BRIDGE2AI

Bridge to Artificial Intelligence (Bridge2AI)

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National Center for Complementary and Integrative Health

NIH Tribal Advisory Committee Meeting
December 7, 2022

NIH National Institutes of Health
Office of Strategic Coordination–The Common Fund

The Promise of AI

- Driverless cars
- Game play (e.g., chess)
- Customized service
- Service bots
- And many more

Protein structure determination and prediction (e.g., DeepMind winning CASP; improvements in structural analysis; AlphaFold)

AI reduced time and effort for diagnosis of rare genetic disorders in infants in the ICU by analyzing massive amounts of variants associated with genetic disorders in minutes

Origins of the Bridge2AI Program

2018 - Workshop by the members of the AI/ML and computational biomedicine research communities

2019 – NIH Director formed the AI Working Group of the Advisory Committee to the NIH Director (ACD) for recommendations:

1. Generate flagship datasets
2. Publish criteria for AI/ML-friendly datasets
3. Publish ethical principles for the use of ML in biomedicine
4. Attract and train AI/ML-Biomedical experts
5. Convene cross-disciplinary collaborators

2021 – Program Announcements were released

2022 – Awards made!

Leadership of NIH Common Fund's Bridge2AI Program

Lead Institutes and Centers

- National Library of Medicine (NLM)
- National Institute of Biomedical Imaging and Bioengineering (NIBIB)
- National Human Genome Research Institute (NHGRI)
- National Center for Complementary and Integrative Health (NCCIH)
- National Eye Institute (NEI)
- The Common Fund (CF)

Working Group Participants

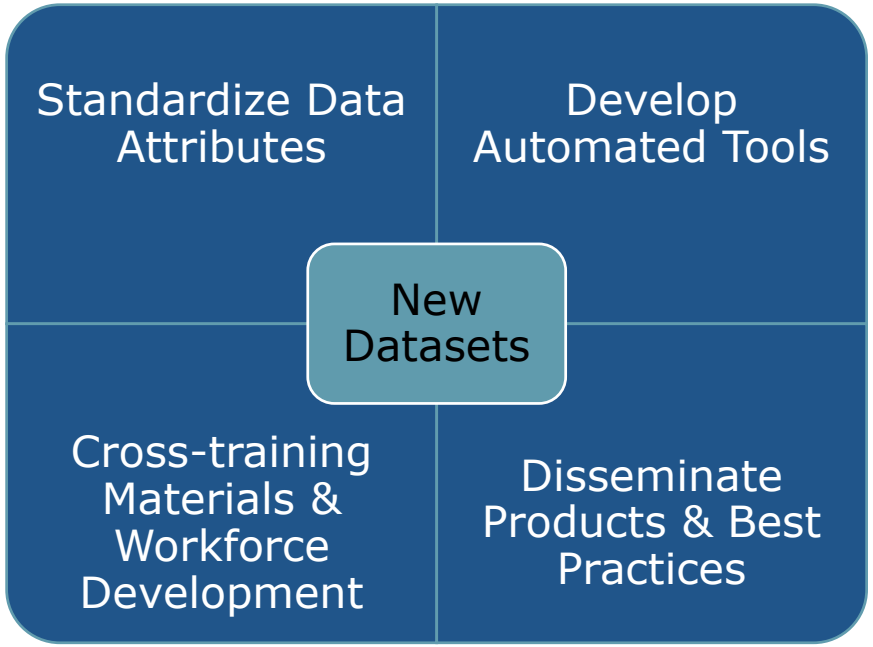
- CC, CIT, FIC, NCATS, NCI, NIA, NIAID, NICHD, NIDA, NIDDK, NIAMS, NIGMS, NIMHD, NINDS
- Other Federal Agencies: DARPA, DOE, FDA, NIST, NSF

