The Multispecies Ovary Tissue Histology Electronic Repository (MOTHER): A resource for evaluating adverse effects (Abstract 1.06.P-Th-006)

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Introduction

The Multispecies Ovary Tissue Histology Electronic Repository (MOTHER) is a Web-searchable repository of digital images[1,2]. Its goal is to maximize the use of ovary histology slides by openly sharing digital images and metadata about each slide. Applications include:

- Comparative studies of female reproductive biology and toxicology
- Development of cell-based computational models
- Use as training data for machine learning algorithms
- A resource for science educators

Figure 1 shows a sample of the species with ovary histology images in MOTHER.

Figure 1: Three taxa with ovary histology images in MOTHER. (A) Mouse (*Mus musculus*)[3]; (B) American Crow (*Corvus brachyrhynchos*)[4]; and (C) Rhesus macaque (*Macaca mulatta*).

This presentation focuses on MOTHER as a resource for environmental toxicology.

1. Sharing ovary histology images in MOTHER
   a. Metadata collection with ezEML+MOTHER, a web-based tool for sharing histology slide images
2. Digitizing histology slides by the MOTHER team

Methods

MOTHER combines a database, semi-automated transfer pipelines for images and metadata, and ezEML+MOTHER for contributing slide images and metadata.

We extended the ezEML tool for the Ecological Metadata Language (EML)[5] that captures data provenance to include additional metadata for MOTHER's ovary histology images:

- Donor animal and slide metadata
  - Species
  - Animal age
  - Reproductive state
  - Xenobiotic exposure
  - Staining technique
  - Immunohistochemistry
- Figure 2 shows the Image and Donor forms from ezEML+MOTHER.

Methods (Continued)

ezEML+MOTHER Sample Web Forms

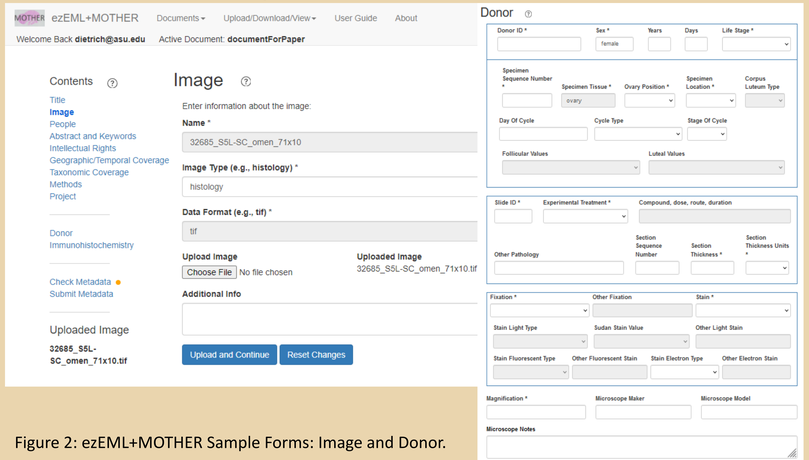

Figure 2: ezEML+MOTHER Sample Forms: Image and Donor.

Digitizing Histology Slides

A written protocol[6] describes the slide scanning procedures developed by the MOTHER team. Figure 3 depicts our slide scanning set-up.

- We used an Olympus CX33 microscope and CellSens™ Entry software.
- Logs record the personnel who:
  - Scanned the slide
  - Performed quality control checks on the image
- Images are stored in a team Dropbox folder until they are uploaded into MOTHER.

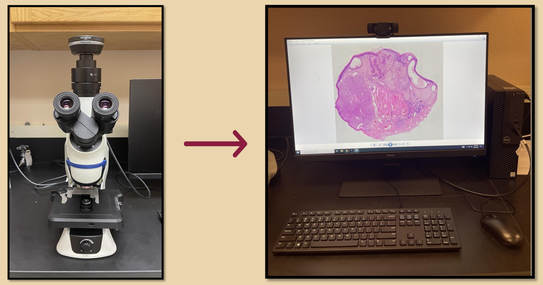

Figure 3: An Olympus CX33 microscope and cellSens™ Entry software were used to scan ovary histology slide sections at 10x magnification.

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Results/Conclusions

Currently, MOTHER contains ovary histology slide images for monkeys, rodents, birds, fish, and a mollusc available at https://mother-db.org/.

Histology Images from Control and Treated Mice in MOTHER

Figure 4 shows output from a search at mother-db.org for *Mus musculus*. Note that the contributor is listed under Attribution, and an overview of the metadata is provided for:

- Taxonomic and Donor information
- Recommended citation format provided
- Details about the slide preparation with
  - Information about whether the donor was a control or treated animal

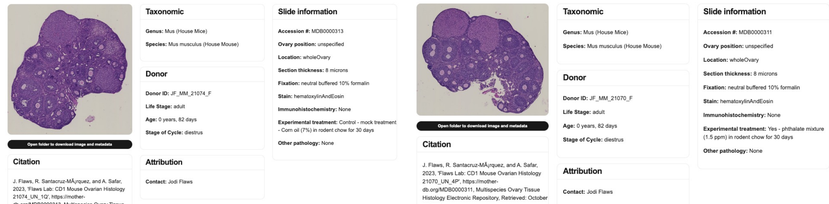

Figure 4: Two examples of the results returned by searching mother-db.org for *Mus musculus* (house mouse).

Figure 5 shows representative images from a mother-db.org search for *Corvus brachyrhynchos, Macaca mulatta,* and *Busycotypus canaliculatus*.

- Currently, mother-db.org contains over 350 ovary histology images from 11 species.
- Additional histology images are in the curation queue for a variety of species, e.g., fishes.

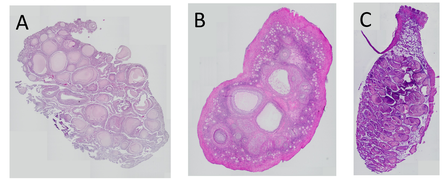

Figure 5: Ovary histology images from mother-db.org for (A) American Crow *(C. brachyrhynchos)*[7]; (B) Rhesus macaque *(M. mulatta)*[8]; and (C) Channeled Whelk *(B. canaliculatus)*[9].

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