

Team 5

Visualizing Sample and Ontology linkages between **HuBMAP** and **SPARC**

Contributing Team Members



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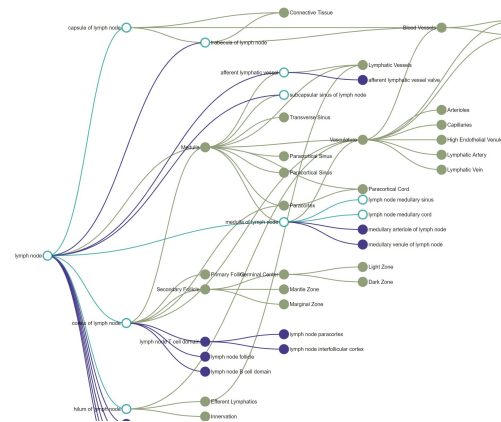
Motivation

HuBMAP and SPARC have a rich reference system, both ontologically and spatially, tied to massive amounts of tissue sample data. Both systems are growing organically and are in danger of being incompatible. To enable future cross-pollination and compatibility, we have implemented a system to assist with mapping and visualization of the overlaps between the systems.

HuBMAP & SPARC Linkages

The product has four modules to facilitate cross-consortium data compatibility:

- Inter-system ontological network visualization
- Inter-consortium dataset comparison
- SPARC-enabled CCF-EUI visualizer
- ASCT+B SPARC data export facility

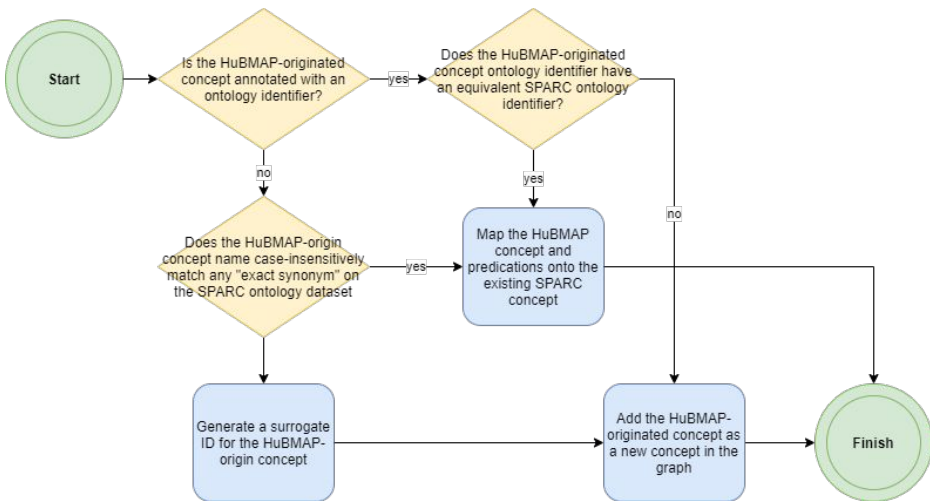


Data sources

Data type	Source	Method
HuBMAP ontology concepts	CCF ASCT+B Reporter ASCT+B API	The API references production versions of the HuBMAP CCF ASCT+B tables where concepts are curated
SPARC AS ontology concepts	FDI Lab SciCrunch/SciGraph API	Organ anatomical structure concept datasets are extracted via neighbor search referencing inbound PART_OF predicate up to 10 degrees
SPARC CT ontology concepts	FDI Lab SciCrunch/SciGraph API	Cell Type concepts are extracted via cypher query on UBERON-to-Cell Ontology single-hop linkages across all predicates
HuBMAP dataset metadata	HuBMAP Elastic Search API	Dataset metadata is ingested directly from the endpoint, filtered to CCF-registered datasets
SPARC dataset metadata	SPARC Elastic Search API	Dataset metadata is filtered to human-species subset

Ontology concept merging

- First pass at merging is based on ontology identifier comparison (UBERON ID in most cases)
- Disambiguation where HuBMAP concepts not annotated with an ontological identifier:
 - The concept name is compared to exact synonyms among participating SPARC nodes
 - If no synonym matches exist in SPARC, the concept is treated as novel and added to the graph



