

Coordinated By the Integrative Understanding of Brain Circuits Team (Team E):

NIH: Grace Peng, PhD and Susan Wright, PhD

U19 Data Consortium: Ben Dichter, PhD and Brent Doiron, PhD

TMM Group: Bill Lytton, MD and Fidel Santamaria, PhD

BRAIN Data and Model Match for Reuse Event November 13, 2020

Schedule

12:00pm-12:25pm	Welcome - Grace Peng
12:25pm-12:35pm	Useful Tools - Ben Dichter
12:35pm-12:40pm	Logistics - Susan Wright & Bill Lytton
12:40pm-1:00pm	Match 1* (Breakout Rooms)
1:00pm-1:20pm	Match 2* (Breakout Rooms)
1:20pm-1:40pm	Match 3* (Breakout Rooms)
1:40pm-2:00pm	Match 4* (Breakout Rooms)
2:00pm	Return to Main Meeting Room
2:00pm-2:20pm	Wrap Up – Group Discussion and Feedback

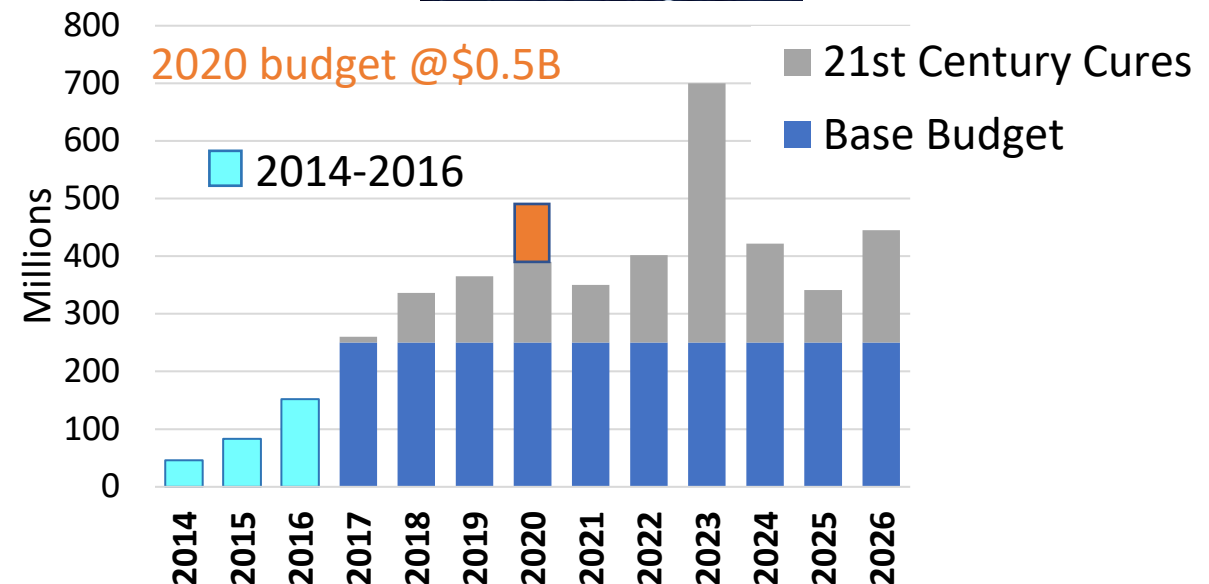
*Not everyone will have a match during each timeslot – that is ok and is a break for you!

Welcome (12:00pm-
12:25pm)

- Purpose of event in the context of the BRAIN Initiative
- How the match was done
- Goals for matching discussions

What is the BRAIN Initiative?

The Brain Research through Advancing Innovative Neurotechnologies® (BRAIN) Initiative is aimed at revolutionizing our understanding of the human brain. By accelerating the development and application of innovative technologies, researchers will be able to produce a revolutionary new dynamic picture of the brain that, for the first time, shows how individual cells and complex neural circuits interact in both time and space. Long desired by researchers seeking new ways to treat, cure, and even prevent brain disorders, this picture will fill major gaps in our current knowledge and provide unprecedented opportunities for exploring exactly how the brain enables the human body to record, process, utilize, store, and retrieve vast quantities of information, all at the speed of thought.



Notice of Data Sharing Policy for the BRAIN Initiative

(released January 22, 2019) NOT-MH-19-010

The purpose of this notice is to inform prospective applicants and current awardees of a new policy concerning data collected with support from awards that are funded by the BRAIN Initiative.

Specifically, this Notice clarifies the expectation that applicants to BRAIN Initiative funding opportunity announcements:

- 1) submit their data to one of the BRAIN data archives for sharing;
- 2) include specific required elements in the Resource Sharing Plan as further detailed below; and
- 3) include costs attributed to data preparation and submission to a data archive in grant applications.

Ming Zhan, Ph.D.
Email: ming.zhan@nih.gov

BRAIN Initiative: Secondary Analysis and Archiving of BRAIN Initiative Data (released August 06, 2019) **RFA-MH-20-120**

This Funding Opportunity Announcement (FOA) encourages secondary analysis of the large amounts of existing data related to the BRAIN Initiative.

The data do not need to be held in one of the funded BRAIN Initiative data archives, but the data must be held in a data archive that is readily accessible to the research community.

Support will be provided for innovative analysis of relevant existing datasets using conventional or novel analytic methods, data science techniques, and machine learning approaches.

Support may also be requested to prepare and submit existing data into any of the BRAIN Initiative data archives. Investigators should not underestimate the time and effort that may be necessary to curate or harmonize data.

Ming Zhan, Ph.D.
Email: ming.zhan@nih.gov

Notice of Special Interest to Encourage Eligible NIH BRAIN Initiative Awardees to Apply for PA-18-906 Research Supplements to Promote Diversity in Health-Related Research (released September 4, 2019) [NOT-MH-19-038](#)

- Encourages institutions to diversify their populations
- Enhances the participation of individuals from groups identified as underrepresented in the biomedical, clinical, behavioral, and social sciences
- Solicits administrative supplements from BRAIN Initiative awardees

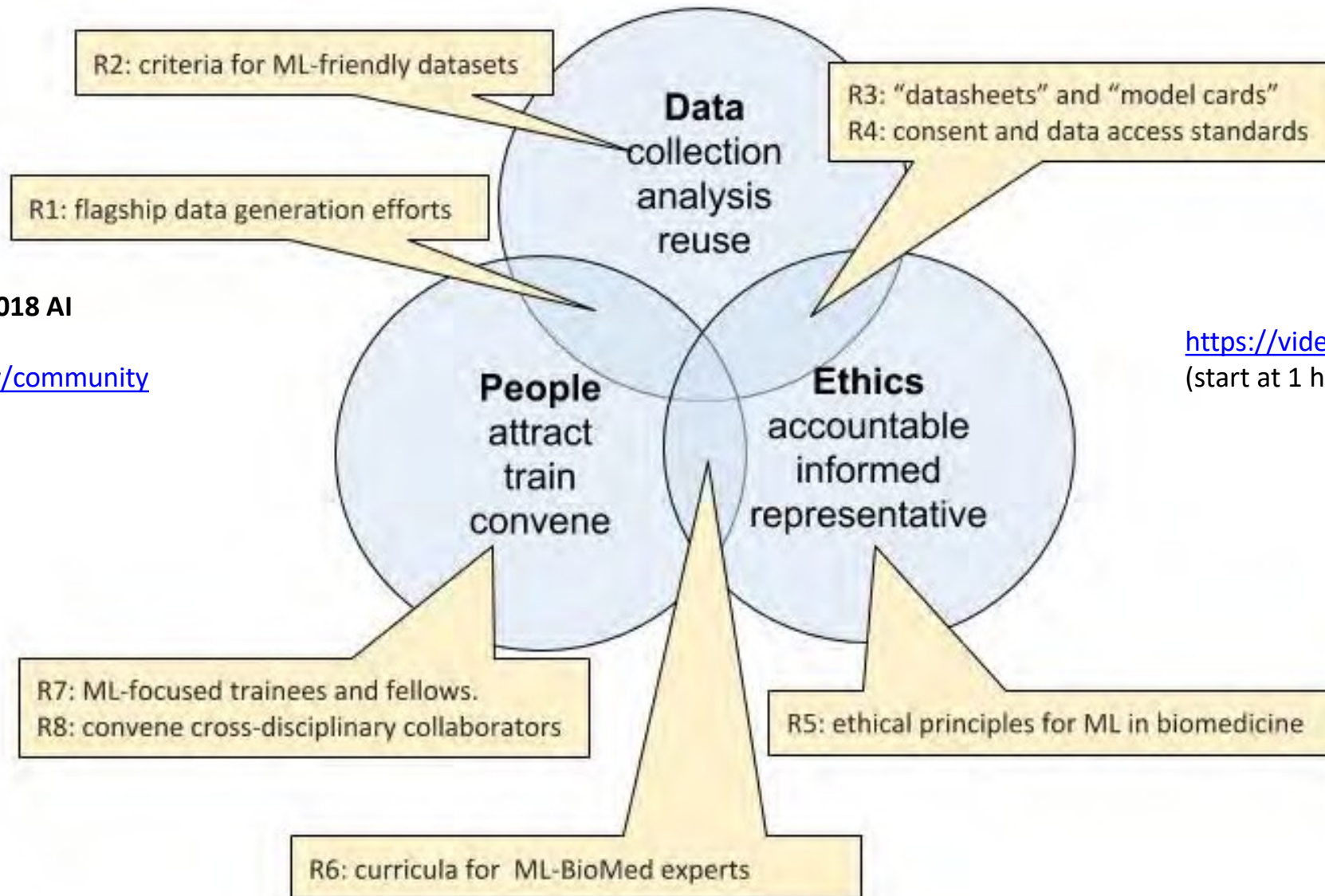
On behalf of all the staff of the NIH BRAIN Initiative, I would like to affirm in the strongest possible terms our commitment to promoting diversity, equity and inclusion in our scientific communities and ensuring that as we develop resources and technologies in the quest for treating human brain disorders, we do so for the benefit of all.

