Biomed21 June 26, 2017

BIOMEDICAL DATA TRANSLATOR - WHAT'S IT GOING TO TAKE?

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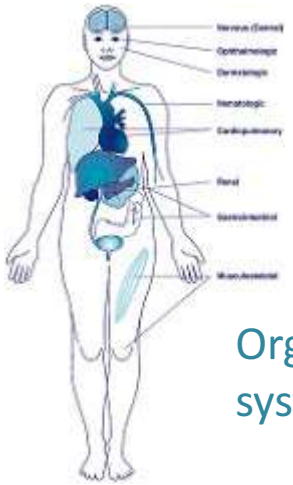
NCATS

NIH National Center for Advancing Translational Sciences

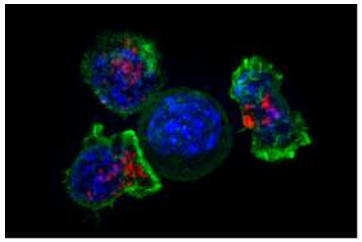
Data Types



Organ systems

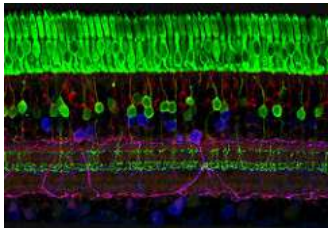
KEGG PATHWAY Database

Wiring diagrams of molecular interactions, reactions, and relations



Cells

Tissues

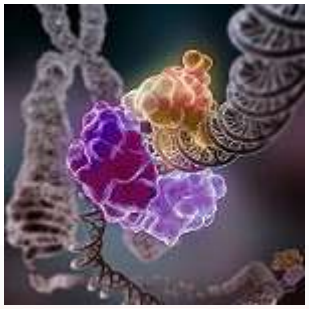


Health records

RCSB PDB PROTEIN DATA BANK

An Information Portal to 119137 Biological Macromolecular Structures

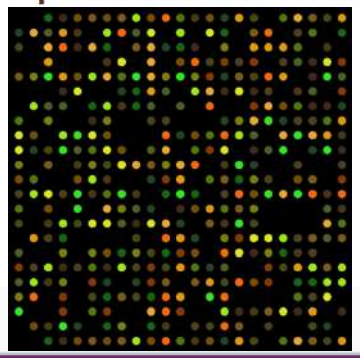
Gene mutations / modifiers



NCBI Resources How To

GEO Home | Documentation | Query & Browse

Gene Expression Omnibus



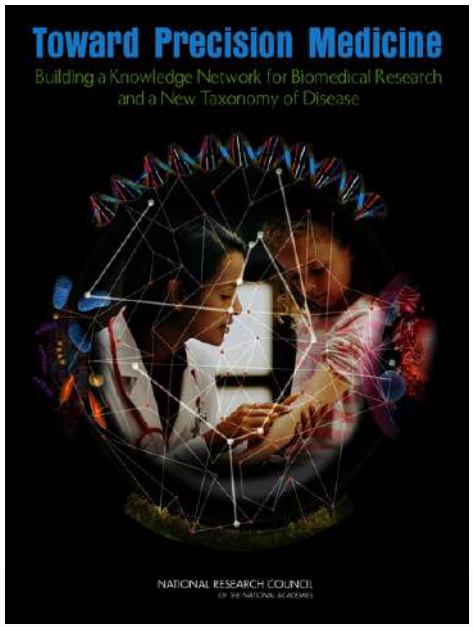
Clinical trial data

The Vision

- Accelerate biomedical translation by developing a biomedical “data translator” for the research community
- Integrate multiple types of existing data sources relevant to understanding pathophysiology
- Enable a user to enter the Translator from any data type and identify all cognates/connections in any other data type
- Open source and completely publicly available

The time is now

- Convergence of data science, engineering, and translational research expertise
  - Can we extract more from the data by not only gathering the data, but also enabling new ways to analyze those data
- Reclassify disease could lead to
  - new intervention opportunities
  - new “patient populations”
  - more success in clinical trial



Goals for the 2-year Program

- This is about assessing feasibility and design
  - what will be technically and scientifically possible
  - what will it cost
- Identify high-value data sources
- Develop a plan for integrating across a comprehensive variety of data types.
  - Identify integration barriers or data inclusion barriers
- Develop and test a plan for data quality control and data updates
- Execute demonstration project
- Define the requirements for a comprehensive Translator

