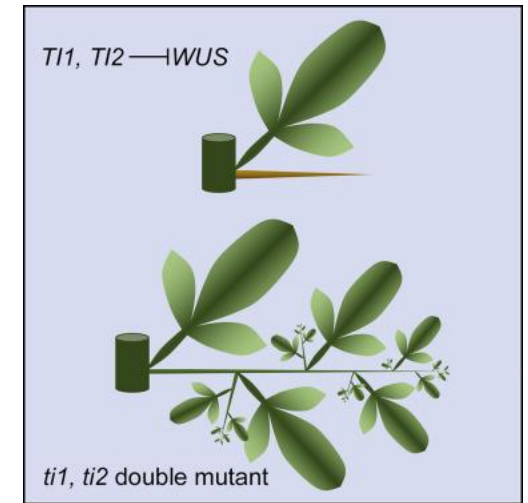
1. Development of form
2. Eco-evo-devo
3. Origin of novelty & diversity in development & evolution



IOS-1256689 PI: Moczek
IOS-2243725



IOS-2145925 PI: Whited



IOS-2306142 PI: Irish



Other Intersecting Programs and/or Partners

- **Co-review within IOS**

- PGRP, NS, PSS, EDGE (Enabling Discovery through Genomics)

- **Co-review with Division of Molecular & Cellular Biosciences (MCB)**

- Cellular Dynamics and Function (CDF)

- *“supports interdisciplinary research aimed at mechanistic understanding of the structure, function and evolution of cellular and subcellular systems across the tree of life”*

- Genetic Mechanisms (GM)

- *“supports research on the fundamental mechanisms involved in the organization, dynamics, processing, expression, regulation and evolution of genetic and epigenetic information”*

- **Co-review with Division of Mathematical Sciences (MPS)**

- Mathematical Biology Program

- *“supports research in areas of applied and computational mathematics with relevance to the biological sciences”*



Scientific Conferences We Often Attend

- Society for Developmental Biology (SDB)
 - International Conference
 - Regional Meetings
- Society for Integrative & Comparative Biology (SICB)
- American Society of Plant Biologists (ASPB)
- FASEB Mechanisms in Plant Development



Tips from our program about transitioning from a Postdoc to a Principal Investigator

- Get as many eyes on your proposal as possible!
 - Ask a colleague in your specific field (i.e.- limb regeneration)
 - Ask a colleague in your general field (i.e.- developmental biology)
 - Ask a talented undergraduate if they understand your proposal
- Register for the IOS Blog and VOH announcements
- Talk to your Program Director! We're friendly!



Contact Information

- Developmental Systems Cluster
 - Anna Allen akallen@nsf.gov
 - Kim Gallagher kgallagh@nsf.gov
- Funding Solicitation NSF 23-547
- Funding Solicitation Link:
<https://www.nsf.gov/pubs/2023/nsf23547/nsf23547.htm>