Dr. John Ngai, Director of the NIH BRAIN Initiative; June 10, 2020

<https://brainupdate.nih.gov/2020/06/10/a-message-to-the-brain-community/>

James Churchill, Ph.D.
Email: BRAIN.Initiative.Training@nih.gov

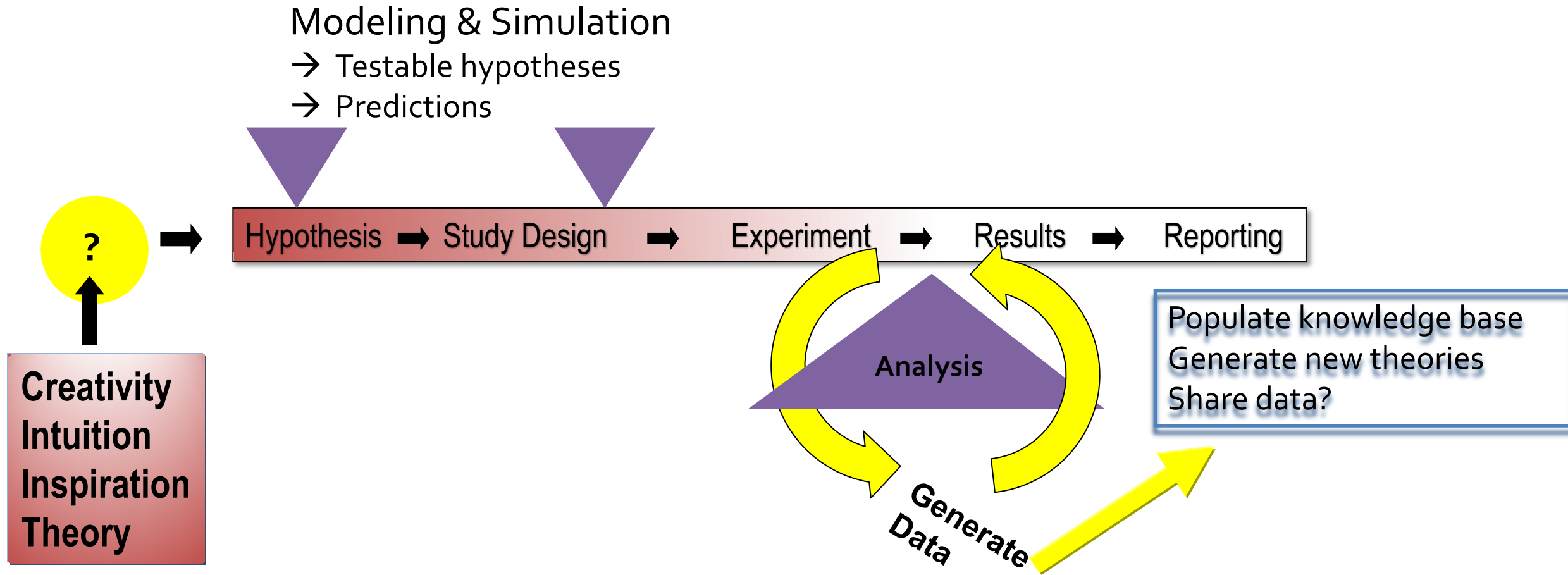
NIH AI Working Group Recommendations (12/13/2019 ACD Report)



A follow-up from the **July 2018 AI Workshop**,
<https://datascience.nih.gov/community/2018biomedAI>

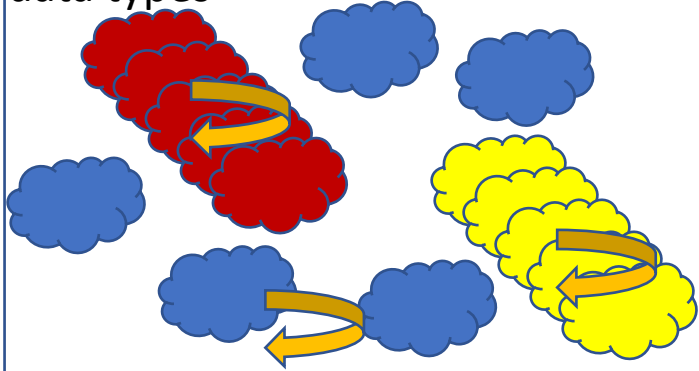
<https://videocast.nih.gov/watch=35426>
(start at 1 hour, 2 minutes)

Current Scientific Process

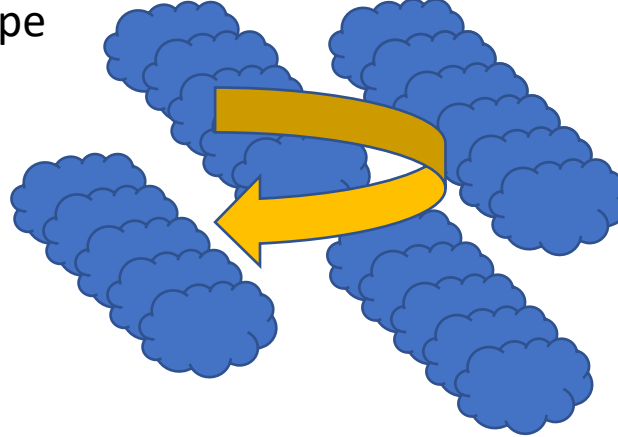


BRAIN Studies

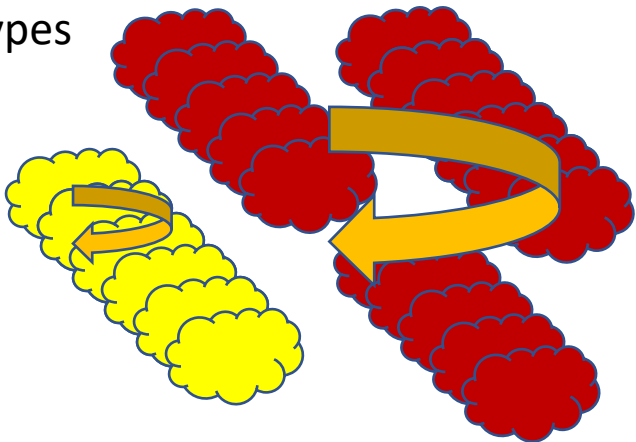
U19 Study (data source) – multiple data types



