

# Consortium Science

## HuBMAP and HTAN

Michael Snyder  
Stanford University  
November 17th

- *Many NIH consortium projects have been initiated*
- *Human Genome Project*
- *ENCODE, modENCODE, mouse ENCODE, psychENCODE*
- *MoTrPAC, HMP, CPTAC*
- *Altas Building: HTAN, HuMAP*
- *NASA Twins Study*

# Consortium Science

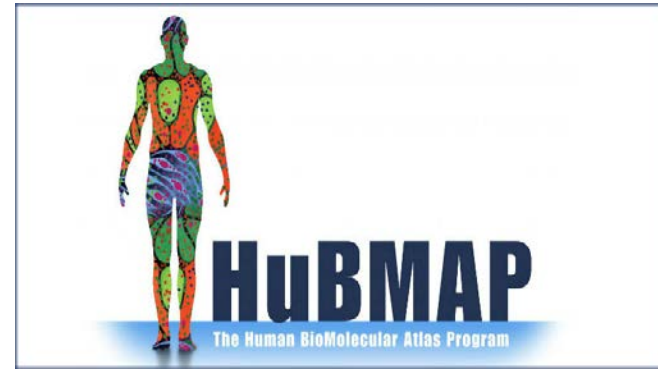
## ***Opportunities***

- *Bring in experts to tackle a lofty goal.*
- *Reduce redundancy and foster collaborations*
- *Lots of committees to coordinate activities*

# HuBMAP

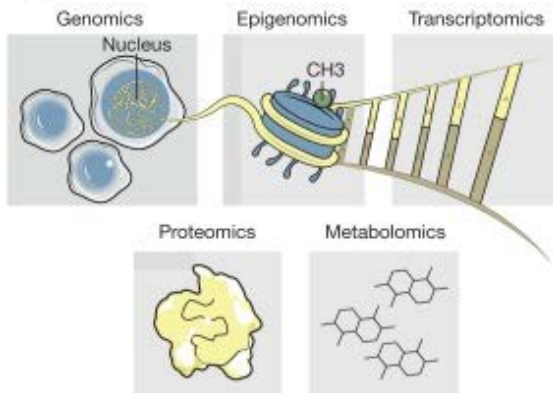
- NIH Common Funded Project
- Human Biomolecular Atlas Program (HuBMAP) intends to develop a widely accessible framework for comprehensively mapping the human body at single-cell resolution by supporting technology development, data acquisition, and detailed spatial mapping.

