

SOP: Using the Registration User Interface

How to register tissue blocks to reference organs

Authors: Andreas Bueckle, Katy Börner, Bruce W. Herr II

Approved by: Katy Börner (6/15/21), Bruce W. Herr II (06/14/2021)

HIVE MC-IU Team, Indiana University

PI: Katy Börner

NIH Award No: 1OT2OD026671

Updated: June 15, 2021

Introduction

This document contains instructions for spatially registering human tissue to a 3D reference organ using the Registration User Interface (RUI). This SOP is written for HuBMAP members that would like to upload tissue data via the [HuBMAP Ingest Portal](#) and for users not affiliated with the HuBMAP consortium who would like to register data using the [public RUI](#).

The latest video demo of RUI version 1.7.0 (06/07/2021) can be found [here](#).

Two Versions of the Registration User Interface

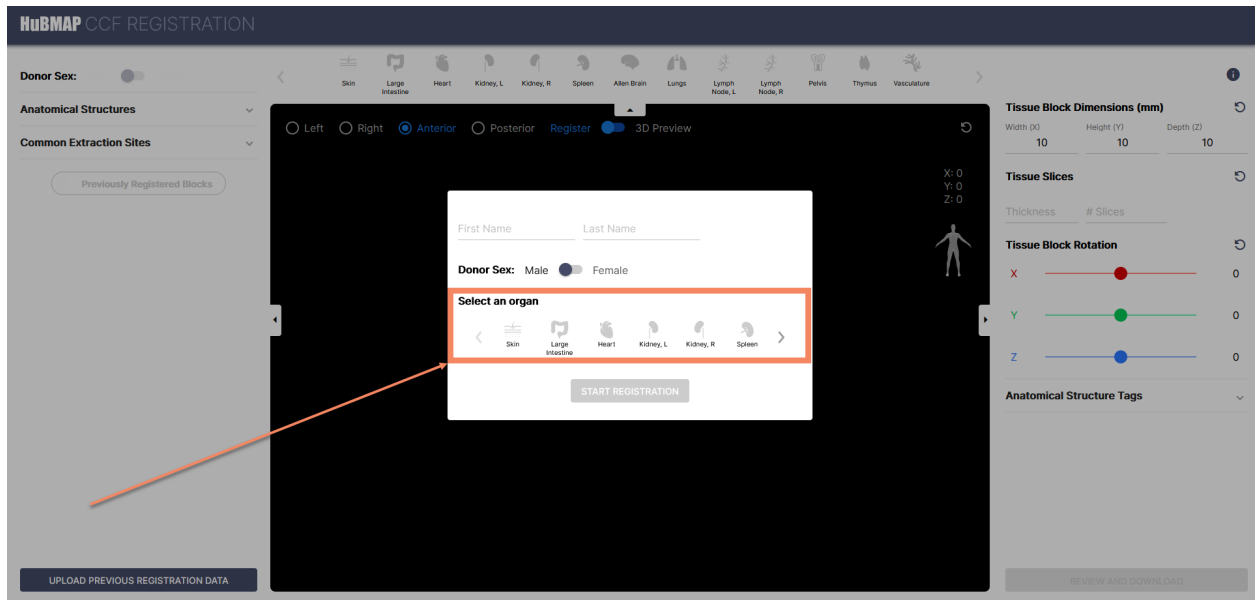
Two versions of the RUI exist, and which one you access depends on whether you are registering tissue blocks via the HuBMAP Ingest Portal or not.

1. If the tissue block you are registering is affiliated with the HuBMAP consortium, go to the [HuBMAP Ingest Portal](#) and follow the instructions [below](#). Metadata such as author name, date, etc. is captured as part of the tissue ingest process and RUI data is automatically associated with the tissue on Globus.
2. If the tissue block you are registering is not affiliated with HuBMAP, go to the [public RUI](#). You will need to enter your first and last name. You will download the RUI data in JSON format and share it with the MC-IU team. The RUI data will then be placed [into this folder](#) and be made available via the public CCF [Exploration User Interface](#). Instructions are [below](#).
3. The difference between the public RUI and the HuBMAP RUI is that the HuBMAP version facilitates submission of the registration data via the HuBMAP Ingest Portal. When opening the RUI from within the Ingest Portal, it appears embedded in the sample registration page.