Bridge2AI Program Goals

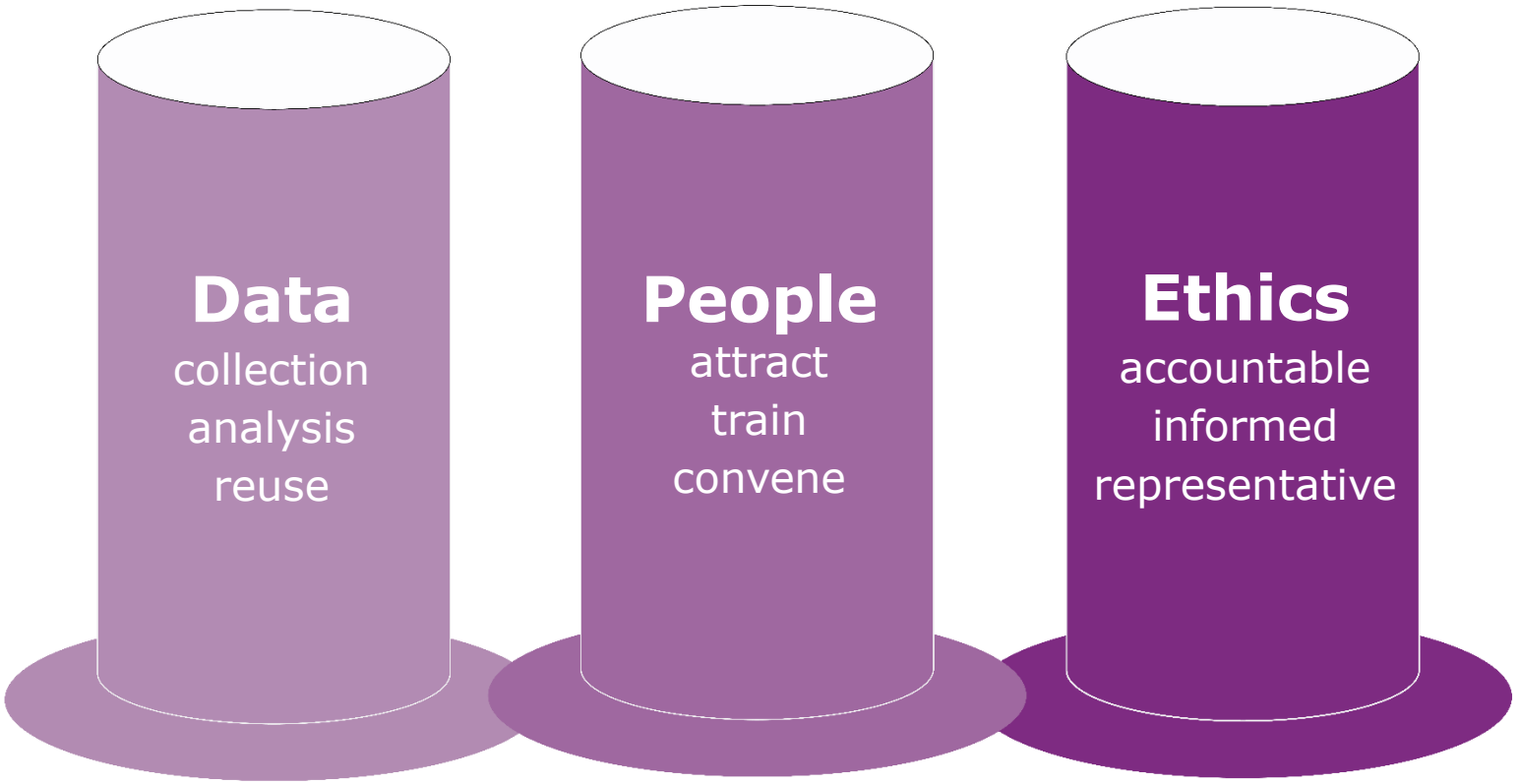
Goal: to propel biomedical and behavioral research forward by setting the stage for widespread use of artificial intelligence (AI) technologies

