

HuBMAP
Human BioMolecular Atlas Program

COMMON COORDINATE
FRAMEWORK WORKSHOP
CCFWS-01

#hubmapccf

Goals

HuBMAP will develop a common reference map or coordinate system called the Common Coordinate Framework (CCF). As stated in the Common Coordinate Framework Meeting (CCFM) document, a CCF makes it possible to uniquely and effectively define and name any location in the human body. A set of robust origin points (serving as landmarks) make it possible to reference organs, tissues, cells over different anatomical scales, tolerate human variability and function across lifespan and disease, and help integrate heterogeneous data layers and a wide range of reference maps such as whole body spatial maps, genetic variant maps, and coordinate systems that align with vascular pathways.

This CCF workshop will focus on a kidney-specific CCF and atlas but also discuss other relevant CCF/atlas efforts. It will feature presentations and discussions on:

- CCF metadata—what data are currently captured, how can they be unified across tissue mapping centers (TMCs), what additional data are needed to meet stakeholder (research) needs.
- CCF ontologies—what ontologies exist and are used in what part of the data pipeline; what ‘desirable properties’ and ‘success criteria’ exist?
- CCF mapping and numerical construction—including dealing with human variation and using CCF user interfaces as a means to properly register data and review data completeness.
- General principles and processes that can inform CCF design for other organs and continuous adaptation of CCF to emerging technologies and ever changing user requirements.

The ultimate goal is a set of draft guidelines for TMCs detailing what data to provide in which formats to maximize CCF mapping accuracy and data utility.

<https://ccfws.cns.iu.edu>



Katy Borner @katycns · May 3

HuBMAP CCF Workshop, May 9, 2019 @IUBloomington and via live stream ccfws.cns.iu.edu. @NIH_CommonFund @_hubmap @ReBuildaKidney @KPMProject @humancellatlas @MathCancer @satijalab @GriffinMWeber #SingleCell #ivmooc #**hubmapccf**



HuBMAP Common Framework Workshop (CCFWS)

May 9, 2019 at Indiana University, Bloomington, IN and virtual

ccfws.cns.iu.edu



Please use #hubmapccf

Organizers



Katy Börner
MC-IU
Indiana University



Jeffrey Spraggins
TMC-Vanderbilt
Vanderbilt University



Sanjay Jain
TMC-UCSD
Washington University, St. Louis

Local Organizers



Lisel Record
MC-IU
Indiana University



Matt Martindale
MC-IU
Indiana University

Acknowledgements

The work was funded by NIH Awards [OT2OD026671](#), [U54DK120058](#), and [U54HL145608](#).

Agenda

All times are in Eastern Daylight Time (UTC-4)

9:00am Welcome by Organizers and Richard Conroy, NIH

9:05am Brief Introductions by Participants

9:30am HuBMAP Overview by Organizers

10:00am **Metadata**

Paul Macklin et al., IU; Kidney Metadata and Ontology Design (HuBMAP)

Bernard de Bono, U of Auckland; Kidney Anatomical Knowledge and Metadata (SPARC)

10:40am *Coffee Break*

11:10am **Metadata**

Jonathan Himmelfarb, U of Washington; The Kidney Precision Medicine Project Overview of KPMP Metadata (KPMP)

11:30am **Ontologies**

Jonathan Silverstein, U Pitt; Graphing UMLS (HuBMAP)

Yongqun "Oliver" He, U Michigan Medical School; Integrative Ontology Development to Support Precision Medicine and Molecular Atlas Research (KPMP)

Olivier Bodenreider, NLM/NIH; Anatomical Ontologies: How many of them do we need?

12:30pm *Catered Lunch*

Agenda

All times are in Eastern Daylight Time (UTC-4)

1:30pm **Anatomical Mapping**

Zorina Galis, NIH/NHLBI; Using the Vasculature for CCF (NIH)

Simon Watkins & Alan Watson, U Pitt; Ribbon Scanning Confocal for High-Speed High-Resolution Volume Imaging

Seth Winfree, IU School of Medicine; Bi-directional Interrogation of Image Volumes and Segmented Cells With 3D Tissue Cytometry

2:30pm *Coffee Break*

3:00pm **CCF User Interfaces**

Katy Börner, IU; Multi-Level, Multi-Modal CCF UI for Data Providers and Users (HuBMAP)

Becky Steck, U Mich; KPMP's User-Centered Approach to User Interfaces and Data Visualization (KPMP)

Peter Hunter, U of Auckland; 3D Scaffolds (SPARC)

4:00pm Discussion of challenges and (collaboration) opportunities

5:00pm *Adjourn*

5:30pm *Dinner at **FARMBloomington Restaurant***

Due to federal funding policy, participants will be responsible for their individual dinner expenses.

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CCFWS Challenges and Opportunities ☆ ↻

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Outline

- CCF Challenges and Opportunities
 - Challenges
 - CCF Metadata
 - CCF Ontologies
 - CCF Mapping and Numerical Con...
 - CCF User interfaces
 - Opportunities
 - CCF Metadata
 - CCF Ontologies
 - CCF Mapping and Numerical Con...
 - CCF User interfaces
 - References
 - Links

CCF Challenges and Opportunities

Collected from participant registration data and during the CCF WS, see <https://ccfws.cns.iu.edu>
Please feel free to add!