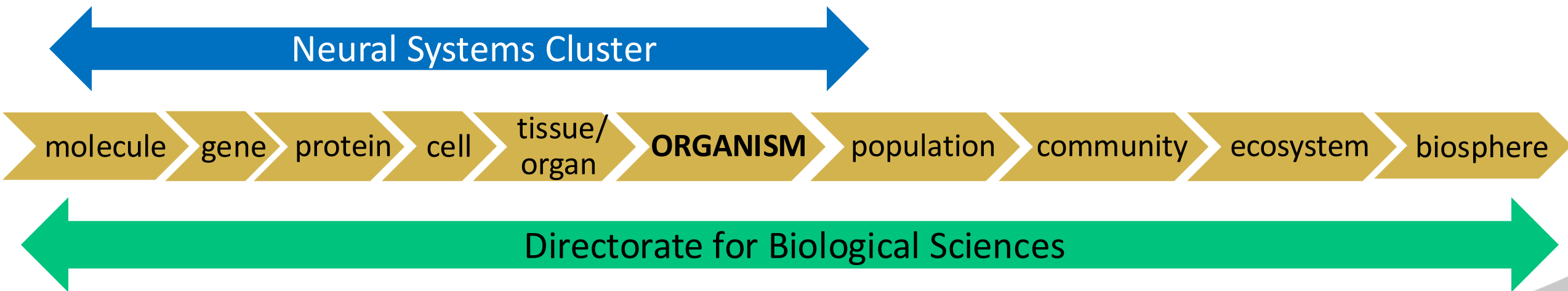




Division of Integrative Organismal Systems Core Programs (IOS)
Neural Systems Cluster (NSC)

Mechanistic understanding of nervous system structure and function

The **Neural Systems Cluster** supports mechanistic studies in neuroscience, from structure to function in natural context, that span multiple levels of analysis, from molecular and cellular to complex behavioral aspects of organisms.



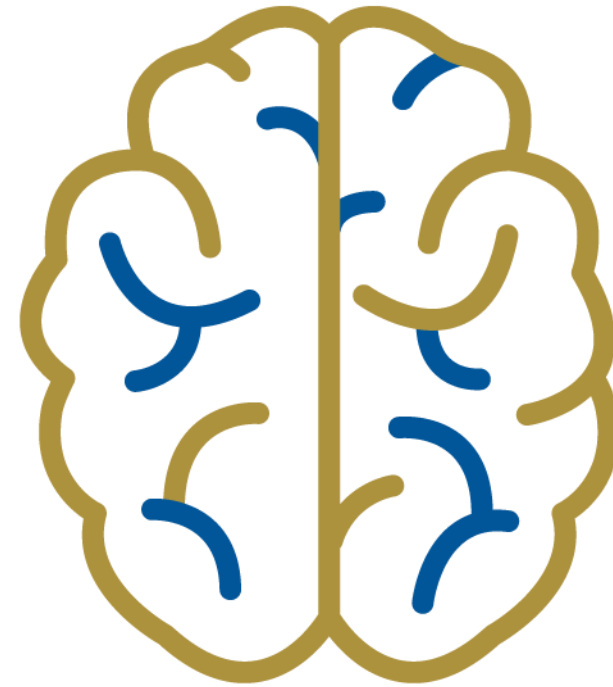
The **Neural Systems Cluster** encourages:

- the use of **comparative approaches** and an **evolutionary framework**;
- studies of organisms in their **natural contexts**; and
- the development of novel **theoretical, computational, and transdisciplinary approaches** to guide and instruct experimental design.



The Neural Systems Cluster is composed of three programs.

1. Organization
2. Activation
3. Modulation



Division of Integrative Organismal Systems Core Programs (IOS-NSC) Organization

Supports:

- research on how the nervous system is organized along developmental, genetic, molecular, and cellular lines;
- explorations of developmental mechanisms; and
- research on how experiential/environmental interactions affect basic structural and functional characteristics of the nervous system.



Division of Integrative Organismal Systems Core Programs (IOS-NSC)

Activation

Supports:

- research focused on how signals from the external environment activate the nervous system;
- studies on how motor output is coordinated and controlled; and
- examination of how the nervous system integrates sensorimotor responses to trigger an action.



Division of Integrative Organismal Systems Core Programs (IOS-NSC)

Modulation

Supports:

- research focused on mechanisms that mediate organism-environment interactions, including, but not limited to, synaptic, circuit, and behavioral plasticity;
- studies of neural mechanisms underlying social and emotional regulation of behaviors;
- studies of neuroendocrine and neuroimmune function; and
- research focused on neural mechanisms underlying biological rhythms and other complex functions.