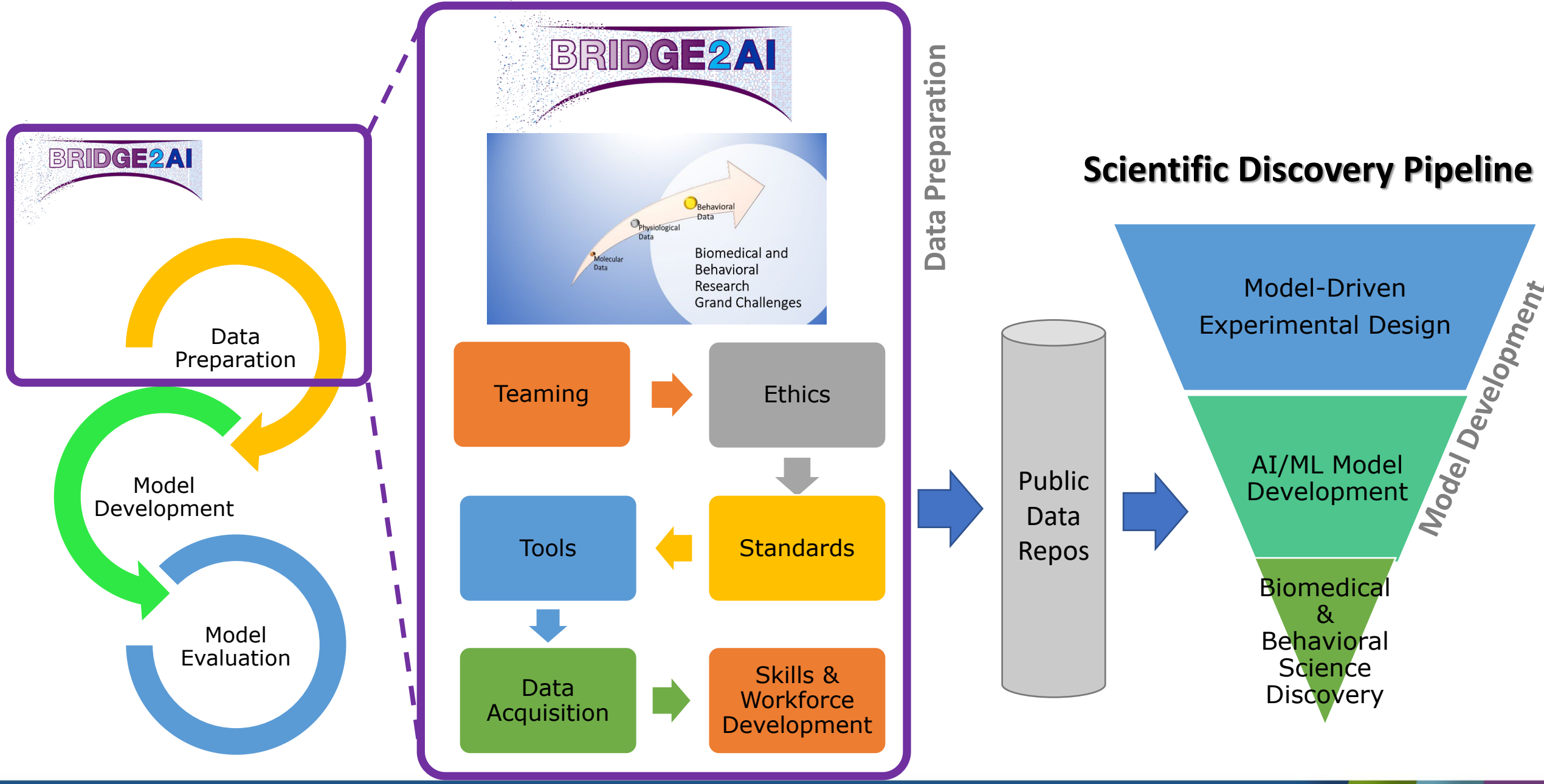
Bridge2AI will:

- Use biomedical and behavioral research grand challenges to generate **flagship data sets**
- **Prepare** AI-ready data
- Emphasize **ethical** best practices
- Promote **diverse teams**