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

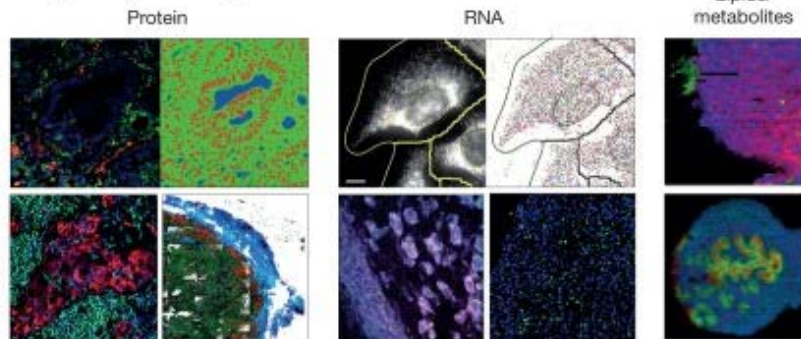


# Build 3D Maps

## Single cell and 'omics assays

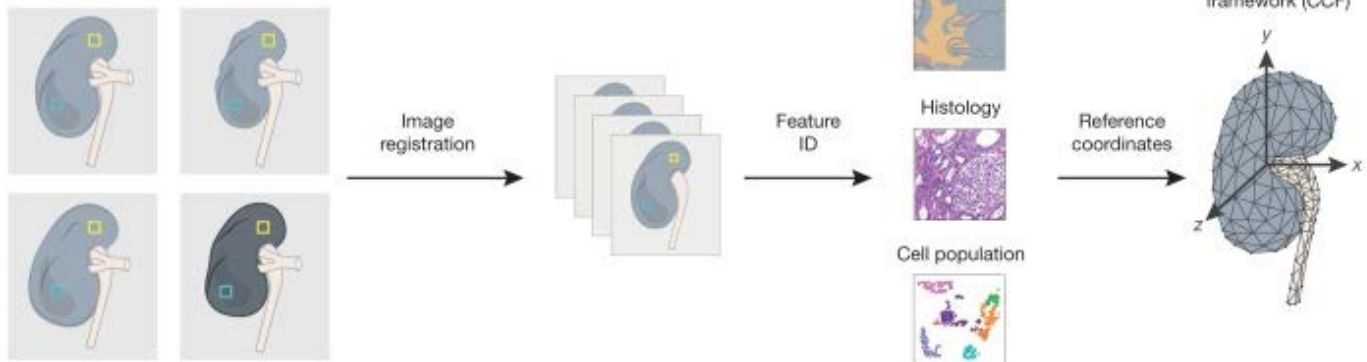


## Multiplexed spatial assays

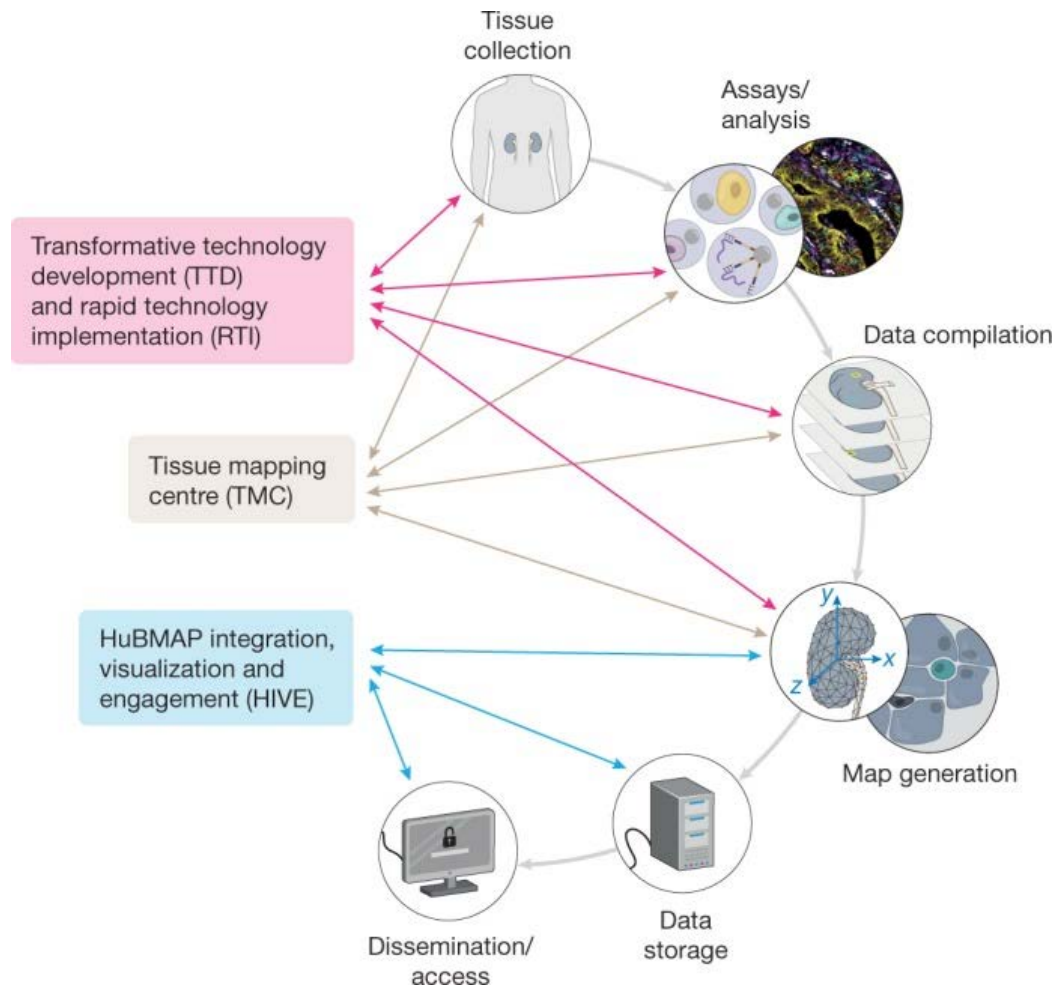


## Map assembly and data query

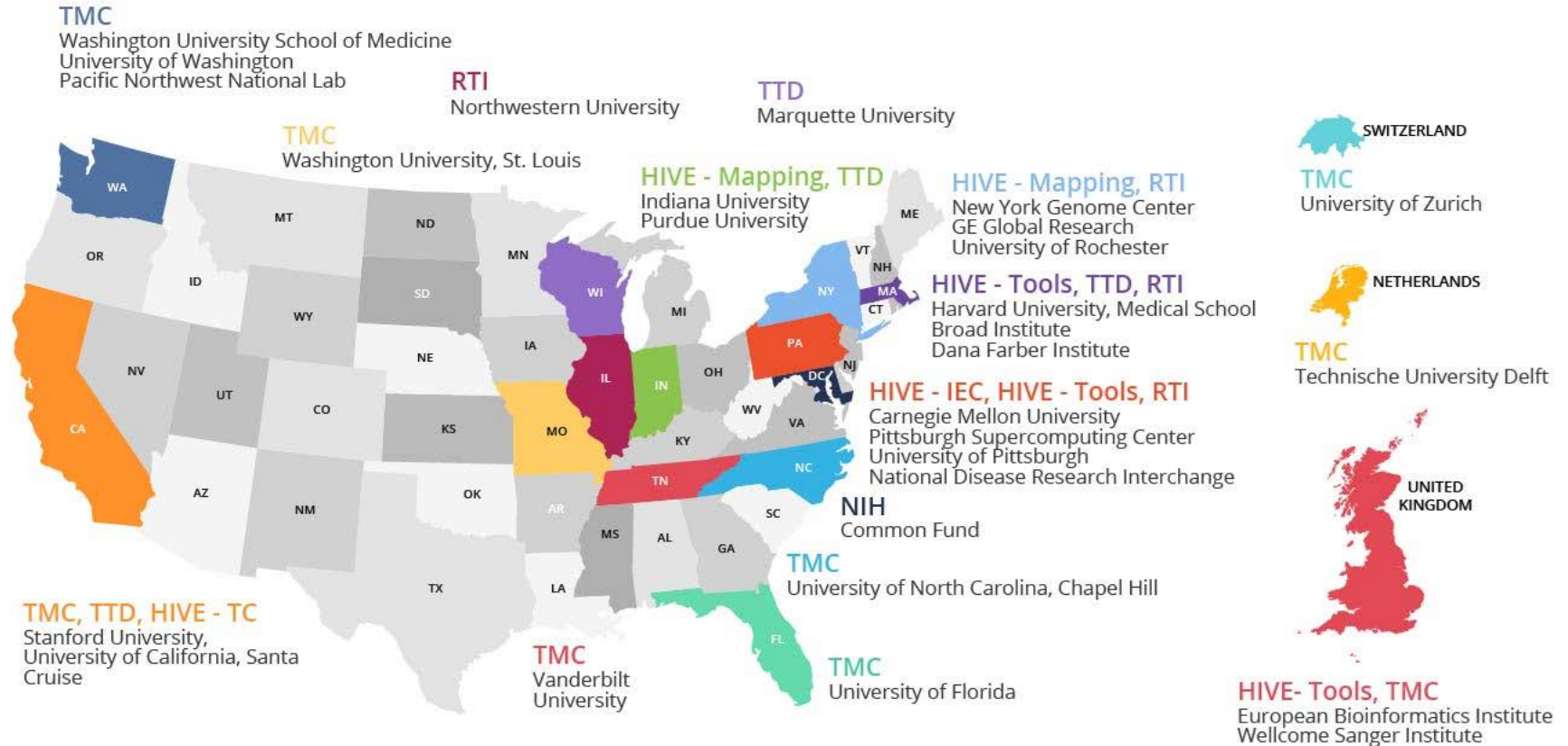
□ Landmark A □ Landmark B



# HuBMAP Overview

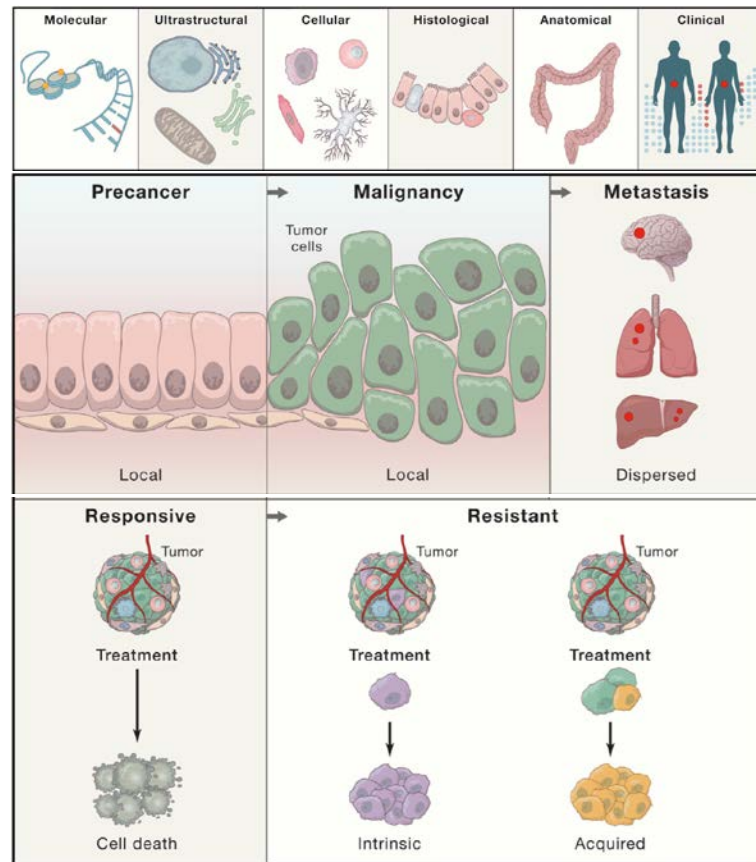


# HuBMAP Funded Groups



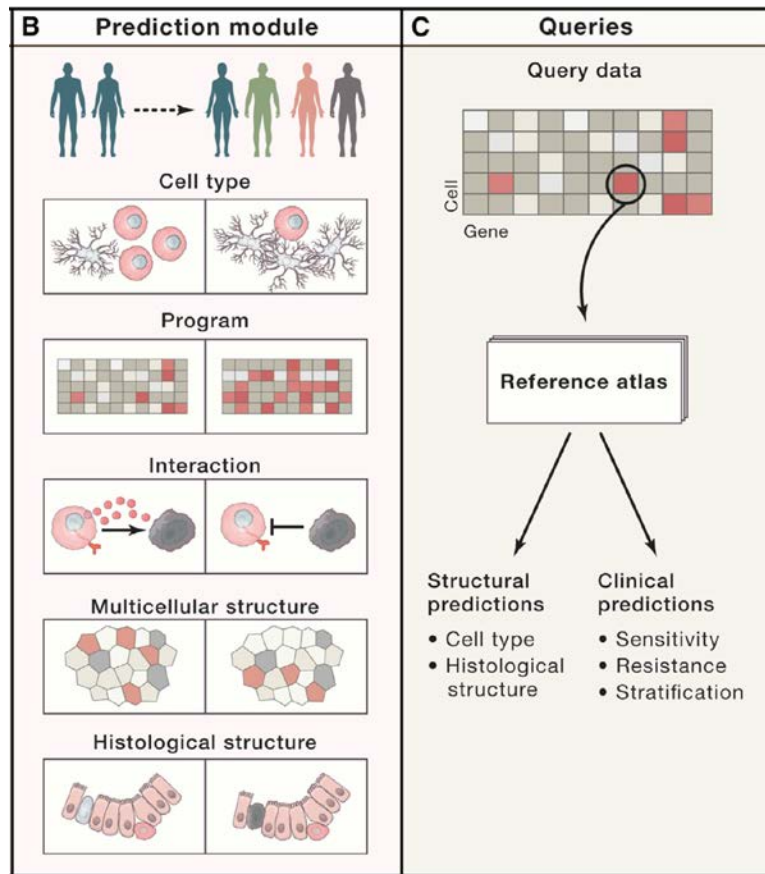
# The NCI Human Tumor Atlas Network

- **Overarching program goal:** Construct dynamic 3D atlases of human cancers
- **Integrate** molecular, cellular, and tumor tissue composition and architecture, including the microenvironment and immune milieu
- Describe **transitions during cancer:** pre-malignant lesions to malignancy, locally invasive to metastatic cancer





- **Overarching program goal:** Construct dynamic 3D atlases of human cancers
- **Integrate** molecular, cellular, and tumor tissue composition and architecture, including the microenvironment and immune milieu
- Describe **transitions during cancer:** pre-malignant lesions to malignancy, locally invasive to metastatic cancer
- Represent a **diverse patient population**, including minority and underserved patients
- Enable **predictive modeling** to discover biomarkers, understand basic cancer mechanisms, (eventually) refine therapeutic choices for patients.