Challenges

CCF Metadata

- Lack of guidance from the NIH
- Balancing between too little and too much information
- The usual, ease of access, search quality, data manipulation, etc.
- Different approaches to the data because of different methodologies
- Human variability is quite diverse by organ. Brain efforts have been able to register datasets to specific cells but many organs won't be able to attain this. I need fast registration of all datasets so they can be explored in a portal.
- Standardising metadata between diverse groups into a model that is sufficiently detailed to capture relevant data but also flexible enough to meet all user needs
- Within HuBMAP, there will soon exist data by 5 TMCs, using 25 different assay types, for 9+ organs. Protocols and workflows are evolving.

CCF Ontologies

- The lack of understanding of what an ontology is, how it is created and what it can do.
- Ability to effectively translate integrate and share across the many expertise domains that are needed for HuBMAP
- How to utilize both spatial and "mother-daughter" relationships
- Identifying existing or creating ontologies that sufficiently cover from acquisition of whole

<https://tinyurl.com/ccfws-feedback>



HuBMAP

The Human BioMolecular Atlas Program

Vision:

Catalyze the development of an open, global framework for comprehensively mapping the human body at a cellular resolution.

<https://commonfund.nih.gov/HuBMAP>

HuBMAP Goals

1. Accelerate the development of the next generation of tools and techniques for constructing high resolution spatial tissue maps
2. Generate foundational 3D tissue maps
3. Establish an open data platform
4. Coordinate and collaborate with other funding agencies, programs, and the biomedical research community
5. Support projects that demonstrate the value of the resources developed by the program



HuBMAP Consortium

Based upon new imaging and biomolecular sequencing technologies, multiple national and international efforts are underway to more comprehensively understand human cells. The Human BioMolecular Atlas Program (HuBMAP) is a consortium composed of diverse research teams funded by the National Institutes of Health (<https://commonfund.nih.gov/HuBMAP>). HuBMAP is committed to developing the next generation of molecular analysis technologies, computational tools, and to generate foundational tissue maps in order to accelerate the construction of an atlas of the human body for the understanding the relationship between tissue organization and function. HuBMAP values secure, open sharing, and collaboration with other consortia and the wider research community.

<https://hubmapconsortium.org>



Funded Research


Learn about HuBMAP funded research.

Latest News

- [The single-cell transcriptional landscape of mammalian organogenesis \(02/20/2019\)](#)
- [Data visualization literacy: Definitions, conceptual frameworks, exercises, and assessments \(02/05/2019\)](#)
- [Cell Hashing from Satija Lab \(12/19/2018\)](#)

[Read More](#)