Registration Procedures

The registration process works as follows:

1. The RUI currently supports a limited number of organs. Check whether the RUI supports your organ by opening the standalone version of the RUI and checking the organ carousel inside the startup modal: <https://hubmapconsortium.github.io/ccf-ui/rui/>



2. Gather any materials needed to document where the tissue block was extracted from.
3. Open the relevant version of the RUI (see [above](#)).
4. When opening the [public RUI](#), you are presented with a small window (also called a modal) as it loads. Here you can adjust settings, including the following parameters.
5. Name
 - a. In the public version, enter your first and last name into the corresponding text entry fields.
 - b. In the Ingest Portal version, your name is already captured on the back end based on data from your user profile.
6. Donor sex and organ selection:
 - a. Select the donor's sex
 - b. In the public version, select an organ from the organ carousel. Make sure to select the right or left version as appropriate. The organ might take a few seconds to load.
 - c. In the Ingest Portal version, the organ is pre-selected.

Tissue Placement

7. For a step-by-step demonstration, please watch [this demo](#).

8. Resize the tissue block using the Tissue Block Dimensions text input fields in the top right corner. The default is a 10x10x10 mm block.
9. Move the tissue block into position by clicking and dragging the left mouse button over the tissue block. Note that in order for the tissue block to be movable, the radio buttons in the top left corner of the 3D window have to be set to either Left, Right, Anterior, or Posterior. When set to 3D, the tissue block cannot be moved.
10. The tissue block can only be moved in two dimensions at a time.
 - a. To make “looking inside” the reference organ easier, all anatomical structures are set to 20% opacity as the default. You can adjust the opacity using the Anatomical Structures accordion menu in the metadata pane (see [below](#)).
 - b. To inspect tissue blocks you placed before (for reference), click the Previously Registered Blocks toggle button in the metadata pane on the left. Clicking this toggle button will show all previously registered tissue blocks based on your browser’s local cache.
 - c. To change the perspective, use the radio buttons in the 3D pane (see [below](#)).
 - d. To verify the placement, switch to 3D Preview mode using the corresponding toggle switch at the top of the 3D pane (see [below](#)).
11. Adjust the rotation of the tissue block by using the rotation sliders in the manipulation pane on the right.

To finalize the registration

12. If you are using the Ingest Portal version of the RUI, click the Register Location button. The RUI window will then close automatically.
13. If you are using the public version of the RUI, click the Review and Download button in the bottom right corner of the screen to review the data and download it as a JSON file. A Registration Review window pops up, where you can check the validity of the data you generated. You can then download the JSON file to your hard drive.

Accessing the RUI from within the HuBMAP Ingest Portal

DISCLAIMER: Although current at the time this SOP was adopted, the steps outlined here may change with future updates to the Ingest Portal. Screenshots may not always reflect what you see on your machine.

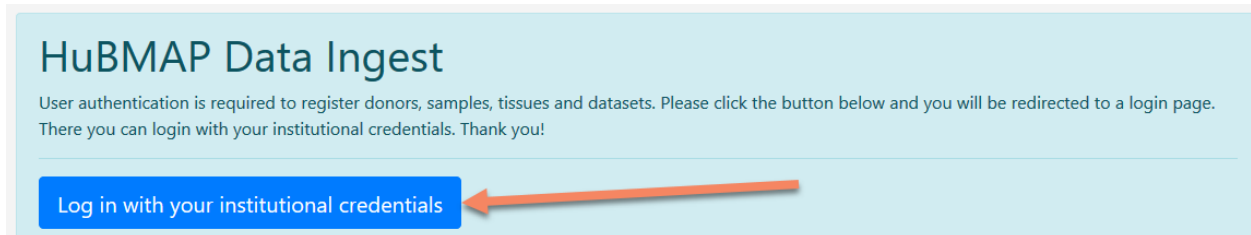
There are three cases where you would access the RUI from the HuBMAP Ingest Portal:

