

HuBMAP-SPARC *anatomical
interoperation of resources*
Collaboration (for the CFDE)

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The Challenge

Work towards semantic and spatial “anatomical and cell type interoperability” via standardization of terminology and metadata used for anatomical structures and spatial mapping data formats, workflows, and user interfaces.

Goals of our CFDE-funded project

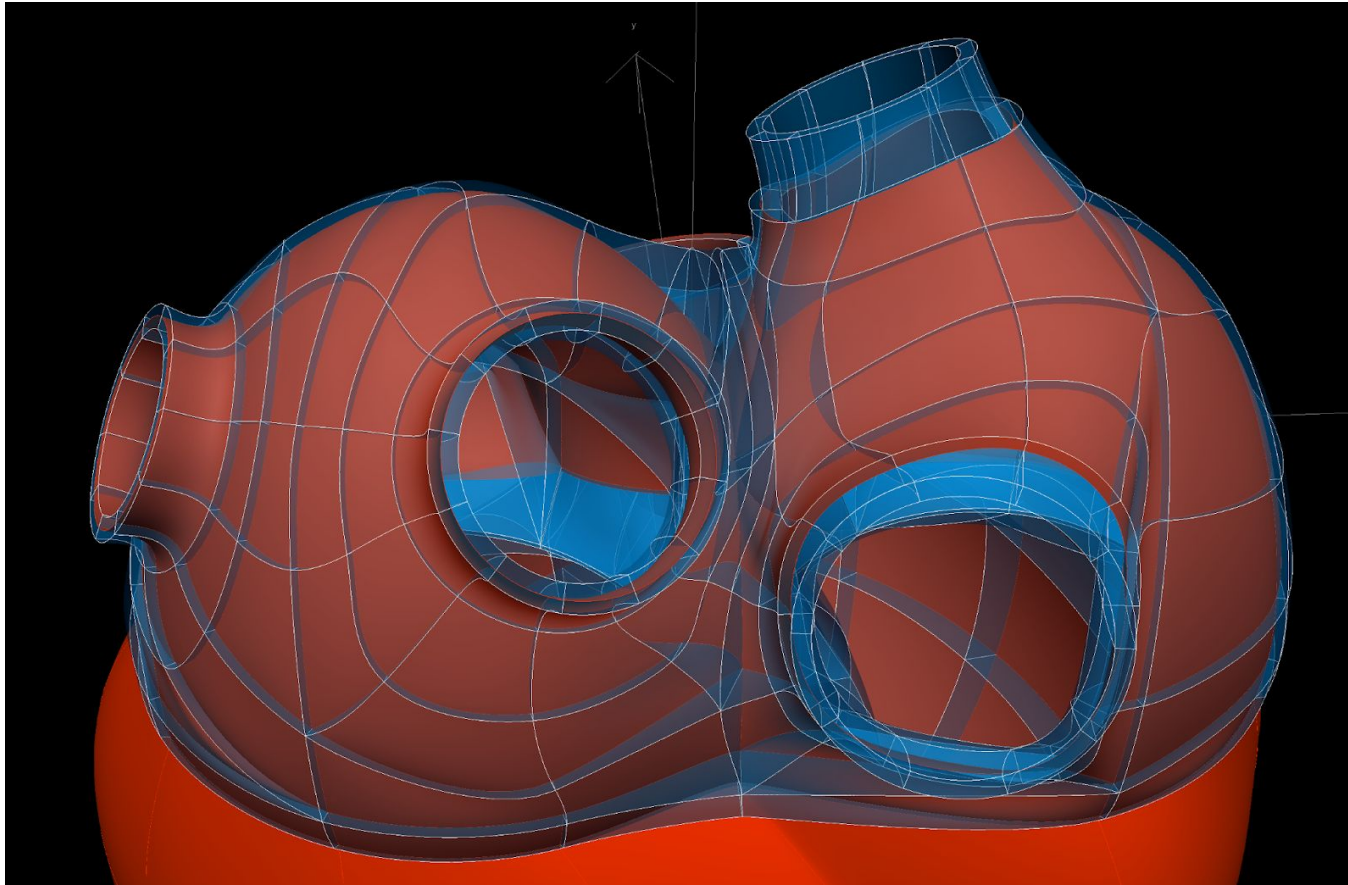
Ultimate goal is to create spatial interoperability between different coordinate systems. Allowing a system to pass spatially linked information to the other system (such as registered datasets) and to query across the two systems.