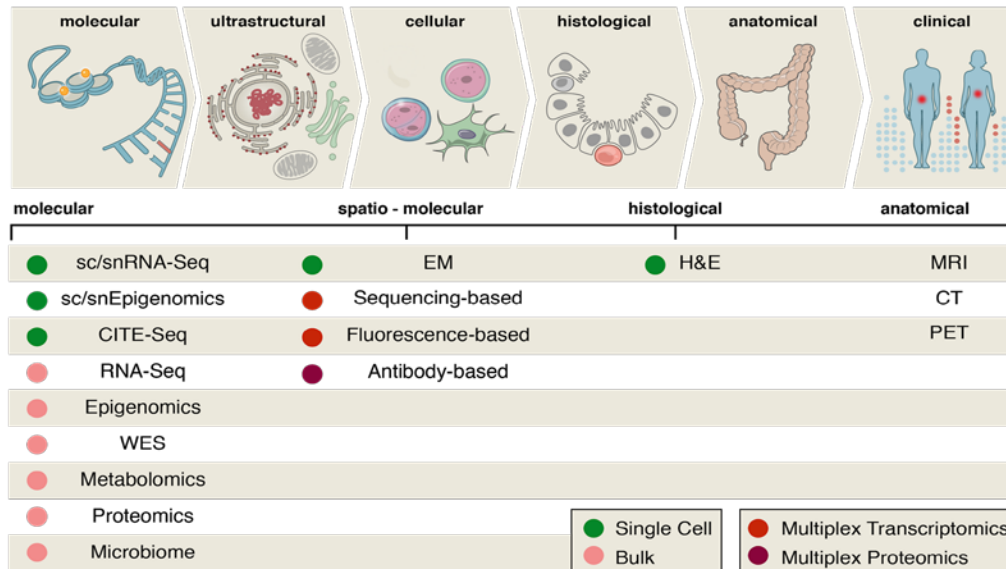


# The NCI HTAN: Overview

**HTAN structure:** 10 HTAN U2C Centers (5 pre-cancer / 5 advanced cancer) + 2 Pilot Projects

**DCC for data handling**

**Number of participants:** 454 unique personnel (investigators, trainees, research staff) + NCI

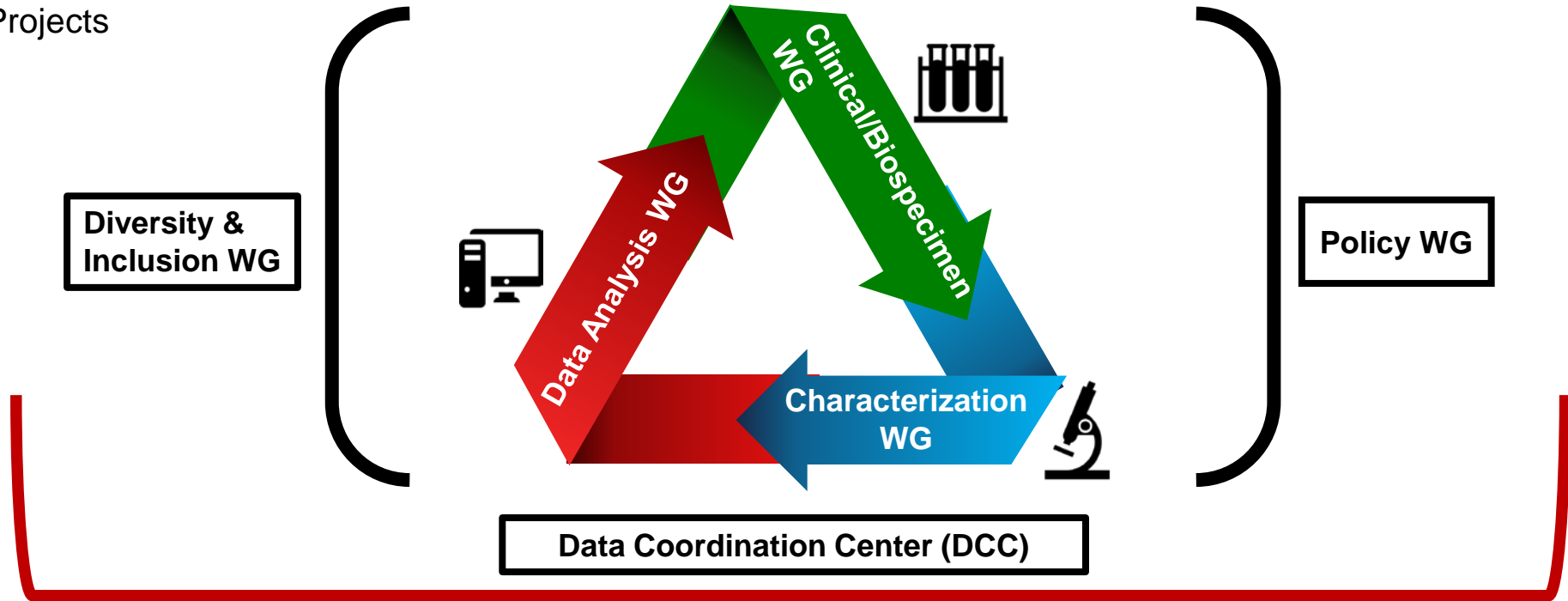


**Technologies employed:**

# HTAN – Network Coordination

## HTAN coordination mechanisms:

HTAN-DCC; Steering Committee Meetings; Bi-annual Meeting, Working Groups, Trans-Network Projects



# HTAN Trans-Network Projects (TNPs)

- Optimizing repeatability, interpretability and accessibility of HTAN characterization methods on shared tissue sources

*Breast Cancer Tumor Microarray*

*Colorectal Cancer - Liver Metastasis*

