

Overview of Spatial Data in BIL and HuBMAP

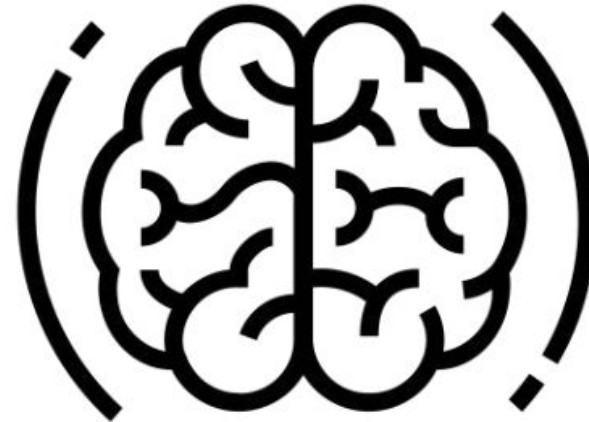
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Senior Data Analyst/Curator, Biomedical
Applications

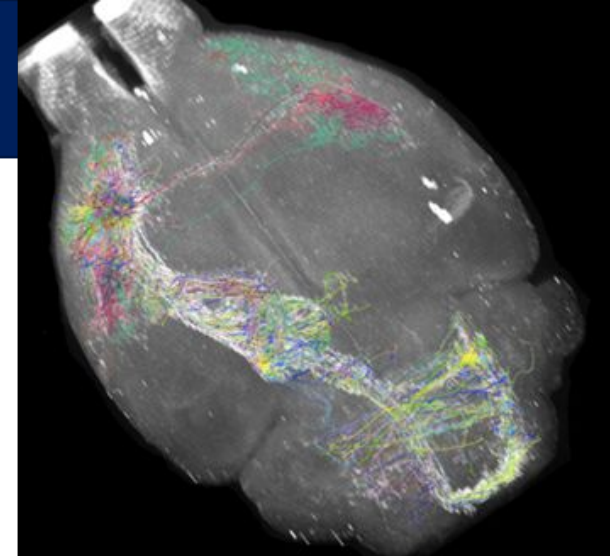
Part 1: The Brain Image Library (BIL)



**BRAIN
IMAGE
LIBRARY**

Brain Image Library

Mission: *National public resource enabling researchers to deposit, analyze, mine, share and interact with optical microscopy datasets of the brain.*



Preserving Data

- No depositor size limitations
- Professional curation
- Help desk support
- Network bottleneck/analysis assistance for depositors transferring large datasets
- DOI Issuance for datasets through DataCite membership
- Landing pages for datasets
- LTO Tape for disaster recovery of data
- LTO tape (7/8/9) capable for import of large datasets

Providing Access

Analysis Ecosystem

- Scalable Architecture
- Data available on PSC's HPC and AI Resources for computational analysis without downloading data
- Frequently used community open-source and commercial software tools available

Web Resources

- Metadata API with web searchable interface + File SDK
- Visualization Resources:
 - Neuroglancer (3d Datasets)
 - OpenSeaDragon (2d Datasets)
 - Napari plug-in

Engagement

Workshops

- Data Submission Workshops
- Spatial Transcriptomics Workshop for BICAN & BICAN Orientation
- CFDE Reproducible Workflow Workshop

Meetings

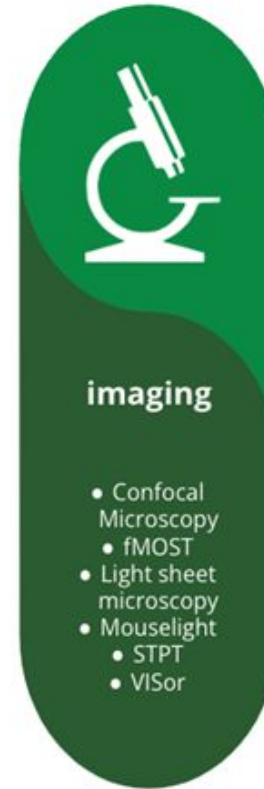
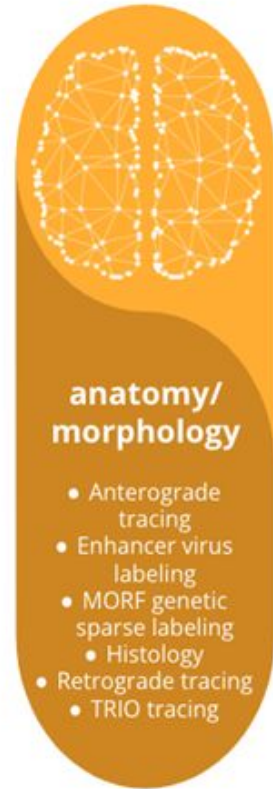
- Society for Neuroscience
- BRAIN Investigators
- Annual Biomedical Research Conference for Minoritized Scientists (ABRCMS)

Newsletter

- The BIL Bulletin

Breadth of Data

- Whole (and partial) optical microscopy brain datasets along with their higher-level data and annotations
- Targeted experiments including connectivity between cells and spatial transcriptomics
- Historical collections



Data Contributed

Data from individual Investigators plus the BICCN, BICAN, ASAP (Aligning Science Across Parkinson), SSPsyGene, CONNECTS consortia

Flagship Papers:

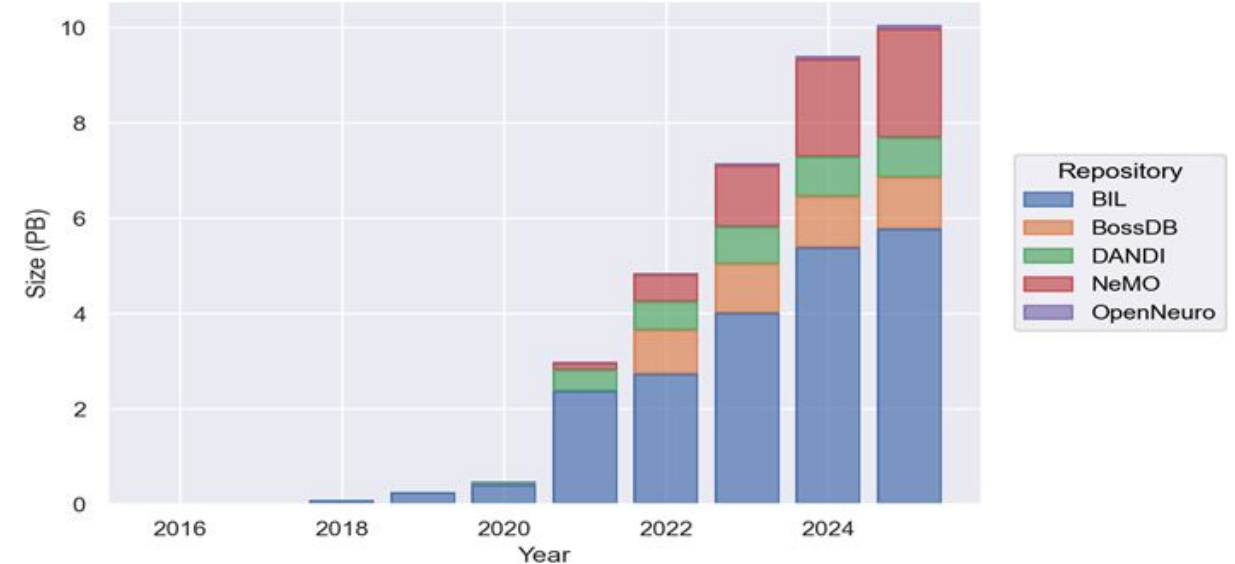
Kenney, M., Vasylieva, I., Hood, G. *et al.* The Brain Image Library: A Community-Contributed Microscopy Resource for Neuroscientists. *Sci Data* **11**, 1212 (2024).

