Biodiversity Data and an Evolving Funding Landscape

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Opportunities

- Research & Collections and Digitization

- **Geoscience Initiatives**
- **Big 10 ideas – NSF Wide**
- **Broadening Participation**
- **Additional Resources**

GEO CyberInfrastructure Working Group

The GEO CI group coordinates the activities of the four GEO divisions (EAR, AGS, OCE, and OPP) and the CISE Office of Advanced Cyberinfrastructure (OAC).

Works to support computational and data-driven infrastructure, training, and applications for enabling potentially transformative geoscience research.

GEO CyberInfrastructure

Cyberinfrastructure = "computing resources, data and software infrastructure, workflow systems and approaches, cybersecurity, workforce development"

NSF Geoscience directorate has a history of funding cutting edge CI for enabling geoscience research such as data software/tools, supercomputers, data repositories

Many resources for GEO

Top 10 Data Resources for Each Division*			
OCE (N=241)	**OPP (N=163)**	**AGS (N=215)**	**EAR (N=283)**
Resource	**Resource**	**Resource**	**Resource**
BCO-DMO	ACADIS	NCAR	IEDA
NCEI	NCEI	NCEI	IRIS
NCBI	NSIDC	NASA	NCEI
R2R	Museums	GEM	UNAVCO
IEDA	IEDA	ICARTT	CUAHSI
GEOTRACES	NCBI	REU Website	CSDMS
DataONE	BCO-DMO	ORNL	SERC
PANGAEA	AMD	AMS DB	USGS
OBIS	GCMD	IRB	EarthCube
LTER	NCAR	NAW	LacCore

OCE = Ocean Sciences

OPP = Office of Polar Programs

AGS = Atmospheric and Geospace Sciences

EAR = Earth Sciences

*From survey of data management plans (DMPs).
NOTE: Most NSF PIs use institutional resources

EAR RESOURCES

Names, URL, Short Description (Data Centers, Data, Sample and Software Repositories, Portals, Community Activities and Portals

Research Needs/Opportunities
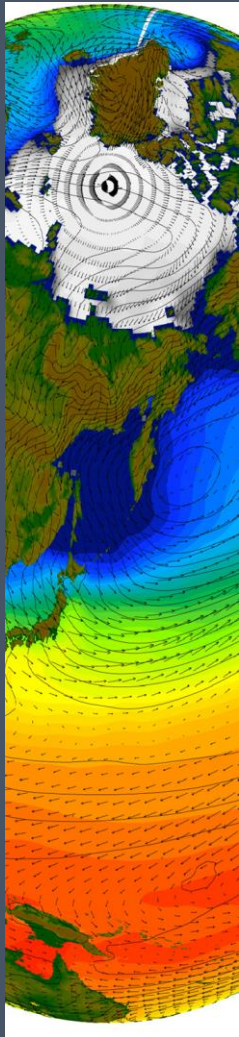
Reports: Dynamic Earth; Geophysics HPC report; Polar HPC report; NCAR strategic plan; EarthCube reports: Weather ensemble forecasting, Community modeling

Earth system models; hazards; complex ecosystems connection to bioinformatics; large field campaigns in real time

Requires iterative, computationally intensive processes for model formulation, verification, simulation-based prediction, validation, data assimilation

CI 2030 Request for Information (RFI)

Question 1: Research Challenge(s)   *[Including institutional challenges…]* *Describe current or emerging science or engineering research challenge(s), providing context in terms of recent research and standing questions in the field.*

Question 2: Cyberinfrastructure Needed to Address the Challenge(s). *Describe any limitations or absence of existing CI or specific advancements that must be addressed to accomplish the identified research challenge(s).*

Question 3: ***Any other aspects or issues that NSF should consider.***

CI 2030 RFI (cont'd)

- *GEO received 14% of total response*
- **Responses of primary GEO interest:** 18 (AGS: 3, EAR: 7, OCE: 8, OPP: 0)
- **Authors:** 72, ~50% from univs., ~50% orgs. & agency labs
- **Key concerns:**
  - Code optimization for earth-system models, big data wrangling, increased bandwidth for remote operations, improved organizational efforts, workforce development

EarthCube

What is it? "System of systems" infrastructure and community for geoscience research - *tying together existing pieces*