1. You would like to register a new sample with HuBMAP and register its location via the RUI at the same time.
2. You would like to register the RUI location for a sample that has already been registered with HuBMAP.

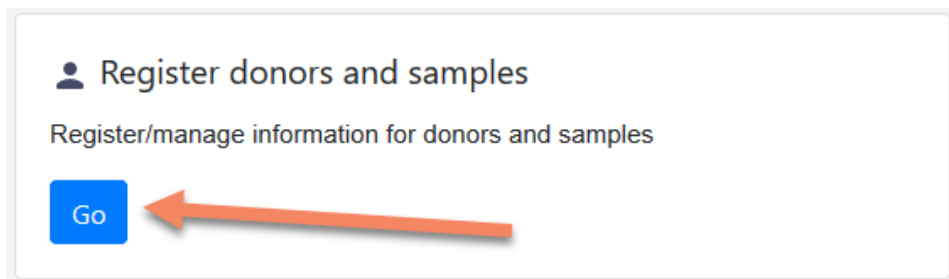
3. You would like to edit an existing RUI registration.

Case 1: Register a new sample and then register its location

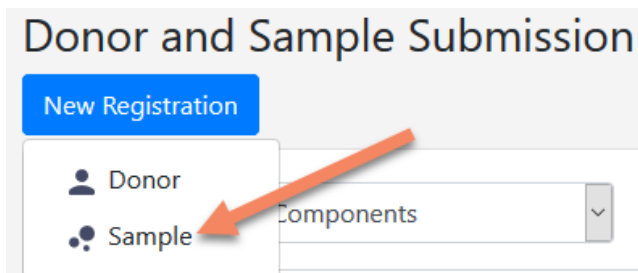
1. Visit <https://ingest.hubmapconsortium.org>
2. If needed, log in using your institutional credentials.



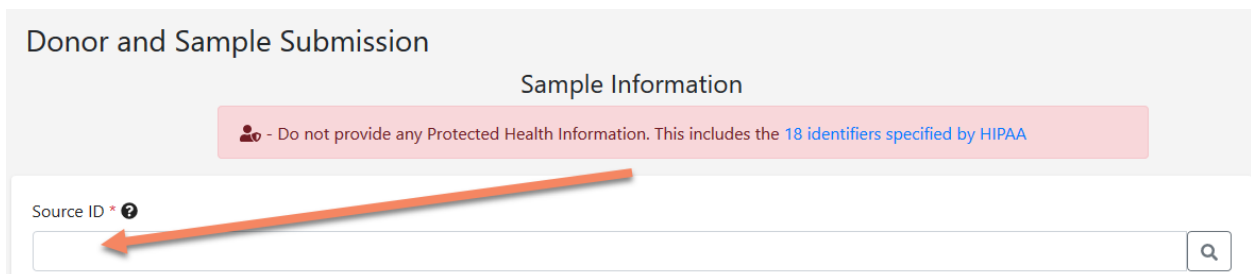
3. Click Go to register a new sample.



4. Click the New Registration button and choose Sample:



5. Click the HuBMAP ID field, which prompts an overlay with a search interface.



HuBMAP ID Look Up

Group Type

[Close](#)

6. Choose your organization from the drop-down menu.

All Components

- All Components
- RTI - Broad
- RTI - GE
- RTI - Northwestern
- RTI - Stanford
- TMC - Cal Tech
- TMC - Stanford
- TMC - UCSD
- TMC - UFlorida
- TMC - Vanderbilt
- TTD - Cal Tech
- TTD - Harvard
- TTD - Purdue
- TTD - Stanford
- IEC Testing Group

7. For Type, choose Organ:

Donor

Organ

Biopsy

Cell lysate


FFPE block


8. Click Search.

9. A list of organs ingested from your organization shows up. Pick one by clicking its row.
10. This opens a screen prepopulated with relevant information about the organ. Additionally, a blue button shows up, labeled Register Location.