<https://doi.org/10.1038/s41597-024-03761-8>

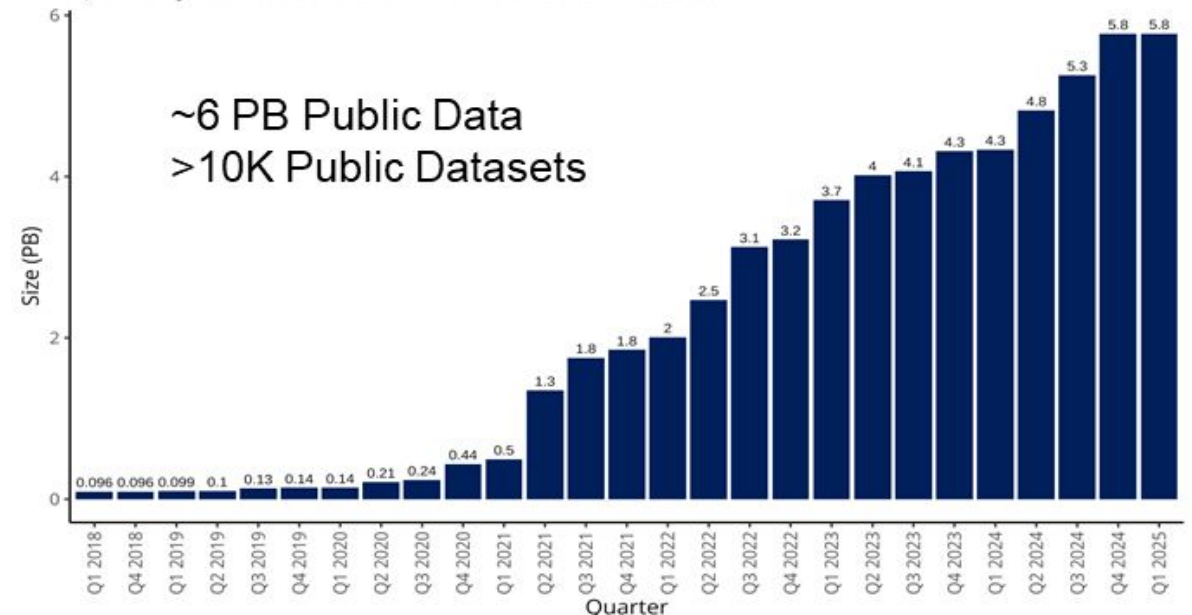
Benninger, K. Hood, G., Simmel, D. *et al.* Cyberinfrastructure of a Multi-Petabyte Microscopy Resource for Neuroscience Research. In Practice and Experience in Advanced Research Computing 2020: Catch the Wave (PEARC '20). Association for Computing Machinery, New York, NY, USA, 1–7.

<https://doi.org/10.1145/3311790.3396653>

www.brainimagelibrary.org

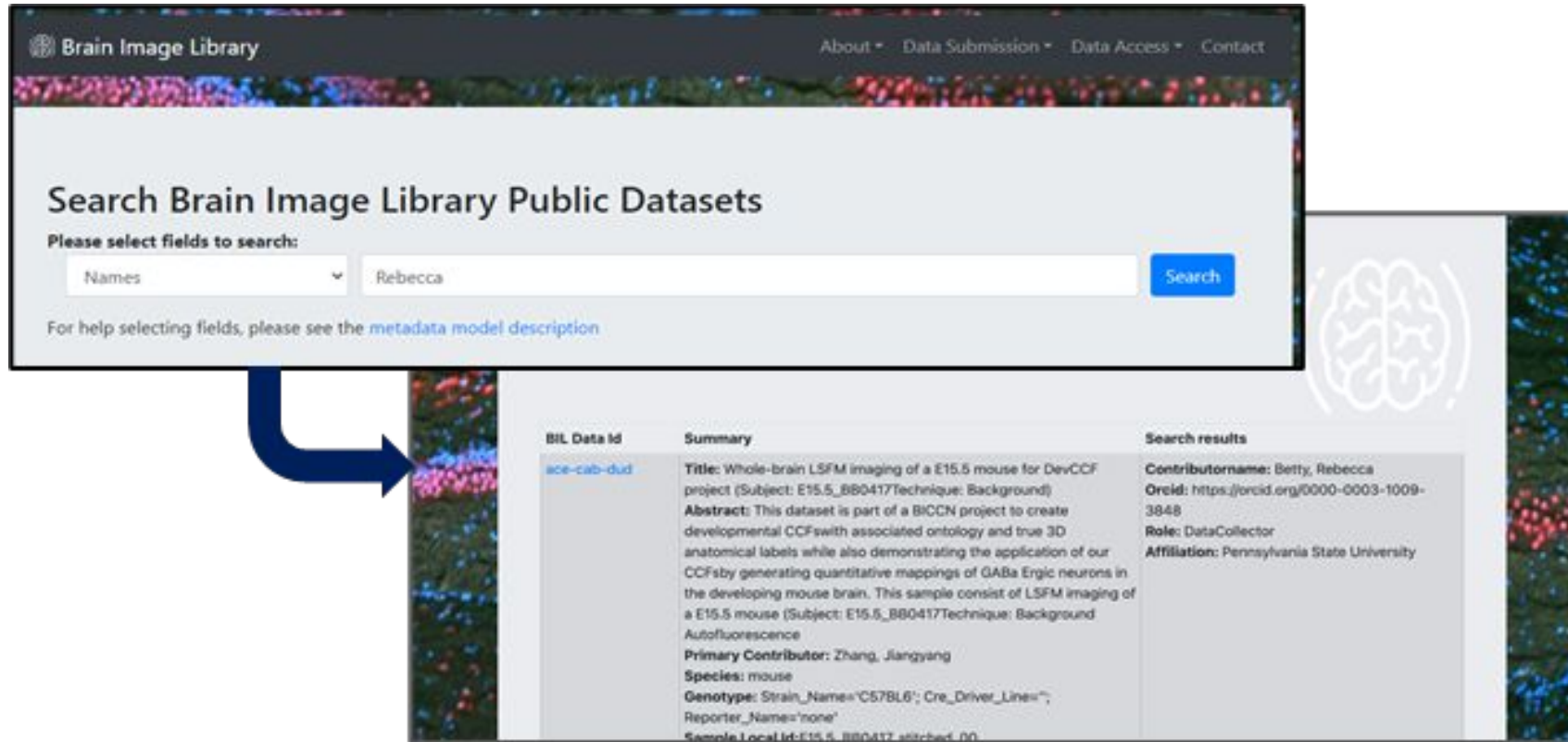


Quarterly Cumulative Growth of Published Datasets



Finding Spatial Data in BIL

Websearch: <https://api.brainimagelibrary.org/web/>



The screenshot shows the Brain Image Library website. At the top, there's a navigation bar with links: About, Data Submission, Data Access, and Contact. Below this is a search bar titled "Search Brain Image Library Public Datasets". The search bar has a dropdown menu labeled "Names" and a text input field containing "Rebecca". A blue "Search" button is to the right of the input field. Below the search bar, there's a link: "For help selecting fields, please see the [metadata model description](#)".

A blue arrow points from the search bar area to a detailed view of a search result. The result is displayed in a table-like format with three columns: "BIL Data Id", "Summary", and "Search results".

