

High-Throughput Megaslide Scanning

By Frank Taylor, Sales Engineer, Prior Scientific

Prior Scientific's PL-200 Slide Loader allows for increased slide scanning efficiency.

When scientists at a California drug company studying gene expression in mouse brains were seeking a way to scan tissue slices at high volumes, they thought it would be a good idea to use the larger 2" x 3" slide platform. This way they could image more slices per slide and save time during the scanning process. When it came time to image the thousands of slides they had prepared, they soon discovered that nearly all commercially available systems could not support their 2" x 3" mega slide platform with the versatility that they required.

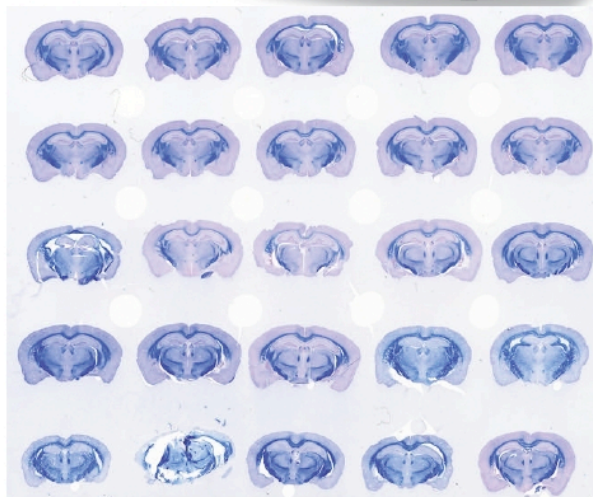
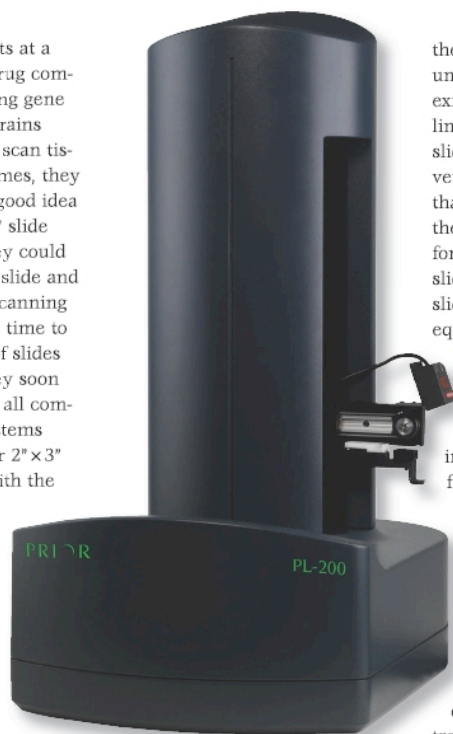
Secondly, due to the volume of data that needed to be handled, they needed equipment that featured the ability to process

the images and store large volumes of data efficiently. Their existing in-house instruments limited their scanning to 1 x 3 slides or could not offer the versatility in imaging choices that they preferred. Add to that the fact the few existing platforms that could image 2" x 3" slides could handle only a few slides at a time. Purchasing new equipment to meet their needs would cost more than \$250k.

They needed something that could automatically load 2 x 3" slides, scan and image them, and archive the files effectively.

For the researchers in California, the solution was to utilize the **Prior PL-200** slide loader, **Leica DM6000** microscope with Prior H101A automated XY stage, and Objective Imaging Surveyor with the Oasis card for software and control. This provided a scalable, versatile solution that was cost effective.

The Prior PL-200 can load up to 100 2" x 3" slides in a single run. This enabled the scanning of a larger sample area per slide while providing high-throughput automation. By automatically scanning an array of slides, the lab is able to save time and resources by utilizing the machine at all hours while researchers are free to work on other projects or while they are home with their families sleeping. The two racks of 50 slides are "hot" swappable. This allows a completed rack to be replaced with a new rack and sensors



Above: Figure 1 Prior Scientific PL200 with Leica DM6000. Right, Figure 2: 2"x3" Megaslide with 24 mouse-brain array. (Source: Neuroscience Associates)

in the system let the software know that there is a new rack to scan, all without interrupting any of the process.

The PL-200 can be controlled by most major imaging platforms for microscopy, including: **Objective Imaging's** Surveyor software with Turboscan, **Molecular Devices'** MetaMorph image acquisition and analysis software, ImagePro by **Media Cybernetics**, and **Nikon Elements**.