Contacts for the Neural Systems Cluster

Organization Program – Andrea Holgado (aholgado@nsf.gov)

Activation Program – Paul Forlano (pforlano@nsf.gov)

Modulation Program – Melissa Coleman (melcolem@nsf.gov)
Edda “Floh” Thiels (ethiels@nsf.gov)

IOSNSC@nsf.gov



Tips from our program about transitioning from a Postdoc to a Principal Investigator

- Register for the IOS Blog and Virtual Office Hours (VOH) announcements and attend VOH
- Familiarize yourself with NSF programs, solicitations, and merit review criteria
- Develop a one-page prospectus of your project (fundamental question, importance of addressing this question now, experimental strategy, expected gain for the field and society) and send it to the program director(s) of a potentially fitting NSF program
- Contact NSF program directors early in the proposal development process
- Solicit frank feedback on drafts of your proposal from colleagues and mentors
- Contact the cognizant NSF program director after receiving feedback from the NSF review process
- Volunteer as an NSF reviewer (panelist or Ad Hoc reviewer)
- Meet with NSF program directors at Scientific Conferences

Be persistent







Division of Integrative Organismal Systems Core Programs (IOS)
**Physiological and Structural
Systems (PSS) Cluster**

Mechanistic understanding of the how and why
of organismal form and physiological function.

PSS supports hypothesis-driven research to advance understanding of whole-organism physiological mechanisms and functional morphology, encompassing a wide range of approaches and perspectives, spanning scales from molecular, genomic, and cellular levels to those interacting with population biology.



The most exciting PSS science:

- integrates across scales and involves interdisciplinary, integrative teams applying appropriate tools to answer fundamental questions and to elucidate basic principles and mechanisms
- tests hypotheses about mechanisms underlying organismal responses to change - involving biotic and abiotic interactions, homeostatic control systems, developmental change and plasticity, resilience, adaptation, and trans-generational effects



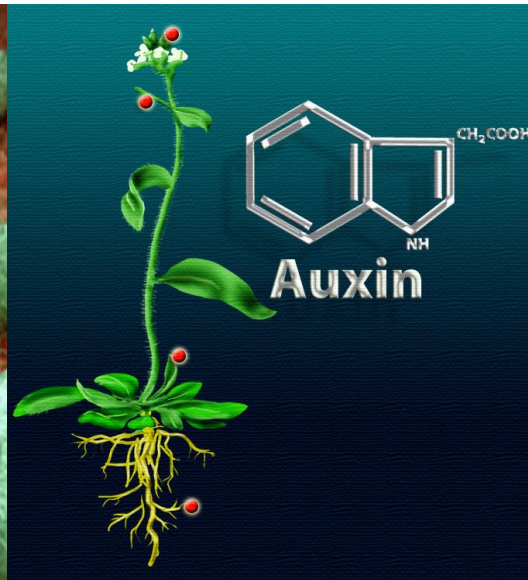
The Physiological and Structural Systems (PSS) Cluster is composed of four programs:

Integrative Ecological Physiology

Physiological Mechanisms and Biomechanics

Plant Biotic Interactions

Symbiosis, Infection, and Immunity



Division of Integrative Organismal Systems Core Programs (IOS-PSS)

Integrative Ecological Physiology (IEP)

Program Directors:

Irv Forseth (iforseth@nsf.gov)

Ted Morgan (tmorgan@nsf.gov)

Keith Reinhardt (kreinhar@nsf.gov)

IEP: Integrative Ecological Physiology

Understanding genetic, biochemical, morphological and physiological mechanisms underlying organismal responses to their abiotic and biotic environments

- Projects that integrate across levels of biological organization and are framed in explicit ecological or evolutionary contexts.
- Projects to test integrative hypotheses to understand mechanisms involved in how organisms evolve and respond to dynamic and/or stressful environments.
- Projects that integrate an understanding of cause-and-effect relationships with theoretical or conceptual models of organismal responses to their environments and comparative studies across multiple organismal systems.