Workshops and pilots (2011 - 2013): Meetings of 25 domain end-user groups	**Design phase and "test" governance (2013 - 2016):** ● *Building Blocks:* novel infrastructure capabilities (tools, semantics, workflows) ● *Conceptual Designs:* envisioning EarthCube	**Governance and implementation (since 2016):** ● *EarthCube Science Support Office (ESSO):* Governance, registry of data resources to improve discovery and access. ● *Data Infrastructure projects:* laying the groundwork for shared data ● *Integration projects:* implementing technologies to advance geosciences research

Research Coordination Networks (RCNs): Organizing research communities

EarthCube ESSO

Project 418: Resource Registration, Data Discovery, and Data Access. Will become a core component linking EarthCube and associated data facilities

New **decentralized** approach to linking data repositories

(IEDA, BCO-DMO, LinkedEarth, Neotoma, Open Core Data, and more coming)

Coordination through **EarthCube Council of Data Facilities** Leaders: Eric Lingerfelt (ESSO), Doug Fils (Ocean Leadership), Adam Shepherd (WHOI)

EarthCube All Hands Mtg.

5th annual meeting

www.earthcube.org/ECAHM 2018

"Highlights will feature a demonstration of the pilot registry work (Project 418), technology integration, how EarthCube defines its own success, and ways to enhance engagement in the scientific community and with external partners."

NSF Wide Initiatives

NSF's *10 Big Ideas*

10 Big Ideas for Future NSF Investments

RESEARCH IDEAS

Navigating the New Arctic
Build a cyber-enabled observing system to document the rapid changes throughout the Arctic region that have profound impacts on the global climate.

DATA SCIENCE
STATISTICAL COMPUTATIONAL FOUNDATIONS · OPEN · EDUCATION · WORKFORCE · ANALYTICS · DATA MINING · FUNDAMENTAL RESEARCH · MACHINE

Harnessing Data for 21st Century Science and Engineering
Generate a world-wide data-enabled future for the U.S. through fundamental research and education in data science and systems.
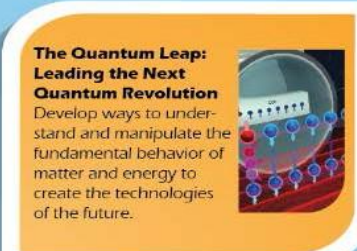
Work at the Human-Technology Frontier: Shaping the Future
Understand how constantly evolving technologies are actively shaping our lives and how we in turn can shape those technologies, especially in the world of work.

Understanding the Rules of Life: Predicting Phenotype
Bridge the biggest gap in biological science by determining how an organism's genes interacting with the environment influences its unique characteristics.

The Quantum Leap: Leading the Next Quantum Revolution
Develop ways to understand and manipulate the fundamental behavior of matter and energy to create the technologies of the future.

Windows on the Universe: The Era of Multi-messenger Astrophysics
Extend our understanding of the cosmos by using NSF's unique facilities to observe the universe in previously impossible detail.

PROCESS IDEAS

Growing Convergent Research at NSF
Integrate knowledge, tools, techniques, and modes of thinking from widely diverse fields to address pressing societal problems and profound research questions.

NSF-Includes: Enhancing Science and Engineering through Diversity
Tap the innovation inherent in America's diversity to strengthen the U.S. science and engineering enterprise.

Mid-scale Research Infrastructure
Develop a nimble process to fund crucial scientific infrastructure projects that fall between traditional funding boundaries.

NSF 2050
Cultivate bold, forward-thinking research that transcends traditional approaches and pushes the frontiers of discovery and innovation for years to come.