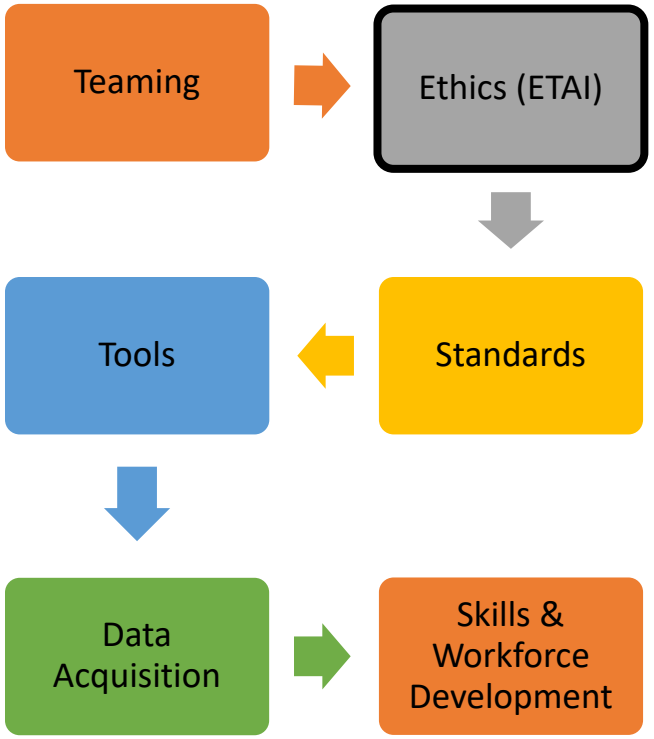


Three pillars of Bridge2AI




BRIDGE2AI
Data Preparation
Model Development
Model Evaluation
BRIDGE2AI
Behavioral Data
Physiological Data
Molecular Data
Biomedical and Behavioral Research Grand Challenges
Teaming
Ethics
Tools
Standards
Data Acquisition
Skills & Workforce Development
Data Preparation
Public Data Repos
Scientific Discovery Pipeline
Model-Driven Experimental Design
AI/ML Model Development
Biomedical & Behavioral Science Discovery
Model Development

Ethical & Trustworthy AI Module (ETAI)

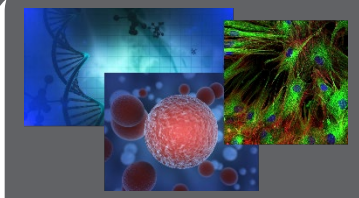


Purpose: **Instill a culture of ethical inquiry (rather than compliance)** to:

- (1) Identify, assess, and help address ETAI issues raised as the data generation project creates and releases AI/ML-ready datasets
- (2) Incorporate ETAI scholars as we create a new biomedical and behavioral AI/ML research community working together across technical, social and health disciplines

