Cyberinfrastructure Research, Learning and Workforce Development (LWD) Programs at NSF

Office of Advanced Cyberinfrastructure (OAC)
Computer and Information Science & Engineering (CISE)
National Science Foundation

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MUG Workshop, 2022
NSF Office of Advanced Cyberinfrastructure (OAC)

Foster a cyberinfrastructure ecosystem to transform science and engineering research... through Research CI and CI research

Rapid (disruptive) changes in S&E and CI landscapes → Cyberinfrastructure ecosystem must evolve!
Learning and Workforce Development: Communities of Concern

CI and the Missing/Invisible Millions

CI Contributors
Cyber Scientists
to develop new capabilities

CI Professionals
Professional Staff
to deploy & support new capabilities

CI Users
Area Scientists
to exploit new capabilities

OAC

NSF Workshop on Building the Research Innovation Workforce, Sept. 2020
https://www.rcac.purdue.edu/ciworkforce2020/report/
Learning and Workforce Development

**RESEARCH TRAINING AND WORKFORCE DEVELOPMENT**
- REU sites – NSF 22-601
- CyberTraining – NSF 22-574

**FACULTY EARLY CAREER RESEARCH**
- CRII – NSF 22-598
- CAREER – NSF 22-586

**RESEARCH AND DEVELOPMENT**
- OAC Core – NSF 21-616
- CSSI – NSF 21-617
CyberTraining Solicitation Goals

• **Long-term vision**: Computational and Data-driven Science for All scientists and engineers.
  • Prepare, nurture, and grow the scientific research workforce.

• Ensure broad adoption of CI tools, methods, and resources.

• Integrate CI and CDS&E skills into undergraduate and graduate curriculum.

• Build communities of CIPs and establish career paths for them.
  • Deeper incorporation of CIPs into the research enterprise.

• Broaden CI access and adoption by varied institutions, scientific communities, and underrepresented groups.

CI Professional Track

FUNDING
- Support for research CI professionals
- 2 FTEs per year per institution; 4 FTE total over all institutions in a project per year
- 5 years maximum
- NSF directorates involved: CISE, ENG, GEO, MPS, EHR, SBE

WHO IS A CIP?
- Deploy, manage, and support effective use of research CI
- Includes scientists, information technology professionals, and engineers who research and develop new CI capabilities, approaches, and methods
- Examples: CI system administrators, CI research staff, research software engineers, CI facilitators

IDEAL FOR PIs WHO ...
- Want to leverage CIPs for a variety of research projects
- Are prepared to train and mentor CIPs
- Will develop sustainable long-term career paths for CIPs
CyberTraining CIP Program Context

Diverse Communities

Fostering and nurturing...
RCN: CIP

CI professionals

Seek support
ACCESS

CI Users

CyberTraining CIP
RCN: CIP Networking

CIP Training and Career Paths

Research CI
Deploy, Support, & Maintain

ACCESS
Other CyberTraining Tracks

- **Pilot**: Exploratory projects, $300K over 2 years.
- Small implementation: $500K over 4 years.
- Medium implementation: $1M over 4 years.

1. Identify challenges in research workforce development
2. (a) Broaden use of CI resources, (b) CI skills training, (c) build a community of CI professionals
3. Scalability and sustainability of the training program
4. Recruitment and evaluation plans
5. Collective impact strategy
6. Fostering a suitable community
7. Integrate with Computational Science Support Network

- **Pilot** (one option in #2)
- Small
- Medium
- CI Professional
Faculty Early Career Development Program (CAREER)

• Supports junior faculty as a teacher-scholar
  • Outstanding research, education, and integration of education and research
  • Future leaders in their research fields and organizations
  • Presidential early career awards (PECASE)

• Minimum $400K/5 years in CISE
  • ~$500K typical in CISE

More guidance can be found at https://www.nsf.gov/pubs/2022/nsf22586/nsf22586.htm
CAREER GUIDANCE

• OAC encourages proposals that are either
  • of primary interest to OAC, or
  • secondary interest to OAC (add OAC on cover page)
  • OAC contact: Juan Jenny Li at jjli@nsf.gov

• OAC interests
  • Relevance to cyberinfrastructure
  • Application of cyberinfrastructure to science need evidence of support from the target science domain

