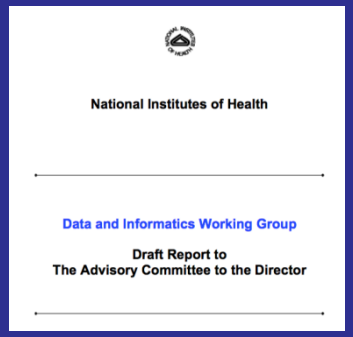
Data Science at the NIH

Philip E. Bourne Ph.D.
Associate Director for Data Science
National Institutes of Health

Data Science Timeline


National Institutes of Health

Data and Informatics Working Group

Draft Report to
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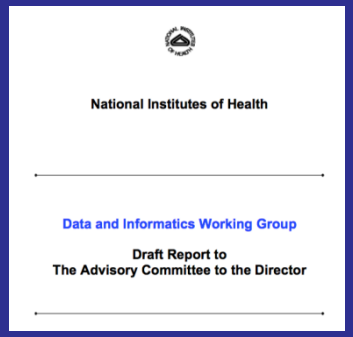
6/12

- Findings:
  - Sharing data & software through catalogs
  - Support methods and applications development
  - Need more training
  - Need campus-wide IT strategy
  - Hire CSIO
  - Continued support throughout the lifecycle

Data Science Timeline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NIH Big Data to Knowledge (BD2K)

6/12 2/14

- U54 Centers of Excellence - under review
- U54 BD2K-LINCS– under review
- U24 Data Discovery Index– under review
- R01, R41, R42, R43, R44, U01 software and analysis methods grants – on-going
- T32, T15, K01, R25 and R26 training awards – under review

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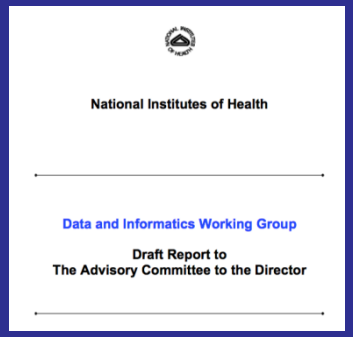
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ADDS Activities Thus Far: Talked to Stakeholders (Examples)

- 20/27 IC Directors
- Agencies
  - NSF
  - DOE
  - DARPA
  - NIST
- Government
  - OSTP
  - HHS HDI
  - ONC
- Private sector
  - Phrma
  - Google
  - Amazon
- Organizations
  - PCORI
  - CCC
  - CATS
  - FASEB
  - Biophysical Society
  - Sloan Foundation
  - Moore Foundation

ADDS Activities Thus Far: Some Initial Observations

- Bad News
  - We do not yet have a data sustainability plan
  - OSTP have defined the *why* but not the *how*
  - We do not know how all the data we currently have are used
  - We can't estimate future supply and demand
  - Hence we have not projected the resources that will be required to store and analyze data in the future
- Good news
  - Genuine willingness to address the problem across IC's
  - Efficiencies can be achieved
  - BD2K is the beginnings of a plan
  - We are beginning to quantify the issues
  - We have some of the best data scientists in the world to work on the problems

Based on this data gathering we have defined 5 thematic areas to pursue towards a vision…

Associate Director for Data Science

Scientific Data Council

External Advisory Board

Programmatic Theme

Sustainability* | Education* | Innovation* | Process | Collaboration

* Hires made

Deliverable

Commons | Training Center | BD2K | Modified Review | Communication

Example Features

- Cloud – Data & Compute
- Search
- Security
- Reproducibility Standards
- App Store

- Coordinate
- Hands-on
- Syllabus
- MOOCs

- Community
- Centers
- Training Grants
- Catalogs
- Standards
- Analysis

- Data Resource Support
- Metrics
- Best Practices
- Evaluation
- Portfolio Analysis

- IC's
- Researchers
- Federal Agencies
- International Partners
- Computer Scientists

The Biomedical Research Digital Enterprise

Some Goals of the Digital Enterprise

- Cost savings through sharing of best practices associated with longitudinal clinical studies
- Collaboration through identification of collaborators at the point of data collection not publication
- Improved reproducibility through data and methods sharing
- Integration of data types and data and literature to accelerate discovery
- Availability of clinical data while respecting patient privacy

On Reproducibility Specifically

- Much of the research life cycle is now digital - encourage the reliability, accessibility, findability, usability of data, methods, narrative, publications etc.
- How?
  - ✓ Data sharing plans
  - ✓ Standards frameworks
  - ✓ Data and software catalogs
  - ✓ PubMedCentral

  - ? The Commons – PMC for the complete lifecycle
  - ? Machine readable data sharing plans
  - ? Small funding to communities
  - ? Support for training and best practices in eScholarship

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The Biomedical Research Digital Enterprise

The Commons (Vivien Bonnazi & George Komatsoulis (NCBI))

- Public/private partnership
- Work with IC's, NCBI and CIT to identify and run pilots – cloud, HPC centers
- Port DbGAP to the cloud
- ? Experiment with new funding strategies
- Evaluate

Sustainability and Sharing: The Commons

Commons == Extramural NCBI == Research Object Sandbox == Collaborative Environment