BIL Data Id	Summary	Search results
ace-cab-dud	<p>Title: Whole-brain LSFM imaging of a E15.5 mouse for DevCCF project (Subject: E15.5_BB0417Technique: Background)</p> <p>Abstract: This dataset is part of a BICCN project to create developmental CCFs with associated ontology and true 3D anatomical labels while also demonstrating the application of our CCFs by generating quantitative mappings of GABAergic neurons in the developing mouse brain. This sample consist of LSFM imaging of a E15.5 mouse (Subject: E15.5_BB0417Technique: Background Autofluorescence)</p> <p>Primary Contributor: Zhang, Jiaoyang</p> <p>Species: mouse</p> <p>Genotype: Strain_Name="C57BL6"; Cre_Driver_Line=""; Reporter_Name="none"</p> <p>Sample Local Id: E15.5_BB0417_stitched1_00</p>	<p>Contributorname: Betty, Rebecca</p> <p>Orcid: https://orcid.org/0000-0003-1009-3848</p> <p>Role: DataCollector</p> <p>Affiliation: Pennsylvania State University</p>

Or Metadata API (Programmatic Access): <https://www.brainimagelibrary.org/metadataapi.html>

Finding Spatial Data in BIL

Websearch: <https://api.brainimagelibrary.org/web/>

Web Search Field	Search Text	Number of Entries
All Metadata	Spatial	710
All Dataset Fields	Spatial	516
All Dataset Fields	Spatial Transcriptomics	436
All Dataset Fields	MERFISH	106
All Dataset Fields	RNA FISH	26
All Dataset Fields	smFISH	229
All Dataset Fields	seqFISH	8
All Dataset Fields	FISH	119
All Dataset Fields	CISI	12

Dataset Location - Noted on the Landing Page

Data:

Visualization Links:

Help with Visualization

https://brainapi.brainimagelibrary.org/ng/bil/assets/ace/cap/bog/asset/brainpi/mouseID_454427-192343.teraflly

Data location on the Brain Image Library Analysis Ecosystem:

[/bil/data/2f/12/2f12b1a3901e4181/mouseID_454427-192343](#)

Dataset download link:

https://download.brainimagelibrary.org/2f/12/2f12b1a3901e4181/mouseID_454427-192343

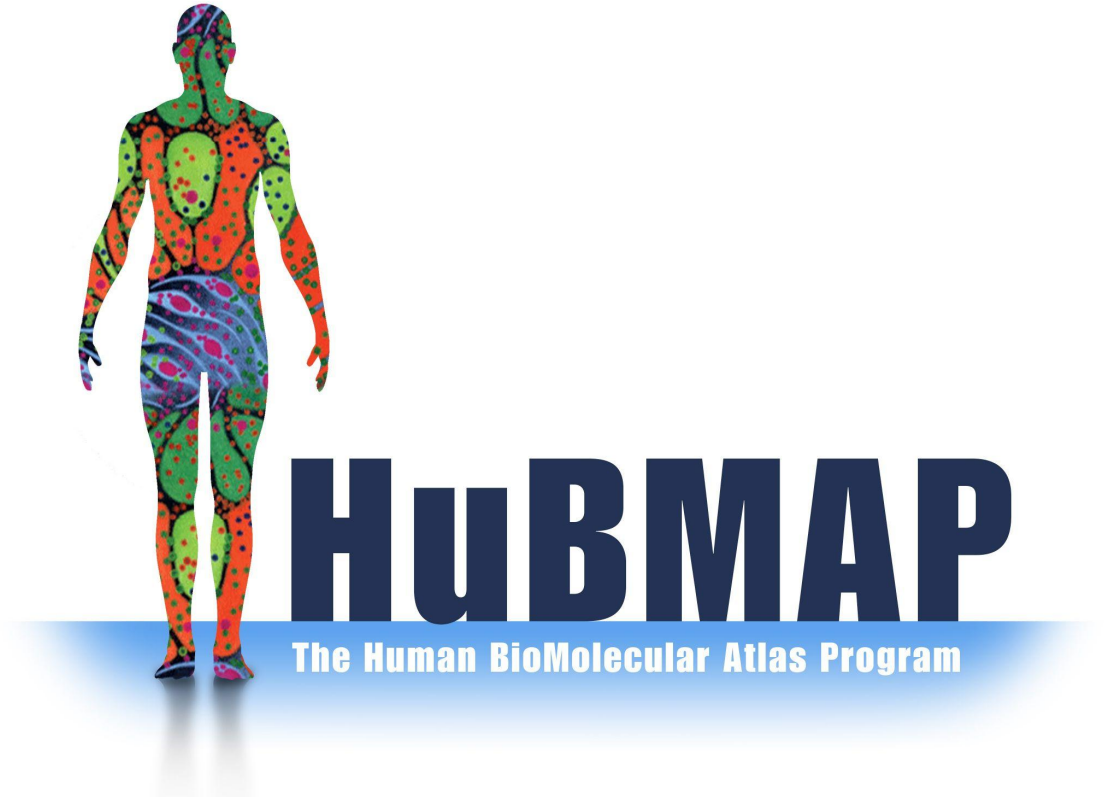
Metadata download link:

<https://api.brainimagelibrary.org/retrieve?bildid=ace-cap-bog>

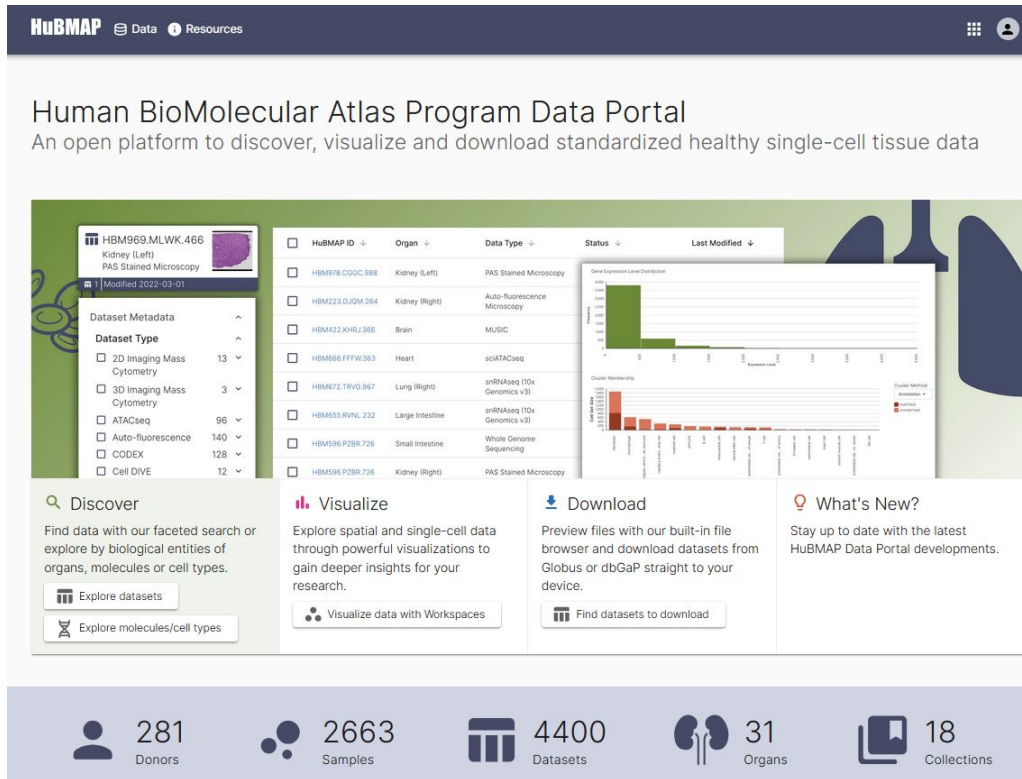
Manifest download link:

<https://download.brainimagelibrary.org/inventory/datasets/c3f113f2-e61c-565d-8158-ab630bdcd03f.json>

Part 2: The Human Biomolecular Atlas Program (HuBMAP)



What is HuBMAP?



The HuBMAP Data Sharing Portal.

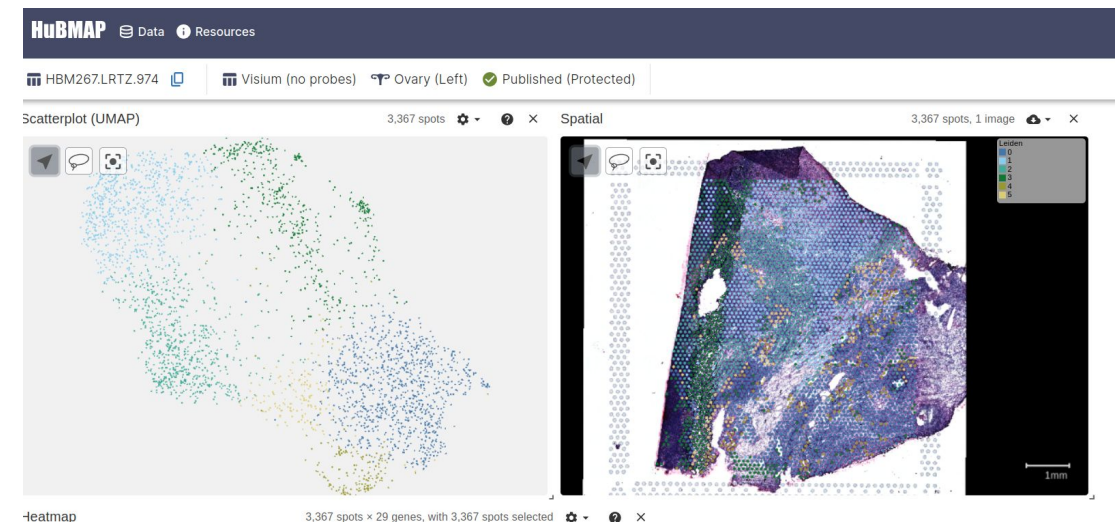
The Human Biomolecular Atlas Program (HuBMAP) is dedicated towards mapping the human body at the single-cell level. It is funded through the National Institutes of Health Common Fund.

