

*DRAFT:*  
*Manual Image*  
*Registration Plug-in*  
*Users' Manual*

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**This is the users' manual for the Manual Image Registration Plug-in developed for ImageJ. Please contact me ([karl.schmidt@umassmed.edu](mailto:karl.schmidt@umassmed.edu)) with any questions or to report any problems with this manual or with the software.**

## *1.0 Release Notes*

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This updated version of the Manual Image Registration has several new features which should make it a more productive tool to use. There is still much work to be done, so as you encounter problems, or opportunities for improvement, please send them to me in an email. Here is an abbreviated list of the new features implemented in this version:

- Re-open saved transforms to review image registration and make changes
- Add multiple slices in one operation
- Apply adjacent slice transforms
- Transform raw data directly from the Image Registration Plug-in

### **1.1 KNOWN BUGS**

- When you apply the transform to raw data, you are prompted for the number of anatomical slices in the raw data twice. Please supply the same number both times - I'll fix this at the earliest convenience.
- Resolution must be consistent between all of the images used as Reference, Source and transformed data. Please see the "Image requirements and limitations" below for more information on this point.

### **1.2 IMAGE REQUIREMENTS AND LIMITATIONS**

Currently, the Manual Image Registration plug-in is designed for use with images of the same resolution. The images used for the Reference, Source, and transformed images must all be the same resolution. In order to accommodate this limitation, select the lowest resolution and convert any images you are using with the plug-in to this resolution. This limitation can be averted if correct image dimensionality (FOV, pixelsize, etc.) is supplied for each image used. If this functionality is important to you, please submit a request ([karl.schmidt@umassmed.edu](mailto:karl.schmidt@umassmed.edu)).

Additionally, the transformation algorithm does not interpolate the destination image. Destination image pixels are re-sampled from the original image space with the inverse of the transformation matrix used to convert the Source image to Reference image space. Contact me if you have questions or concerns about how this may impact your analysis.

## *2.0 Creating and saving a transform*

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### **2.1 STARTING IMAGEJ**

Start imagej from the launch imagej page on the Quickvol site:

- **<http://www.quickvol.com>**  
(NOTE: you must disable any pop-up blocker software that you have running in order to launch the application)

After starting ImageJ, open the images you plan to use as the reference and source images. The reference image will be the image to which you transform the source image (and eventually source data). The reference image could be an atlas image, etc.

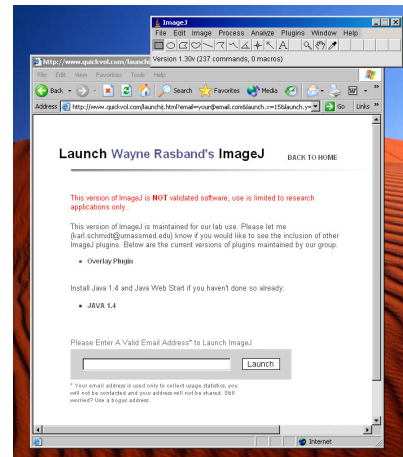
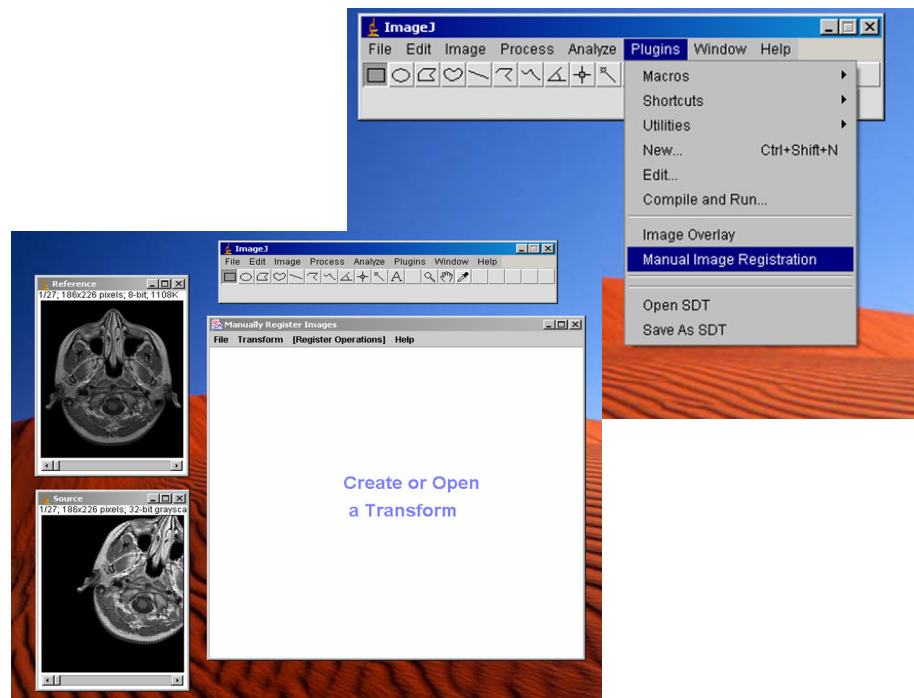


FIGURE 1. The ImageJ Launch page showing ImageJ running at the top

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## 2.2 RUNNING THE MANUAL REGISTRATION PLUG-IN

Before running the plug-in, you should open the images you will use as the reference and source. Once those have been opened, you can launch the Manual Registration Plug-in from the Plug-ins menu as shown in the figure.



