

Module 1: Imaging, Fluid-preserved

Module 1D: Image Processing

Task ID	Task Name	Explanations and Comments	Resources
T1	Populate core metadata in RAW image file (to include process, administrative, and technical data).	Core metadata to include depends on institutionally specific guidelines but generally reflect Exchangeable Image File Format (EXIF) and International Press Telecommunications Council (IPTC) standards. This is most easily effected through the use of software that allows metadata editing, storage, and retrieval.	See, for several tasks in M1D: https://www.idigbio.org/content/idigbio-image-file-format-requirements-and-recommendations Commercial software for metadata editing within the image processing workflow includes, but is not limited to: <ul style="list-style-type: none"> • Adobe Lightroom, • Canon Digital Photo Professional, • Nikon Capture.
T2	Archive RAW, TIF, or other unedited images with metadata intact.	Only copies of the unedited originals should be destructively edited.	See M1CT13.
T3	Load and process image stack (if necessary).	Workflows that include focal plane merging and z-axis stacking (i.e. stacking) require several identically framed images at varying foci for processing and merging (see M1CT9). Stacking software is often used for this process, including Helicon Focus for smaller image stacks (<50 images) and Zerene	Stacking software examples: <ul style="list-style-type: none"> • Helicon Focus, • Automontage, • Zerene Stacker, • CombineZ.

		<p>Stacker for stacks larger than 50 images.</p> <p>The resulting image from a stacking and merging operation is a composite and not technically archival. However, unedited versions of these composite images are often stored as archival. Some institutions also archive the entire stack of images to allow for future re-creation of stacked versions on demand or in cases where the stacked versions are lost or destroyed.</p>	<p>Note: Workflows for Helicon Focus and Zerene Stacker are in process.</p>
T4	Batch process image adjustments.	<p>Processing assumes that a scale and color checker with white, black, and RGB reference bars are included within the image (see M1CT9).</p> <p>Caution: do not over process. Images should accurately reflect the natural appearance of the specimen. This is especially true for images destined for illustration of scientific papers. Most journals will not accept images that have been modified in ways other than whole-image manipulations.</p> <p>Adjustments might include:</p> <ul style="list-style-type: none"> • rotating, • cropping, 	<p>See for reference: <i>Avoiding twisted pixels: ethical guidelines for the appropriate use and manipulation of scientific digital images</i>, by D. W. Crome, <i>Science and engineering ethics</i> 16 (4) p. 639-67. http://www.ncbi.nlm.nih.gov/pubmed/20567932#</p>

		<ul style="list-style-type: none"> • resizing, • adjusting contrast, • adjusting white balance (unless accurately calibrated in M1CT9). 	
T5	Perform custom, individualized image processing for fine editing.	<p>Consult institutional digitization guidelines governing image editing and refinement.</p> <p>Note cautions in T4.</p> <p>Hand-made edits might include:</p> <ul style="list-style-type: none"> • removing human or mechanically induced imperfections (e.g., specks, air bubbles, etc.), • introducing a standard, monotone background, • extracting subject from backgrounds. 	<p>Image aggregator or repository guidelines, e.g., Morphbank, EOL, etc.</p> <p>Institutionally specific digitization or imaging guidelines.</p>
T6	Create derivatives.	<p>Derivatives might include:</p> <ul style="list-style-type: none"> • low-resolution JPEG files for web display, • high quality illustrations for journal articles or book illustrations, • high quality TIFF or JPEG files for distribution to researchers, • thumbnails for catalogs, • thumbnails for attachment to database records, • thumbnails for web-based preview images. 	<p>Image processing software, e.g.</p> <ul style="list-style-type: none"> • Canon Digital Photo Professional, • Nikon Capture NX2, • Adobe Photoshop, • Adobe Lightroom, • GIMP, • Aperture.

T7	Document changes made to image, including batch processing steps.	Enter image manipulations into media record database or image metadata to alert users to changes made and to the availability of original, unedited images.	
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