



NATIONAL SCIENCE FOUNDATION

NSF IDEAS FOR  
FUTURE  
INVESTMENT

**2016 Large Facilities Workshop – May 25, 2016**  
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# NSF Ideas for Future Investment

## RESEARCH IDEAS

- Harnessing Data for 21<sup>st</sup> Century Science and Engineering
- Shaping the New Human – Technology Frontier
- Understanding the Rules of Life: Predicting Phenotype
- The Quantum Leap: Leading the Next Quantum Revolution
- Navigating the New Arctic
- Windows on the Universe: The Era of Multi-messenger Astrophysics

## PROCESS IDEAS

- Growing Convergent Research at NSF
- Mid-scale Research Infrastructure
- NSF 2050



# Harnessing Data for 21<sup>st</sup> Century Science and Engineering



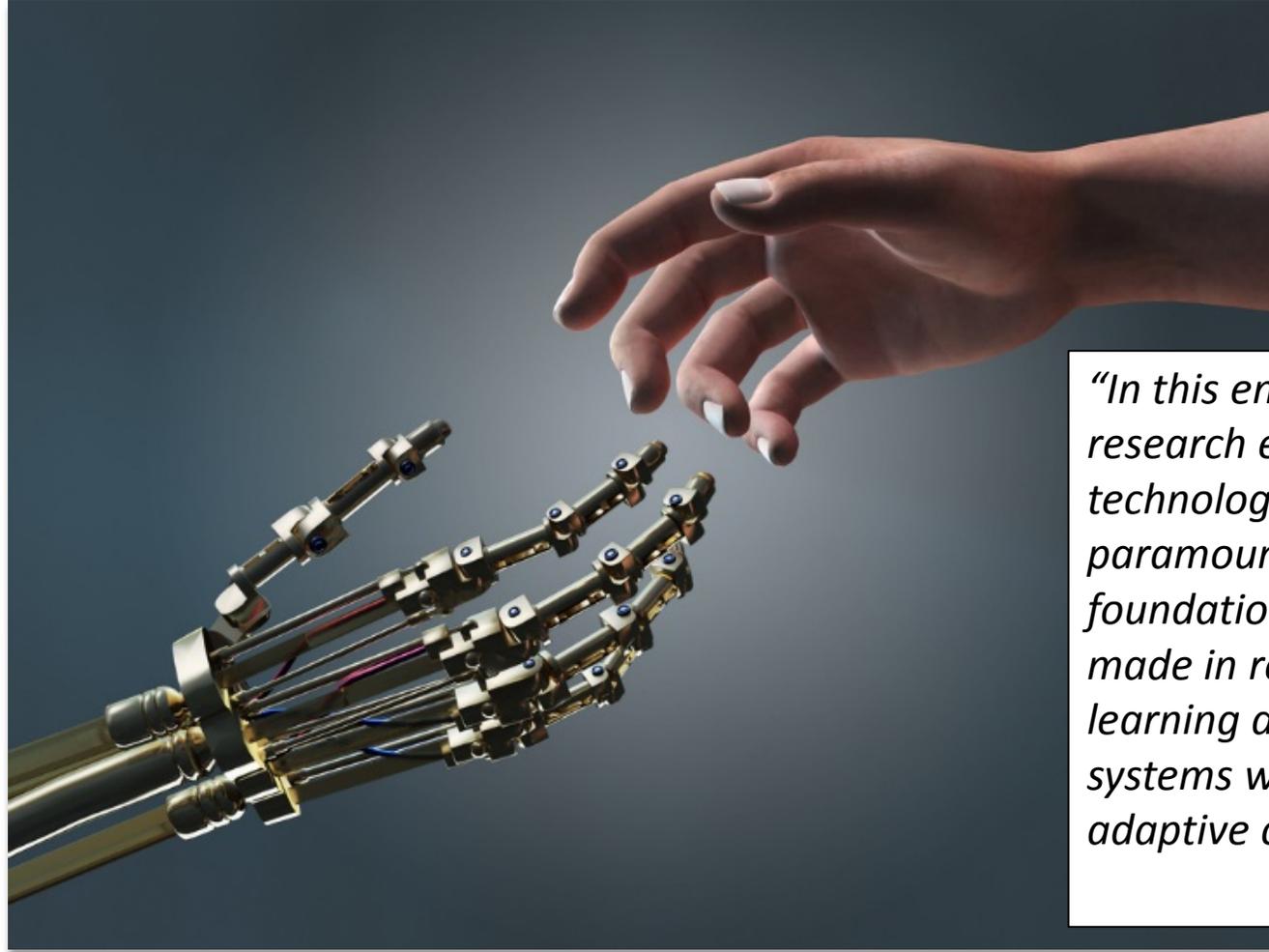
*"...develop a national-scale initiative aimed at fundamental data science research, research data cyberinfrastructure, and the development of a 21st century data-capable workforce."*