Donor and Sample Submission

Sample Information

 - Do not provide any Protected Health Information. This includes the [18 identifiers specified by HIPAA](#)

Source ID * 

Source Type: Organ
Organ Type: Kidney (Right)
Group Name: Vanderbilt TMC

Tissue Sample Type * 

11. Click the button
12. The RUI is displayed, embedded into the page.
13. Follow the steps outlined [above](#) for placing tissue.

Case 2: Register the location for an existing sample.

1. Follow steps 1-3 of the [Case 1 instructions](#).
2. Choose the Organization and Type of sample you would like to add a registration for, e.g., FFPE.

Donor and Sample Submission

New Registration

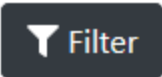
Group: All Components Type: ----

Search by keywords or HuBMAP ID

HuBMAP ID	Submission ID	Submission Type
-----------	---------------	-----------------

- Donor
- Organ
- Biopsy
- Cell Isolate
- FFPE block**
- PFA Fixed frozen OCT block
- Fixed tissue piece
- Flash frozen, liquid nitrogen
- Formalin fixed OCT block
- Fresh frozen tissue
- Fresh frozen oct block
- Fresh tissue
- Frozen cell pellet (Buffy coat)
- Module
- PBMC
- Plasma

3. Click the Filter button.



4. When the search is done, click on the HuBMAP ID of the desired sample.

Donor and Sample Submission

New Registration

Group: TMC - UFlorida Type: FFPE block

Search by keywords or HuBMAP ID [Filter] [Clear]

HuBMAP ID	Submission ID	Submission Type	Lab Group	Lab's Non-PHI Name/ID	Entered By
HBM237.NWXR.445	UFL0010-SP-3-5	FFPE block	University of Florida TMC	21-010 SP-CC3 Block F	marda@ufl.edu
HBM484.JPVZ.733	UFL0010-SP-3-4	FFPE block	University of Florida TMC	21-010 SP-CC3 Block E	marda@ufl.edu
HBM426.GTHM.924	UFL0010-SP-3-1	FFPE block	University of Florida TMC	21-010 SP-CC3 Block A	marda@ufl.edu
HBM566.ZFJH.722	UFL0010-SP-2-6	FFPE block	University of Florida TMC	21-010 SP-CC2 Block C	marda@ufl.edu
HBM238.ZPGJ.835	UFL0010-SP-2-4	FFPE block	University of Florida TMC	21-010 SP-CC2 Block 2B	marda@ufl.edu
HBM858.RMZC.795	UFL0010-SP-2-3	FFPE block	University of Florida TMC	21-010 SP-CC2 Block B	marda@ufl.edu
HBM328.CLRM.273	UFL0010-SP-1-5	FFPE block	University of Florida TMC	21-010 SP-CC1 Block F	marda@ufl.edu

5. Perform steps 10-13 of the Case 1 instructions above.

Case 3: Edit an existing registration

1. Perform steps 1-4 of the [Case 2 instructions](#).

2. You can then access the RUI location via the View Location button.

Source ID * ⓘ
HBM939.JNJG.745

Source Type: Organ
Organ Type: Kidney (Left)
Submission ID: VAN0035-LK
Group Name: Vanderbilt TMC

Tissue Sample Type * ⓘ
FFPE block

Case Selection Protocol * ⓘ
dx.doi.org/10.17504/protocols.io.bfskjcw

Lab Sample Id ⓘ
T6-1

Sample Location [View Location](#) ⓘ

3. Follow the steps outlined [above](#).

Description of the user interface (UI)

