## 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 Websearchable repository of digital images<sup>1,2</sup>. 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*)<sup>3</sup>; (B) American Crow (Corvus brachyrhynchos)<sup>4</sup>; 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)<sup>5</sup> 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.

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### Methods (Continued)

ezEML+MOTHER Sample Web Forms	
MOTHER   ezEML+MOTHER   Documents -   Upload/Download/View -   User Guide   About     Welcome Back dietrich@asu.edu   Active Document: documentForPaper	Donor Image: D
ContentsImageTitleEnter information about the image:ImageMame *PeopleName *Abstract and Keywords32685_S5L-SC_omen_71x10Intellectual Rights32685_S5L-SC_omen_71x10Geographic/Temporal CoverageImage Type (e.g., histology) *	Specimen   Specimen Tissue *   Ovary Position *   Specimen Tissue *   Corpus     *   Specimen Tissue *   Ovary Position *   Location *   Luteum Type     ovary   *   *   *   *   *     Day Of Cycle   Cycle Type   Stage Of Cycle   *   *     Follicular Values   Luteal Values   *   *   *
Methods histology   Project Data Format (e.g., tif) *   Donor tif   Immunohistochemistry Upload Image   Schoose File No file chosen   32685_S5L-SC_omen_71x10.tif	Slide ID *   Experimental Treatment *   Compound, dose, route, duration     v   v     Section   Section     Sequence   Section     Other Pathology   Number     Thickness *   *     v   v
Check Metadata • Submit Metadata Additional Info Uploaded Image 32685_\$5L- SC_omen_71x10.tif Upload and Continue Reset Changes	Fixation *   Other Fixation   Stain *     ✓   ✓   ✓     Stain Light Type   Sudan Stain Value   Other Light Stain     ✓   ✓   ✓     Stain Fluorescent Type   Other Fluorescent Stain   Stain Electron Type     ✓   ✓   ✓
Figure 2: ezEML+MOTHER Sample Forms: Image and Donor.	Magnification *   Microscope Maker   Microscope Model     Microscope Notes

R Sample We	eb Forms							
ents - Upload/Download/View - Us	ser Guide About	Donor 💿						
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<b>nage</b> ? Enter information about the image:		Specimen Sequence Number *	Specimen T ovary	ïssue * Ova	ry Position * v	Specimen Location ?	t	Corpus Luteum Type
Name *		Day Of Cycle		Cycle Type		Stage Of	Cycle	
32685_S5L-SC_omen_71x10		Follicular Values			Luteal Valu	es		
Image Type (e.g., histology) *				,	~			~
histology								
Data Format (e.g., tif) *		Slide ID * Experi	imental Treat	tment *	Compound, de	ose, route, d	uration	
tif					Section Sequence	Section		Section Thickness Units
Upload Image Choose File No file chosen	Uploaded Image 32685_S5L-SC_omen_71x10.tif	Other Pathology			Number	Thickne	is *	*
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		Stain Light Type		Sudan Stain Va	lue	Other	Light Stair	
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Upload and Continue Reset Changes	5	Stain Fluorescent Type	Other F	luorescent Stair	n Stain Elec	tron Type	Other E	lectron Stain
		Magnification *		Microscope Ma	iker	Micr	oscope Mo	del
		Microscope Notes						
ER Sample Forms: Ima	ige and Donor.							//
		Save and Continue Re	set Changes					

### Digitizing Histology Slides

A written protocol<sup>6</sup> 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<sup>™</sup> 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<sup>™</sup> Entry software were used to scan ovary histology slide sections at 10x magnification.

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### 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



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.

- Accessed October 13, 2024.

- https://mother-db.org/MDB0000200. Accessed October 13, 2024.
- Electronic Repository. Available from <u>https://mother-db.org/MDB0000322</u>. Accessed October 13, 2024.

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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/.

### • Information about whether the donor was a control or treated animal

	Slide information	A start is	Taxonomic	Slide information	
e)	Accession #: MDB0000313		Genus: Mus (House Mice)	Accession #: MDB0000311	
(House Mouse)	Ovary position: unspecified	30.00	Species: Mus musculus (House Mouse)	Ovary position: unspecified	
	Location: wholeOvary			Location: wholeOvary	
	Section thickness: 8 microns		Donor	Section thickness: 8 microns	
4_F	Stain: hematoxylinAndEosin	Coo Man Strong	Donor ID: JF_MM_21070_F	Fixation: neutral buffered 10% formalin Stain: hematoxylinAndEosin	
	Experimental treatment: Control - mock treatment	Open folder to download image and metadate		Immunohistochemistry: None	
	- Corn oil (7%) in rodent chow for 30 days	Open rolder to download image and metadata	Stare of Cycle: diestrus	Experimental treatment: Yes - phthalate mixture (1.5 ppm) in rodent chow for 30 days	
	Other pathology: None	Citation	Stage of Cycle. desitus	Other pathology: None	
		J. Flaws, R. Santacruz-MÃirquez, and A. Safar,			
		2023, 'Flaws Lab: CD1 Mouse Ovarian Histology 21070_UN_4P', https://mother- db.org/MDB0000311, Multispecies Ovary Tissue Histology Electronic Repository, Retrieved: October 13, 2024	Attribution		
			Contact: Jodi Flaws		



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

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