In this project, we moved towards this goal through the co-registration of HuBMAP and SPARC scaffold coordinate systems and the development of the ability to pass blocks of information registered to those systems between both projects.

HuBMAP Milestones

- Y2.701: Release of SPARC-HuBMAP cardiac scaffold (SPARC)
 - Y2.701.3 Modification of the SPARC human heart scaffold to incorporate fat pads around the atria and ventricles.
- Y2.702: Ensure interoperability between 3D SPARC scaffolds and HuBMAP reference organs, starting with heart and colon
- Y2.703: Ensure resource metadata interoperability, which is requisite to facilitate HuBMAP-SPARC cross platform querying
- Y2.704: Share spatially registered, biomolecular RNAseq data for sampling sites for the heart

SPARC scaffold incorporating fat pads around the atria and ventricles

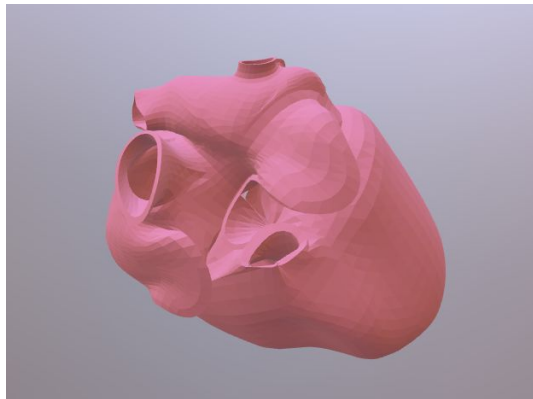
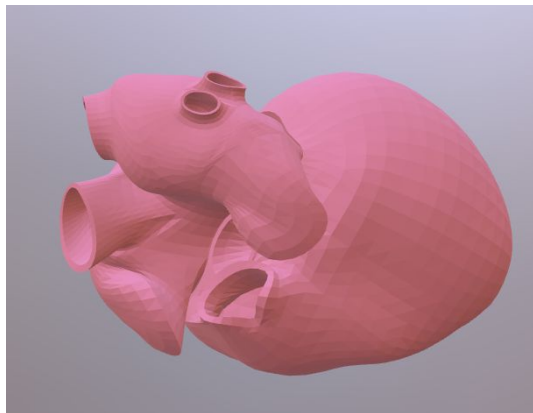


Diseased human hearts have significant peripheral fat pads containing intracardiac neurons. To enable the mapping of this data, the SPARC human heart scaffold was updated to include this adipose tissue.

This shows how the fat pads sit on top of the epicardial surface (red/brown colour) and bridge across the gap between the left and right atria.

Example of cells registered to Rat heart in [SPARC Scaffold viewer](#) from dataset: <https://doi.org/10.26275/gbxz-in-cd>

SPARC scaffolds placed in HuBMAP CCF



HuBMAP CCF EXPLORATION LOGIN

Sex: Both Age: 1-110 BMI: 13-83

Search anatomical structures...

- body 300
- brain 0
- lymph node 29
- eye 0
- fallopian tube 0
- heart 22
- kidney 0
- knee 0
- liver 2
- lung 9
- ovary 0

Search cell types...