NCATS Be Nimble, NCATS Be Quick: *Other Transactions* Are Different

- Solicitation
  - **On our website**, not in the NIH Guide for Grants and Contracts
- Eligibility
  - **Includes Individuals**, not just institutions/organizations
- Application content and submission includes
  - **Submit via e-mail**, not Grants.gov
- Evaluation
  - Objective review to assess science and complementarity
  - Included in-person presentations by invitees
- Implementation
  - Highly collaborative, staff-intensive
  - **Dynamic management**
    - Projects or components of projects can be expanded, modified, partnered or discontinued depending on the needs of the science

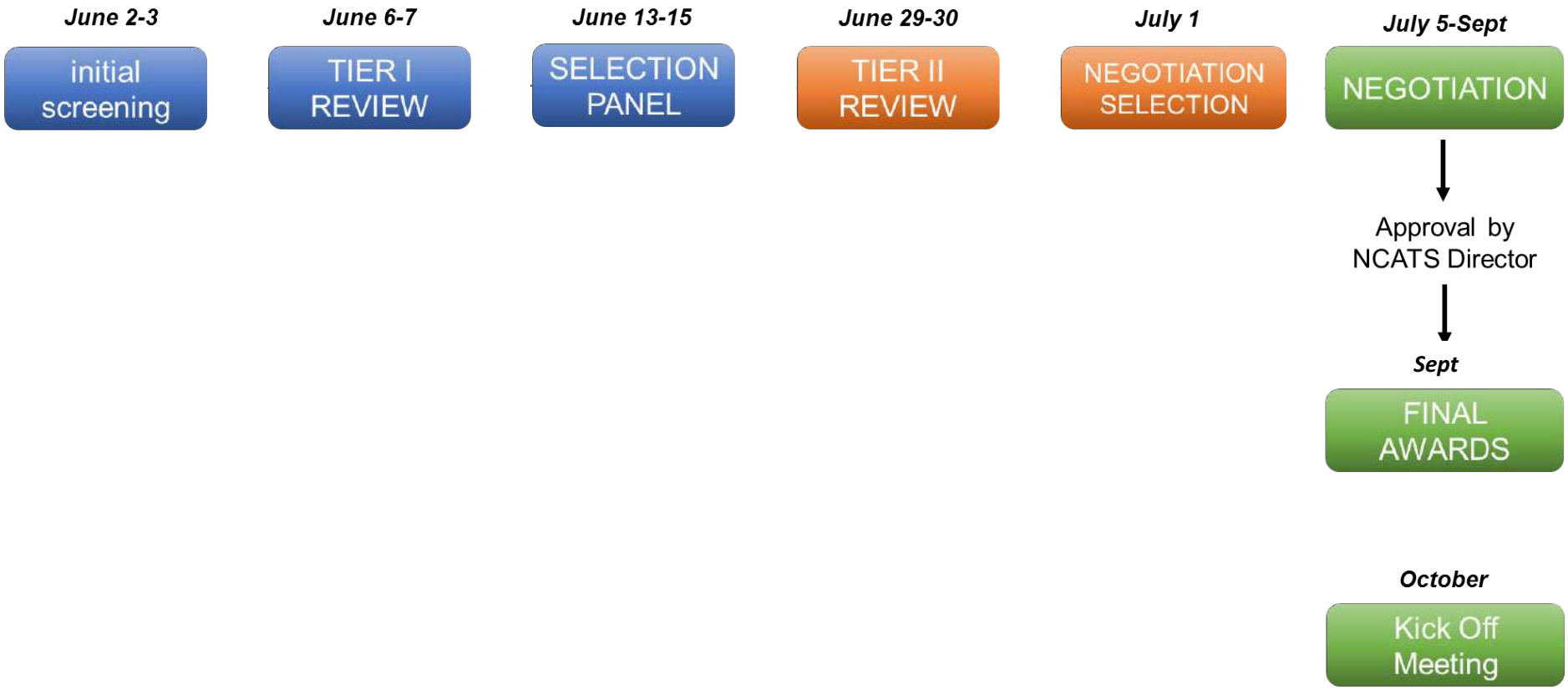
Timeline

Key Events	Dates	Action needed by applicants
Call for projects posted	April 29, 2016	
Project applications due	June 1, 2016	Email completed application by 5pm local time
Review of written applications completed	June 14, 2016	
Invitations to present in person sent out	June 15, 2016	
Responses to invitations	June 17, 2016	Accept or decline invitation to present
Presentation by invited candidates in Bethesda	June 29-30, 2016	*Candidates and team attend in person
Negotiations begin	July 2016	

*Presentation in person by at least one team member was required.
NCATS provided limited travel support.