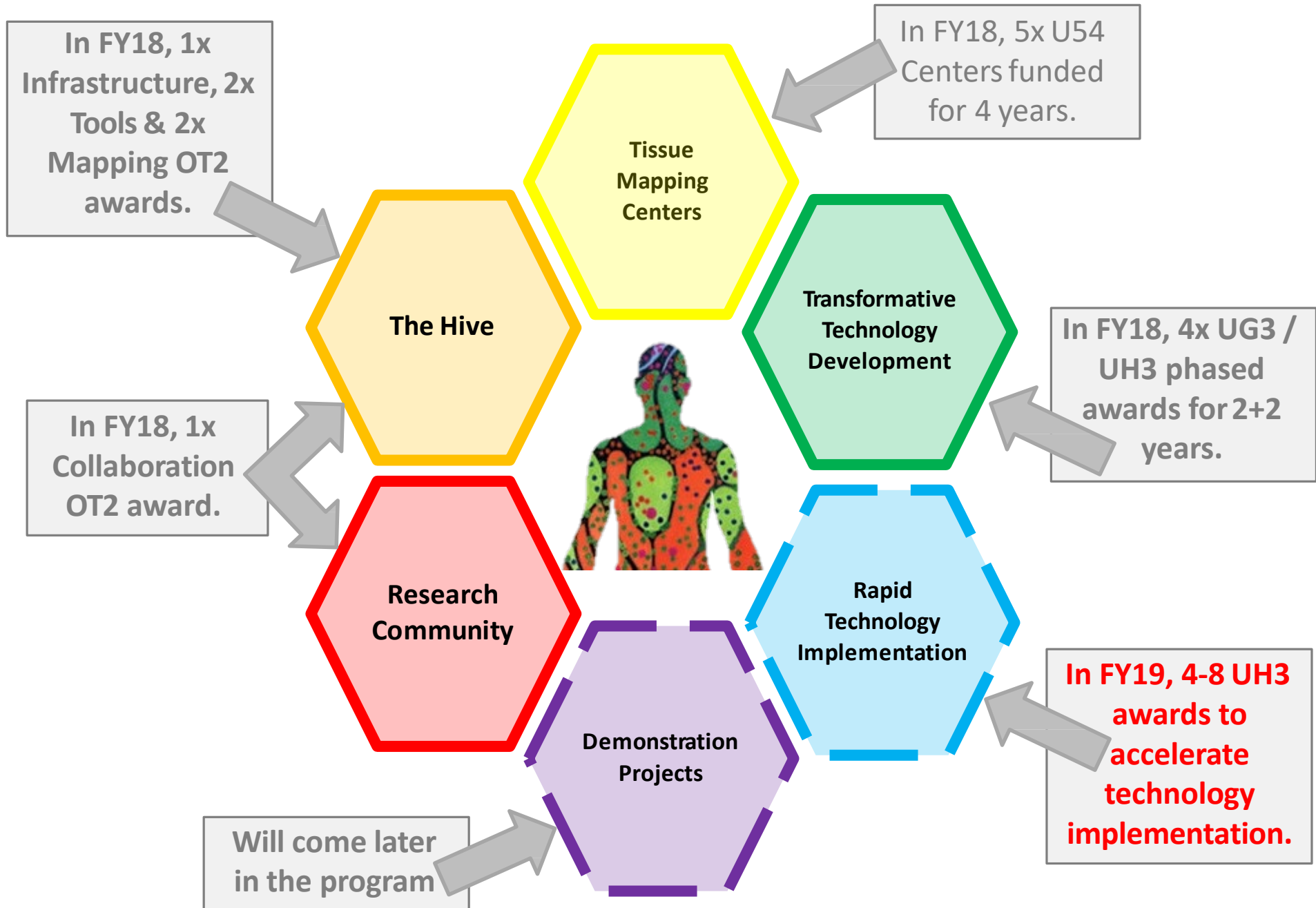
Twitter Feed

 Human BioMolecular Atlas Program (HuBMAP)
Retweeted



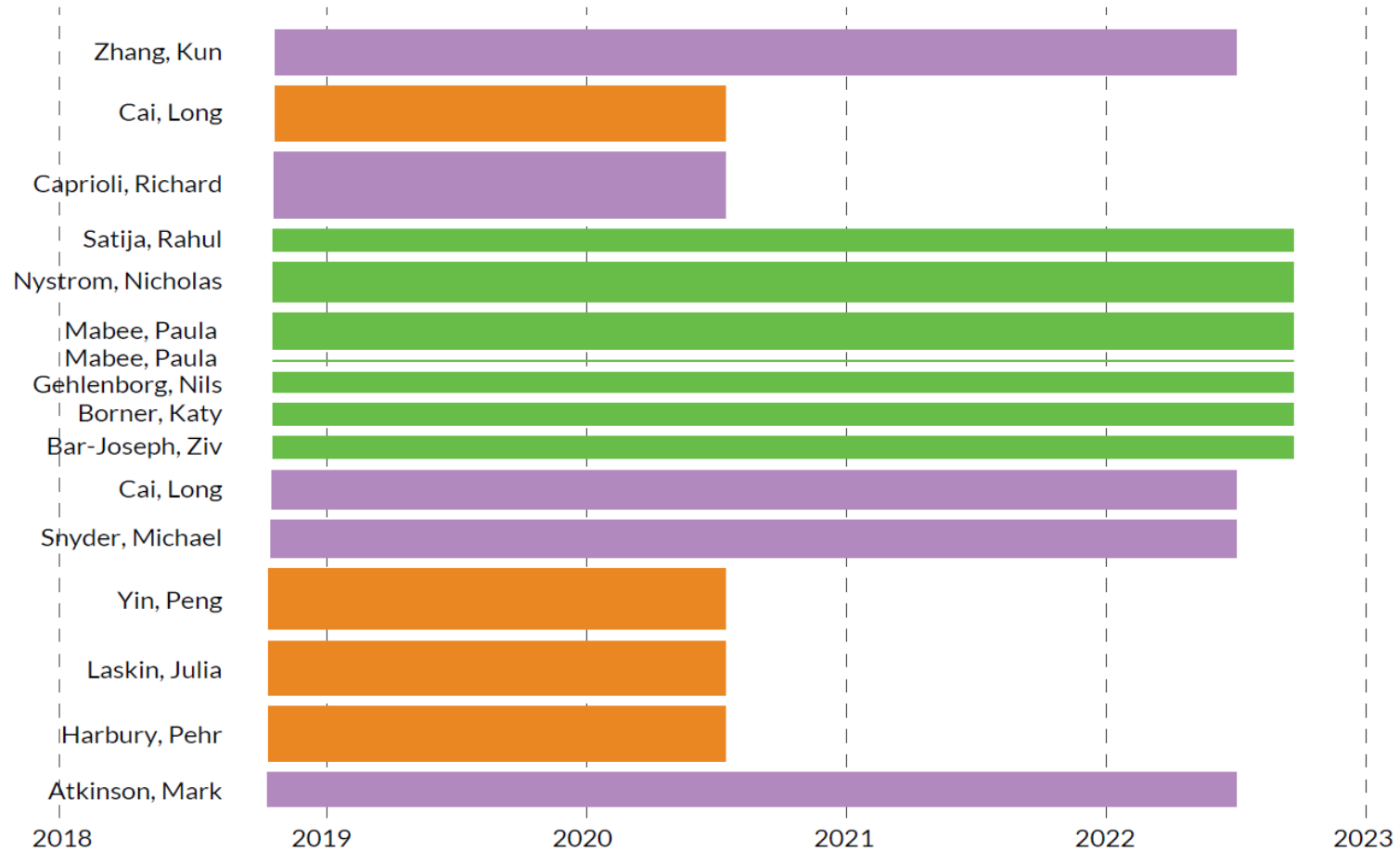
Katy Borner 3 May

HuBMAP CCF Workshop, May 9, 2019
@IUBloomington and via live stream <https://t.co/QSV0fofQ0C>. @NIH_CommonFund @_hubmap @ReBuildaKidney @KPMProject @humancellatlas @MathCancer @satijalab @GriffinMWeber #SingleCell #ivmooc #hubmapccf