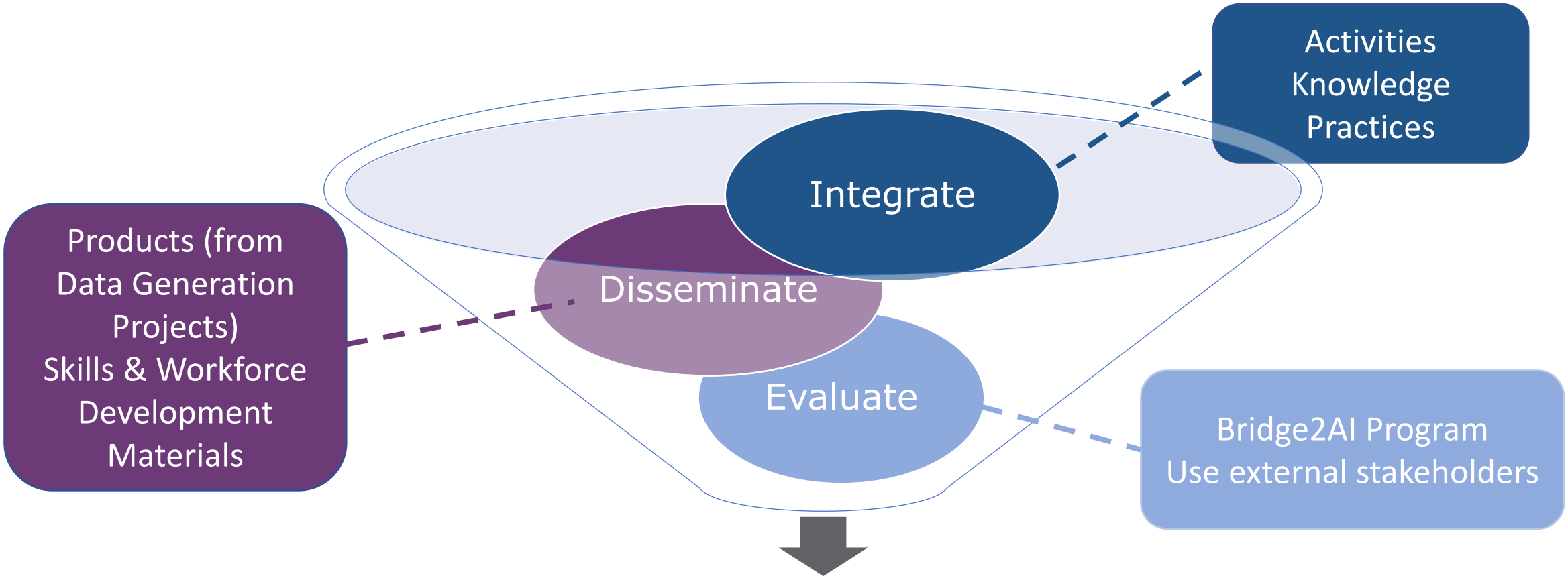
Bridge2AI Structure

Data Generation Projects

	Critical Care	*Functional Genomics*	*Salutogenesis*	*Voice as a Biomarker*
				
	ACQUISITION	*ACQUISITION*	*ACQUISITION*	*ACQUISITION*
ADMIN	*TEAMING*	*TEAMING*	*TEAMING*	*TEAMING*
TEAMING	*ETHICS*	*ETHICS*	*ETHICS*	*ETHICS*
ETHICS	*STANDARDS*	*STANDARDS*	*STANDARDS*	*STANDARDS*
STANDARDS	*TOOLS*	*TOOLS*	*TOOLS*	*TOOLS*
TOOLS	*S&WFD*	*S&WFD*	*S&WFD*	*S&WFD*
SKILLS AND WORKFORCE DEVELOPMENT				

Bridge Center

Bridge Center Purpose



Best Practices for AI/ML in Biomedical and Behavioral Research

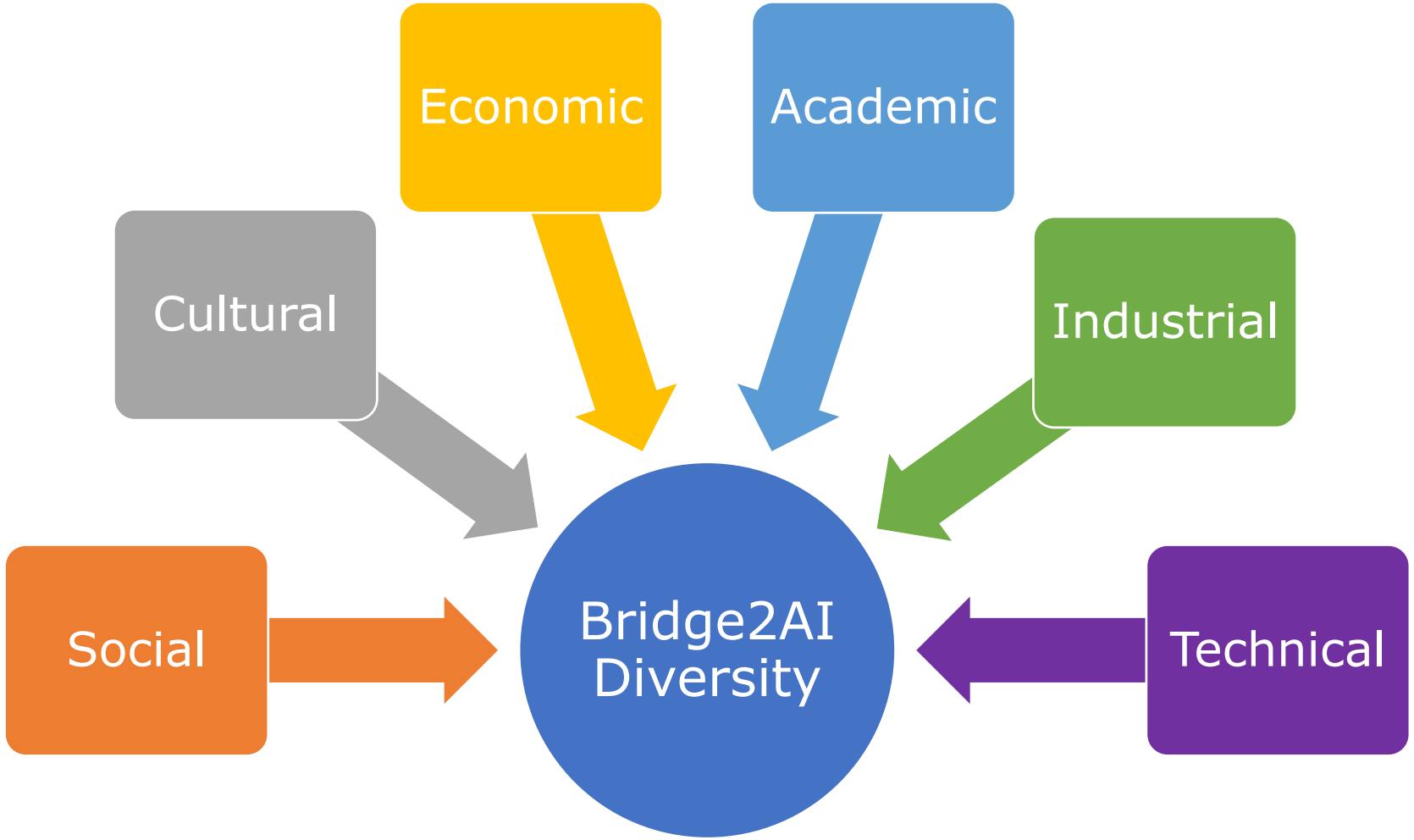
Who needs to come together?