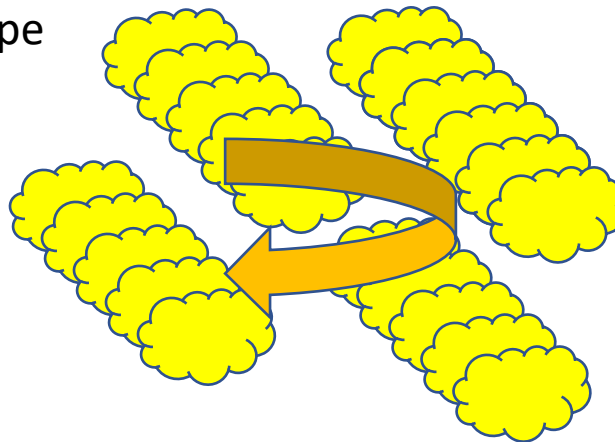
R01 Study (data source) – one data type



U01 Study (data source) – two data types



R34 Study (data source) – one data type



Current Analysis

Ideas

- Multiple theories
- Multiple models
- Multiple testable hypotheses

Data Collection

- Multiple devices & instruments
- Multiple study designs
 - collection protocols
 - context of collection
- Ethical issue for collection

Data Analysis

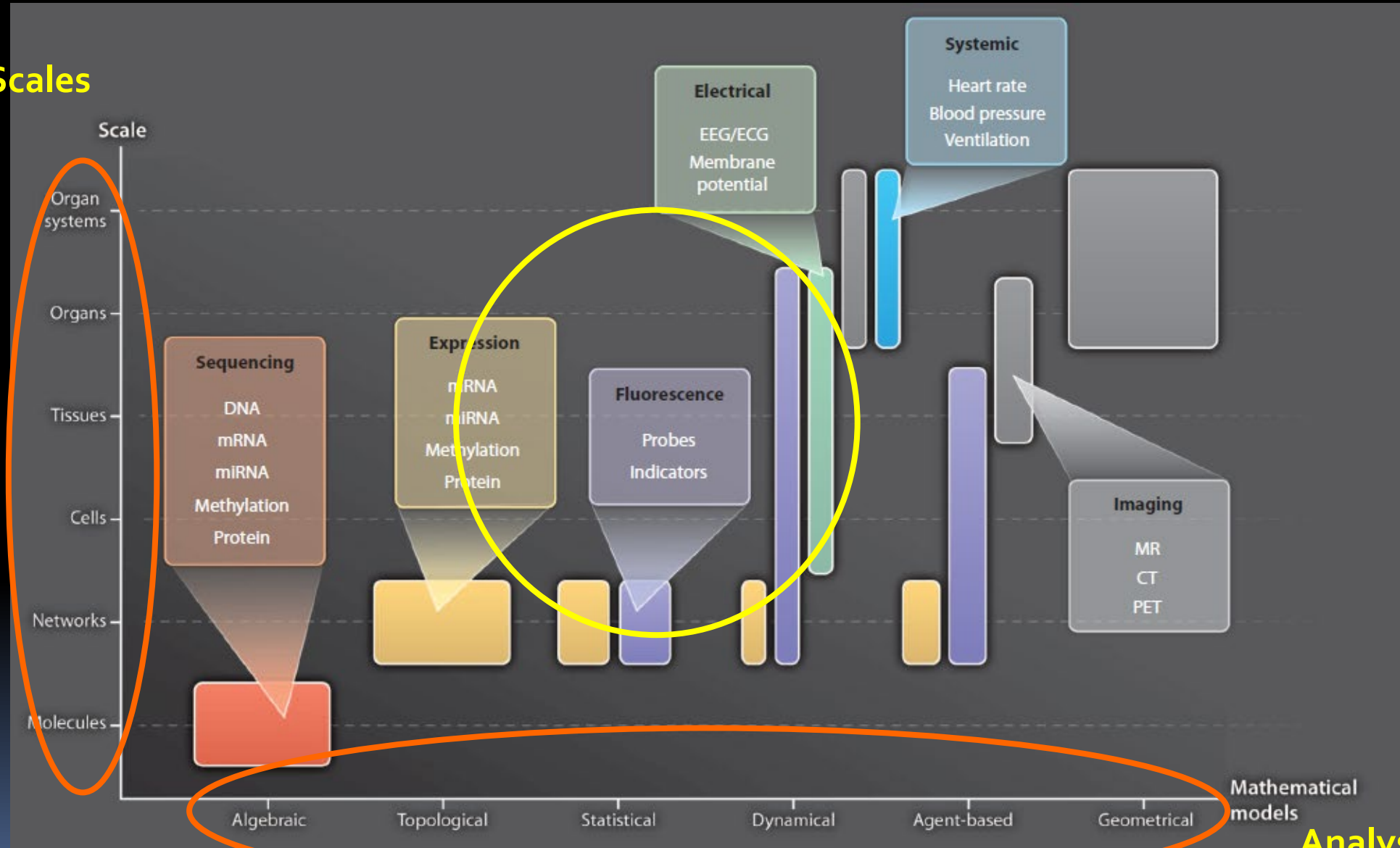
- Multiple contexts of analysis
- Multiple contexts for reuse
- Ethical issues for analysis

Knowledge Sharing

- Trustworthy, credible predictions
- Ability to compare with other knowledge bases
- Ethical issues for sharing