Temporal Bar Graph of HuBMAP Project

MC-IU within HuBMAP (<https://hubmapconsortium.org>)
03/25/2019



Legend

Area size: FY Total Cost by IC
Label: PI (Contact)
Maximum = \$ 650,000
Minimum = \$ 15,000

- HIVE
- TMC
- TTD

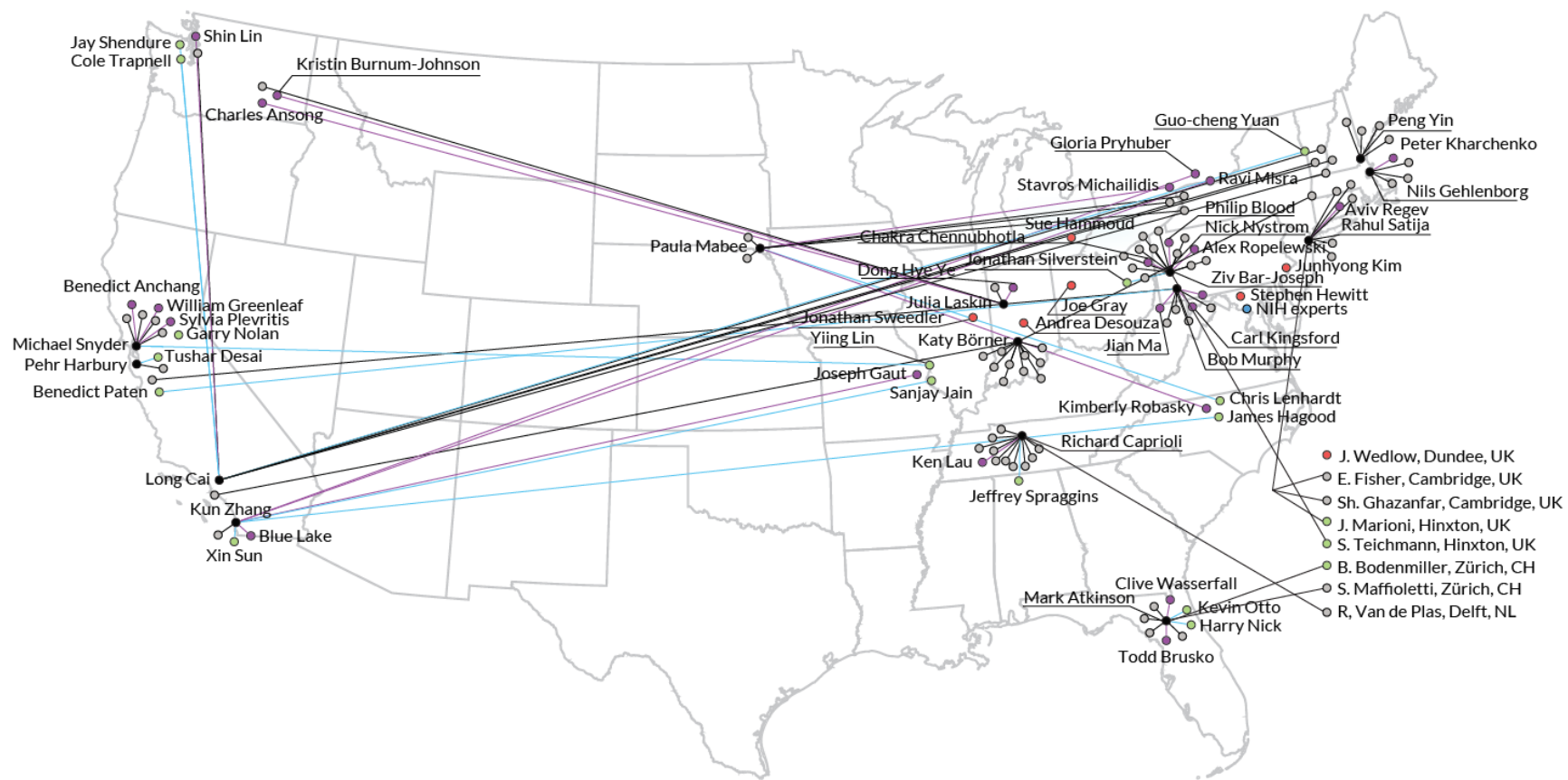
How To Read This Visualization

This temporal bar graph visualization shows total funding by NIH center or institute (IC) for the period from 2018 to 2022, indicating contact principal investigator (PI) of funded projects. Maximum and minimum total costs per project are given in the legend. Bars are colored by project types.