- cell 300
- absorptive 47
- absorptive 37
- adipocyte 22
- adipocyte 61
- adipocyte 27
- adventitial stromal cell 53
- afferent arteriole endothelial cell 56
- airway smooth muscle 9
- alveolar macrophage 9
- apocrine 31

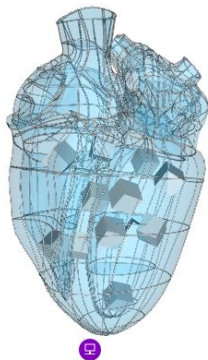
body | cell


- 7 Tissue Data Providers
- 90 Donors
- 300 Tissue Blocks
- 575 Tissue Sections
- 1074 Tissue Datasets

- Female, Age 67, BMI 30.2 Entered 12/27/2019, Yiling Lin, TMC-Stanford
- Female, Age 67, BMI 30.2 Entered 12/27/2019, Yiling Lin, TMC-Stanford
- Female, Age 14, BMI 18.7 Entered 2/16/2020, Marda Jorgensen, TMC-F...
- Female, Age 21, BMI 37.1 Entered 10/19/2020, Marda Jorgensen, TMC-...
- Male, Age 18, BMI 27.1 Entered 2/17/2020, Marda Jorgensen, TMC-F...
- Male, Age 18, BMI 27.1 Entered 2/17/2020, Marda Jorgensen, TMC-F...
- Male, Age 18, BMI 25.5 Entered 2/16/2020, Marda Jorgensen, TMC-F...
- Male, Age 45, BMI 33.1 Entered 12/11/2020, Yiling Lin, TMC-CalTech
- Male, Age 56, BMI 32.5 Entered 12/26/2019, Jamie Allen, TMC-Vande...
- Male, Age 43, BMI 41.3 Entered 2/10/2021, Yiling Lin, TMC-CalTech
- Male, Age 38, BMI 29.0 Entered 9/7/2021, daniel cotter, TMC-Stanford
- Male, Age 78, BMI 35.1 Entered 2/19/2020, Yiling Lin, TMC-Stanford
- Male, Age 78, BMI 35.1

HuBMAP CCF registrations mapped to SPARC scaffolds

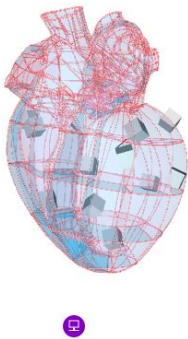
 Beta SPARC heart + HuBMAP CCF Male Heart registrations



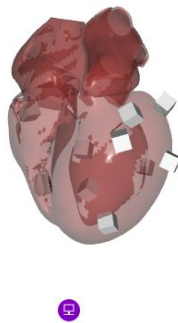
 Beta HuBMAP CCF Male Heart Reference Organ + registrations



 Beta SPARC heart + HuBMAP CCF Female Heart registrations



 Beta HuBMAP CCF Female Heart Reference Organ + registrations



ASCT+B Heart Table Improvements

HuBMAP CCF ASCT+B REPORTER

Toggle



Heart



E

Legend

- Anatomical Structures
- Cell Types
- Gene Biomarkers
- AS-AS, AS-CT, CT-BM Paths