- 42 contributing sites
 - HuBMAP Integration, Visualization, and Engagement (HIVE) group
 - Includes the Infrastructure and Engagement Component (IEC) - HuBMAP's "data core"
 - Tissue Mapping Centers (TMCs)
 - Transformative Technology Developers (TTDs)
- TMCs work with a variety of experimental assays on tissue samples from 31 organs throughout the human body

Classifying HuBMAP

HuBMAP is...

- **A data repository**
 - HuBMAP ingests, validates, and publishes a wide array of data from different modalities. Some of the data types stored include the following:
 - Spatial transcriptomics - Xenium, Visium, GeoMX
 - Transcriptomics - sc/snRNAseq, bulk RNAseq, SNAREseq2
 - Antibody-based imaging - Phenocycler, CODEX, Cell DIVE
 - Microscopy - H&E, PAS, AB-PAS, Autofluorescence
- **A knowledge base**
 - HuBMAP develops tools and resources for public use, including metadata and directory schemas, the Human Reference Atlas, Vitessce, and Azimuth.

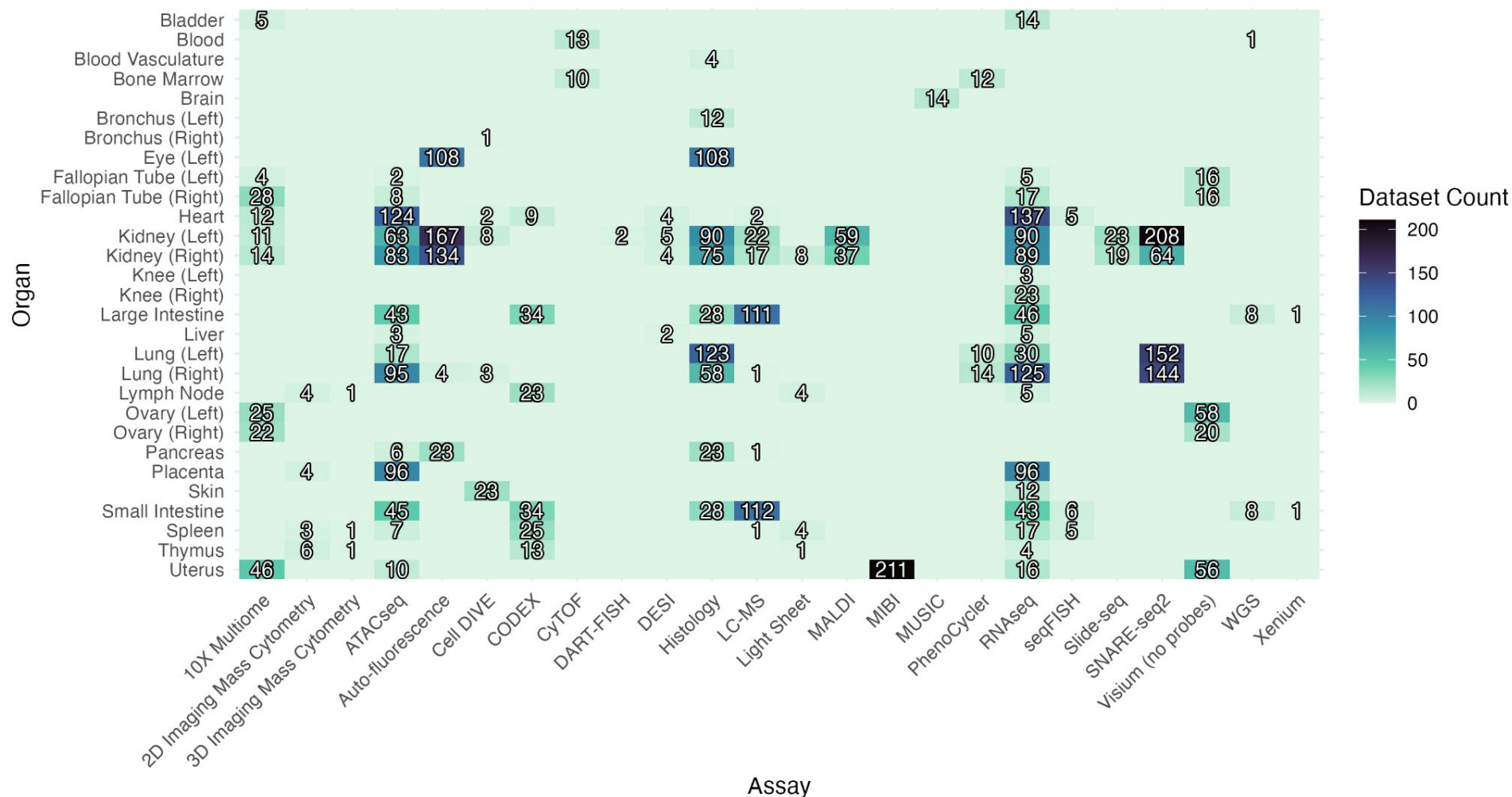


HIVE central analysis (Salmon + Scanpy) of a uterine Visium (no probes) dataset from TMC-University of Pennsylvania ([HBM267.LRTZ.974](https://hbm267.lrtz.974))

HuBMAP Data Coverage

HuBMAP Organ and Assay Coverage

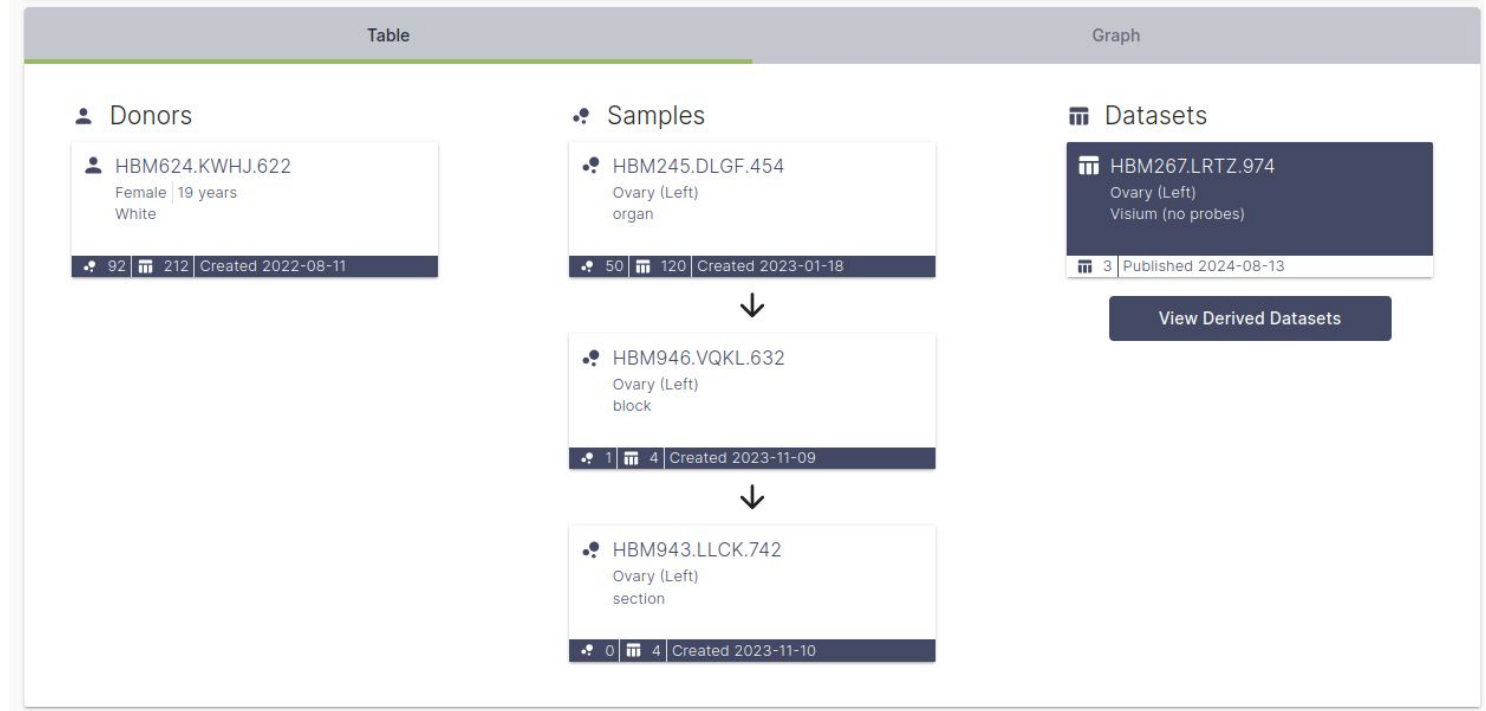
Since project inception, as of April 2025