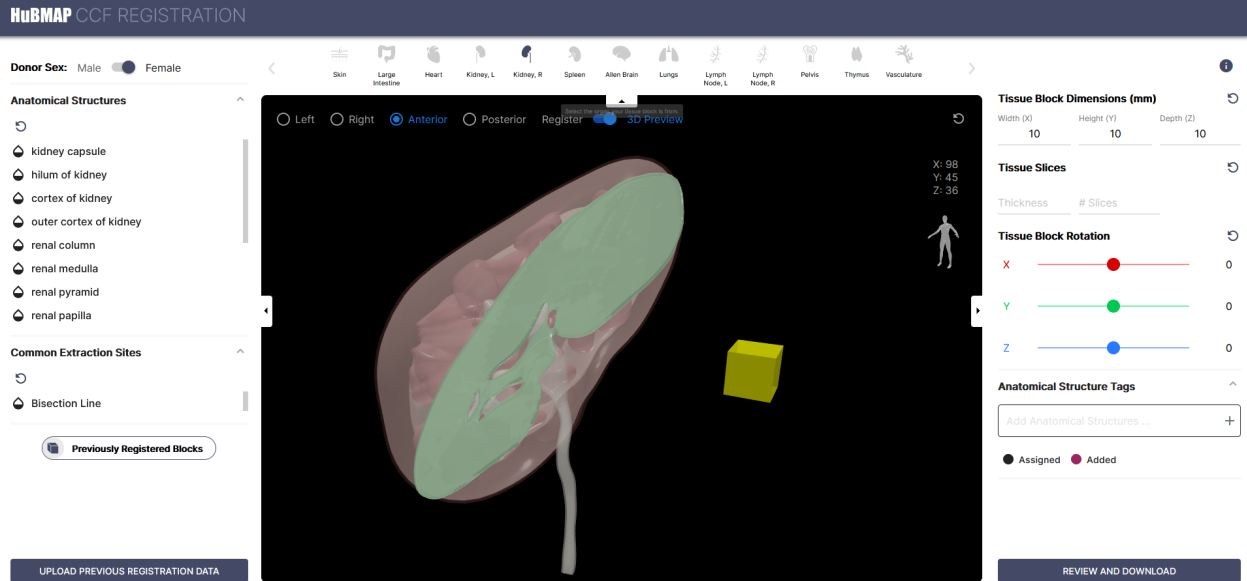


Figure 1: The stand-alone CCF Registration User Interface (RUI) currently supports tissue registration for 11 organs: skin, large intestine, heart, kidney (left/right), spleen, brain, lungs, lymph nodes (left/right), pelvis, thymus, and vasculature. The yellow cuboid represents the tissue block. The green slide indicates the bisection line inside the kidney. Tissue block size and rotation can be adjusted on the right. Anatomical structure tags (bottom right) are automatically assigned based on 3D collision with semantically annotated 3D reference objects. Users can add additional tags using the text input field.