Data

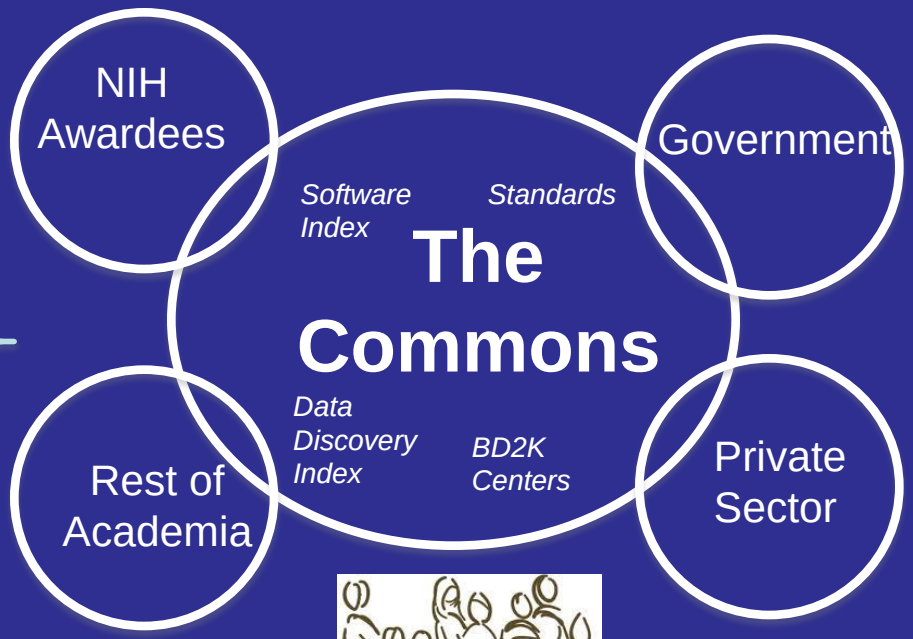
The Long Tail

Core Facilities/HS Centers

Clinical /Patient

The Why:
Data Sharing Plans

The How:



Cloud, Research Objects, Business Models

The End Game:

Scientific Discovery

Knowledge

Usability

Quality

Security/ Privacy

Metrics/ Standards

Sustainable Storage

What Does the Commons Enable?

- Dropbox like storage
- The opportunity to apply quality metrics
- Bring compute to the data
- A place to collaborate
- A place to discover

http://100plus.com/wp-content/uploads/Data-Commons-3-1024x825.png

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The Biomedical Research Digital Enterprise

Training (Michelle Dunn)

- Training Goals:
  - Develop a sufficient cadre of researchers skilled in the science of Big Data
  - Elevate general competencies in data usage and analysis across the biomedical research workforce
  - Combat the Google bus
- How:
  - Traditional training grants
  - Work with IC's on a needs assessment
  - Work with institutions on raising awareness
  - Training center(s)?

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BD2K Innovation (Jennie Larkin and Mark Guyer)

- ***Data Discovery Index*** Coordination Consortium (U24) (*under review*)
- ***Metadata standards*** (under development)
- ***Targeted Software Development***

  Development of Software and Analysis Methods for Biomedical Big Data in Targeted Areas of High Need (U01)

  - RFA-HG-14-020
  - Application receipt date June 20, 2014
  - Topics: data compression/reduction, visualization, provenance, or wrangling.
  - Contact: Jennifer Couch (NCI) and Dave Miller (NCI)

BD2K Innovation (Jennie Larkin and Mark Guyer)

- ***BISTI PARs***
  - BISTI: *Biomedical Information Science and Technology Initiative*
  - Joint BISTI-BD2K effort
  - R01s and SBIRs
  - Contacts: Peter Lyster (NIGMS) and Jennifer Couch (NCI)
- **Workshops:**
  - Software Index (Last week)
    - Need to be able to find and cite software, as well as data, to support reproducible science.
  - Cloud Computing (Summer/Fall 2014)
    - Biomedical big data are becoming too large to be analyzed on traditional localized computing systems.
  - Contact: Vivien Bonazzi (NHGRI)

BD2K Innovation (Jennie Larkin and Mark Guyer)

- **FY14**
  - Investigator-initiated Centers of Excellence for Big Data Computing in the Biomedical Sciences (U54) RFA-HG-13-009 (*closed*)
  - BD2K-LINCS-Perturbation Data Coordination and Integration Center (DCIC) (U54) RFA-HG-14-001 (*closed*)

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The Biomedical Research Digital Enterprise

Process (All / OD /CSR)

- Goals:
  - Better data sharing e.g., genomic data sharing plan
  - Capture the best investigators
- How:
  - Machine readable data sharing plans?
  - Open review?
  - Micro funding?
  - Standing data committees to explore best practices?
  - Crowd sourcing?

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The Biomedical Research Digital Enterprise

Data Science Timeline FY15

Some Acknowledgements

- Eric Green & Mark Guyer (NHGRI)
- Jennie Larkin (NHLBI)
- Leigh Finnegan (NHGRI)
- Vivien Bonazzi (NHGRI)
- Michelle Dunn (NCI)
- Mike Huerta (NLM)
- David Lipman (NLM)
- Jim Ostell (NLM)
- Andrea Norris (CIT)
- Peter Lyster (NIGMS)
- All the over 100 folks on the BD2K team




NIH…

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Turning Discovery Into Health