*"The cyberinfrastructure ecosystem must be robust, open, and science-driven, and capable of mining data delivered by our large-scale facilities."*

Dr. Córdoba



# Shaping the New Human — Technology Frontier



*“In this emerging techno-world, research examining this human-technology frontier becomes paramount. We would build on foundational investments we’ve made in research in machine learning and efficient engineered systems with cognitive and adaptive capabilities.”*

Dr. Córdova



# Understanding the Rules of Life

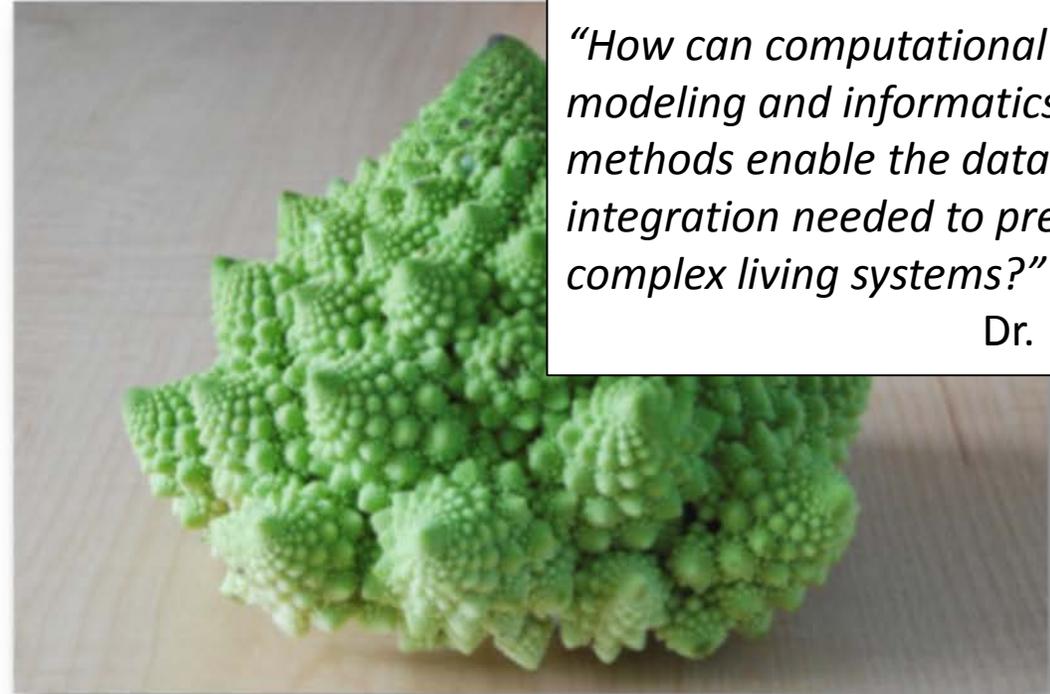
## Predicting Phenotype

*“To understand the “rules of life” will require convergence of research across biology, computer science, mathematics, the physical sciences, behavioral sciences and engineering.”*