Division of Integrative Organismal Systems Core Programs (IOS-PSS)

Physiological Mechanisms and Biomechanics (PMB)

Program Directors:

Miriam Ashley-Ross (mashleyr@nsf.gov)

Kathy Dickson (kdickson@nsf.gov)

PMB: Physiological Mechanisms and Biomechanics

Understanding mechanisms of physiological processes and biomechanics in the context of the whole organism, and studies of physiological responses and control, plasticity, and adaptation

- Projects that integrate across levels of biological organization.
- Modeling approaches to predict physiological or biomechanical principles of organismal function, and to test mechanistic hypotheses.
- Broad thematic areas include homeostatic control and signaling mechanisms, solute and water transport, gas exchange, circulation, ion- and osmo-regulation, metabolism, energetics, comparative endocrinology, feeding mechanisms and digestive physiology, reproductive physiology, stress physiology, muscle physiology and locomotion, biomechanics, biomaterials and functional morphology.



Division of Integrative Organismal Systems Core Programs (IOS-PSS)

Plant Biotic Interactions (PBI)

Program Director:

Courtney Jahn (cjohn@nsf.gov)

PBI: Plant Biotic Interactions

USDA-NIFA collaboration NSF 20-576

Understanding processes that mediate beneficial and antagonistic interactions between plants and their viral, bacterial, oomycete, fungal, plant, and invertebrate symbionts, pathogens and pests, as well as pollen-pistil interactions and other examples of plant self/non-self recognition

- Projects on the biology of the plant host, its pathogens, pests or symbionts, interactions among these, or on the function of plant-associated microbiomes; may include current and emerging model and non-model systems, and agriculturally relevant plants.
- Projects on the dynamics of initiation, transmission, maintenance and outcome of these complex associations
- Projects must be strongly justified in terms of fundamental biological processes and/or relevance to agriculture, and may be purely fundamental or applied, or may include aspects of both perspectives.



Division of Integrative Organismal Systems Core Programs (IOS-PSS)

Symbiosis, Infection, and Immunity (SII)

Program Directors:

Mamta Rawat (mrawat@nsf.gov)

Joanna Shisler (jshisler@nsf.gov)

SII: Symbiosis, Infection, and Immunity

How viruses, prokaryotes, and eukaryotes interact – beneficial and antagonistic relationships
Initiation, transmission, maintenance, and dissolution of interactions

- Self/non-self recognition
- Immune defense and countermeasures
- Host-microbiome interactions
- Evolution of interactions and relationships, including organelles

- Comparative and integrative approaches
- Modeling and theoretical approaches integrated with experimental approaches

NOT

- Projects that have plants as hosts
- Human-centered research



Tips from our program about transitioning from a Postdoc to a Principal Investigator

- Register for the IOS Blog and Virtual Office Hours (VOH) announcements; attend VOH
- Become familiar with NSF structure, solicitations, merit review criteria, etc.
- Talk to Program Directors; ask for advice in finding a program fit for your proposal ideas
- Attend Scientific Conferences and meet with NSF program directors there
- Develop a one-page summary of the project, hypotheses to be tested, general experimental plan, gap in research to be filled, etc.
- Ask a colleague or mentor to read drafts of your proposal and provide critical feedback
- Volunteer as an NSF reviewer
- Be persistent







Division of Integrative Organismal Systems Core Programs (IOS)

Plant Genome Research Program (PGRP)

Program Directors:

Kan Wang - kawang@nsf.gov

Gerald Schoenknecht - gschoenk@nsf.gov

Diane Jofuku Okamuro - dokamuro@nsf.gov

Plant Genome Research Program

- *Started* as part of the National Plant Genome Initiative (NPGI) in 1998
- *Supports* cutting-edge science addressing questions of biological, societal and economic importance in plants
- *Develops* tools and resources as key elements
- *Promotes* hypothesis-driven research on a **genome-wide** scale
- *Maintains* high standards of data sharing and release
- *Encourages* collaboration and community culture change
- *Advocates* cross disciplinary programs; small to large; solo to multiple PIs, single institution to multi, full participation