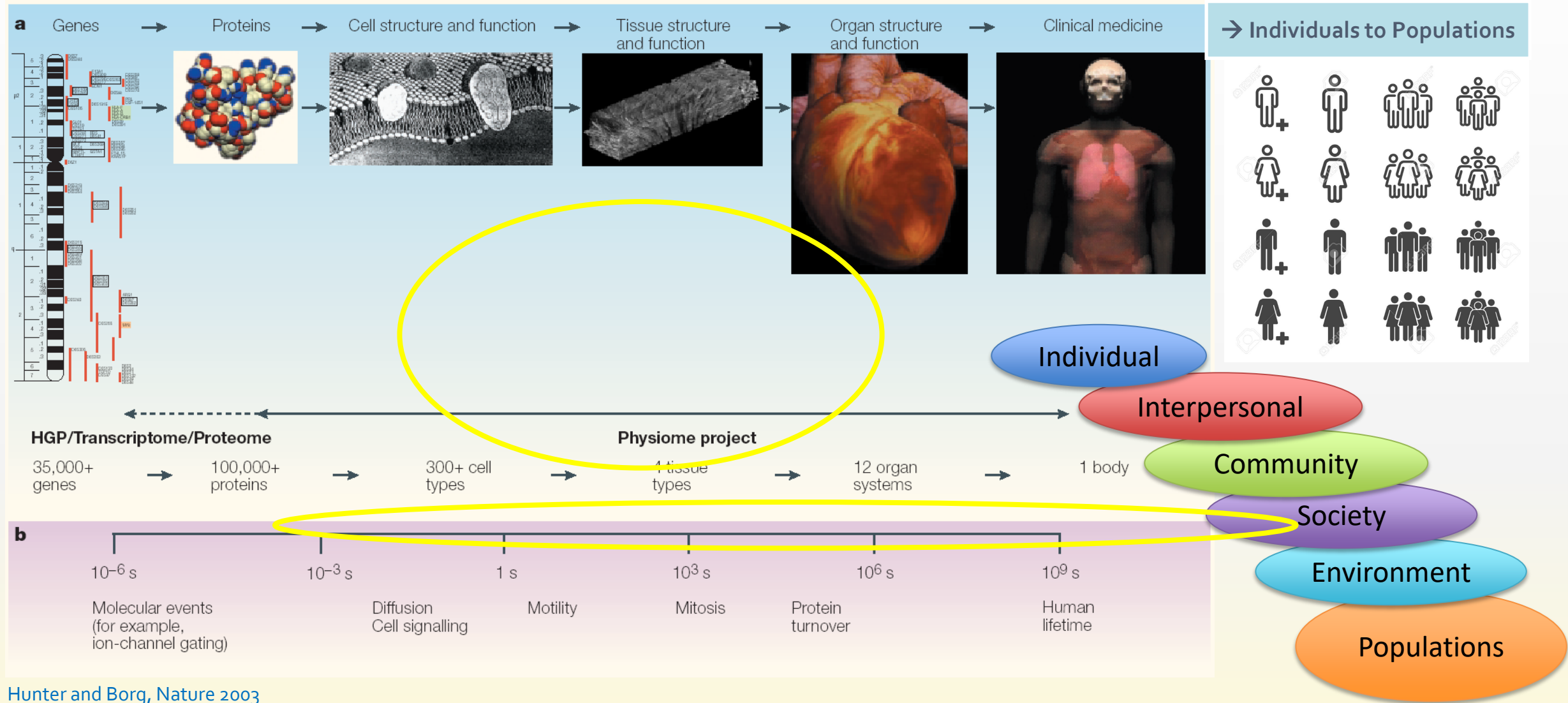
Quantitative Measures

Biological Scales



Analysis Methods

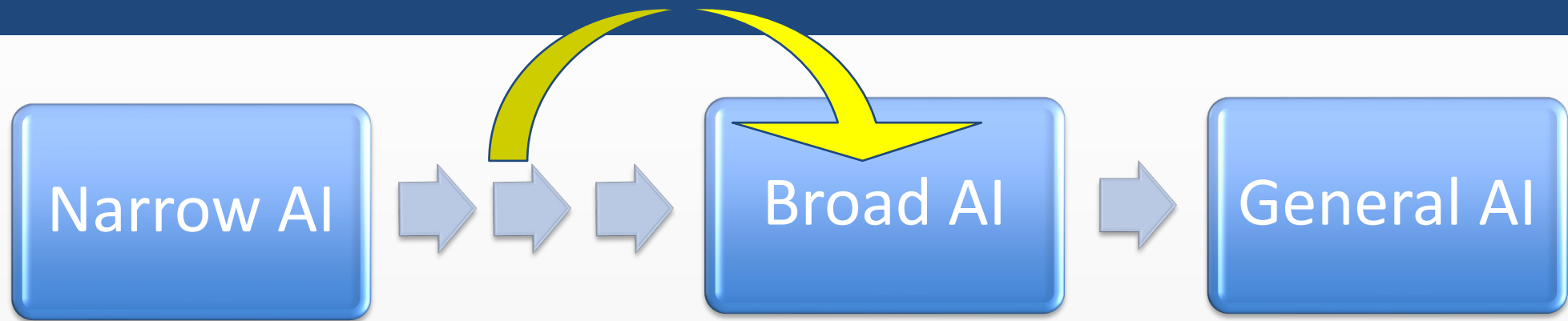
Biomedical Spatiotemporal Scales



Hunter and Borg, Nature 2003

Social-Ecological Systems

Artificial Intelligence – what's next?



NARROW AI

- Self-driving cars
- Facial recognition tools → predict depression & mental health
- Detection of cancerous pulmonary nodules on chest X-rays
- Improved accuracy & speed of interpretation of pathology slides
- Classification of skin cancer by image analysis
- Diagnosis of heart attack from ECG data
- Finding diminutive (<5mm) polyps in colonoscopy
- Diagnosing eye conditions from retinal fundus photographs

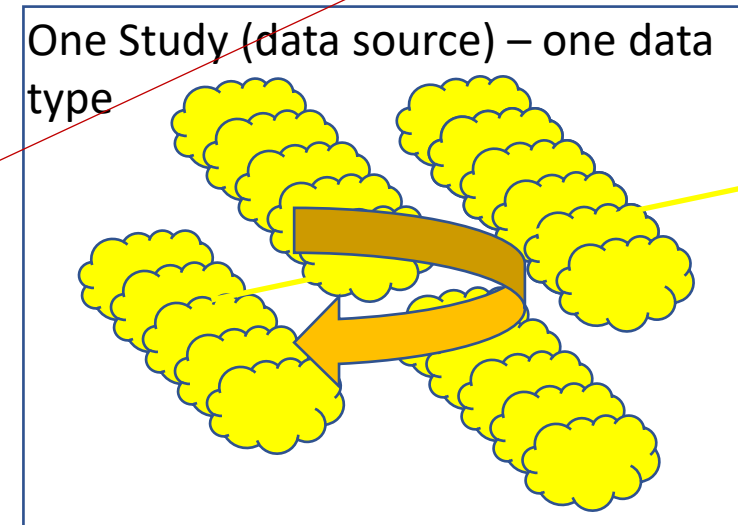
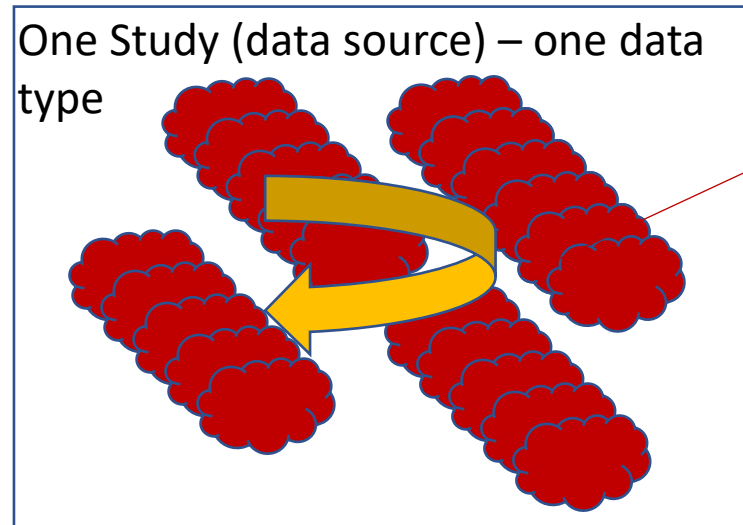
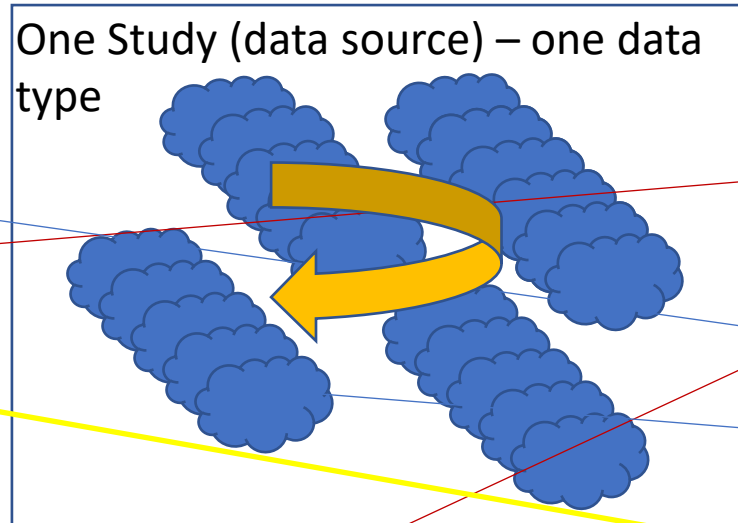
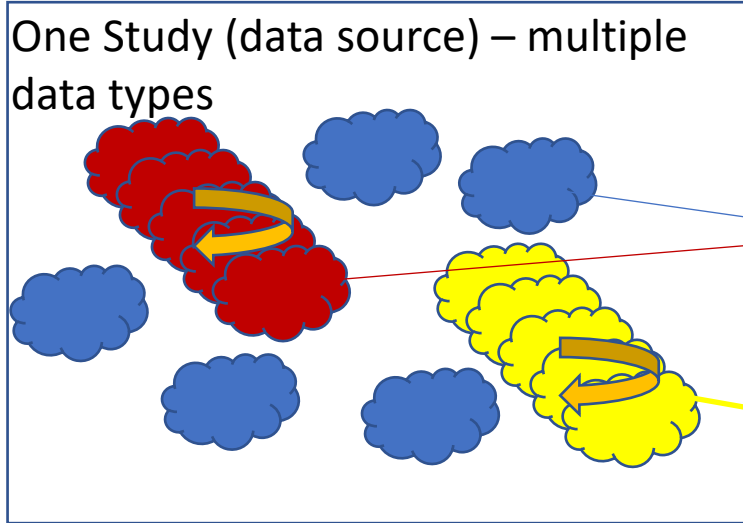
BROAD AI