Geospatial Layout of HuBMAP Teams

MC-IU within HuBMAP (<http://hubmapconsortium.org>)

04/16/2019



Legend

Label: Experts
Color: Role

Nodes and Edges

- PI (Contact)
- PI
- Co-Investigator

- NIH
- EPC

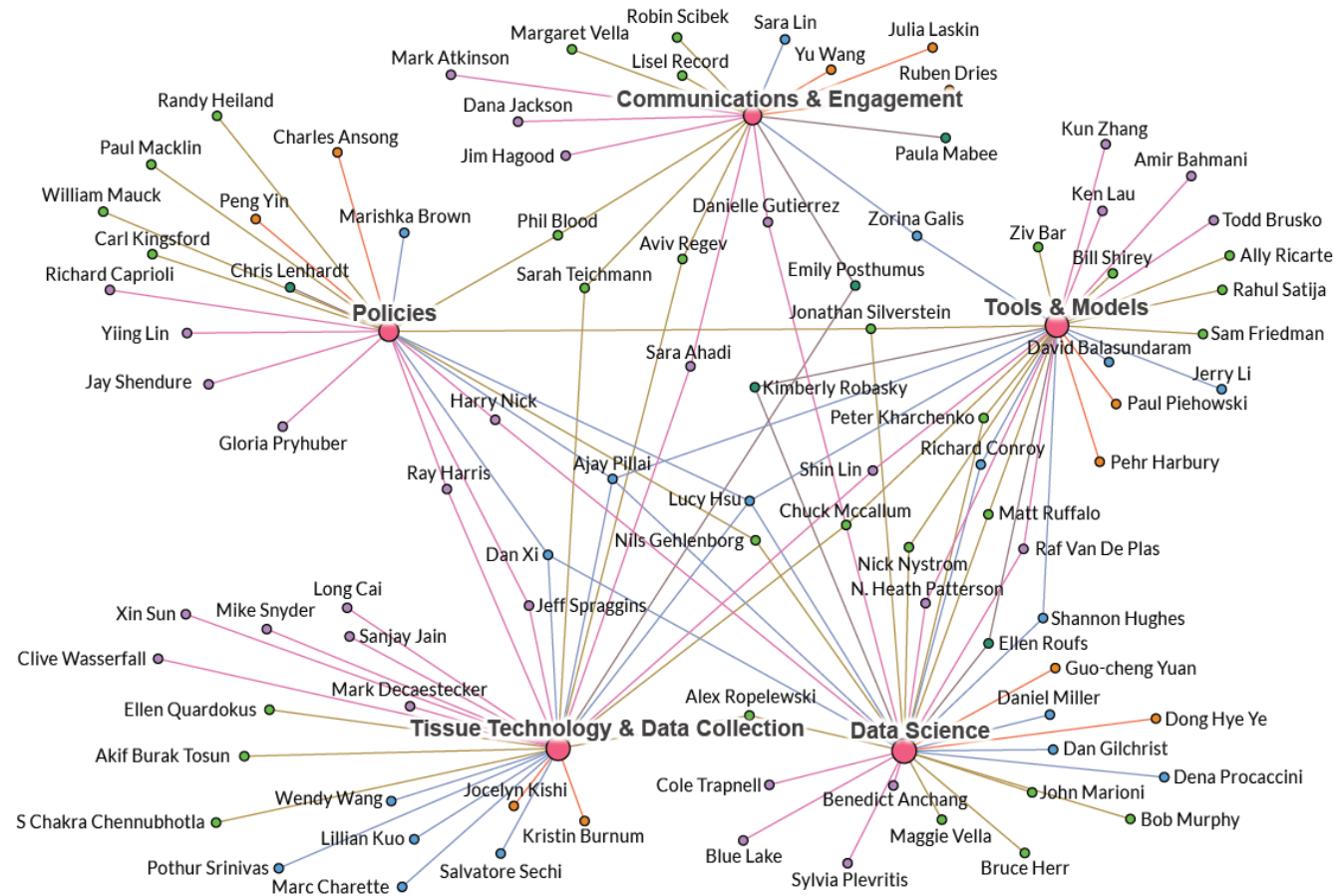
How To Read This Visualization

This geospatial map shows the collaboration network of 134 experts. Principal investigators (PIs) are placed at their exact geolocation. Team members are placed nearby and are linked to PIs. Nodes and edges are colored according to their roles.

Bimodal Network of Experts and Working Groups

MC-IU within HuBMAP (<https://hubmapconsortium.org>)