Examples of Awarded Projects to Give a Better Understanding of the Program

Hypothesis-Driven Research on a Genome-Wide Scale

Study of structural variants in cacao genomes yields clues about plant diversity



Examples of Awarded Projects to Give a Better Understanding of the Program

Hypothesis-Driven Research on a Genome-Wide Scale

Capitalizing on genetic diversity, non-model systems, and advances in genomics technologies for manipulating complex traits in plants



Examples of Awarded Projects to Give a Better Understanding of the Program

Tool and Resource Development

Identification of novel CRISPR-Cas12a variants, expanding potential for plant genome engineering



Examples of Awarded Projects to Give a Better Understanding of the Program

Results from Basic Research Translating to the Field

Approach using evolutionary principles and machine learning identifies genes that enable plants to grow with less fertilizer



Other Intersecting Programs and/or Partners

Within NSF:

BIO/IOS – Plant Biotic Interactions (PBI), Physiological Mechanisms and Biomechanics (PMB) – Plant

BIO/MCB – Genetic Mechanisms (GM), Systems and Synthetic Biology

BIO/DBI – Postdoctoral Research Fellowships in Biology (PRFB); Infrastructure Innovation for Biological Research (Innovation): Bioinformatics

PGRP/MCB/GEO – PlantSynBio ([NSF 20-045](#))

Between Agencies:

NSF/USDA NIFA – PlantTransform ([NSF 23-019](#))



Scientific Conferences We Often Attend

- Plant and Animal Genome (PAG)
- American Society for Plant Biology (ASPB)
- Maize Genetics meeting
- Society for In Vitro Biology (SIVB)
- SACNAS
- ASA-CSAA-SSSA Tri-Societies meeting



Tips from our program about transitioning from a Postdoc to a Principal Investigator

- Read the solicitation!
- Contact us – we are here to help you!
- Send us a 1-pager summarizing the project and broader impacts – we will discuss, share with other program directors, and get back to you with comments and suggestions



Contact Information

- Plant Genome Research Program/Cluster
 - Cluster alias (dbipgr@nsf.gov)
 - Kan Wang (kawang@nsf.gov)
 - Gerald Schoenknecht (gschoenk@nsf.gov)
 - Diane Jofuku Okamuro (dokamuro@nsf.gov)
- Solicitation: NSF 23-559
- Solicitation link:
https://www.nsf.gov/publications/pub_summ.jsp?WT.z_pims_id=5338&ods_key=nsf23559







Integrative Research in Biology (IntBIO)

*IOS NSF 23-547
Suzy Renn (srenn@nsf.gov)*

*DEB NSF 23-549
Matt Herron (mherron@nsf.gov)*

*MCB NSF 23-548
Loretta Jackson Hayes (lojackso@nsf.gov)*

Contact: IntBIO@nsf.gov

IntBIO Integrative Research in Biology

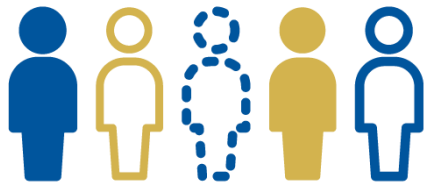
- **Who:** There are no restrictions
- **What:** Integrative biological research spans subdisciplines and incorporates cutting-edge methods, tools, and concepts from each to produce groundbreaking biological discovery. Research should be synergistic and produce novel, holistic understanding of how biological systems function and interact across different scales of organization.
- **Where:** At any U.S. Institution of Higher Education or non-profit organization
- **When:** NO DEADLINES
- **How:**



IntBIO Program Goals



Scientific: To support *collaborative* scientists for innovative, *integrative* research on fundamental questions that cross different scales of biological organization, using perspectives and approaches from more than one biological *subdiscipline*



Training: To prepare a *new generation* of scientists who reflect the diversity of the nation and are ready to contribute to future research through *integrative* approaches