Timeline

Funding opportunity published April 29
Applications due June 1



So far

- October - Awardees meet for first time, collaborations formed through a series of 1:1 speed meetings
- November- Milestones adjusted and finalized based on October discussions and funds are released
- January 2017 – Blackboard architecture proposed
- May - Hackathon to assess feasibility of the architecture

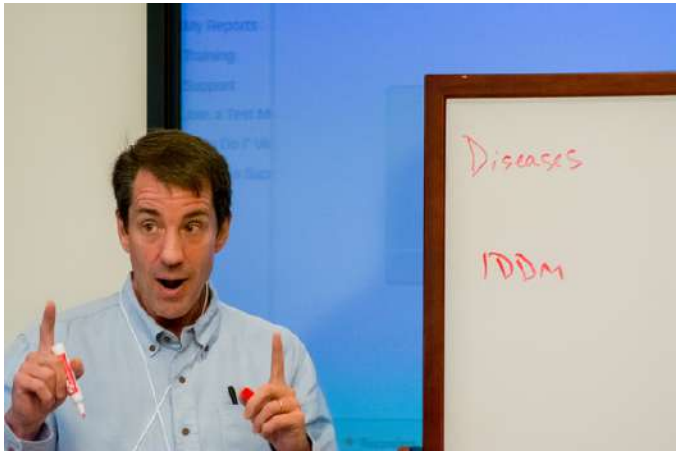
Feasibility assessment investigators

Organization	Investigator(s)
Broad Institute of MIT and Harvard	Paul Clemons, Ph.D. Joshua Bittker, Ph.D. Jason Flannick, Ph.D.
Columbia University	Nicholas Tatonetti, Ph.D. Chunhua Weng, Ph.D. George Hripcsak, M.D., M.S. Aris Floratos, Ph.D.
Institute for Systems Biology	Sui Huang, M.D., Ph.D. Gustavo Glusman, Ph.D.
Jackson Laboratory	Peter Robinson, Ph.D.
Johns Hopkins University	Christopher Chute, M.D., Dr.P.H. Ada Hamosh, M.D., M.P.H. Kim Doheny, Ph.D. Casey Overby, Ph.D.
Lawrence Berkeley National Laboratory	Christopher Mungall, Ph.D.
Maastricht University	Michel Dumontier, Ph.D.
Mayo Clinic	Hongfang Liu, Ph.D. Guoqian Jiang, M.D., Ph.D.

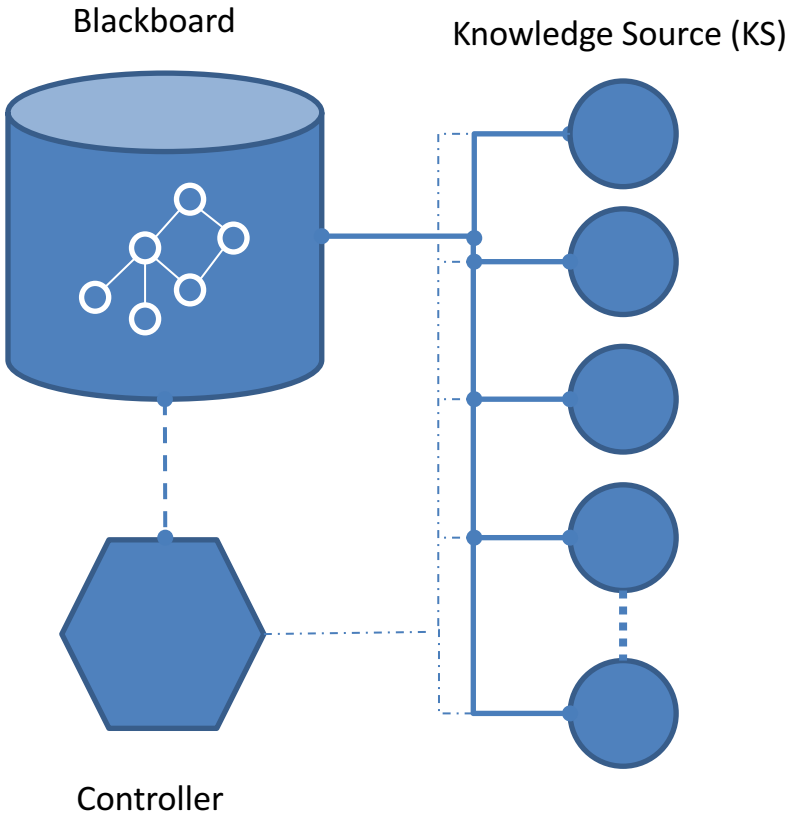
Feasibility assessment investigators

Organization	Investigator(s)
Oregon Health & Science University	Melissa Haendel, Ph.D. Shannon McWeeney, Ph.D. David Koeller, M.D. Maureen Hoatlin, Ph.D.
Scripps Research Institute	Andrew Su, Ph.D. Benjamin Good, Ph.D. Chunlei Wu, Ph.D.
St. Jude Children's Research Hospital	Jinghui Zhang, Ph.D.
University of Alabama	James Ciminio, M.D.
University of California, San Diego	Trey Ideker, Ph.D.
University of Montreal	Michael Tyers, Ph.D.
University of North Carolina at Chapel Hill	Stanley Ahalt, Ph.D. Alexander Tropsha, Ph.D.