The Prior PL-200 and motorized stage can be fitted to virtually any modern upright microscope. The Prior ProScan3 controller or equivalent controller such as the Oasis PCI card, appropriate imaging software, and a computer capable of handling software and data storage requirements are all that is needed for complete automation. For those who are developing

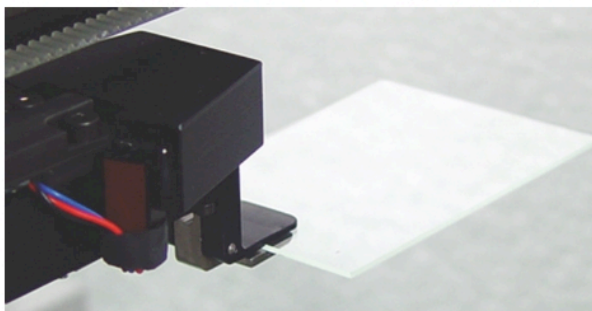


Figure 3: Prior PL200 loading a 2"x3" slide.

their own software, Prior Scientific provides a software development kit (SDK) with drivers, DLL, and code samples in Visual Basic.

The Prior PL-200 has the advantage that it can work with existing microscope systems and provide an effective high-throughput scanner for less than half the cost of existing scanning systems. In many cases, existing

equipment is sufficient to begin high-throughput scanning. Any imaging method that is supported by the software, microscope, and does not interfere with the PL200 and stage movements can be utilized, such as Fluorescence, phase contrast, or DIC.

The PL-200 offers additional benefits as well. It is easy to setup, align, and maintain.

Movement uses a 3-axis coordinate system that is equipped with sensors on the gripper, on each axis of the loader robot, and at the stage to detect when and where a slide is present. This is essential if a problem does arise during loading. Sensors also monitor the presence of the slide racks so the system can intelligently respond when racks are changed in the middle of a run. Individual slides are also detected in each rack so that the software knows exactly where the slides are in each rack. This allows for random sampling or sorting the slides based on the analysis from the scan on the microscope. Prior has optimized the loader and stage to provide the highest productivity with a complete system capable of performing load/unload cycles in as little as 24 seconds.

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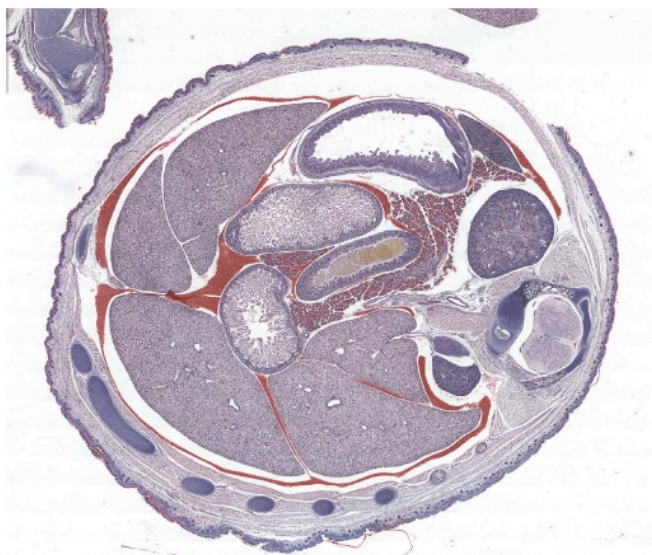


Figure 4: Mosaic image of Mouse Brain courtesy of Objective Imaging

In the case of the California lab, the software and control of the PL-200, automated stage, and microscope were provided by Objective Imaging's Surveyor with Turboscan and the Oasis PCI card respectively. Surveyor with Turboscan provides for fully-automated tissue detection and focus setup for one or more tissues per slide. In this case, researchers required an array of mouse brain slices on a single slide. The software can detect each brain and scan appropriately. Additional features such as tiling and stitching are also supported. A typical sample can be scanned at 10 \times producing an image with a resolution of 0.4 $\mu\text{m}/\text{pixel}$ with a total size of 1.4GB, for example. With Mosaic capability Surveyor can provide a very high resolution image (Figure 4). For archiving, Surveyor appends the barcode for each slide to its file name, allowing for easy file handling and archiving of tissue images.

For this application, the Leica DM6000 microscope offered excellent optical precision and image quality. It came equipped with an automated condenser, objective turret, and z focus control which can also be controlled by the Oasis PCI card.

The slides were prepared at Neuroscience Associates, which provided a novel approach to sampling mouse brain tissues. The company's methods are capable of providing up to 24 brain

slices per slide, thanks to their MultiBrain Technology. The benefits of "mass production" are thus made available to neurohistology. Using this novel approach, it is possible to perform neurohistology up to 25 times faster than by conventional techniques.

Just as the lab in California was able to provide a fully operational 2" \times 3" slide scanner using the Prior PL200, Leica DM6000, and Surveyor software, it is possible to assemble an equally powerful high-throughput scanner on 2 \times 3" slides using the PL200. All that is required is a suitable upright microscope and appropriate imaging software. The PL200 is compatible with most major upright scopes and some inverted models.

As researchers, reference labs, hospital histology, and biopharmaceutical companies working in Neurohistology expand and need higher throughput, there is a greater demand for equipment that is scalable, versatile, and cost effective. The Prior PL-200 provides a workable solution that is expandable and works with a broad range of microscope systems. It offers scalability for the changing needs of the user. The PL200 along with Prior's many microscope and software partners, can now offer high-throughput capability to neurohistology at a fraction of the cost of previously available systems. ■



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