04/09/2019



Legend

Label: Experts
Working Groups
Color: Team Type

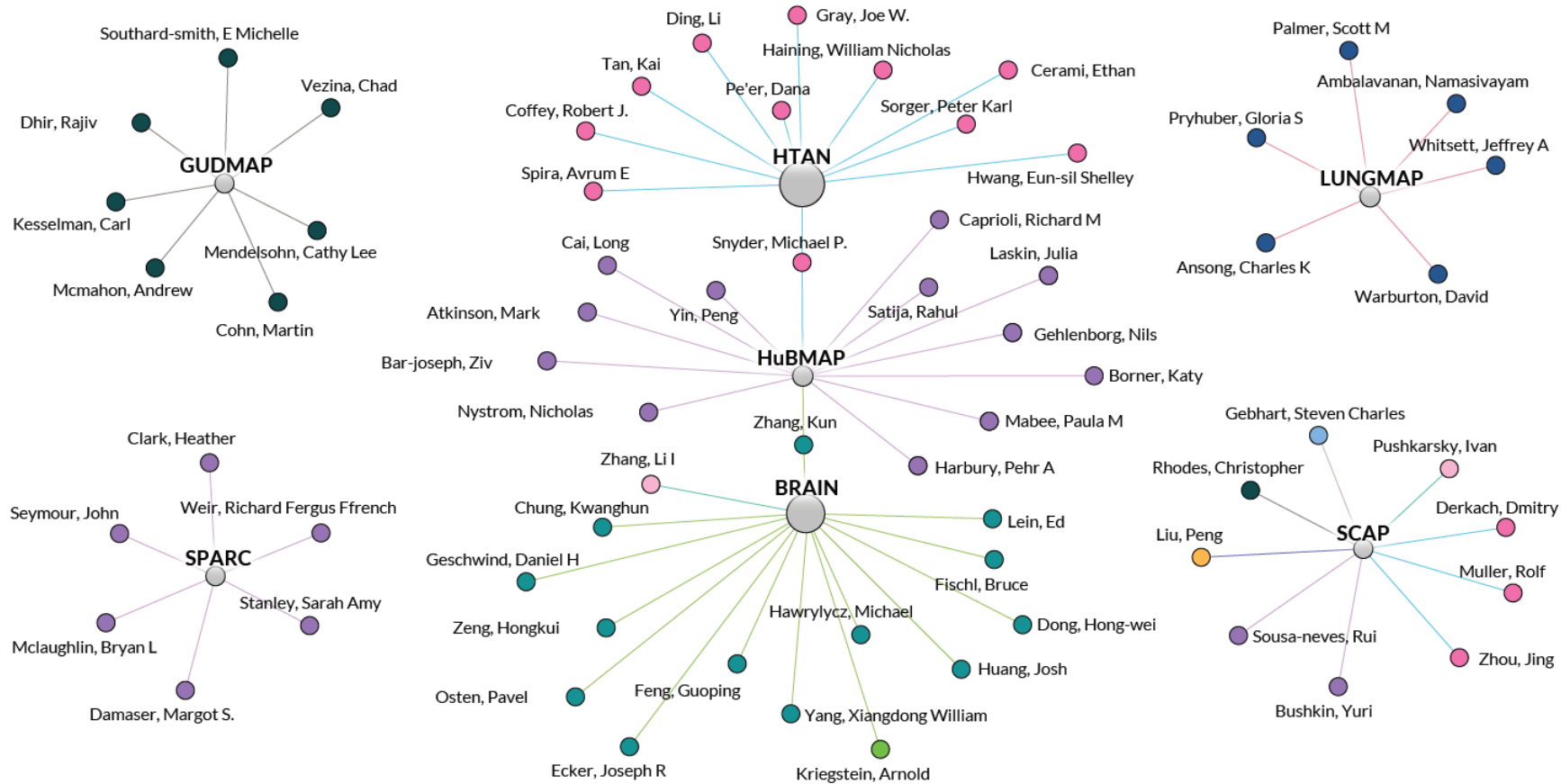
Nodes and Edges
 ■ WGs ■ TMC
 ■ HIVE ■ NIH
 ■ TTD ■ CC

How To Read This Visualization

This bimodal network represents a network between five working groups and 126 experts of those groups. Nodes and edges are colored according to the team type that expert belongs to. Working group nodes are sized by the total number of experts in the group.