- Black box → explainable AI
- Increase safety and security
- Remove biases – ethics in AI
- Learn from small data
- Use new AI infrastructure

General AI

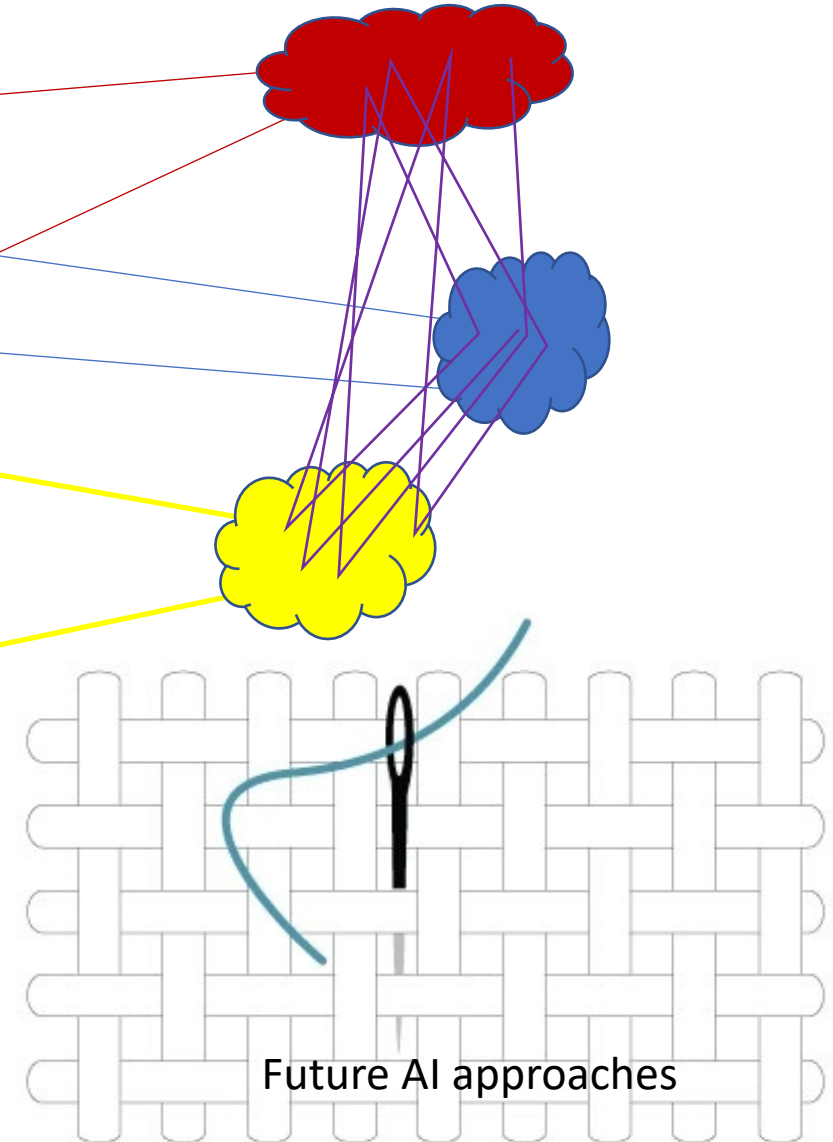


Narrow AI

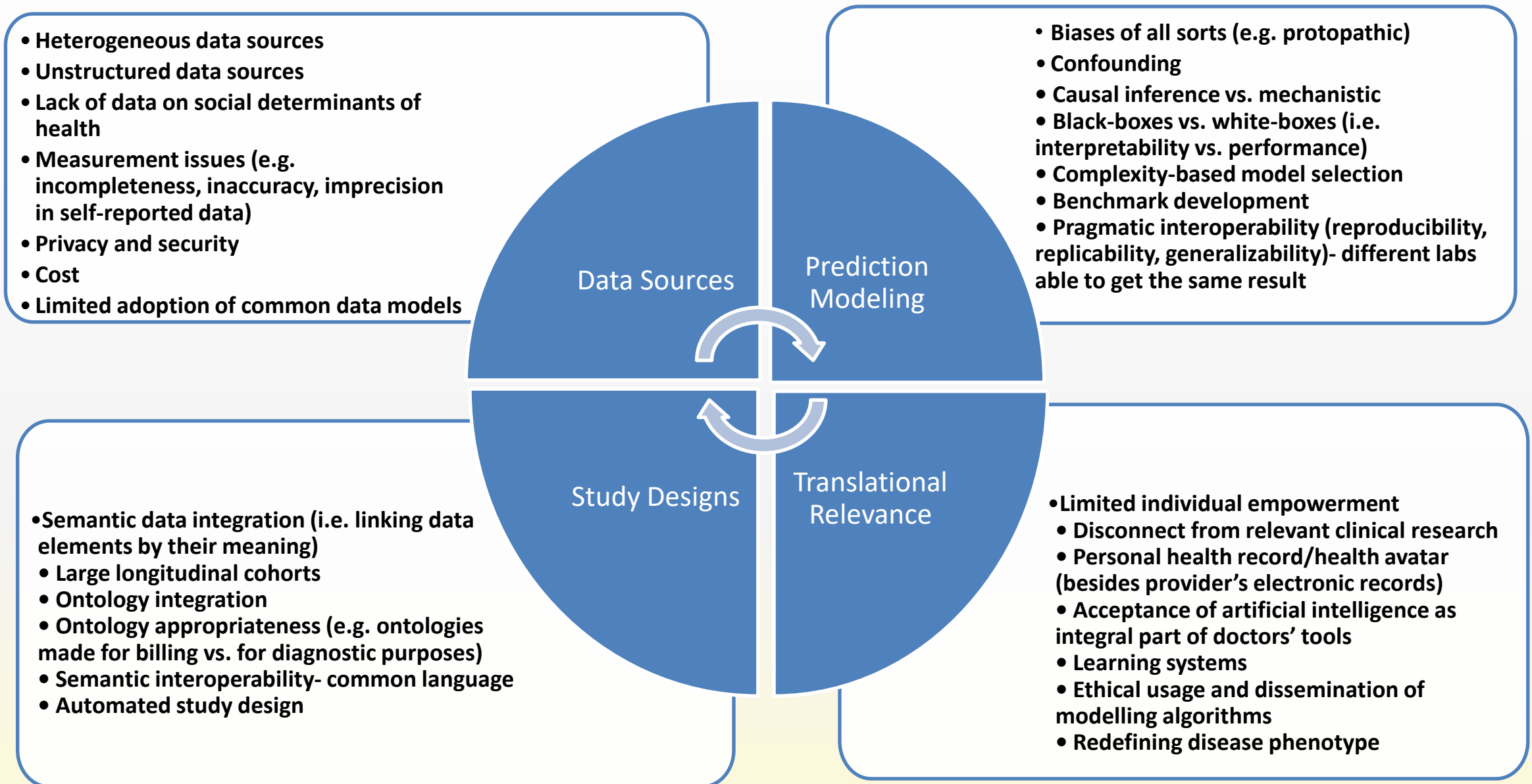


 Current AI approaches

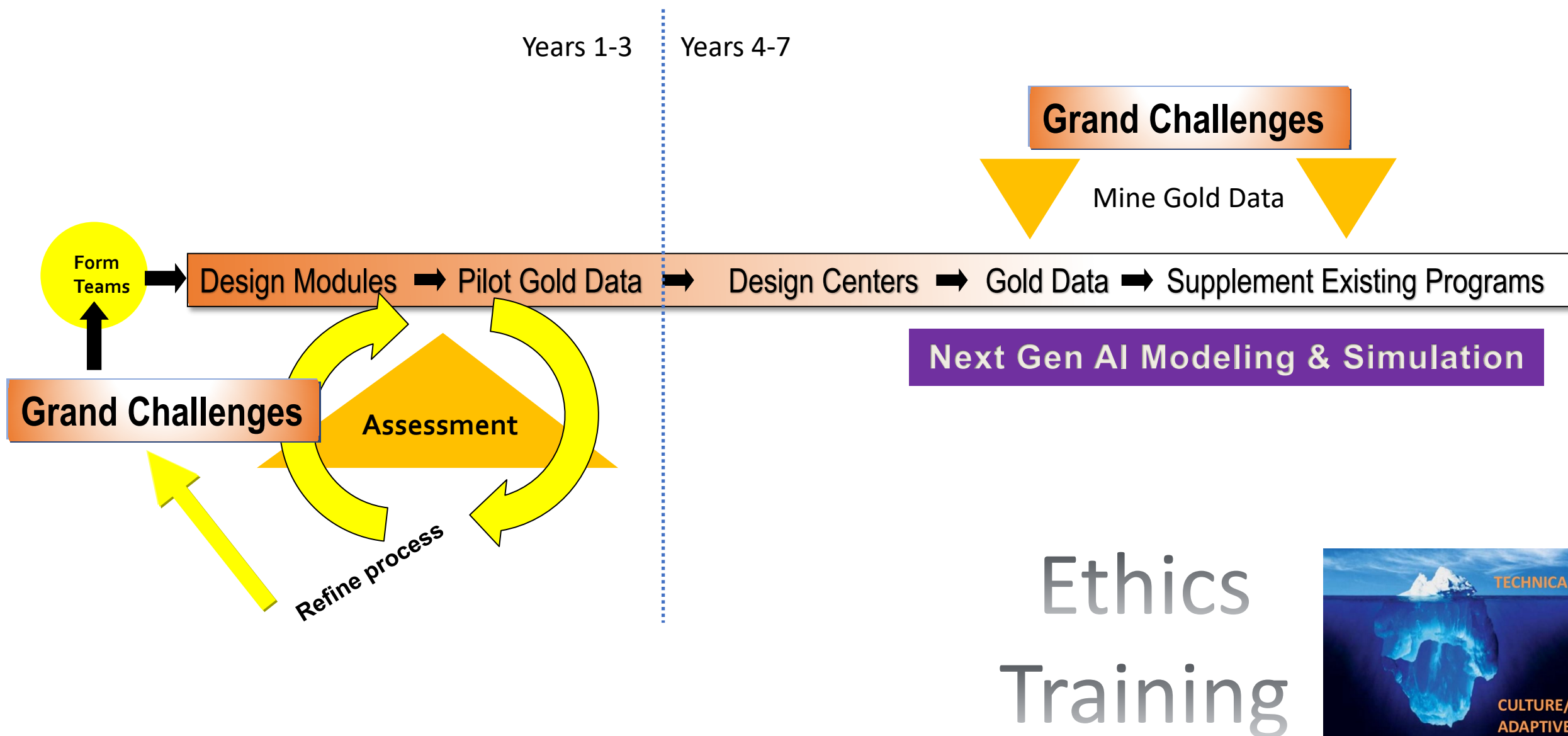
Broad AI



Biomedical and Behavioral Research Challenges



NIH AI Initiative



Overall Initiative Goals

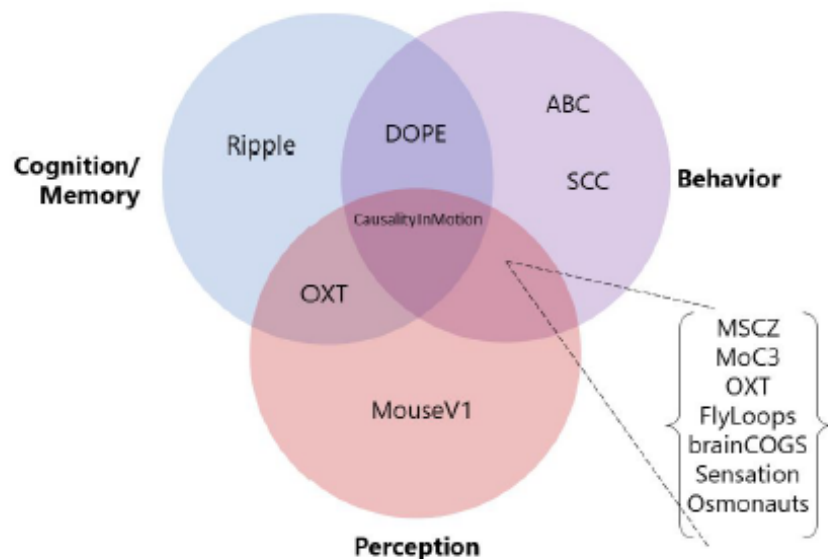
- ❖ Establish a launchpad for widespread adoption of **Next-Generation AI**