n = 4,218. Datasets are included regardless of publication status.

Entity Provenance in HuBMAP

- Entities in HuBMAP have unique identifiers starting with “HBM”
- Common provenance
 - Donors registered first
 - Organs registered to donors
 - Tissue blocks registered to organs
 - Tissue sections/suspensions registered to blocks
 - Datasets registered to sections/suspensions
- Donors, tissue blocks/sections/suspensions, and datasets can all have metadata



How Do I Find Spatial Transcriptomics Data in the HuBMAP Portal?

In this example, we are going to look for Visium (no probes) data in the HuBMAP Data Portal.

First, go to portal.hubmapconsortium.org.

The screenshot shows the HuBMAP Data Portal interface. At the top, the header includes the HuBMAP logo, navigation links for Data and Resources, and a user profile icon. The main title is "Human BioMolecular Atlas Program Data Portal" with the subtitle "An open platform to discover, visualize and download standardized healthy single-cell tissue data".

The interface is divided into several sections:

- Dataset Metadata:** A sidebar on the left showing filters for Dataset Type (2D Imaging Mass Cytometry: 13, 3D Imaging Mass Cytometry: 3, ATACseq: 96, Auto-fluorescence: 140, CODEX: 128, Cell DIVE: 12).
- Table:** A central table listing datasets with columns for HuBMAP ID, Organ, Data Type, Status, and Last Modified. The table includes entries for Kidney (Left), Kidney (Right), Brain, Heart, Lung (Right), Large Intestine, Small Intestine, and Kidney (Right) with various data types like PAS Stained Microscopy, Auto-fluorescence Microscopy, MUSIC, sciATACseq, snRNAseq, and Whole Genome Sequencing.
- Visualizations:** Two charts are displayed on the right. The top chart is a "Gene Expression Level Distribution" bar chart showing frequency vs. Expression Level. The bottom chart is a "Cluster Membership" bar chart showing the number of cells per cluster.
- Navigation and Action Buttons:** At the bottom, there are four main sections: "Discover" (Find data with our faceted search or explore by biological entities of organs, molecules or cell types), "Visualize" (Explore spatial and single-cell data through powerful visualizations to gain deeper insights for your research), "Download" (Preview files with our built-in file browser and download datasets from Globus or dbGaP straight to your device), and "What's New?" (Stay up to date with the latest HuBMAP Data Portal developments).

At the bottom of the page, there is a summary bar with icons and counts:

- 281 Donors
- 2663 Samples
- 4400 Datasets
- 31 Organs
- 18 Collections

How Do I Find Spatial Transcriptomics Data in the HuBMAP Portal?

HuBMAP Data Resources

Human BioMolecular Atlas Program Data Portal

An open platform to discover, visualize and download standardized healthy single-cell tissue data

HBM969.MLWK.466
Kidney (Left)
PAS Stained Microscopy
Modified 2022-03-01

Dataset Metadata
Dataset Type

- 2D Imaging Mass Cytometry 13
- 3D Imaging Mass Cytometry 3
- ATACseq 96
- Auto-fluorescence 140
- CODEX 128
- Cell DIVE 12

<input type="checkbox"/>	HuBMAP ID	Organ	Data Type	Status	Last Modified
<input type="checkbox"/>	HBM978.CGGC.988	Kidney (Left)	PAS Stained Microscopy		
<input type="checkbox"/>	HBM223.DJQM.264	Kidney (Right)	Auto-fluorescence Microscopy		
<input type="checkbox"/>	HBM422.KHRJ.366	Brain	MUSIC		
<input type="checkbox"/>	HBM666.FFW.363	Heart	sciATACseq		
<input type="checkbox"/>	HBM672.TRVG.967	Lung (Right)	snRNAseq (10x Genomics v3)		
<input type="checkbox"/>	HBM655.RVNL.232	Large Intestine	snRNAseq (10x Genomics v3)		
<input type="checkbox"/>	HBM596.PZBR.726	Small Intestine	Whole Genome Sequencing		
<input type="checkbox"/>	HBM596.PZBR.726	Kidney (Right)	PAS Stained Microscopy		

Gene Expression Level Distribution

Cluster Membership

Cluster Method: t-SNE

Discover
Find data with our faceted search or explore by biological entities of organs, molecules or cell types.
[Explore datasets](#)
[Explore molecules/cell types](#)

Visualize
Explore spatial and single-cell data through powerful visualizations to gain deeper insights for your research.
[Visualize data with Workspaces](#)

Download
Preview files with our built-in file browser and download datasets from HuBMAP Data Portal developments. Globus or dbGaP straight to your device.
[Find datasets](#)

What's New?
Stay up to date with the latest HuBMAP Data Portal developments.

281 Donors

2663 Samples

4400 Datasets

31 Organs

18 Collections

Click on "Datasets."

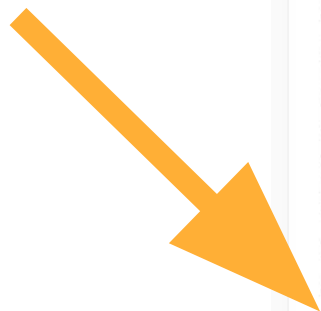
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How Do I Find Spatial Transcriptomics Data in the HuBMAP Portal?

The datasets search page has multiple facets with which a user can filter datasets.

Published datasets can be browsed without logging into the portal. Further details on portal access/login will be covered in the HuBMAP workspaces talk later this afternoon.

For this example, we will click on “Visium (no probes).”



HuBMAP Data Resources

Datasets

Search datasets

Metadata

0 selected

<input type="checkbox"/>	HuBMAP ID	Group	Data Types	Organ	Status	Publication Date
<input type="checkbox"/>	HBM382.BZLT.236	Vanderbilt TMC	Auto-fluorescence Microscopy	Kidney (Left)	Published	2025-05-09
<input type="checkbox"/>	HBM749.LVPD.269	Vanderbilt TMC	Auto-fluorescence Microscopy	Kidney (Right)	Published	2025-05-09
<input type="checkbox"/>	HBM777.SRKM.985	Vanderbilt TMC	Auto-fluorescence Microscopy	Kidney (Left)	Published	2025-05-09
<input type="checkbox"/>	HBM279.DLBL.347	Vanderbilt TMC	Auto-fluorescence Microscopy	Kidney (Right)	Published	2025-05-09
<input type="checkbox"/>	HBM582.GWPR.459	Vanderbilt TMC	Auto-fluorescence Microscopy	Kidney (Right)	Published	2025-05-09
<input type="checkbox"/>	HBM872.ZXXH.343	Vanderbilt TMC	Auto-fluorescence Microscopy	Kidney (Left)	Published	2025-05-09
<input type="checkbox"/>	HBM386.RVHN.555	Vanderbilt TMC	Auto-fluorescence Microscopy	Kidney (Left)	Published	2025-05-09
<input type="checkbox"/>	HBM677.WVXV.272	Vanderbilt TMC	Auto-fluorescence Microscopy	Kidney (Right)	Published	2025-05-09
<input type="checkbox"/>	HBM858.FPFN.693	Vanderbilt TMC	Auto-fluorescence Microscopy	Kidney (Right)	Published	2025-05-09
<input type="checkbox"/>	HBM698.VCVL.422	Vanderbilt TMC	Auto-fluorescence Microscopy	Kidney (Left)	Published	2025-05-09
<input type="checkbox"/>	HBM686.CGWL.564	Vanderbilt TMC	Auto-fluorescence Microscopy	Kidney (Left)	Published	2025-05-09
<input type="checkbox"/>	HBM345.RSLG.839	Vanderbilt TMC	Auto-fluorescence Microscopy	Kidney (Left)	Published	2025-05-09