Bimodal Network of PI (Contacts) and NIH Projects

MC-IU within HuBMAP (<https://hubmapconsortium.org>)
04/22/2019



Legend

Label: PI (Contacts)
NIH Projects
Maximum = 71,882,084
Minimum = 3,065,740

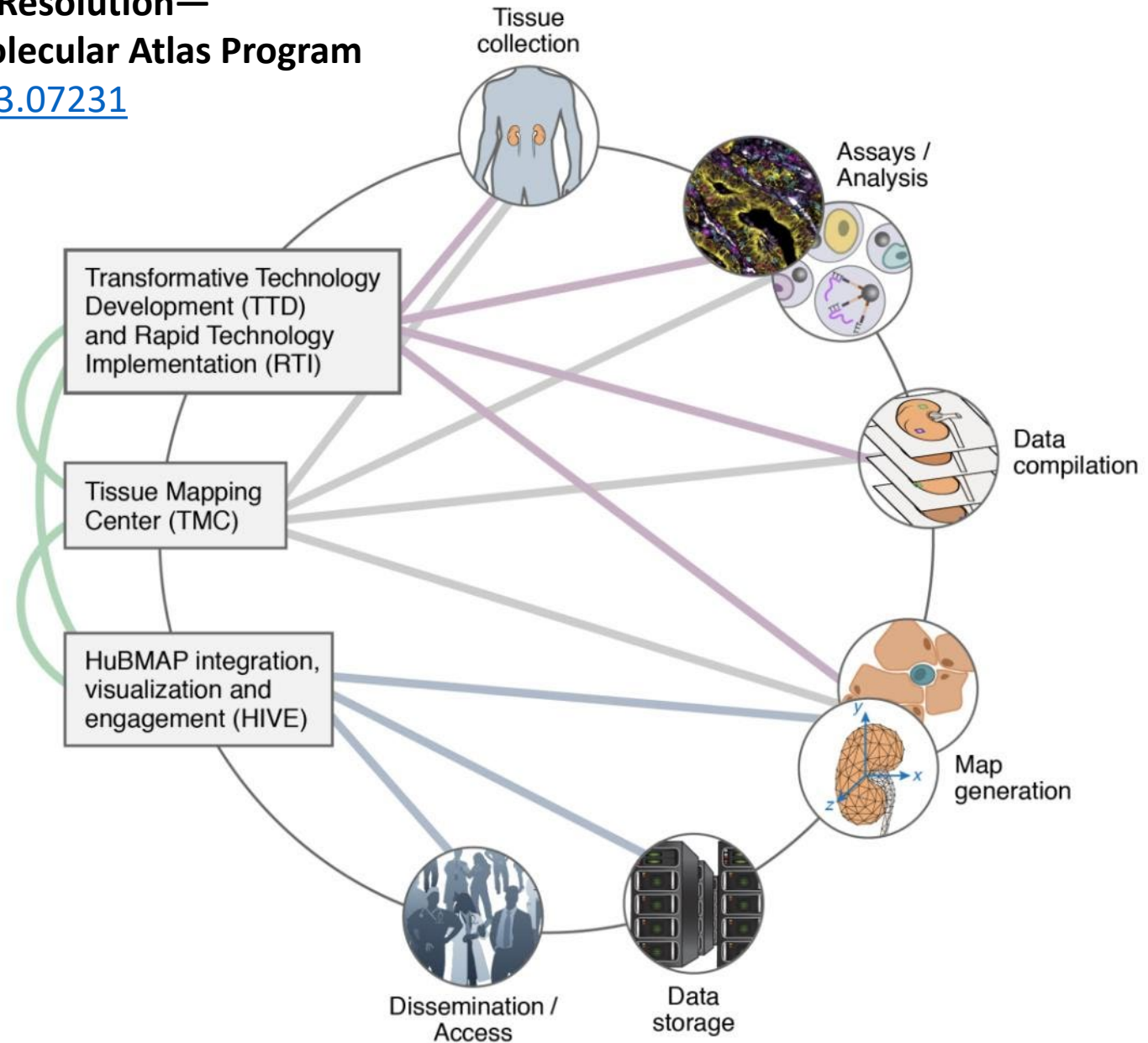
- OD
- NIMH
- NCI
- NIDDK
- NHLBI
- NCCIH
- NHGRI
- NIGMS

How To Read This Visualization

This bimodal network represents a network between six NIH projects and 73 PI (Contacts). Nodes and edges are colored according to the Funding Institute & Center that project of Pi (Contact) is financed from. NIH project's node sizes based on award amount.

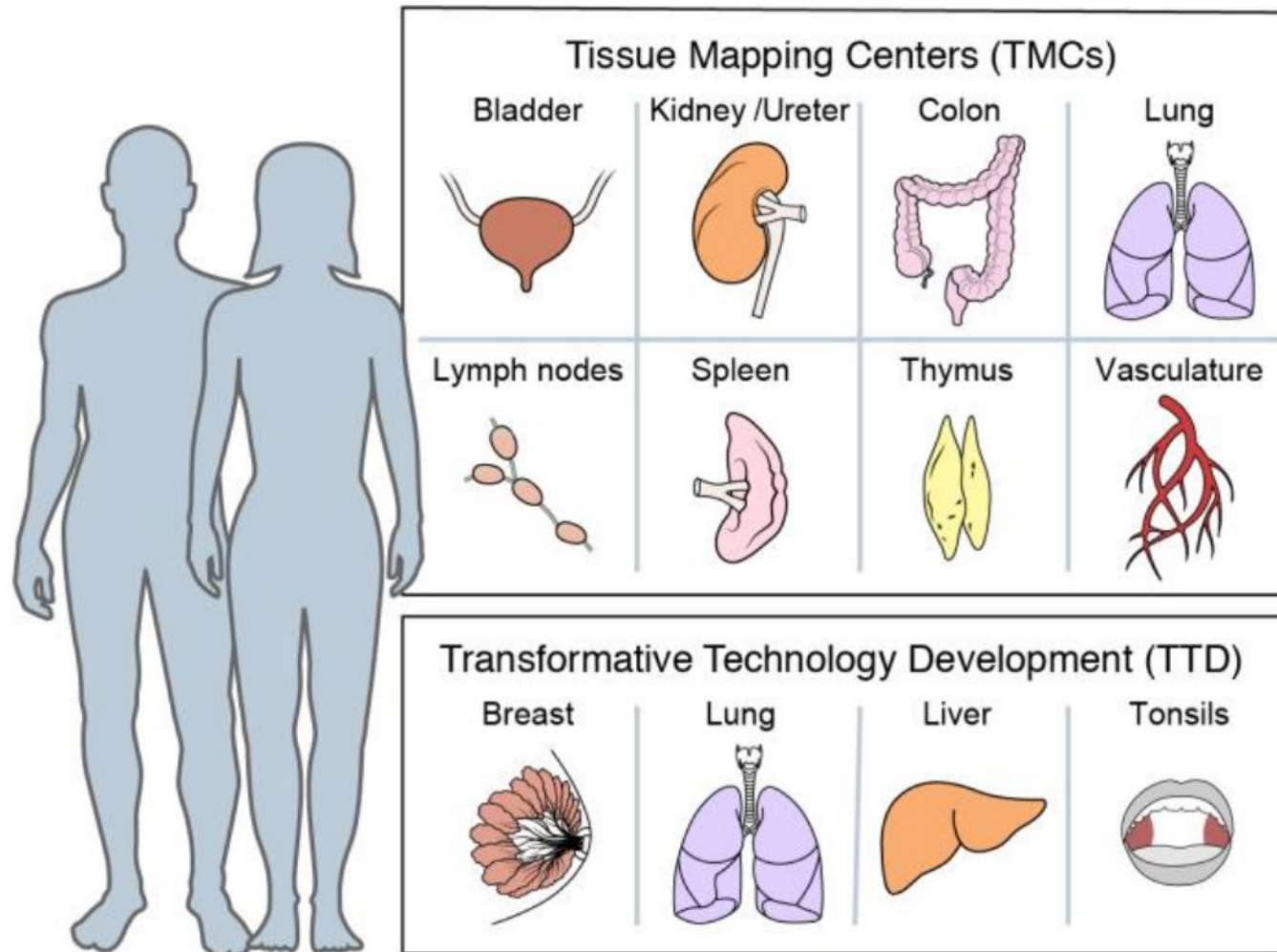
Mapping the Human Body at Cellular Resolution— The NIH Common Fund Human BioMolecular Atlas Program