Kick Off Meeting October 12-14



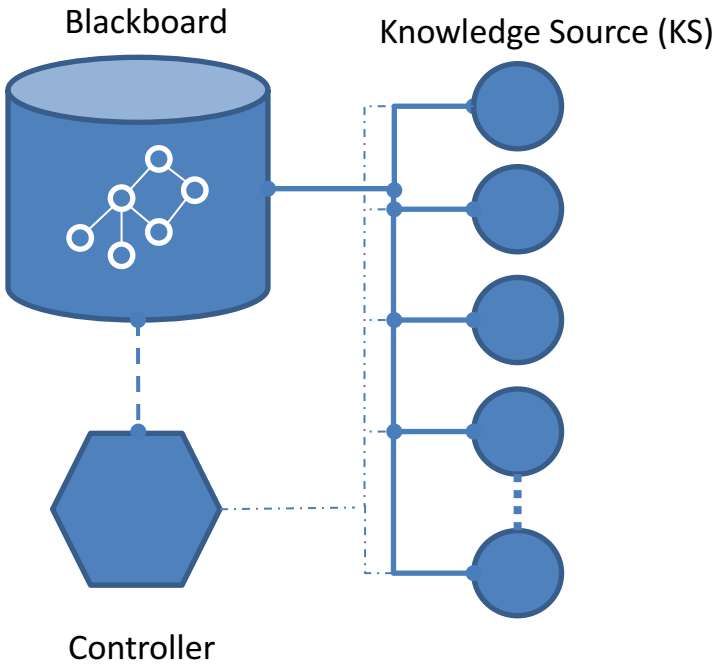
January 2017 Meeting



Imagine a group of human specialists seated next to a large blackboard. The specialists are working cooperatively to solve a problem, using the blackboard as the workplace for developing the solution.

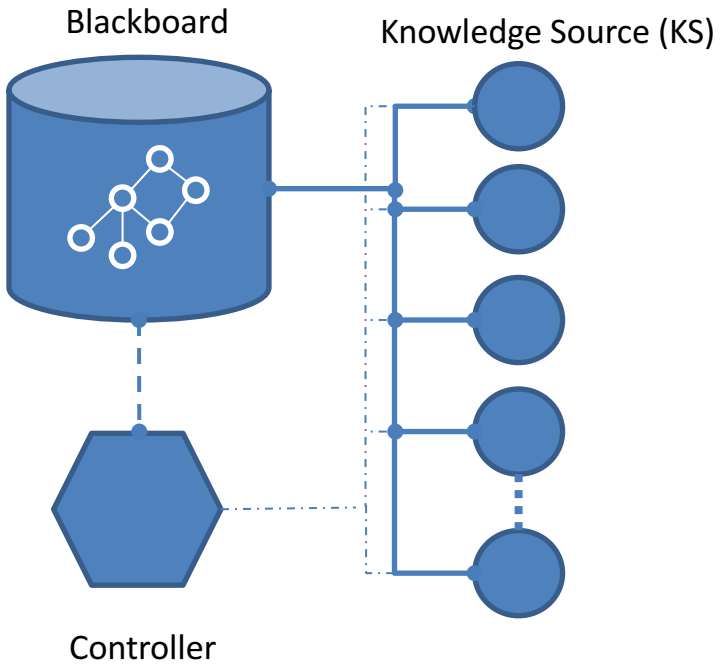
AI Expert 6(9), 40—47, Sep 1991

Blackboard Architecture



- Blackboard has three main components:
  - *Blackboard*—contains data relevant to the current state of the problem and its solutions
  - *Knowledge sources*—independent agents that encode (domain) knowledge needed to solve the problem *incrementally*
  - *Controller*—an independent module that *dynamically* controls the flow of knowledge source invocations at runtime

Blackboard Architecture



- Blackboard system is suitable for:
  - Open-ended problems for which there are competing approaches and/or no obvious line of attack
  - Problems that require dynamic decision making (e.g., multi-resolution assay screening paradigm)
  - Problems that span many domains and levels of abstraction

Going beyond the mechanics

"…each of the five teams has taken a look at what they do individually and thought deeply about the missing components that limit that work's impact and how they would integrate their data and results with those of other groups, other fields. Instead of starting up five new research projects, you have five teams shifting their perspective on science."

Nicholas Tatonetti, PhD; Assistant Professor, Columbia University

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