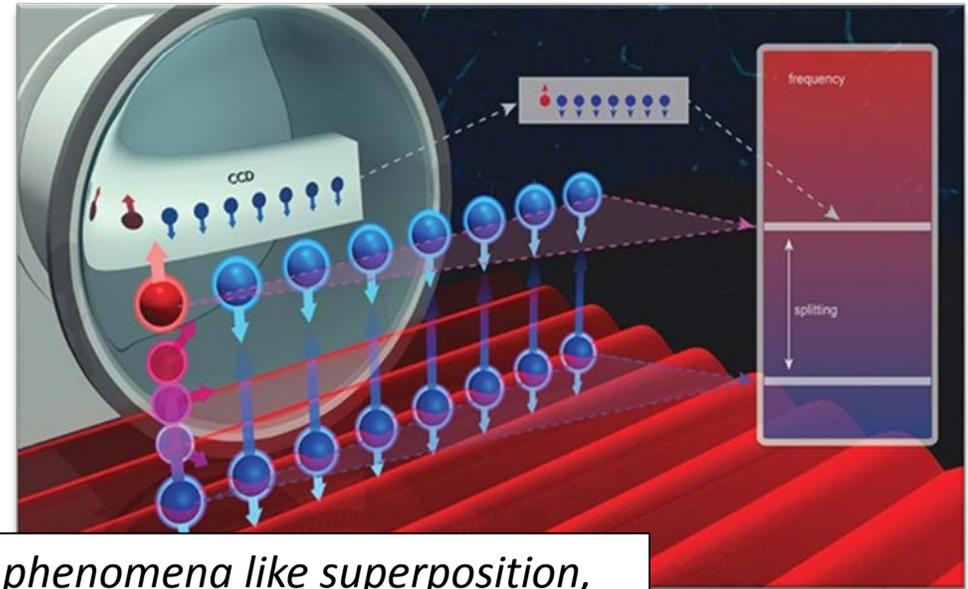
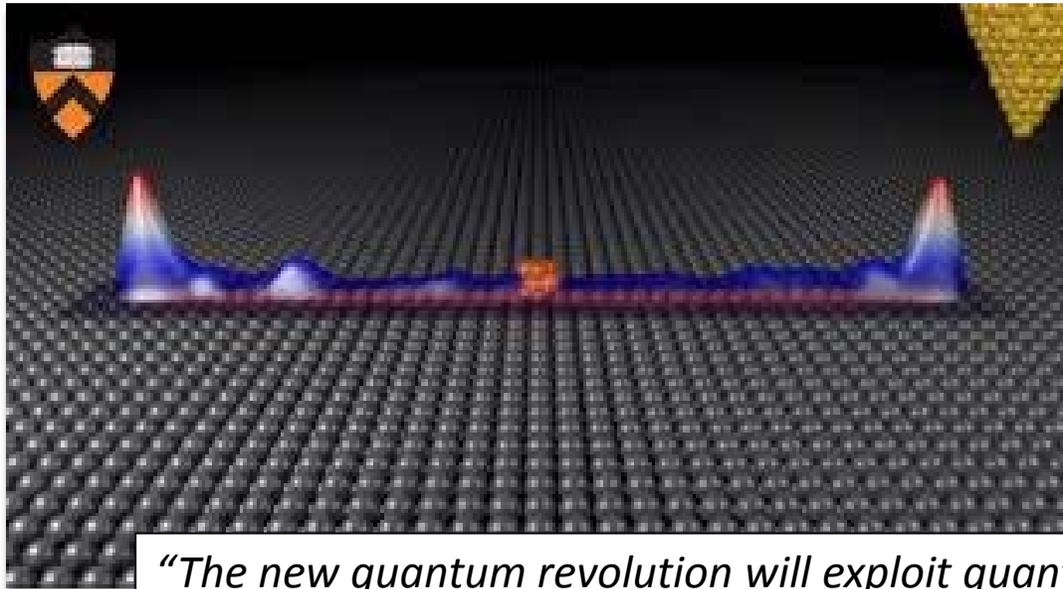
*“How can computational modeling and informatics methods enable the data integration needed to predict complex living systems?”*