Snyder et al. <https://arxiv.org/abs/1903.07231>



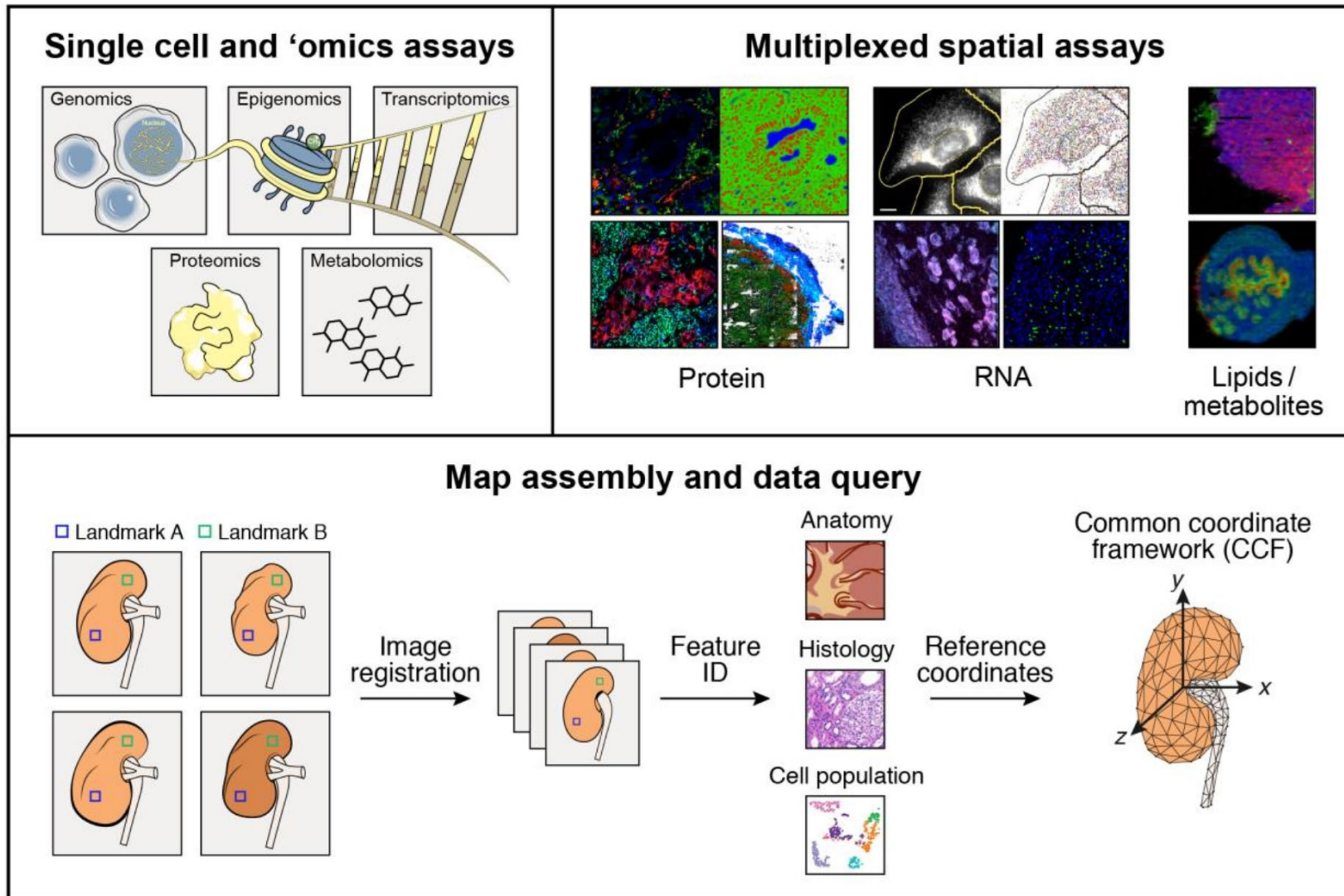
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HuBMAP

The Human BioMolecular Atlas Program

<http://sampledata.hubmapconsortium.org>

Summary of Sample Data



Upload Files To HuBMAP

Transfer files to HuBMAP using Globus file transfer service where you'll be able to monitor the status of your upload



Download Files From HuBMAP

Search for, select and download files from HuBMAP