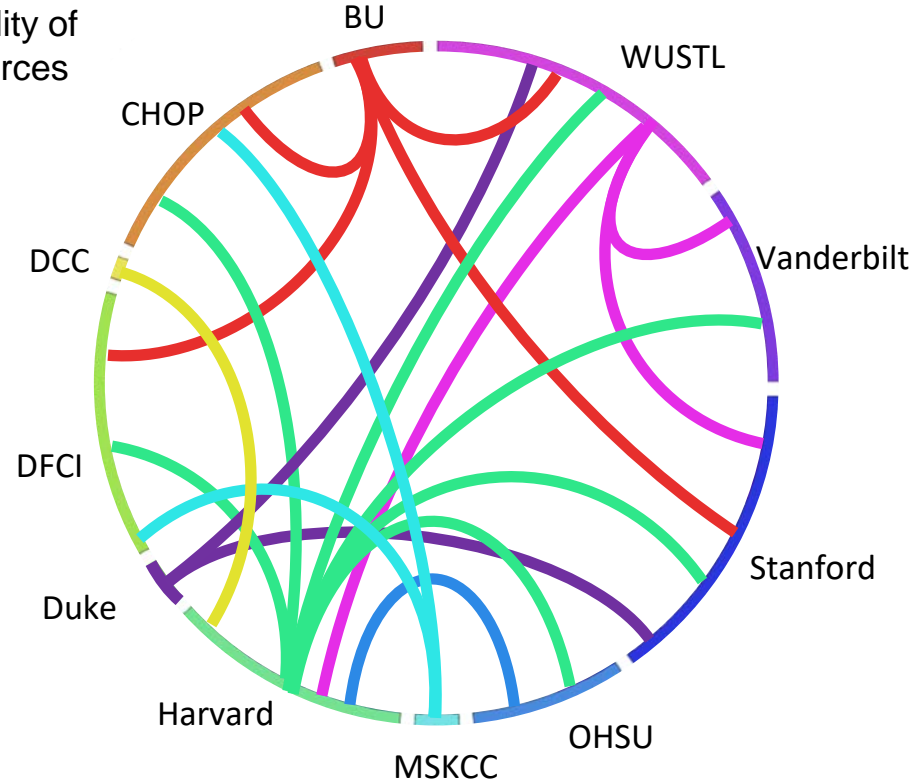
- \* *SARDANA (various tissues and methods)*
- \* *SRRS (virtual repository for HTAN biospecimen)*
- Ductal Carcinoma In Situ*

- Defining cell annotation and signatures

*CASI*

- Image data sharing, visualization and analysis

*Image Data Project*



# Key FY20 Activity: Developing HTAN Consensus Data Formats and Metadata Dictionaries

1. Existing Standards



2. HTAN Working Group  
input



3. Request for comments  
(RFC)



4. HTAN Consensus



# The HTAN Data Portal

## First Data Release – May 2021



**HTAN**  
HUMAN TUMOR ATLAS NETWORK

EXPLORE

DATA STANDARDS

DATA TRANSFER

ANALYSIS TOOLS

HTAN MAIN SITE

## Human Tumor Atlas Network Data Portal

Welcome to the HTAN Data Portal!