- ❖ Create next generation AI-driven scientific **design and assessment frameworks**



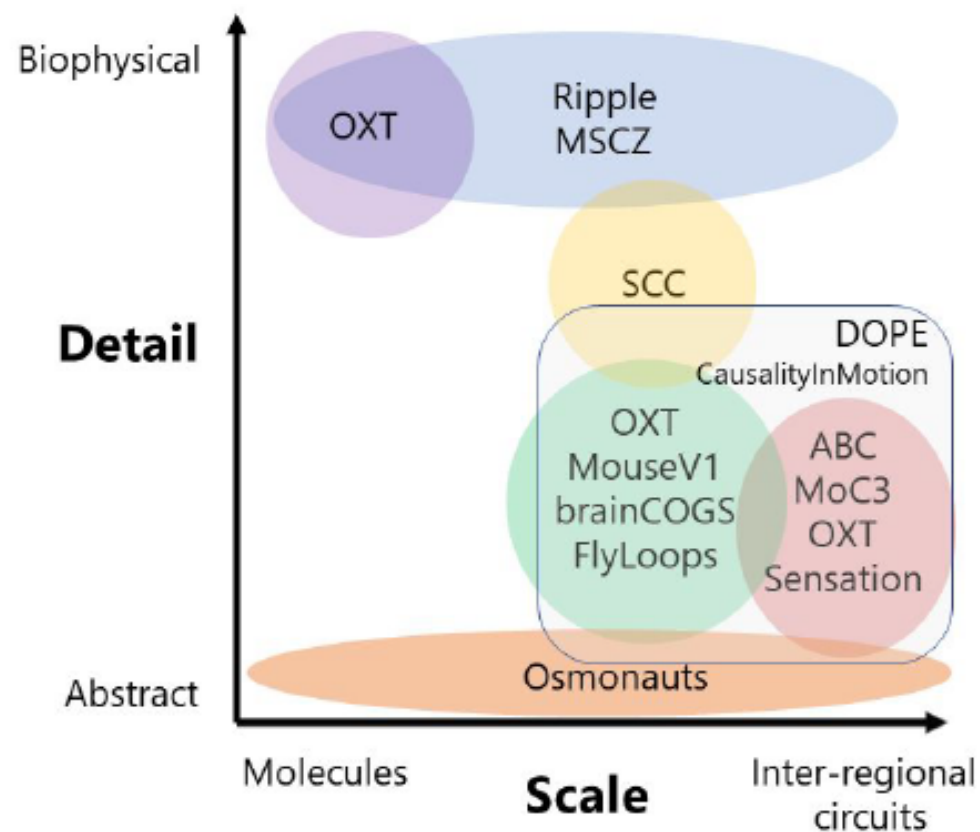
- ❖ Enable **transformative data collection** around **grand challenges** in biomedical research → **at all scales**
 - ❖ Challenges that are currently beyond our human intuition and **require next-generation AI approaches** to solve
 - ❖ All future challenges to use adaptive, evolving framework
- ❖ Integrate **ethics** and **training** throughout the entire program