Harnessing the Data Revolution

Active working group developing the next steps

THEMES:

1. Science domains – link existing data

2. Systems, algorithms –transparent data sci

3. Theoretical foundations – Data Sci

4. Cyberinfrastructure –sci driven

5. Education, workforce, outreach

Recent/Current solicitations

Training-based Workforce Development for Advanced Cyberinfrastructure (**CyberTraining**) (18-516, closed February)

"…developing innovative, scalable training and education programs to address the emerging needs and unresolved bottlenecks in scientific and engineering research workforce development, from the postsecondary level to active researchers"

Cyberinfrastructure for Sustained Scientific Innovation (**CSSI**) Data and Software: Elements and Frameworks (18-531, closed April): *formerly DIBBS and SI2*

This year was focused on data/software "Elements" and "Framework"

Partnerships between Science and Engineering Fields and the NSF TRIPODS (Transdisciplinary Research in Principles of Data Science) Institutes (**TRIPODS + X**) (18-542, closed May)

"…researchers in science & engineering domains and foundational data scientists…working in concert with an existing TRIPOD organization"

Convergence

NSF 18-058: Dear Colleague Letter: Growing Convergence Research

Prospectus Deadlines
May 1, 2018
Oct 15, 2018

Must include a convergent approach = Must be essential to bring together substantially different science and engineering disciplines

Integration of knowledge, tools, and models of thinking

Team should be ready to engage in convergent research

Must involve next generation convergence researchers
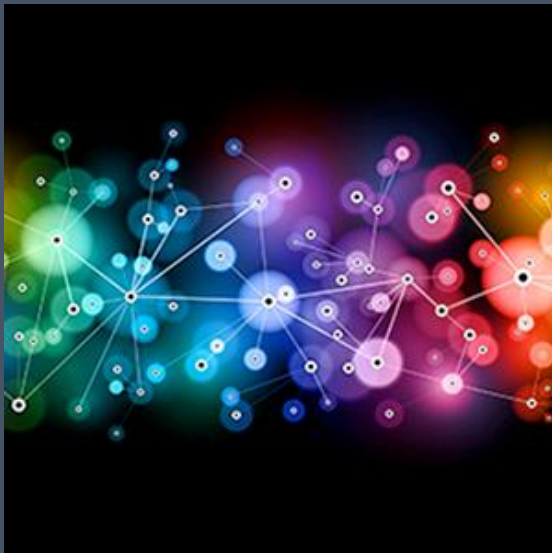
Understanding the Rules of Life

NSF 18-031 **Dear Colleague Letter: Rules of Life (RoL): Forecasting and Emergence in Living Systems (FELS)**

Prospectus Deadline:
FY18 passed

THEMES:

To identify rules for phenomena that cross spatial or organizational levels (from the molecular and sub-cellular to organisms, populations, communities, clades, and biomes)

and/or temporal scales (e.g., from macromolecular folding to development to evolutionary processes across all of life).

Conferences
EAGERs – across programs
RAISES – across directorates

Navigating the New Arctic

NSF 18-048 **Dear Colleague Letter: Stimulating Research Related to Navigating the New Arctic (NNA)**

Prospectus Deadlines:
Varies – see sites
Deadline for FY18funding passed

THEMES:
Establish observation research sites, platforms or networks of sites

Study change in biogeochemical, geophysical, ecological and societal processes

Feedbacks between design and engineering of urban and rural infrastructure and changes in natural ecosystems

Advance STEM education through Arctic research, especially in local communitieis

NSF Includes

NSF 18-529 **Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science**

Deadline: April 2, 2019

THEMES: Focus on Alliances

Broadening participation in STEM

Partnerships and Networks of collaboration are key

Goals and Metrics – throughout life of alliances

Leadership and Communication amongst partners

Expansion, Sustainability and Scale

Broadening Participation

HBCU – UP (18-522) – in EHR

> Many upcoming due dates
>
> Faculty at HBCUs, STEM ed at HBCUs, Institution-wide programs, HUBs

TCUP (18-546) – in EHR

> Many upcoming due dates
>
> Faculty at TCUs, STEM ed at TCUs, Institution-wide programs, Across Tribes, Multi-institution internship (discipline specific)

iUSE: Hispanic Serving Institutions (18-524) – in EHR

> Support STEM ed, retention, faculty at HSIs, research partnerships w/ other institutions,

RESOURCES

NSF.GOV DIRECTORATE AND DIVISION WEBPAGES

NSF.GOV RECENT FUNDING

RESOURCES

https://www.nsf.gov/publications/obtain.jsp

TAKE HOME

Be the leaders that we are meant to be

    Who knows the potential better than us

Seek out new partners

    The best opportunity for innovation

Be Bold and Dream Big

    Think of the possibilities and go for it

Talk to your program officers

    We are here to help you!