Dr. Córdova



# The Quantum Leap

## Leading the Next Quantum Revolution



*“The new quantum revolution will exploit quantum phenomena like superposition, entanglement, and squeezing to enable the next wave of precision sensors, and more efficient computation, simulation, and communication. NSF would invest in research that addresses the manipulation of quantum states, and the control of material-light interactions, involving physicists, mathematicians and engineers.”*

Dr. Córdova



# Navigating the New Arctic

*“NSF would establish an observing network of mobile and fixed platforms and tools across the Arctic to document biological, physical and social changes, and invest further in theory, modeling and simulation of this changing ecosystem and its broader effects on the planet.”*

Dr. Córdova



# Windows on the Universe

## The Era of Multi-messenger Astrophysics



*“We have come to a special moment in understanding our universe: for the first time we can explore its mysteries in the electro-magnetic regime, the particle regime, and the gravitational wave regime. NSF is the agency that uniquely can do this with ground based observatories...”*

*“With so much potential for discovery, we must increase our investment in the large number of potential U.S. users, in exploiting the big data that these observatories are producing, and in increasing the sensitivity of these and other ground-based facilities.”*



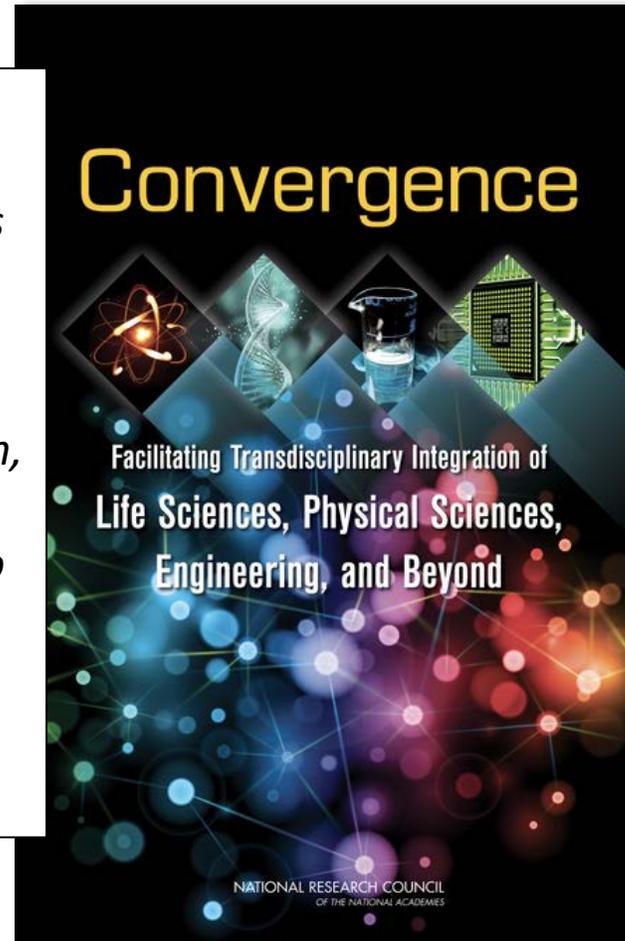
Dr. Córdoba

# Growing Convergent Research at NSF

*“Convergence is a relatively new way of thinking about bringing people with their disciplinary knowledge together to address grand challenges.”*

*“The convergent approach would frame challenging research questions at inception, and foster the collaborations needed for successful inquiry. NSF is well-positioned to foster convergence because of its deep connections to all fields of science and engineering.”*