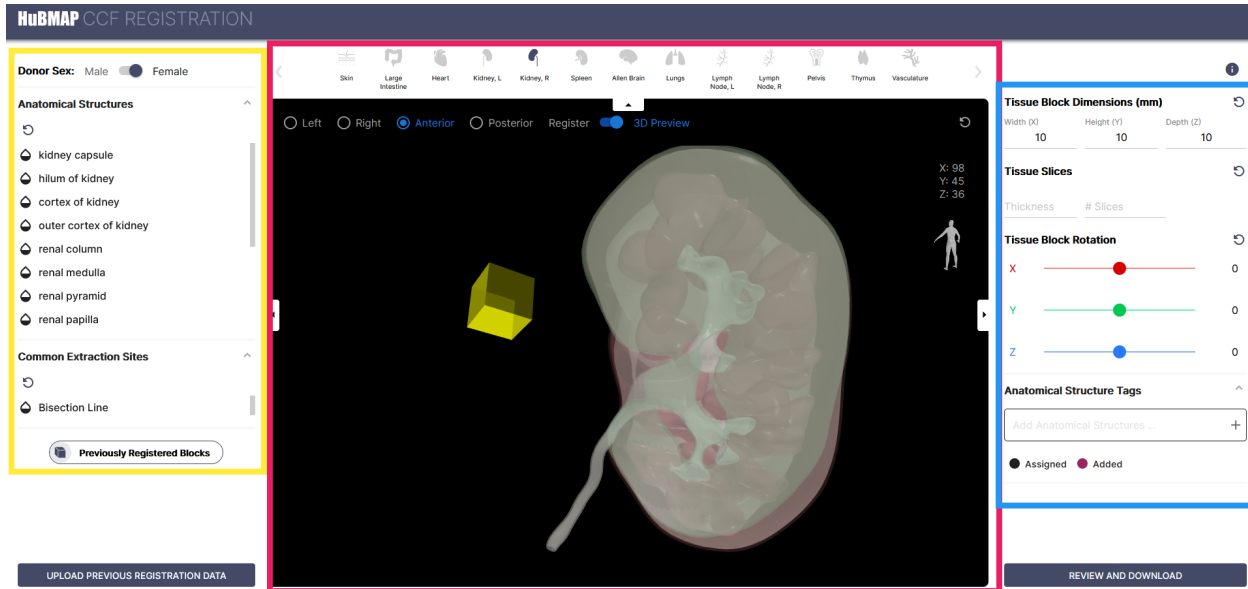


Figure 2: The RUI has three panes: metadata (yellow), 3D (pink), and manipulation (blue).

The RUI consists of three panes: the metadata pane on the left, the 3D pane in the middle, and the manipulation pane on the right, see Fig. 2. Here are brief explanations of what can be accomplished in each pane:

- a. The metadata pane contains the following elements:
 - i. Donor Sex: enter the sex of the tissue donor.
 - ii. Anatomical Structures menu: The anatomical structures listed here correspond to 3D structures inside the reference organ. A slider appears when the user hovers over the drop icon to the left of the anatomical structure text entry, allowing one to adjust the opacity of the structure. This allows the user to make certain parts of the organ more transparent than others, allowing them to retain certain structures as landmarks while placing the tissue block. Also, clicking the eye icon to the right of the slider will hide the structure. It can be turned on by clicking the icon again.
 - iii. Common Extraction Sites menu: When hovering over a drop icon, the Common Extraction Sites menu reveals frequently used extraction locations, such as the apex for the heart. Extraction sites can also serve as important landmarks (such as the bisection line for the kidney). All extraction sites are hidden by default. Extraction sites are rendered green.