• CAREER resources
  • Program page: https://www.nsf.gov/career
  • CISE CAREER workshops: https://www.nsf.gov/cise/workshops/career/
CISE Research Initiation Initiative (CRII)

- Independent research for faculty or research scientists or educator in their first three years
  - Non-R1 institutions or non-profit, non-academic institutions
  - No more than 6 years after receipt of PhD (for 2022 only)
  - See solicitation for other requirements and recommendations

- OAC research focus
  - Advanced CI research: translational, use-inspired, multi-disciplinary, end-to-end
  - Computational and data intensive scientists in addition to computer scientists

- Award up to $175K/ 2 years

CRlI GUIDANCE

• Start a research program and career
  • PI need not have significant prior research results or maturity
  • Start a path toward research independence
  • Develop collaborations across research disciplines
  • Undertake exploratory investigations
  • Acquire and test preliminary data

• Broadens the community of researchers
  • Reach underserved communities, under-represented groups, and non-traditional institutions
Cyberinfrastructure for Sustained Scientific Innovations (CSSI)

• Supports the development and deployment of robust, reliable and sustainable data and software cyberinfrastructure

• Brings innovative capabilities towards sustained scientific innovation and discovery

• Provides a cross-directorate opportunity to advance common approaches to sustain and innovate research cyberinfrastructures

• Follows accepted data management and software development practices

CSSI GUIDING PRINCIPLES

PROJECT MOTIVATION AND IMPACT
- Science-driven
- Innovation

CI PLANS
- Project plans; system and process architecture
- Building on existing, recognized capabilities
- Close collaborations among stakeholders

MEASURABLE OUTCOMES
- Deliverables
- Sustained and sustainable impacts
- Metrics
## CSSI Award Classes

<table>
<thead>
<tr>
<th>Project Class</th>
<th>Description</th>
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<tbody>
<tr>
<td>Elements</td>
<td>Small groups that will create and deploy robust capabilities for which there is a demonstrated need that will advance one or more significant areas of S&amp;E. (Awards &lt;= $600K, up to 3 years)</td>
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<tr>
<td>Framework Implementations</td>
<td>Larger, interdisciplinary teams organized around the development and application of common infrastructure aimed at solving common research problems faced by NSF researchers in one or more areas of S&amp;E, resulting in a sustainable community framework serving a diverse community or communities. (Awards between $600K - $5 Million, between 3-5 years)</td>
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<tr>
<td>Transition to Sustainability</td>
<td>Groups who will execute a well-defined sustainability plan for existing CI with demonstrated impact in one or more areas of S&amp;E supported by NSF. The sustainability plan should enable new avenues of support for the long-term sustained impact of the CI. (Awards &lt;= $1 Million, up to 2 years)</td>
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OAC Core Goals

• Advanced Cyberinfrastructure (CI) research to impact the future capabilities of research CI
  • New knowledge in design, development, deployment, experimentation, and application of CI to enable new frontiers of discovery and innovation

• Research career paths of cyber-scientists/engineers
  • Broaden participation from underrepresented groups

Characteristics of OAC-Core

• Translational research
  • Design, development, deployment, experimentation, and application of CI
  • Spanning design to practice

• Other common characteristics
  • Multi-disciplinary
  • Extreme-scale
  • Science and engineering drivers
  • End-to-end solution or deployable as robust CI

Example Research Areas

• Architecture and middleware for extreme-scale systems
  • Design, benchmarking, and analysis
  • Storage, networks, and I/O
  • Resource monitoring, fault tolerance, and cybersecurity

• Scalable algorithms and applications
  • Numerical and high-performance scientific computing methods
  • Data, software, and visualization
  • Modeling and simulation

• Advanced cyberinfrastructure ecosystem
  • Programming languages, libraries, and environments
  • Tools
  • Sociotechnical aspects
Other LWD Opportunities within OAC

• INTERN DCL
  • Supplements for non-academic graduate student research (~$50K per student)

• EAGER (up to $300K), workshops (up to $50K), RCN
  • Seed exploration of research, training and education, broadening participation
  • Students, post-docs, faculty, CI professionals

• Student travel grants
  • Discuss with OAC program officers

• To subscribe to the OAC mailing list, email: OAC-ANNOUNCE-subscribe-request@listserv.nsf.gov
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