Track-specific Criteria

- **Overarching question**
 - Should be addressed through bold, integrative, hypothesis- or question-driven research about function/interaction of biological systems across scales of organization
 - Requires integration across subdisciplines, or development of tools/technology for integrative analysis
- **Synergistic outcomes** from interdependent, integrative components



Track-specific Criteria

- **Graphical illustration** conveys integrated elements and synergistic outcomes
- **Description of investigative team**, including roles and qualifications of two or more investigators (may be from the same institution)
- **Training and education plan** as part of the broader impacts that is inclusive and likely to produce new generation of scientists trained in integrative approaches to biological research

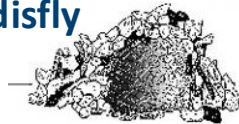


2217155-9: Silk Protein Innovation and Novelty (SPIN) : integrating across disciplines to decipher silk fiber evolution

A team of natural historians, molecular biologists, developmental biologists, and bioengineers combine their expertise to uncover the molecular, developmental, and functional basis of silk produced by a diversity of insects.

This research is foundational to engineering new materials that can be applied to many products, from surgical adhesives to sustainable clothing.

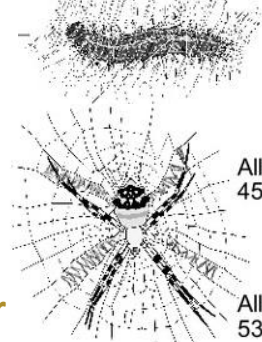
Net-Spinning Caddisfly



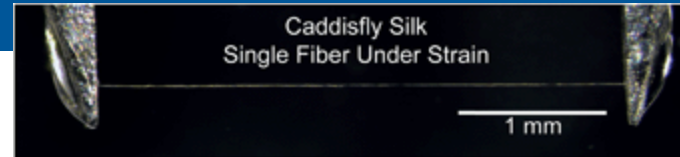
Case-making Caddisfly



Painted Lady Butterfly

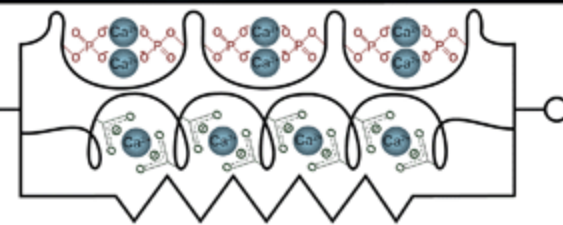


Silver Argiope spider

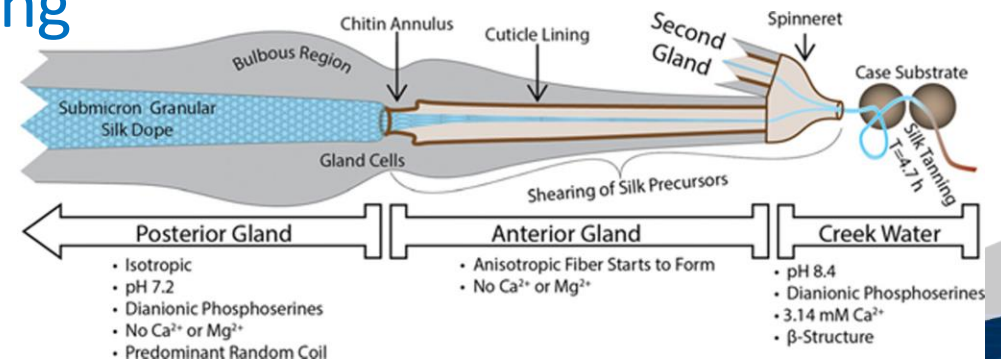
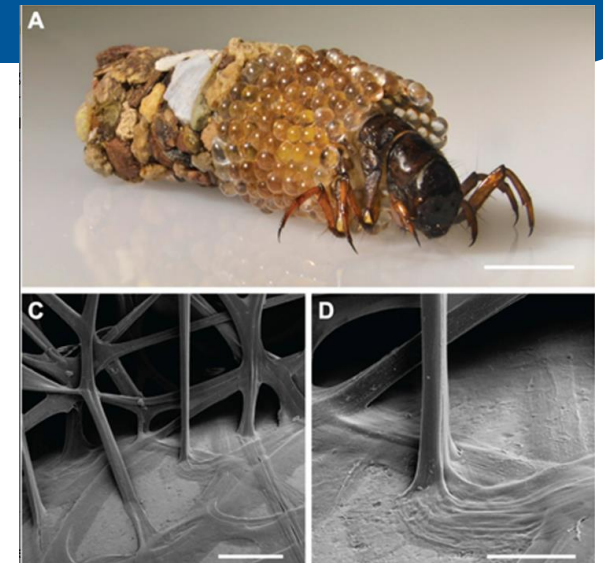


