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# Multi-Axial Stage for a Stereo Dissecting Microscope

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The stereo dissecting microscope is a widely used instrument for macro-structure observation and documentation. The emergence of digital imaging, along with sophisticated imaging software, makes this macro-imaging more efficient. It also makes possible certain special imaging modes that are difficult to accomplish with traditional (film) imaging, such as extended depth of focus imaging (EDF), automatic montaging, etc. These special imaging techniques often require dedicated hardware on the microscope, such as a motorized stage. This hardware is often offered in newer model microscopes, but for the case of older microscopes, the new hardware may be unavailable or expensive and difficult to incorporate. With this in mind, I developed a simple, multi-axial stage that can be used for multi-purpose image acquisition on a stereo dissecting microscope (patent pending). The stage is relatively small (Figure 1) and can be easily attached to any dissecting microscope. Applications of the multi-axial stage include:

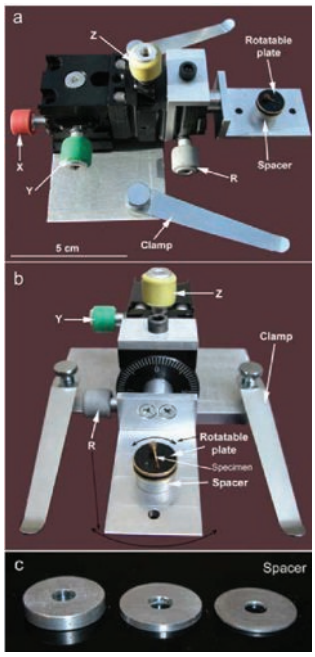


*Figure 1. Images of the multi-axis stage with side view (a), front view (b) and the spacers (c). The specimen can be moved in X, Y, Z directions. It can be rotated or tilted (R) for stereo pair imaging. The specimen can also be rotated without touching the specimen itself through the rotatable plate. The spacers, with different thickness', can be added or removed, based upon the size of the specimen, to make the specimen on the plate eucentric, i.e., keep the specimen focused during rotation. The clamps are used to attach the stage to the microscope and hold it firm (see Figure 2).*

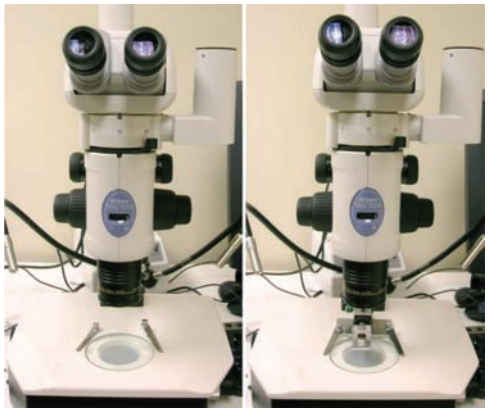

*Figure 2. The stereo microscope without (left) and with (right) the multi-axial stage. Standard clamps are used to attach the stage onto the microscope, so that the stage can be used on any microscope.*

1). It can be rotated or tilted such that the specimen can be imaged at any angle. It can be used, for example, for stereo pair imaging (Figure 3), which usually has a 12 degree inter-image tilting angle.

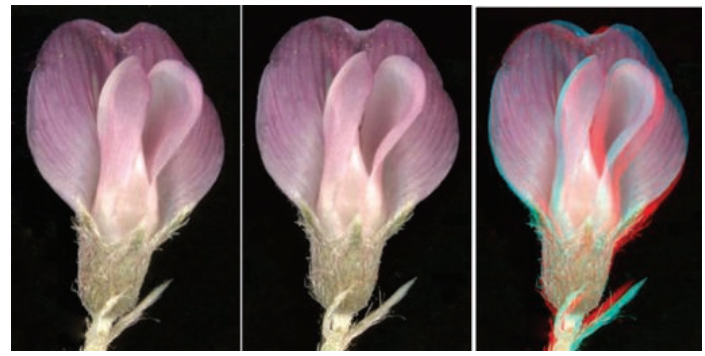

*Figure 3. A pair of images taken with 12 degree angle. Once the images are taken, it can viewed directly side by side (above), or create a stereo image that can be viewed using red-green glasses (left). The stereo image is created using the Two Shot Anaglyph plugin of ImageJ (http://rsb.*

2). The *Z*-axis has a 0.5 mm incremental marker, which can be used to manually change the focus and acquire images at different focal points, then to create an image with extended depth of focus (Figure 4). The *Z*-axis control can be implemented with a motorized version for more accurate and automatic acquisition.

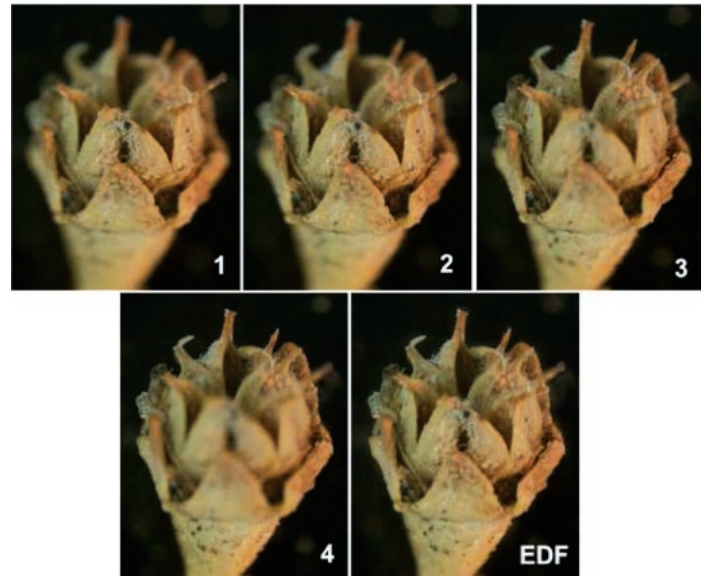


*Figure 4. Extended Depth of Focus. Four sequential images were taken at different focal points (1-4) (Z = 1mm). The 5th image (EDF) was created using the Extended Depth of Field plugin for ImageJ (http://rsb.info.nih.gov/ij/)*

3). The *X*-*Y* stage can be used to create montages. If a specimen is too large to be imaged in one frame, or a small sample needs to be imaged at high magnification, several images can be taken and then stitched together (Figure 5). The *X*-*Y* stage is also useful to slightly move or center the specimen without touching it. ■

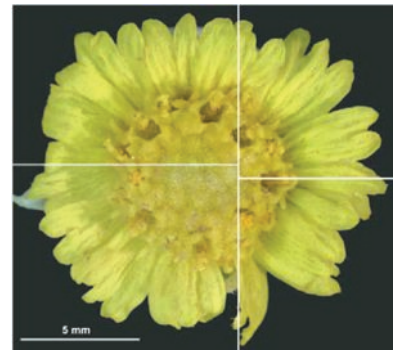


*Figure 5. Montage. Four individual images were taken (with about 20% overlapping) and manually stitched together using Photoshop. Lines are purposely drawn to show places of stitching. Automatic montage software is available through ImageJ software.*

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