Back to BRAIN

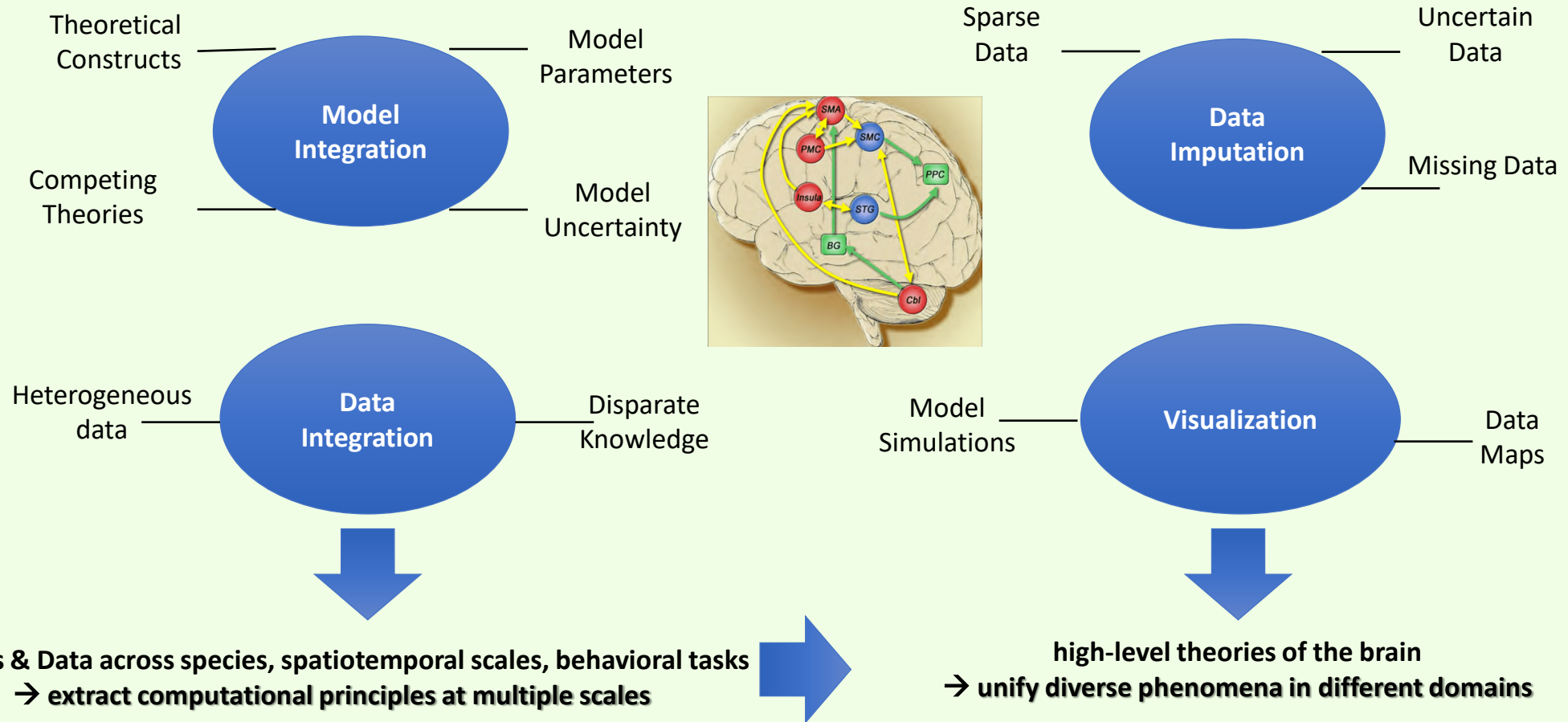
U19 Brain Circuit Domains of Study



U19 Brain Circuit Models



BRAIN 2.0 – Integrated theories of the brain



DARPA Automating Scientific Knowledge Extraction (ASKE) & the NIH BRAIN Initiative
Joshua Elliott, DARPA; Mohammed Ghassemi, NIH Data Scholar (January 2021)

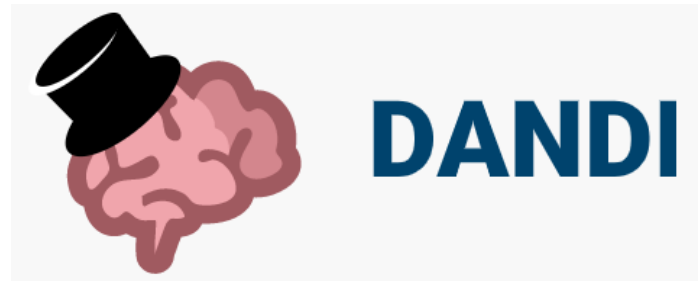
Today - the meeting of the minds



- Showcase what our taxpayer dollars have funded
- Social engineering to connect projects
- For Tool Developers
 - Stakeholder needs for analysis
 - Data for testing tools
- For Data collectors
 - New theories and models
 - New testable hypotheses to drive study designs

Useful Tools (12:25pm-12:35pm)

- NWB: <https://www.nwb.org/>
- DANDI: <https://www.dandiarchive.org/>
- NIH RePORTER Matchmaker:
https://projectreporter.nih.gov/reporter_matchmaker.cfm



QUERY

BROWSE NIH

MATCHMAKER

SEARCH PUBLICATIONS ^{BETA}

Logistics (12:35pm-12:40pm)

- Find your match in the schedule
- Rename yourselves in the Participant List: {Room# Name (U19 or TMM)}
- If you have technical issues -- Return to Main ZOOM Room and/or post Questions into the Slack Channel:

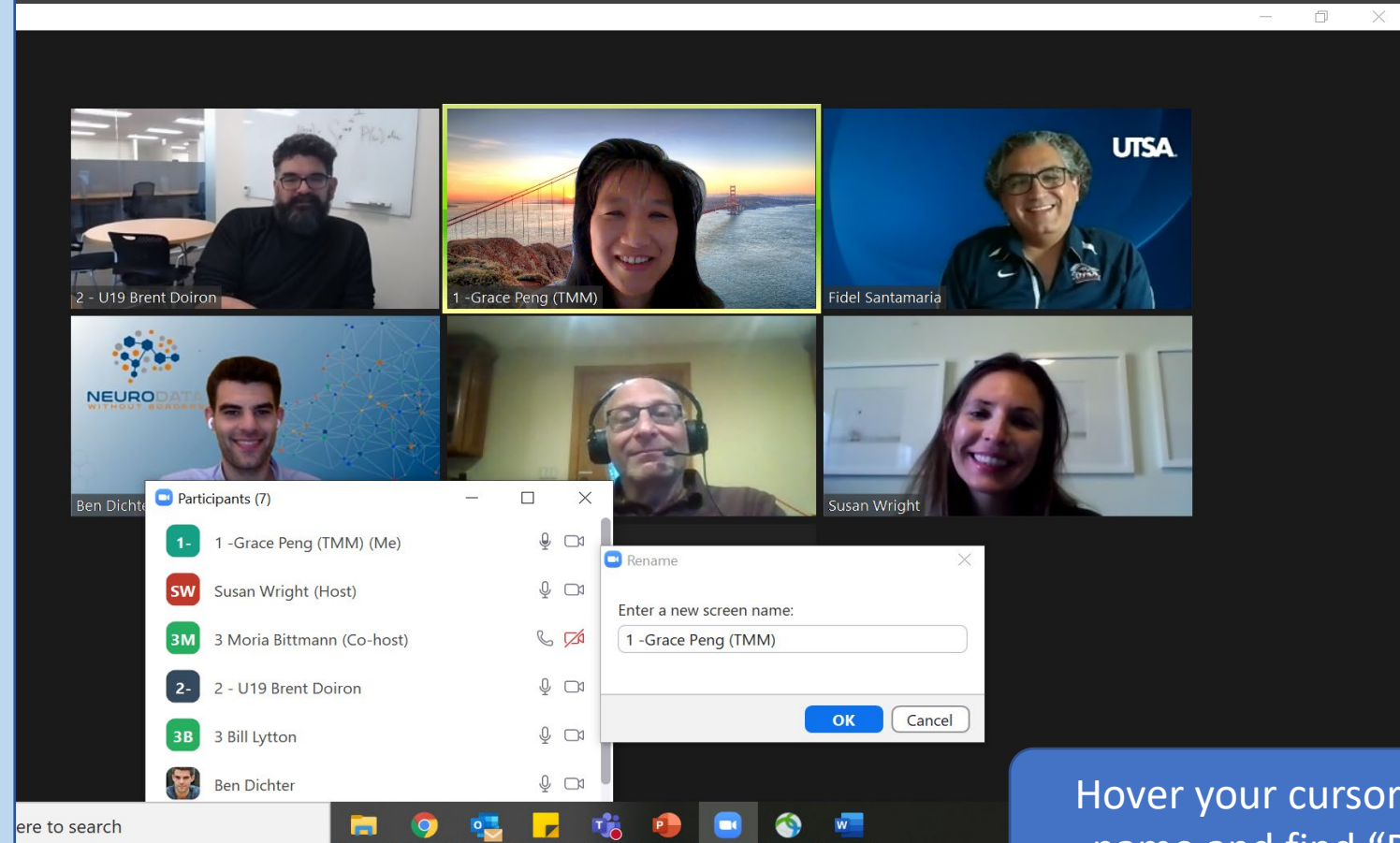
<https://theoriesmodel-zlk2740.slack.com/archives/C01C22VAJ92>