Dataset Metadata

Dataset Type

- ☐ 10X Multiome 132
- ☐ 2D Imaging Mass Cytometry 13
- ☐ 3D Imaging Mass Cytometry 3
- ☐ ATACseq 957
- ☐ Auto-fluorescence 204
- ☐ CODEX 255
- ☐ Cell DIVE 20
- ☐ DESI 15
- ☐ Histology 354
- ☐ LC-MS 267
- ☐ Light Sheet 3
- ☐ MALDI 89
- ☐ MIBI 211
- ☐ MUSIC 14
- ☐ PhenoCycler 4
- ☐ RNAseq 1288
- ☐ SNARE-seq2 304
- ☐ Slide-seq 84
- ☐ Visium (no probes) 148
- ☐ WGS 17
- ☐ seqFISH 18

Organ

- ☐ Lung (Right) 562
- ☐ Kidney (Left) 539
- ☐ Lung (Left) 471

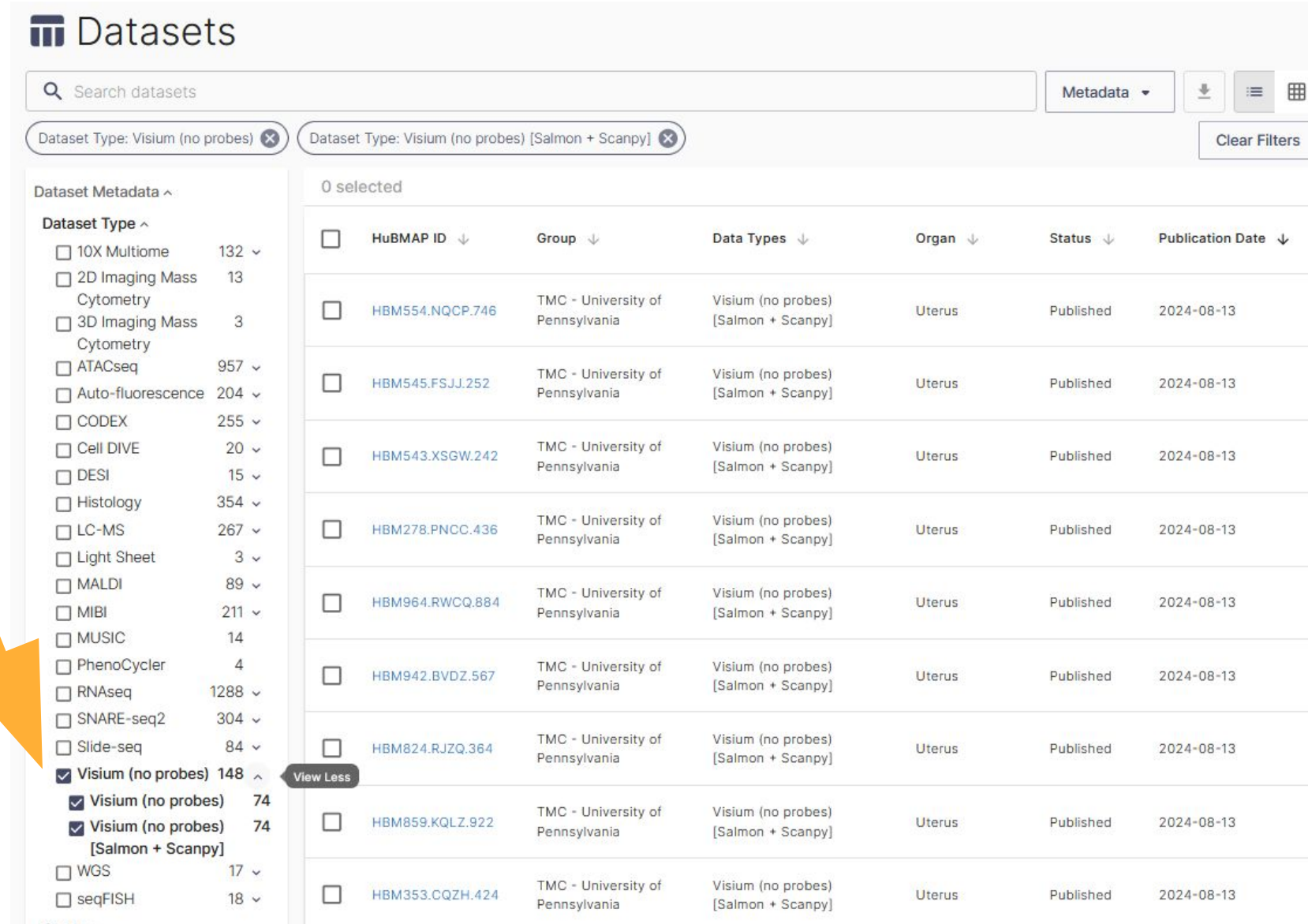
How Do I Find Spatial Transcriptomics Data in the HuBMAP Portal?

When we select “Visium (no probes),” both primary datasets and processed datasets are automatically selected.

Among the multiple data classes, there are two main ones, primary and processed.

Primary datasets contain the raw data from an experimental modality.

Processed datasets feature further analysis performed on primary datasets using standardized HIVE pipelines. These can be identified by the name of the pipeline in square brackets, such as “[Salmon + Scanpy].” Processed datasets are displayed on their “parent” primary datasets via a unified view.



Datasets

Search datasets

Dataset Type: Visium (no probes) Dataset Type: Visium (no probes) [Salmon + Scanpy]

Clear Filters

0 selected

<input type="checkbox"/>	HuBMAP ID	Group	Data Types	Organ	Status	Publication Date
<input type="checkbox"/>	HBM554.NQCP.746	TMC - University of Pennsylvania	Visium (no probes) [Salmon + Scanpy]	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM545.FSJJ.252	TMC - University of Pennsylvania	Visium (no probes) [Salmon + Scanpy]	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM543.XSGW.242	TMC - University of Pennsylvania	Visium (no probes) [Salmon + Scanpy]	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM278.PNCC.436	TMC - University of Pennsylvania	Visium (no probes) [Salmon + Scanpy]	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM964.RWCQ.884	TMC - University of Pennsylvania	Visium (no probes) [Salmon + Scanpy]	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM942.BVDZ.567	TMC - University of Pennsylvania	Visium (no probes) [Salmon + Scanpy]	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM824.RJZQ.364	TMC - University of Pennsylvania	Visium (no probes) [Salmon + Scanpy]	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM859.KQLZ.922	TMC - University of Pennsylvania	Visium (no probes) [Salmon + Scanpy]	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM353.CQZH.424	TMC - University of Pennsylvania	Visium (no probes) [Salmon + Scanpy]	Uterus	Published	2024-08-13