- iv. Previously Registered Blocks toggle button: This button allows you to view tissue blocks you have registered before, which show as blue in the 3D pane. This information is taken from your browser cache. When previously registered blocks are shown, anatomical structure opacity is reduced to 20%.
- b. The 3D pane contains the reference organ and the tissue block. It is a 3D window, similar to what one would find in 3D modeling software or a video game. In the top left corner, a set of radio buttons allow the user to control the 3D camera of the scene.
 - i. Using the radio buttons labeled Left, Right, Anterior, and Posterior, the user can rotate the camera around the reference organ in increments of 90 degrees. The current camera view is visually indicated by a small human icon on the right side of the 3D pane.
 - ii. When Left, Right, Anterior, or Posterior are clicked, the camera movement is restricted to 90 degree increments, and the mouse is used to move the tissue block. Select 3D Preview to verify tissue placement. When in 3D Preview mode, the user can rotate the camera at two degrees of freedom while clicking and dragging the left mouse button. The user can also zoom in by using the mouse scroll wheel (or whatever input method is assigned to scrolling) and pan the camera (i.e., move it laterally) by clicking and dragging the right mouse button.
 - iii. In the top right corner, the current x, y, z-coordinates of the tissue block are shown, with the origin in the back bottom left corner of the reference organ.
 - iv. The circular arrow in the top right corner of the 3D pane can be used to reset the position of the tissue block.
- c. The manipulation pane on the right allows the user to resize and rotate the tissue block, indicate thickness and number of slices, and review anatomical structure tags generated via collision detection between the tissue block and the anatomical structures in the reference organ.
 - i. On the top of the manipulation pane, the Tissue Block Dimensions fields allow the user to define the size of the tissue block in millimeters (mm). These fields can be reset by clicking the small circular arrow button in the top right.
 - ii. Below that, the Tissue Slices fields let the user indicate the thickness and number of slices for the tissue block. Note that the thickness is indicated in micrometers (μm). These fields can be reset by clicking the small circular arrow button in the top-right.
 - iii. The Tissue Block Rotation sliders allow the user to add rotation to each axis of the tissue block individually. The sliders are color coded (red: x, green: y, blue: z). All slider values can be reset by clicking the small circular arrow button in the top-right. Note that the RUI is a “y-up” 3D application where the y-axis corresponds to the global “up” vector.

- iv. The Anatomical Structure Tags menu can be expanded via a click. This section is empty by default but is automatically filled as the user moves the tissue block into the reference organ. Once a collision between an anatomical structure and the tissue block has been detected, the name of the anatomical structure is added to the Anatomical Structure Tags section as a tag. Tags can be removed by clicking on the little X to the right of the tag. Tags can also be added manually. Anatomical structures must be selected from the auto-complete suggestions provided.

References and Definitions

The below references and definitions were used in writing this Standard Operating Procedure. When available, definitions were taken from the [HuBMAP Dictionary](#), and aligned with standard terminologies used in relevant fields.

References

- The public Common Coordinate Framework Registration User Interface (CCF RUI): <https://hubmapconsortium.github.io/ccf-ui/rui>. Accessed on Feb 20, 2021.
- HuBMAP Ingest Portal: <https://ingest.hubmapconsortium.org>.
- The CCF Portal: <https://hubmapconsortium.github.io/ccf>. Accessed on Feb 20, 2021.

Glossary

HuBMAP: The Human BioMolecular Atlas Program is a consortium composed of diverse research teams funded by the [Common Fund at the National Institutes of Health](#). HuBMAP is developing the tools to create an open, global atlas of the human body at the cellular level. These tools and maps will be openly available, to accelerate understanding of the relationships between cell and tissue organization and function and human health.

HuBMAP Ingest Portal: The HuBMAP Ingest Portal is where HuBMAP members generate HuBMAP IDs.

Globus: Globus is software-as-a-service for research data management, used by hundreds of research institutions and HPC facilities worldwide for secure, reliable file transfer, sharing and publication. (Globus.org)

Modal: A modal is an overlay that appears in an application interface above all other content, that usurps control or focus from the parent content, and typically prompts the user to perform an action (e.g. entering login credentials) or providing the user with information (e.g. help text or video).

HuBMAP

Reference Organ: A reference organ is a 3D model based on a variety of potential data sources produced by MC-IU. 3D models are created with the involvement of subject matter experts. [This SOP](#) outlines the creation of reference organs.

Standard Operating Procedures (SOPs): SOPs are issued to specifically instruct team members in areas of responsibility, procedural steps, appropriate specifications and required records. SOPs outline procedures, which must be followed to support the reproducibility of scientific research. Procedures can take the form of a narrative, a flow chart, a process map, computer screen printouts or combination of all or any other suitable form, however must be written in appropriate, effective grammatical style. (e.g. plain English).

Tissue Block: A tissue block is a digital, 3D representation of a tissue sample. In the RUI, tissue blocks are cuboids that the user can spatially register to a reference organ.