Aquatic

Terrestrial

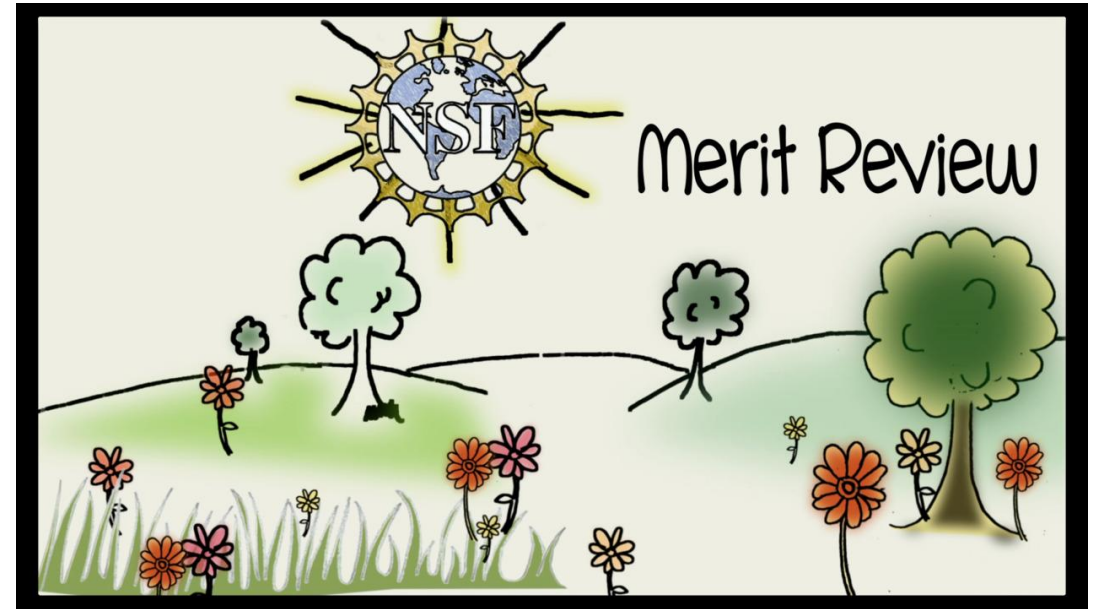


Gene Editing



IntBIO Proposal Review

- Traditional merit review and solicitation-specific criteria will apply
- Proposals will be reviewed by at least one and possibly more core-solicitation panel(s) (co-review)
- Solicitation Specific Criteria



Tips from our program about transitioning from a Postdoc to a Principal Investigator

- All IntBIO proposals are co-reviewed, but so are many core-solicitation proposals
- There are many reasons for co-review
- As a PI, if you think your proposal is appropriate for co-review, it is good to talk with Program Officers from both Programs



For More Information

Email IntBIO@nsf.gov

or

Contact an IntBIO Working Group Member

Loretta Jackson-Hayes (MCB)

Matt Herron (DEB)

Suzy Ren (IOS)