Pre-existing resources

The following infrastructure items that will appear in today's demonstration were developed prior to this team's participation in the SPARC FAIR Codeathon:

- [HuBMAP CCF Explorer User Interface \(CCF-EUI\)](#)
- [HuBMAP CCF ASCT+B Reporter](#)

However, note that SPARC data ETL into formats compatible with these two HuBMAP facilities is new and was not available prior to our submission for the Codeathon

All other software that we will demonstrate today (ie. the HuBMAP and SPARC Linkages application) is new development for the Codeathon

Product Demonstration

HuBMAP & SPARC Linkages

[Ontology Comparison](#)[Dataset Comparison](#)[View Datasets](#)[Export SPARC Ontologies](#)

Organ	ID	Name	HuBMAP	SPARC	Cell Types
Heart	UBERON:0011820	atrioventricular region	✓	✓	endothelial cell smooth muscle cell fibroblast smooth muscle cell pacemaker cell fat cell
Table view	UBERON:0000946	cardial valve	✓	✓	valve interstitial cell blood vessel endothelial cell
Tree view	UBERON:0002348	epicardium	✓	✓	mesothelial cell epicardial adipocyte Schwann cell smooth muscle cell fibroblast
Graph view	UBERON:0000948	heart	✓	✓	blood vessel endothelial cell 1 more... pacemaker cell endothelial cell smooth muscle cell fibroblast cardiac muscle cell fibroblast
Treemap view	UBERON:0002137	Aortic valve	✓	✓	15 more... valve interstitial cell blood vessel endothelial cell
Organ statistics	UBERON:0002135	Mitral valve	✓	✓	valve interstitial cell blood vessel endothelial cell
Data status: Ready	FMAID:7272	Moderator band	✓	✓	cardiac muscle cell Purkinje fiber cell fibroblast macrophage blood vessel endothelial cell
Anatomical structures: 109	UBERON:0002146	Pulmonary Valve	✓	✓	smooth muscle cell 3 more... valve interstitial cell blood vessel endothelial cell
HuBMAP-only AS: 47	UBERON:0002134	Tricuspid valve	✓	✓	valve interstitial cell blood vessel endothelial cell
SPARC-only AS: 58	FMAID:76767	anterior cardiac veins	✓	✓	endothelial cell smooth muscle cell fibroblast blood vessel endothelial cell
Shared AS: 4	FMAID:3851	atrioventricular nodal artery	✓	✓	endothelial cell smooth muscle cell fibroblast
HuBMAP-only AS links: 57	UBERON:0002352	atrioventricular node	✓	✓	pacemaker cell fat cell
SPARC-only AS links: 58	UBERON:0002353	bundle of His	✓	✓	pacemaker cell
Shared AS links: 3	FMAID:15736	conus artery	✓	✓	endothelial cell blood vessel endothelial cell fibroblast
Cell types: 39					
SPARC-only CTs: 12					
HuBMAP-only CTs: 23					
Shared CTs: 4					
Legend					

Implementation highlights

- Web application (Angular) plus API microservice (Express) architecture
- Use of web-components to embed the CCF Exploration User Interface
- CI/CD workflow built in
- Live, always up-to-date resources
- Code documentation, UI hints/descriptions, and repository docs
- Project management with GitHub Issues and Project Boards

Impact - Key Takeaways

- A great start for HuBMAP and SPARC to systematically compare and share data and ontologies
- A dashboard to track progress
- An initial method for adding SPARC scaffolds to the HuBMAP CCF
- A first implementation for integrating SPARC datasets into the CCF
- A path for SPARC to be able to contribute to the active ontology development efforts around ASCT+B working group (100+ individual members)

Future Directions

- User studies to determine what metrics, visualizations, and features would be useful to SPARC & HuBMAP stakeholders
- Add more visualizations and aggregations to the dashboard
- Finalize SPARC scaffold to CCF Reference Organ interoperability
- Better placement of SPARC datasets in the CCF reference system
- Go the other direction (CCF -> SPARC)

Thank you!

Any questions?