Dr. Córdova



# Mid-scale Research Infrastructure



MRI

MREFC

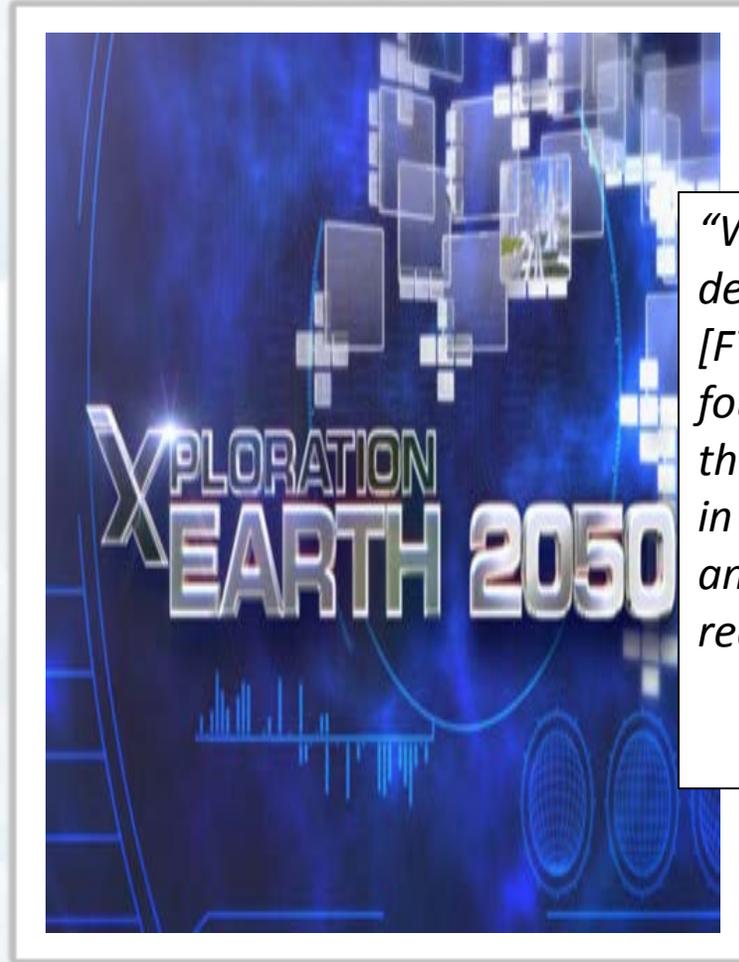
*“You are now familiar...with the limitation of our MREFC process with respect to funding opportunities that cost between several M\$ and 100 M\$.”*

*“Lowering the threshold for MREFC expenditures, with appropriate modification of processes, would increase the flexibility for excellent science to be done across the agency.”*

Dr. Córdova



# NSF 2050



*“With this initiative NSF would dedicate a special fund now [FY18?], to invest in bold foundational research questions that are large in scope, innovative in character, originate outside of any particular directorate, and require a long-term commitment.”*

Dr. Córdoba



# NAPA Study Implementation

- Study commissioned by NSF in early 2015
- Evaluate NSF's use of Cooperative Agreements for Large Scale Research Infrastructure Investments
- Final Report received December 17, 2015
- Implementation now underway

A Report by a Panel of the  
**NATIONAL ACADEMY OF PUBLIC ADMINISTRATION**  
for the National Science Foundation



*National Science Foundation:  
Use of Cooperative Agreements to Support Large Scale  
Investment in Research*



December 2015  
National Academy of  
Public Administration \*



# Business Practices

Cost Analysis, Cost Estimating, Contingency, and Management Fee

- Exceptions to recommendations from pre-award cost analyses reviewed by the Large Facilities Office and forwarded to the Chief Financial Officer for final determination (3.1) – **COMPLETE (Internal NSF Standard Operating Guidance)**
- Clarify the Large Facilities Manual (LFM) requiring Recipients to follow the guidance in the GAO Cost Estimating and Schedule Assessment Guides when developing cost estimates (4.2) – **COMPLETE (2016 Revision to the LFM: “*should*” to “*shall*”)**
- Evaluate the impacts of eliminating management fee (4.3) – **UNDER CONSIDERATION/IN PROGRESS**



