Submission in Response to NSF CI 2030 Request for Information

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Research Domain, discipline, and sub-discipline

Cyber Infrastructure, Bioinformatics, Genetics

Title of Submission

Cyberinfrastructure knowledge and support is important at all levels

Abstract (maximum ~200 words).

Technology continues to move at speeds that daunt traditional scientists. The nation needs to focus on supporting technology by supporting those who use it. Continued emphasis on the human connection will embolden today's students to become tomorrow's researchers, needing across-discipline approaches to conducting science. The people responsible for connecting researchers with computational technology as well as supporting the technology are those who are the most influential, but also the most forgotten when it comes to funding support.

Question 1 Research Challenge(s) (maximum ~1200 words): Describe current or emerging science or engineering research challenge(s), providing context in terms of recent research activities and standing questions in the field.

The field of "omics" research has boomed in recent years. The price for sequencing a whole genome has dropped to values that allow anyone to sequence anything they wish. With this technology comes large amounts of data and very little training. My career started as a plant biologist and quickly turned to bioinformatics during my post-doc. Since that initial position, I have brought bioinformatics to several labs both to those that employed me and also to others on campus. However, my training was never formal. Despite some schools shifting towards bioinformatics majors and degrees, well trained scientists are difficult to find.

With this influx of large datasets, also comes the problem of how and where to analyze the data. Many scientists are not aware of the vast array of free supercomputing resources that are available to them. Until taking my position as Cyber Infrastructure Architect at NMSU, a position generously funded through an NSF CC*Engineer grant, I had not been aware of all of the resources available. It is now my job and my joy to advertise and expand the resources available to researchers both on campus and on neighboring campuses.

Researchers currently have simple needs. They need access to computational systems and they need the knowledge to use those systems to their fullest capacity. While these needs are simple, for a lone researcher they are daunting. My group reaches out to the community to teach them the skills they need, advertises other training and learning opportunities, and connects researchers with computational power. We offer classroom and one-on-one learning opportunities. We are actively trying to remove the walls that have kept some researchers from exploring the computational aspect of their discipline.

Current cyberinfrastructure needs on campuses are high and vast, but can be overcome if NSF continues to support the various dimensions of hardware and humans.

Question 2 Cyberinfrastructure Needed to Address the Research Challenge(s) (maximum ~1200 words): Describe any limitations or absence of existing cyberinfrastructure, and/or specific technical advancements in cyberinfrastructure (e.g. advanced computing, data infrastructure, software infrastructure, applications, networking, cybersecurity), that must be addressed to accomplish the identified research challenge(s).

Suggestion: Expand support for those who wish to change the focus of their labs to include more informatics. Training of these individuals will result in an increase in cyberinfrastructure-aware and -capable researchers, benefiting all aspects of science. Changing the focus of a lab is daunting and requires time and resources; all of these pains are soothed by grant funding during the transition.
Suggestion: Current cyberinfrastructure needs on campuses are high and vast, but can be overcome if NSF continues to support the various dimensions of hardware and humans. Supporting growth or the establishment of centralized computational resources allows researchers to have a “stepping stone” to national resources. It allows them a “safe” space to learn about high performance/throughput computing as it alleviates the worry of removing computational time from “real” computation because a novice is using the hardware to learn. Additionally, continued support of the Cyberinfrastructure Architect/Engineer position provides an invaluable resource to a campus or community. This position unites researchers with campus and national infrastructure, providing resources and removing boundaries, both real and imagined.
Suggestion: Continue to focus on the training of those fluent in cyberinfrastructure, both in STEM and the underlying IT. Without those who know how to administer to the hardware (be it computers, networks, etc), our national community is as lost as if no one knows how to take advantage of the hardware. This training needs to start early (high school or younger) and continue through to those who are full professors.
Suggestion: Although today’s grants include information about local resources and require explanations for the purchasing of new technology (computers), a heavier emphasis on technology complementing and growing existing systems should be emphasized. Coming from the research world, I understand that a one-size approach doesn’t work; there should be a way for researchers to opt-out of contributing to campus infrastructure (ie purchase their own machine). For many, however, contributing to or sharing existing resources would be best. It may be beneficial to require a letter of support from someone within the university that supports the lack of a complementary system on campus. Many researchers don’t know what resources their neighbor has. Encouraging communication and sharing of resources will allow funding to be channeled towards research instead of duplicating resources.

Consent Statement

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