1. Right-click on your own Zoom box with your video feed in it in Zoom; click on your face. Choose “Rename.”

2. Click or mouse-over on your own box with your video feed in Zoom and see three dots appear in the top corner. Click on the three dots. Then click on “Rename.”

3. Go to the “Participants” button at the bottom of your Zoom screen (you may have to put your mouse over it for it to appear). Click the “Participants” button. See a list of participants. Click on yourself. Rename yourself.

4. If these options don’t work, use the Zoom Chat or Slack and ask to have the number you want added to your name.



Hover your cursor over your name and find “Rename”

Timeslot 1 (12:40pm-1:00pm)

Room #	Match	
	U19 Name	TMM Grant #
1	SCC (PI: Goulding)	EB028159 (PI: Ye)
2	brainCOGS – Abstract 2 (PI: Brody)	EB028154 (PI: Ching)
3	DOPE (PI: Sabatini)	EB022903 (PI: Lytton)
4	Ripple (PI: Soltesz)	EB026955 (PI: Sommer)
5	brainCOGS – Abstract 1 (PI: Brody)	EB028155 (PI: David)
6	Learning2Learn (PI: Buffalo)	EB026939 (PI: Santamaria)
7	ABC (PI: Kleinfeld)	EB029847 (PI: Kilpatrick)
8	MoC3 (PI: Costa)	EB026953 (PI: Doiron)
9	CausalityInMotion (PI: Deangelis)	EB022891 (PI: Shouval)
10	brainCOGS – Abstract 3 (PI: Brody)	EB022864 (PI: Howard)
11	MSCZ (PI: Engert)	EB028157 (PI: Makse)
12	MouseV1 (PI: Miller)	EB028166 (PI: Rajan)
13	Osmonauts – Abstract 2 (PI: Rinberg)	EB026908 (PI: Witten)

Timeslot 2 (1:00pm-1:20pm)

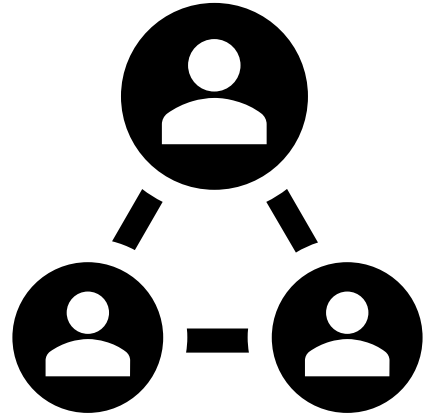
Room #	Match	
	U19 Name	TMM Grant #
1	ABC (PI: Kleinfeld)	EB028159 (PI: Ye)
2	OXT – Abstract 2 (PI: Tsien)	EB026946 (PI: Park)
3	OXT – Abstract 1 (PI: Tsien)	EB028155 (PI: David)
4	OXT – Abstract 3 (PI: Tsien)	EB026937 (PI: Carlson)
5	SCC (PI: Goulding)	EB022903 (PI: Lytton)
6	CausalityInMotion (PI: Deangelis)	EB026949 (PI: Engel)
7	DOPE (PI: Sabatini)	EB022864 (PI: Howard)
8	Osmonauts – Abstract 1 (Datta) (PI: Rinberg)	EB028171 (PI: Druckmann)
9	brainCOGS – Abstract 1 (PI: Brody)	EB028166 (PI: Rajan)
10	Learning2Learn (PI: Buffalo)	EB026938 (PI: Kramer)
11	Holobrain (Sensation) (PI: Maunsell)	EB026936 (PI: Mishne)
12	MouseV1 (PI: Miller)	EB022891 (PI: Shouval)
13	brainCOGS – Abstract 2 (PI: Brody)	EB026908 (PI: Witten)
14	FlyLoops (PI: Dickinson)	EB026939 (PI: Santamaria)

Timeslot 3 (1:20pm-1:40pm)

Room #	Match	
	U19 Name	TMM Grant #
1	FlyLoops (PI: Dickinson)	EB029847 (PI: Kilpatrick)
2	Osmonauts – Abstract 1 (Datta) (PI: Rinberg)	EB026939 (PI: Santamaria)
3	Ripple (PI: Soltesz)	EB026938 (PI: Kramer)
4	OXT – Abstract 2 (PI: Tsien)	EB026955 (PI: Sommer)
5	MSCZ (PI: Engert)	EB026937 (PI: Carlson)
6	MouseV1 (PI: Miller)	EB028171 (PI: Druckmann)
7	SCC (PI: Goulding)	EB028157 (PI: Makse)
8	brainCOGS – Abstract 3 (PI: Brody)	EB028154 (PI: Ching)
9	Holobrain (Sensation) (PI: Maunsell)	EB026908 (PI: Witten)
10	MoC3 (PI: Costa)	EB022903 (PI: Lytton)
11	brainCOGS – Abstract 2 (PI: Brody)	EB026949 (PI: Engel)
12	OXT – Abstract 1 (PI: Tsien)	EB026953 (PI: Doiron)
13	OXT – Abstract 3 (PI: Tsien)	EB028155 (PI: David)
14	CausalityInMotion (PI: Deangelis)	EB026946 (PI: Park)
15	Osmonauts – Abstract 2 (PI: Rinberg)	EB026936 (PI: Mishne)

Timeslot 4 (1:40pm-2:00pm)

Room #	Match	
	U19 Name	TMM Grant #
1	DOPE (PI: Sabatini)	EB026946 (PI: Park)
2	Holobrain (Sensation) (PI: Maunsell)	EB026953 (PI: Doiron)
3	FlyLoops (PI: Dickinson)	EB028157 (PI: Makse)
4	OXT – Abstract 1 (PI: Tsien)	EB022891 (PI: Shouval)
5	Osmonauts – Abstract 2 (PI: Rinberg)	EB028159 (PI: Ye)
6	Osmonauts – Abstract 1 (Datta) (PI: Rinberg)	EB026949 (PI: Engel)
7	brainCOGS – Abstract 3 (PI: Brody)	EB029847 (PI: Kilpatrick)
8	OXT – Abstract 2 (PI: Tsien)	EB026938 (PI: Kramer)
9	ABC (PI: Kleinfeld)	EB026937 (PI: Carlson)
10	Ripple (PI: Soltesz)	EB022864 (PI: Howard)
11	MSCZ (PI: Engert)	EB028171 (PI: Druckmann)
12	Learning2Learn (PI: Buffalo)	EB026936 (PI: Mishne)
13	MoC3 (PI: Costa)	EB028166 (PI: Rajan)
14	brainCOGS – Abstract 1 (PI: Brody)	EB028154 (PI: Ching)
15	OXT – Abstract 3 (PI: Tsien)	EB026955 (PI: Sommer)



Wrap Up (2:00pm-2:20pm)

- Group Discussion
- Feedback