Dataset Metadata

Dataset Type

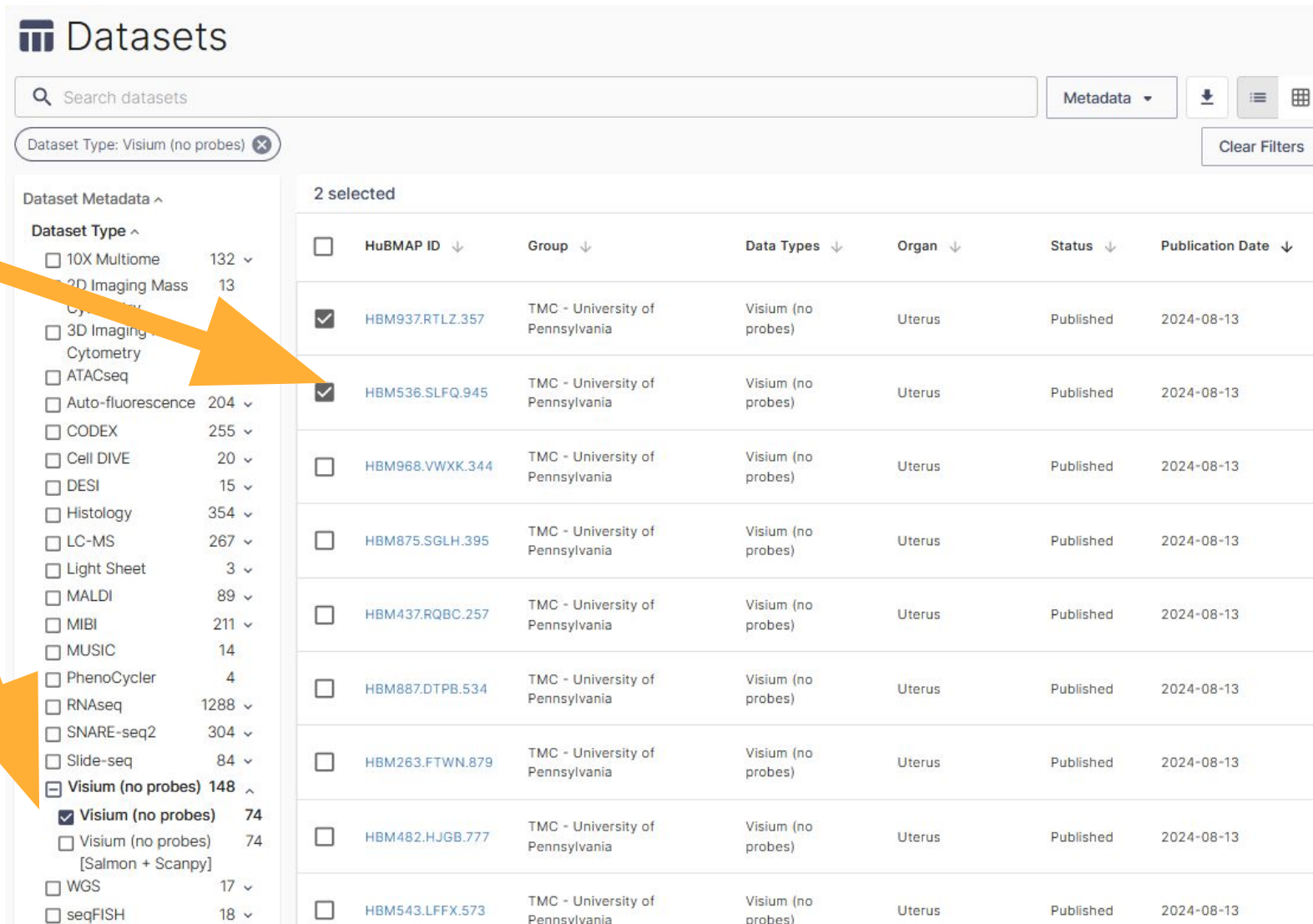
- ☐ 10X Multiome 132
- ☐ 2D Imaging Mass Cytometry 13
- ☐ 3D Imaging Mass Cytometry 3
- ☐ ATACseq 957
- ☐ Auto-fluorescence 204
- ☐ CODEX 255
- ☐ Cell DIVE 20
- ☐ DESI 15
- ☐ Histology 354
- ☐ LC-MS 267
- ☐ Light Sheet 3
- ☐ MALDI 89
- ☐ MIBI 211
- ☐ MUSIC 14
- ☐ PhenoCycler 4
- ☐ RNAseq 1288
- ☐ SNARE-seq2 304
- ☐ Slide-seq 84
- ☒ **Visium (no probes) 148**
- ☒ **Visium (no probes) 74**
- ☒ **Visium (no probes) 74**
- ☐ WGS 17
- ☐ seqFISH 18

View Less

How Do I Find Spatial Transcriptomics Data in the HuBMAP Portal?

For now, let's filter by raw
"Visium (no probes)" datasets.

We will take a look at the
second dataset listed,
[HBM536.SLFQ.945](#).



Datasets

Search datasets

Dataset Type: Visium (no probes)

Metadata

2 selected

<input type="checkbox"/>	HuBMAP ID	Group	Data Types	Organ	Status	Publication Date
<input checked="" type="checkbox"/>	HBM937.RTLZ.357	TMC - University of Pennsylvania	Visium (no probes)	Uterus	Published	2024-08-13
<input checked="" type="checkbox"/>	HBM536.SLFQ.945	TMC - University of Pennsylvania	Visium (no probes)	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM968.VWVK.344	TMC - University of Pennsylvania	Visium (no probes)	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM875.SGLH.395	TMC - University of Pennsylvania	Visium (no probes)	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM437.RQBC.257	TMC - University of Pennsylvania	Visium (no probes)	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM887.DTPB.534	TMC - University of Pennsylvania	Visium (no probes)	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM263.FTWN.879	TMC - University of Pennsylvania	Visium (no probes)	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM482.HJGB.777	TMC - University of Pennsylvania	Visium (no probes)	Uterus	Published	2024-08-13
<input type="checkbox"/>	HBM543.LFFX.573	TMC - University of Pennsylvania	Visium (no probes)	Uterus	Published	2024-08-13

Dataset Metadata

Dataset Type

- ☐ 10X Multiome 132
- ☐ 2D Imaging Mass 13
- ☐ 3D Imaging Cytometry
- ☐ ATACseq
- ☐ Auto-fluorescence 204
- ☐ CODEX 255
- ☐ Cell DIVE 20
- ☐ DESI 15
- ☐ Histology 354
- ☐ LC-MS 267
- ☐ Light Sheet 3
- ☐ MALDI 89
- ☐ MIBI 211
- ☐ MUSIC 14
- ☐ PhenoCycler 4
- ☐ RNAseq 1288
- ☐ SNARE-seq2 304
- ☐ Slide-seq 84
- ☒ **Visium (no probes) 148**
- ☒ **Visium (no probes) 74**
- ☐ Visium (no probes) [Salmon + Scanpy] 74
- ☐ WGS 17
- ☐ seqFISH 18

How Do I Find Spatial Transcriptomics Data in the HuBMAP Portal?

At the top of a dataset's portal page, we can see a brief description, its DOI, and an overview of the different dataset classes associated with it in HuBMAP's internal graph database.

Contents

Summary

Metadata

Processed Data

Salmon + Scanpy

Summary

Visualization

Files

Analysis

Bulk Data Transfer

Provenance

Attribution

Dataset

HBM536.SLFQ.945

Visium (no probes) | Uterus

Published (Protected)

Description

Visium spatial transcriptomics data from Penn-TMC for 99 tissue slices from uterus/ovary/Fallopian tube, from two human female donors. : ./Visium_13_85_S2_b

Group

TMC - University of Pennsylvania

Consortium

HuBMAP

Citation

doi:10.35079/HBM536.SLFQ.945

Publication Date

2024-08-13

Multi-Assay Relationship

This dataset is a component of a multi-assay dataset and the relationships between datasets are displayed below. The current dataset will be highlighted by a green line.

Component Datasets (Raw)

H&E Stained Microscopy: HBM674.KJRV.548

Capture bead RNAseq (10x Genomics v3): HBM949.CBJP.442

Primary Dataset (Raw)

Visium (no probes): HBM536.SLFQ.945

Primary Dataset (Processed)

Visium (no probes) [Salmon + Scanpy]: HBM545.FSJJ.252

Dataset Relationship Diagram

This diagram illustrates any additional processing applied to this dataset.