- Biomedical Scientists
- Behavioral Scientists
- Social Scientists
- Clinicians
- Economists
- Ethicists
- Philosophers
- Anthropologists

- Diverse career stages
- Diverse social and cultural backgrounds
- Academic, industrial, and technical backgrounds
- Diverse communities and institutions

- AI/ML Experts
- Statisticians
- Computer Scientists
- Data Scientists
- Mathematicians
- Bio-informaticists
- Engineers
- Team Science Experts…

Plan for Enhancing Diverse Perspectives (PEDP)



Example Elements of the PEDP

- Plan to engage with different types of **institutions and organizations**
- Partnerships to enhance **geographic diversity**
- Enhanced recruitment of **women and individuals from under-represented groups** in biomedical and behavioral research
- Activities to **monitor and assess benchmarks**
- Career-enhancing activities for diverse **students, postdocs, junior, early- and mid-career** team members
- Developing **transdisciplinary collaborations** that require diverse perspectives
- **Publication** plan
- Outreach and engagement activities to enhance **recruitment of individuals from diverse groups as research participants**

Funded Bridge2AI Awards

Bridge Center

Consists of three awards:
- **Admin and Ethics** cores (contact PI: *Lucila Ohno-Machado**, UC San Diego)
- **Standards and Teaming** cores (contact PI: *Monica Munoz-Torres*, U. Colorado, Denver)
- **Tools and S&WD** cores (contact PI: *Alex Bui*, UC Los Angeles)

* Lead PI: Lucila Ohno-Machado

Data Generation Projects

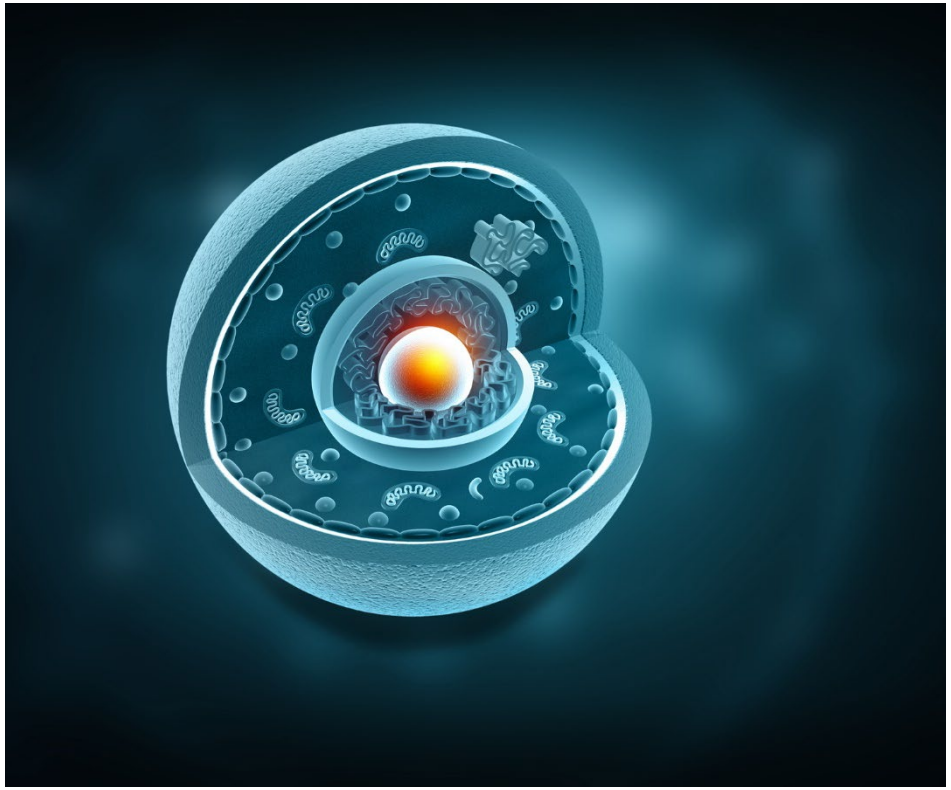
- **Expanding AI/ML in Clinical Care** (contact PI: *Eric Rosenthal*, Massachusetts General Hospital)
- **Functional Genomics** (contact PI: *Trey Ideker*, UC San Diego)
- **Salutogenesis** (contact PI: *Aaron Lee*, U. Washington, Seattle)
- **Precision Public Health** (contact PI: *Yael Bensoussan*, U. South Florida)