The Human Tumor Atlas Network (HTAN) is a National Cancer Institute (NCI)-funded Cancer Moonshot<sup>SM</sup> initiative to construct 3-dimensional atlases of the dynamic cellular, morphological, and molecular features of human cancers as they evolve from precancerous lesions to advanced disease.

Explore the Data

### Assay Type:

Files

<input type="checkbox"/> Bulk DNA-seq	1526
<input type="checkbox"/> Bulk RNA-seq	240
<input type="checkbox"/> CyCIF	7
<input type="checkbox"/> H&E	101
<input type="checkbox"/> IMC	78
<input type="checkbox"/> MIBI	5564
<input type="checkbox"/> MxIF	6467
<input type="checkbox"/> mIHC	54
<input type="checkbox"/> scATAC-seq	240
<input type="checkbox"/> scRNA-seq	2239

8

Atlases

7

Organs

516

Cases

1125

Biospecimens

## Lymphocytes in breast cancer liver metastasis biopsy



1/6

This biopsy taken from a breast cancer liver metastasis was analyzed using multiplex IHC and displays the interface of tumor and host, as immune cells are seen surrounding the strong GATA3+ epithelial tumor cells (CK+ staining not shown here).

### Table of Contents

1. Introduction
2. Immune cells
3. GATA3+ Tumor
4. T and B Cells



NUCLEI  
CD3  
CD20  
CD8  
CD45  
GATA3

### Channel Groups:

Tumor-Immune Interface MORE

CD45 Immune Cells

Lymphocytes

CD3

CD8

CD20

GATA3

### Viewers

CellxGene (1)

CellxGene (3)

CellxGene (11)

Minerva Story (1)

CellxGene (1)

- ☒ SpecimenType >
- ☒ TCellPhenotype >
- ☒ Therapy >
- ☒ detected\_fusion >
- ☒ detected\_wt >



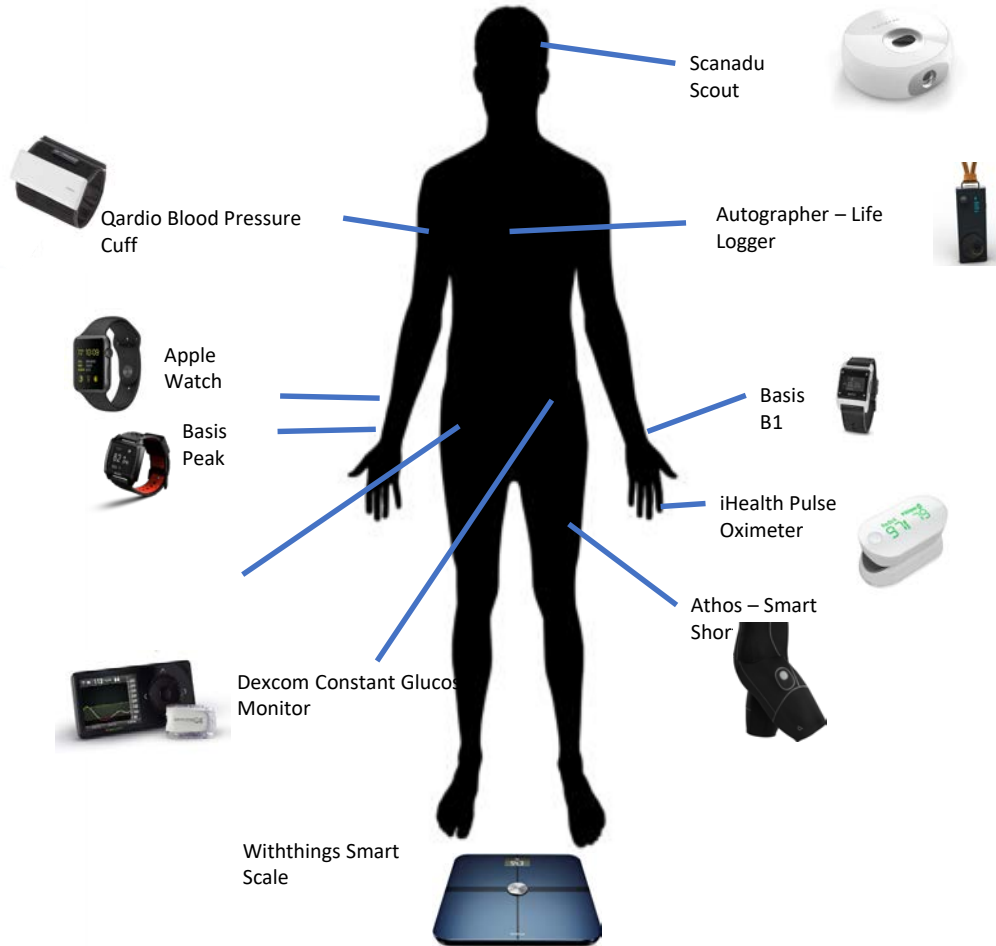
umap: 0 out of 36313 cells

1. Tackles large problems hard to cover by any individual laboratory
2. Brings together world's experts
3. Avoids redundancy
4. Foster collaborations
5. Can bring a lot of attention to an understudied areas
6. Generally well funded