**FIGURE 2. Launching the Manual Registration Plug-in**

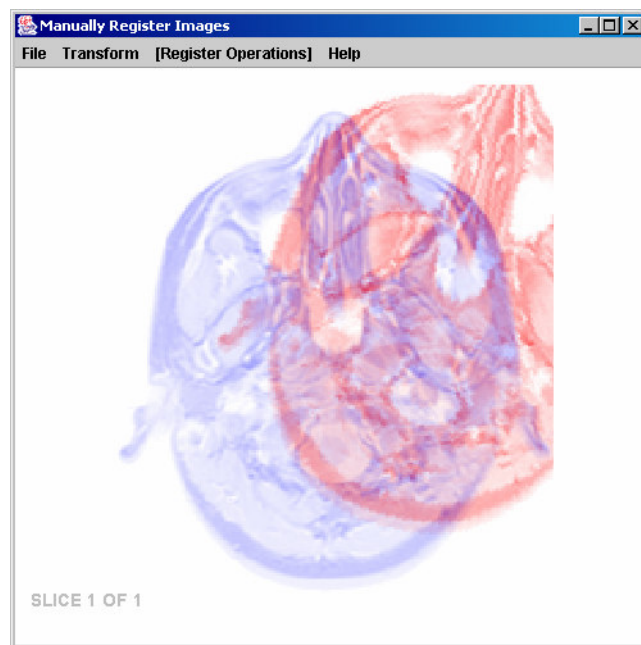
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From the “Manually Register Images” File menu, select File => New and specify the number of slices that the transform will have when prompted to do so.

### 2.3 SELECTING THE REFERENCE AND SOURCE IMAGES

Once the transform has been created, you must select the Reference and Source images from the Transform menu. When the image is selected, the Reference image will appear in Blue, and the Source Image will appear in Red. It is the Source image that you will translate, rotate and scale to line up with the Reference image.

The figure below shows the Reference image in Blue, and the Source image in Red.



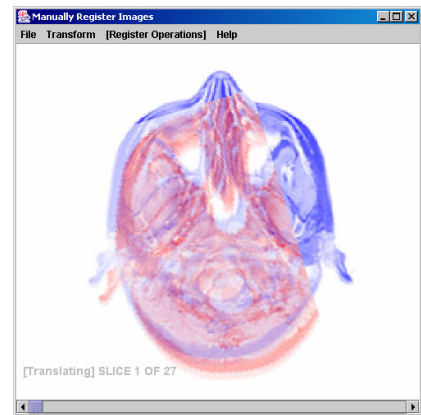
**FIGURE 3. Plug-in with Reference and Source Images Selected**

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### 2.4 ALIGNING THE SOURCE TO THE REFERENCE IMAGE

Once the Reference and Source images have been selected, you must align the Source image to the reference *for each slice in your transform* by using the Register Operations menu options.

Once you select an operation, your mouse will control the operations on the Source image, and the display will be updated as you work. Operations available include:



**FIGURE 4. Nearly aligned Source and Reference Images**

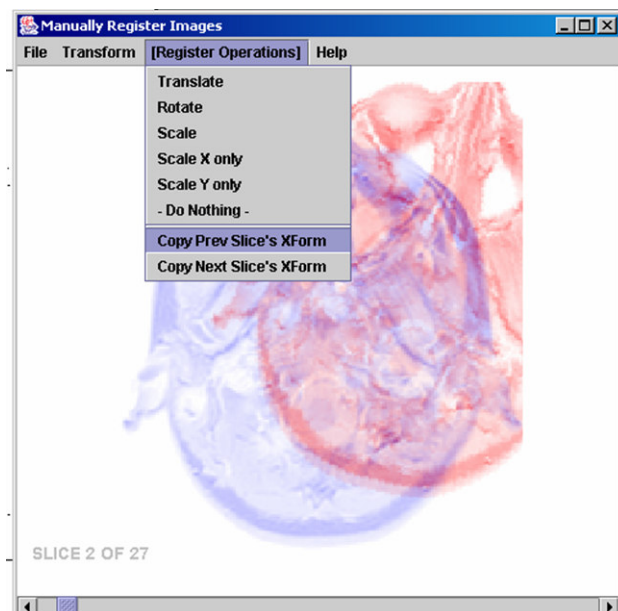
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## 2.5 SWITCHING SLICES

Each slice in your transform must be registered independently.

Switch between slices using the slider at the bottom of the window.

You can apply the preceding or proceeding transform from adjacent slices to make your job a bit easier as is shown in the Figure below.



**FIGURE 5. Copying the previous slice's transform**

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### Saving the Transform

Once you have completed a transform, always save it so that you can come back to it later to review the registration and use it to transform raw data. From the File menu select File => Save to preserve the transform in xml file format; you should rename it to something that will help you reference it in the future.

## *3.0 Applying a transform to an image or image series*

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Once your transform is complete you will use it to transform raw data sets. Select File=>Apply Transform to transform raw data using this transformation.

PLEASE SEE THE RELEASE NOTES for image resolution restrictions regarding data transformation.

## *4.0 Transform XML file format*

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This section is under construction. Contact the author with any questions.