Expanding AI/ML in Clinical Care

- Create a dataset of >100,000 patients from 14 ICU sites to improve recovery from acute illnesses through AI
- Phenotyping from clinical notes via natural language processing
- Develop a model to predict adverse events from ICU-monitoring data

Functional Genomics

- Map the spatiotemporal architecture of human cells and use these maps toward the grand challenge of interpretable genotype-phenotype learning.
- 3 complementary mapping approaches:
  - proteomic mass spectrometry,
  - cellular imaging,
  - genetic perturbation via CRISPR/Cas9
- Create a library of large-scale maps of cellular structure/function and disease contexts using cell lines

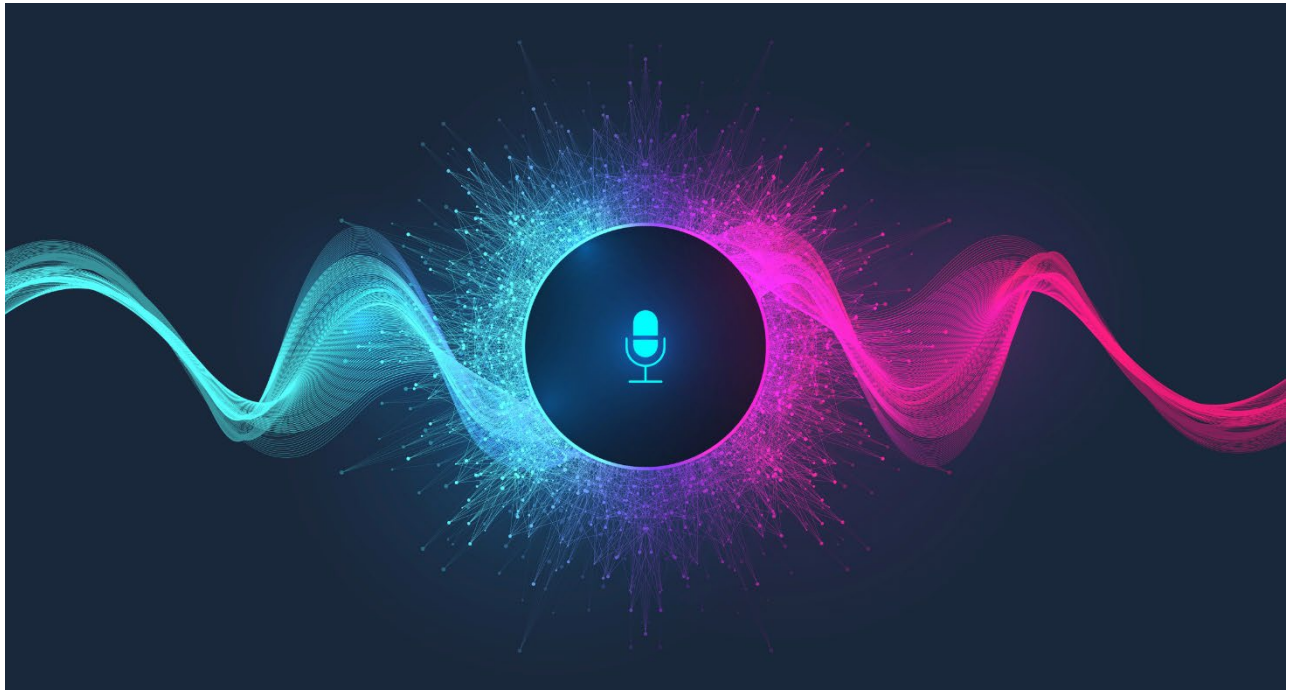


Salutogenesis

- Reconstruct a temporal atlas of pathogenesis and salutogenesis to expand AI/ML applications in clinical care
- Utilize type 2 diabetes as a model for understanding disease progression and regression
- Working on a Native American partnership through Tribal Consultation