# Business Practices

Cost Analysis, Cost Estimating, Contingency, and Management Fee

- Retain control of a portion of contingency funds (4.1) - **COMPLETE (Internal NSF Standard Operating Guidance)**
  - Internal documentation of decision process which is based on risks (Recipient & Project)
  - Documentation of NSF-approved contingency budget and allocations to the Recipient in the award notice and the cooperative support agreement (CSA).
  - **No change to Recipient processes** in Project Execution Plan (CCB, NSF approval thresholds, etc.)
  - In compliance with the Uniform Guidance (“Known-Unknowns”, Part of award, Recipient manages)
  - Recipient to manage/report against both the total contingency budget and the allocations to-date.

## “Contingency” is NOT a dirty word!

However...Beware of the term “Reserve” (drawing down and holding funds “just in case”) since this is **NOT allowed** under the Uniform Guidance. NSF itself does not have a mechanism for (nor does it fund) “Management Reserve” (See LFM).



# Project management knowledge and skills

- Identify NSF project management skill requirements by role and develop/implement required project management training/workshops (6.7) – **IN PROGRESS**
- Require Recipient project managers be certified in project management and specify the minimum experience thresholds in the cooperative agreement (6.8) – **UNDER CONSIDERATION/IN PROGRESS (Breakout Session)**
- Formally establish “communities of practice” to share best practices and implement a “lessons learned” requirement for all MREFC projects (6.9) – **IN PROGRESS (Breakout Session)**



# Planning, oversight & accountability

## Roles and responsibilities

- Establish and publish a joint NSF-NSB duties and responsibilities document(6.1) – **IN PROGRESS**
- (1) Authorize LFO to hire two additional FTEs; and (2) Revise MREFC Panel charter changing the LFO Head status to a full-voting member (6.5) – **COMPLETE**
- Re-scope the MREFC Panel to include review of projects in the development and construction stages (6.2) – **IN PROGRESS**



# Planning, oversight & accountability

## Roles and responsibilities

- Identify/codify project management and financial management expertise and explicitly add the requirements to the criteria for selection of external reviewers (6.3) – **IN PROGRESS**
- Establish a FACA advisory committee for the Director to use as a sounding board for objective insight on large research projects (6.4) – **IN PROGRESS**
- Evaluate development/uses the NSF Facility Plan and how it aligns with the agency's strategic planning processes (6.6) – **IN PROGRESS**



# Large Facilities Manual (LFM)

- Current version dated June 2015
- Annual Review and Up-date Cycle
- 2016 Revision out for public comment:

Federal Register: <https://www.gpo.gov/fdsys/pkg/FR-2016-05-09/pdf/2016-10793.pdf>

LFO Website: [https://www.nsf.gov/bfa/lfo/lfo\\_documents.jsp](https://www.nsf.gov/bfa/lfo/lfo_documents.jsp)

## **NSF Documentation Related to Large Facilities:**

- ✓ Proposal and Awards Policy and Procedures Guide (PAPPG)
- ✓ Large Facilities Manual (LFM)
- ✓ Business Systems Review (BSR) Guide
- ✓ NSF Internal Standard Operating Guidance – “Consult with PO or G&AO”



# New Policies and Procedures

- Cost Analysis – New Section 4.2 of the LFM (Cost Model, BoE & Proposal Format – **Breakout Session**)
- Incurred Cost Audit Tool (**Breakout Session**)
- Obligations and Allocations of Budget Contingency (NAPA)
  - No change in Recipient practices per the LFM
  - NSF holding up to 100% until need justified (See 2016 revision of LFM)
- Management Fee > Under Review
  - Policy published in June 2015 LFM still in effect



QUESTIONS & DISCUSSION?

