3D Reference Object Approval SOP

Process for approval of 3D assets produced by Kristen Browne (NIAID) for integration into EUI and RUI tools

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Process for approving 3D reference organs

Gathering Requirements

Each organ set for production is assigned at least one Subject Matter Expert (SME) who is responsible for answering questions from Kristen Browne, the 3D medical modeller. SMEs will also provide information about tissue extraction sites, will assist with obtaining additional organ data (e.g. vasculature), and will assist with organ segmentation. SMEs serve as the final authority on biological accuracy of the model.

Subject Matter Experts (SMEs)

Kidney (L, R)	Jeffrey Spraggins (jeff.spraggins@Vanderbilt.Edu), Sanjay Jain (sanjayjain@wustl.edu)
Spleen	Clive Wasserfall (wasserfa@pathology.ufl.edu), Marda Joregensen (marda@ufl.edu)
Colon	Yiing Lin (liny@wustl.edu)
Heart	Shin Lin (shinlin@cardiology.washington.edu)
Lung	Gloria Pryhuber (Gloria_Pryhuber@URMC.Rochester.edu)
Brain	Pre-approved by Allen Brain

On-boarding SMEs

At time of SME recruitment s/he will be instructed about what expectations are for their role, technical requirements and how to use the required tools for viewing the models as well as limitations, expected turn-around times for information requests, what extraction sites are and how they will function, and will be given clear guidelines for the review/approval process. It will be communicated to them that Kristen Browne's role is that of medical illustrator. The models she creates are adapted from real clinical data to better fit textbook anatomy. SMEs are required to evaluate whether the product adequately reflects a "normal" healthy organ. SMEs will be presented with the full list of approved ASCT terms that will be used by Browne. SMEs will be educated about what the models created by Browne will be used for: as navigation for tools like EUI, for generic registration in a tool like RUI, and for presentation purposes for online and print, etc.

SME guidelines for review/approval will include information about:

- Organ structures from the ASCT table that will be used to build the models
- What they should be looking for in regards to: tissue thickness, vessel branching, relative sizes of structures, etc.

Organ Construction

Clear guidelines will be determined by Katy Börner, Bruce Herr II, and other stakeholders then provided to Browne for what she is building and to the SMEs for how/what they are reviewing and approving.

Browne will produce 3D reference organs from data sets including the Visible Human project organs. If other data sets are required those will be identified and provided by MC-IU. Organs will include sub-structures, vasculature, and SME defined extraction sites. Browne will use industry standard tools, e.g. Autodesk Maya, ZBrush, and Blender.

Extraction sites will be determined by SME(s) and provided to Browne. These sites are common locations where tissue samples are extracted. Browne will work with SME(s) to in effect segment the reference organ model into the regions that define the extraction sites. These extraction sites will map to the reference organ exactly. Based on need in tools such as RUI, Browne will be provided additional instructions about how to create the extraction sites by a designated representative for MC-IU. Browne will label sites appropriately and provide a mapping of label to site so that developers, et al can programmatically identify sites for tasks such as tissue block registration, collision detection, etc.

Browne will correspond directly with SMEs via email and Zoom conference sessions as needed for direction on biological accuracy and extraction sites. She will use the ASCT Table in partnership with the SMEs as reference for segmentation to align structures with the HuBMAP

Common Coordinate Framework (CCF) and ontology. Models will be shared throughout the build process with SMEs to ensure high fidelity and correctness.

Completed organs are shared with SMEs for final approval. This approval is tracked in a primary document that also provides decision-makers with status updates during the build.

When a model is completed and has SME final approval, Browne will take screenshots of each organ which will be stored in the same directory. Each organ will be exported in two formats (FBX, GLB) and at three fidelities: low, medium, high. The low fidelity model will be added to a master file that contains all completed organs, this file referred to as the “united” version. A screenshot will be made of the master file and stored in the directory. All files will be uploaded to a non-IU cloud storage solution with version control. A review of all files is made by Browne and Cross as a final step before they are released for integration to confirm that the files are the correct version and functional.

Organ Integration

Following SME approval the organ is submitted to Bruce Herr II in FBX and GLB formats for review and approval in relation to integration to the EUI, RUI, and other HuBMAP project tools. The organs are provided individually and as part of a single file that contains all completed organs. This level of review ensures that organs, sub-structures and vasculature are capable of linking to terms in the ontology and to the CCF, and that they work visually inside of viewers. Models need to load, have proper appearance, can be manipulated in 3D space, and contain regions that can both be interacted with and that align with the agreed-upon annotation and extraction sites.

File Naming Schema

Currently under review.

General formatting:

- Year as YYYYMMDD
- No special characters ~ ! @ # $ % ^ & * ( ) ` ; < > ? , [ ] { } ' "
- Sequential numbers use leading zeros (e.g. 001, 002...110, etc)
- No spaces, use dashes
- Use caps only for abbreviations (e.g. an assay type like PAS). Otherwise, all lower-case.

- Include origin in file name, place file in a folder to designate (e.g. Kidney/VH/Male/vh-kidney-left-male.xxx).
- GitHub flow versioning: A GitHub Release is made for each new version. Main branch includes the latest (potentially unreleased) version. Feature branches can be used for new reference organs to aid in review via Pull Requests. When approved it is then merged into main or develop in preparation for inclusion in a formal release. A develop branch may be used for staging changes before a release and merge to main.
- When testing files, create a feature branch. When ready for review, create a Pull Request to the main or develop branch. Once it passes review, it can be merged into the main branch. If not, the branch can be safely deleted.
- In situations where organs have two references (e.g. kidney and renal), keep files consistent in the containing folder, do not name some one way and others another.

Specific formatting:

- Organ (sub-structures should include the name of the organ, e.g. kidney_minor_calyx)
- Organ specific (i.e. left, right, small, large)
- Location. If needed to better define a file, include medically approved terms (e.g. anterior, posterior, superior, inferior, proximal, distal, etc).
- Gender
- Descriptor (ideally a single word, e.g. extractions)

Examples
vh-kidney-left-female
vh-kidney-left-pyramid-female
vh-intestine-lower-male
Vh-kidney-left-female-extractions