Cell Types

A-Z Alphabetically

None

Biomarkers

A-Z Alphabetically

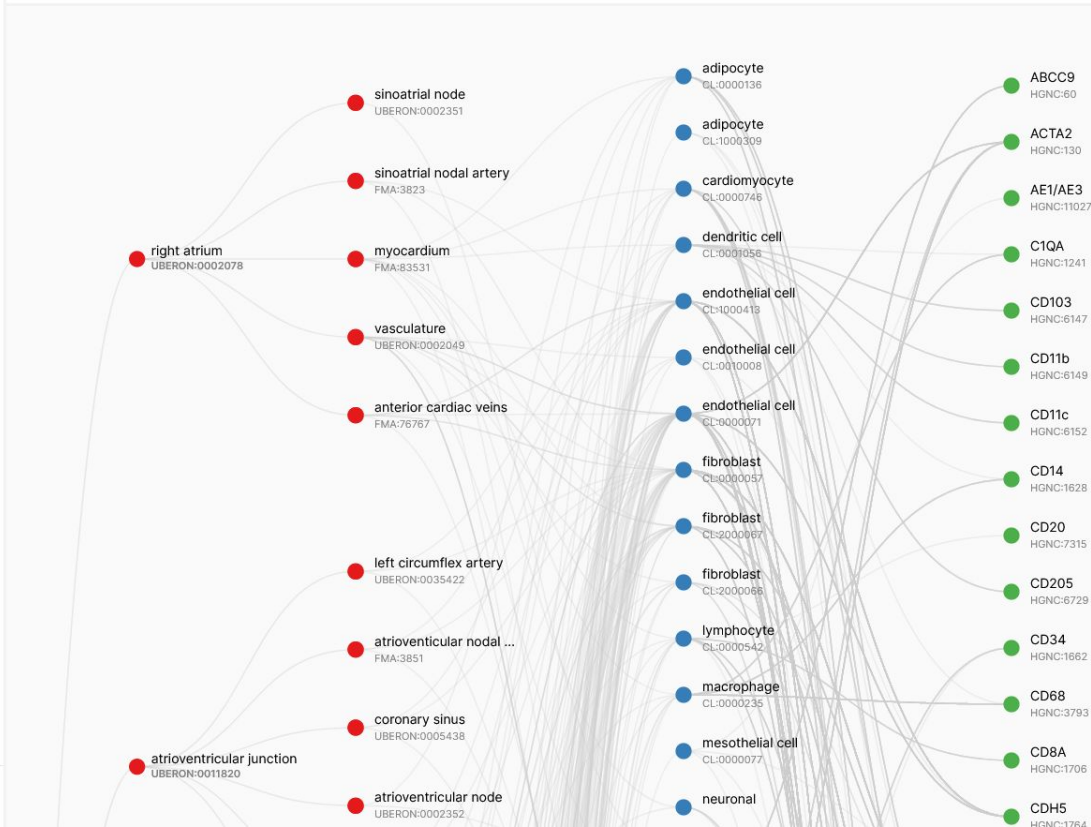
None

All

Controls

Ontology IDs

Contact Us



CCF-SPARC Pilot DEMO

CCF-SPARC Pilot

NIH Title: Anatomical Interoperation of Resources

Primary Deliverables

- [SPARC heart scaffold fitted to HuBMAP CCF Heart reference organs](#)
- [HuBMAP CCF Tissue Block registrations mapped to SPARC scaffold registrations](#)
- A bi-directional process for mapping HuBMAP CCF RUI registrations to SPARC scaffold registrations ([code](#))
- Revised Heart ASCT+B Table: [data demo](#)
- Documentation: [Overview \(source\)](#), [Scaffold Conversion](#), [Registration Conversion](#)

Deliverables by Milestone

DELIVERABLE OR MILESTONE	DUE DATE	STATUS	LINKS
Y2.701.1 First release of SPARC-HuBMAP cardiac scaffold	3/31/2022	Complete	docs demo data
Y2.702: Ensure interoperability between 3D SPARC scaffolds and HuBMAP reference organs, starting with heart and colon	6/30/2022	Complete	code docs demo data
Y2.703: Ensure resource metadata interoperability, which is requisite to facilitate HuBMAP-SPARC cross platform querying	9/23/2022	Complete	ASCT+B data ASCT+B demo
Y2.704: Share spatially registered, biomolecular RNAseq data for sampling sites for the heart	9/23/2022	Complete	demo data (registrations) RNAseq data ASCT+B data

Potential Next Steps

- We now have a Proof of Concept for Heart scaffolds and CCF registrations
- Scale this up to all (shared) human organs and all CCF registrations
- Advertise all CCF registrations as SPARC scaffold registrations
- Advertise all SPARC scaffold-registered data as CCF registrations (no PoC yet for this)

Questions?

More to explore here:

<https://hubmapconsortium.github.io/ccf-sparc-pilot/>