- 1. Most investigators are not trained to do individual science**
- 2. Can have trouble working in a consortium e.g. might be secretive and not collaborative**
- 3. Lots of committees to coordinate activities**

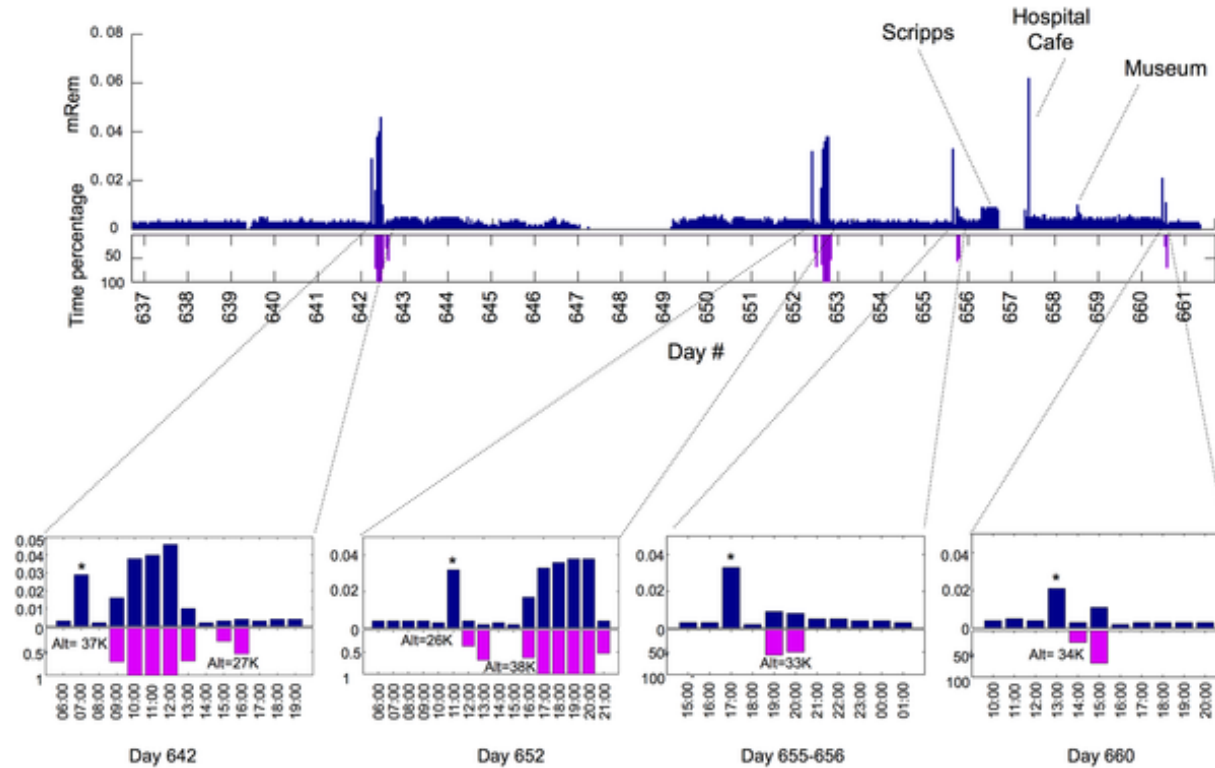
# Wearable Sensors: Over 900 Devices



Radtarge  
Radiation

Li, Dunn et al.  
PloS Biol 2017

# Exposure to Radiation in Daily Life



Li X, Dunn J, Salins D, Zhou G, Zhou W, et al. (2017) Digital Health: Tracking Physiomes and Activity Using Wearable Biosensors Reveals Useful Health-Related Information. PLOS Biology 15(1): e2001402. <https://doi.org/10.1371/journal.pbio.2001402>  
<https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2001402>