Precision Public Health

- Use voice as a biomarker for respiratory disorders, sleep apnea, mental health, and neurological disorders
- Create a database of bioacoustic waveforms
- Ethics: voice-hacking
- Tools: waveform compression, minimum acoustic quality



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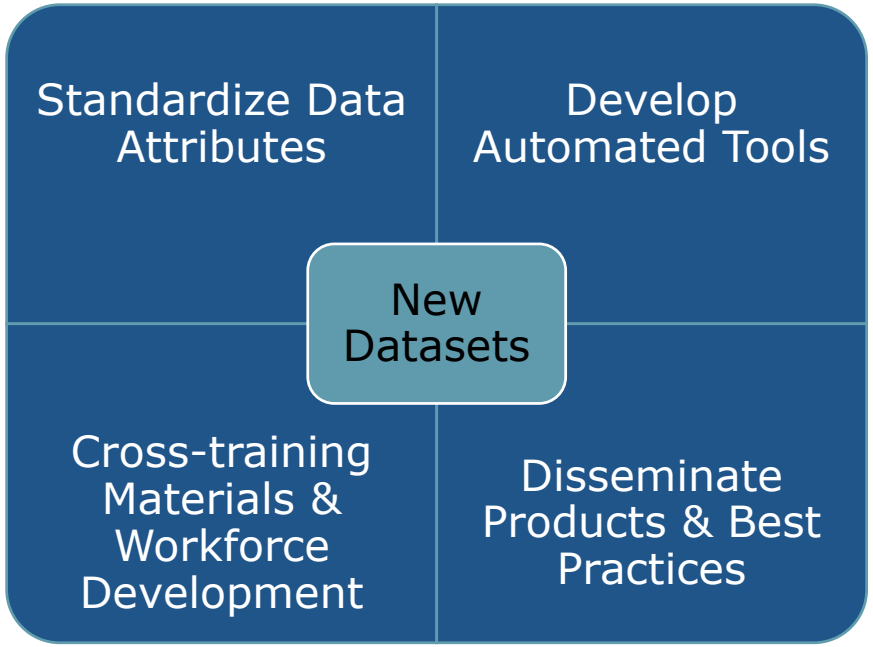

Ideas for Collaboration with Tribal Communities

- Data Generation Projects
  - Salutogenesis project beginning Tribal Consultation process
- Ethics Activities
  - What concerns/unique challenges to address?
- Skills and Workforce Development Activities
  - How to involve Native American trainees and Tribal Colleges and Universities?
- Community Engagement and Stakeholder Activities
  - Participation in advisory boards and other efforts?
  - How to ensure inclusivity diversity to ensure outcomes of Bridge2AI are representative and useful to multiple communities?
- Other ideas?

Learn More

Listserv signup: bit.ly/Bridge2AINews

Website: commonfund.nih.gov/bridge2ai

Email: Bridge2ai@od.nih.gov

NIH Team

LEADERSHIP TEAM

Co-Chairs (IC Directors)
Patricia Brennan (NLM)
Eric Green (NHGRI)
Michael Chiang (NEI)
Helene Langevin (NCCIH)
Bruce Tromberg (NIBIB)

Common Fund Leadership
Betsy Wilder
Douglas Sheeley

PROGRAM MANAGEMENT TEAM

Program Leader: Haluk Resat (OSC/Common Fund)

Program Co-Coordinators
James Gao (NEI)
Lanay Mudd (NCCIH)
Grace Peng (NIBIB)
Shurjo Sen (NHGRI)

Program Officers

Bridge Center
Shurjo Sen (PO)
James Gao*
Lanay Mudd*
Grace Peng*

DGPs (OSC)
Tyler Best
Chris Kinsinger
George Papanicolaou
Haluk Resat

Program Managers
Adam Politis
Jenell Glover

Comm & Ops
Katelynn Milora
Tony Casco

Grants Management
Erna Petrich (DOTM)
Deanna Ingersoll (NHGRI)

+ Large group of **Project Scientists**

Coordinator: Elizabeth Ginexi (NCCIH)

+ Very large group of **NIH Internal Working Group**