HBM536.SLFQ.945
Visium (no probes)

Multi Assay Pipeline
Create component datasets

Salmon + Scanpy

HBM674.KJRV.548
Histology

HBM949.CBJP.442
RNAseq

HBM545.FSJJ.252
Visium (no probes) [Salmon + Scanpy]

Nodes Legend

Raw Dataset

Processed Dataset

Action/Pipeline

Component

Status Legend

Published

How Do I Find Spatial Transcriptomics Data in the HuBMAP Portal?

We can browse metadata for different entities in the dataset's provenance chain.

Metadata

This is the list of metadata that was provided by the data provider. Metadata from the donor or sample of this dataset may also be included in this list.

Visium (No Probes)	Donor	Block	Section
Key	Value		
capture_area_id ⓘ	D1		
dataset_type ⓘ	Visium (no probes)		
mapped_area_unit ⓘ	mm^2		
mapped_area_value ⓘ	42.25		
metadata_schema_id ⓘ	babf1e69-f0eb-479a-bdc5-b70199669675		
number_of_sections ⓘ	4002		

How Do I Find Spatial Transcriptomics Data in the HuBMAP Portal?

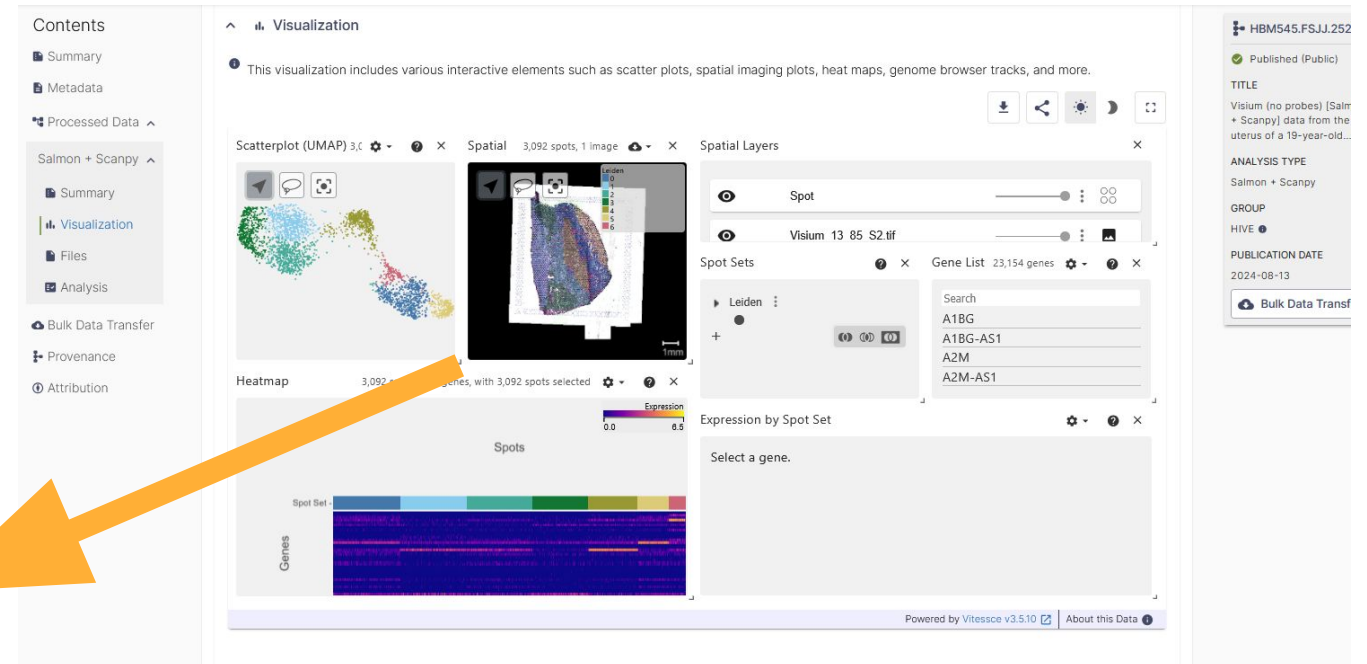
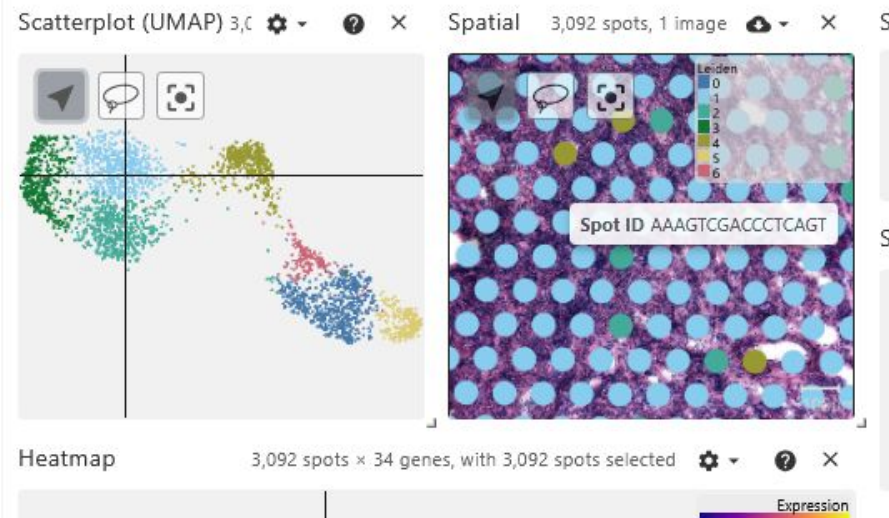
Any processed datasets are embedded on the primary dataset's page.

If you select a processed dataset from the search results, it will redirect you to its primary dataset's page.

The screenshot displays the HuBMAP Portal interface for a specific dataset. At the top, a navigation bar shows the dataset ID 'HBM536.SLFQ.945' and filters for 'Visium (no probes)', 'Uterus', and 'Published (Protected)'. View options include 'Summary View', 'Diagram View', and 'Narrow View'. A left sidebar titled 'Contents' lists 'Summary', 'Metadata', 'Processed Data', 'Salmon + Scanpy', 'Bulk Data Transfer', 'Provenance', and 'Attribution'. The 'Salmon + Scanpy' section is expanded, showing a list of processed datasets, with 'HBM545.FSJJ.252' selected. The main content area shows the 'Summary' tab for this dataset, including its title, group (HIVE), consortium (HuBMAP), contact (HuBMAP Help Desk), and publication date (2024-08-13). Below the summary is a 'Visualization' section with a descriptive note and interactive tools. At the bottom, three panels are visible: 'Scatterplot (UMAP) 3,0', 'Spatial 3,092 spots, 1 image', and 'Spatial Layers' with a legend for 'Spot' and 'Visium 13 85 S2.tif'.

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An interactive visualization of the HIVE central analysis pipeline results is displayed via Vitessce.



HuBMAP Data for This Workshop

- For this workshop, HuBMAP TMC-Rochester has provided unpublished data:
 - https://app.globus.org/file-manager?origin_id=af603d86-eab9-4eec-bb1d-9d26556741bb&origin_path=%2Fspatial-data-workshop%2FTMA2%2F&two_pane=true
-

Other Helpful Resources

- List of HuBMAP metadata and directory schemas for assays
 - <https://docs.hubmapconsortium.org/metadata>
- HuBMAP donor LineUp
 - <https://portal.hubmapconsortium.org/lineup/donors>
- HuBMAP APIs + examples
 - <https://docs.hubmapconsortium.org/apis>



HuBMAP

Spatial Transcriptomics

Visium (no probes)

Prepare your metadata based on the latest metadata schema using one of the template files below. See the instructions in the [Metadata Validation Workflow](#) document for more information on preparing and validating your metadata.tsv file prior to submission.

Related files:

-  [Excel template](#): For metadata entry.
-  [TSV template](#): Alternative for metadata entry.

REQUIRED - For this assay, you must also prepare and submit two additional metadata.tsv files following the metadata schemas linked here for [RNAseq](#) and [Histology](#). [This link](#) lists the set of fields that are required in the OME TIFF file XML header.

Metadata schema

[Version 3 \(use this one\)](#)

[Version 2](#)