



## CHAPTER 5

# Applied Spectral Imaging

## Company Background

Since 1993, Applied Spectral Imaging (ASI) has maintained its role as a leading provider of advanced microscopy imaging solutions. ASI's imaging technologies have a global presence with more than 2,800 systems deployed throughout the world. The company's product offerings focus on several areas including cytogenetics, pathology and life sciences, covering cancer and pre- and post-natal diagnosis for both clinical and research applications.<sup>33</sup>

Having already built a reputation for expertise in workflow management and excellent product offerings among cytogenetic labs, ASI's Chief Executive Officer, Limor Shiposh explains that for ASI, "the evolution to digital pathology was very natural." It was simply "a matter of developing new pathology applications" because the fundamental structure of the platform, algorithmic "know-how", and experience with laboratory workflow management were already intrinsic parts of the company's technological offerings. ASI introduced applications for IHC, CISH, and tissue FISH with the addition of GenASIs HiPath, allowing the company to offer the pathology community improved workflow and clinical results through its products. This chapter will address ASI's various digital pathology technologies, competitive advantage, and perspectives on the future of the digital pathology space.

## Technologies

ASI's GenASIs product line includes several different platforms: Review & Analysis, Capture & Analysis, Scan & Analysis, High Throughput, and HyperSpectral. The diversity of platforms allows GenASIs to support a variety of different workflows and applications. Shiposh reports that "GenASIs is an innovative solution, capable of meeting the needs of any lab." It is important to note that ASI's product offering is integrated with its versatile data management platform, GenASIs Case Data Management (CDM); however, for the purposes of this report, the focus shall remain on the company's imaging platforms.<sup>28</sup>

Unlike whole slide imaging systems which, according to Shiposh, "simply extract a digital representation of the slide to enable remote review and archiving," the GenASIs platforms focus on a specific region of interest and provide qualitative and quantitative analysis. The GenASIs platforms are digital pathology imaging solutions that are compatible with any lab's existing microscope and therefore integrate seamlessly into the current workflow. While WSI systems may, in some cases, have a speed or capacity advantage, Shiposh explains that this comes at the expense of efficiency and smaller data output. According to Shiposh, GenASIs "provides more efficient functionality" as it manages

only the regions of interest, resulting in a significantly smaller data output as compared to WSI systems. GenASIs platforms are also modular and therefore can be dictated by the customer's choice of configuration, hardware, and software.<sup>29</sup> This modular nature affords great flexibility allowing GenASIs to easily accommodate changing needs and market demands. As an open platform, any slide probe or staining can be used with GenASIs, regardless of the manufacturer. Table 5.1 summarizes the foremost advantages of the GenASIs platforms.

**Table 5.1. Advantages of ASI's GenASIs Platforms**

- Easily integrates into existing workflow; increases workflow efficiency
- GenASIs Capture & Analysis system is compatible with any brand of brightfield or fluorescent microscope
- Enables pathologists to work on tumor area, for quantitative analysis and standardization of results
- Provides the benefits of digital pathology at a significantly lower cost as compared to a WSI system; requires no complex and expensive IT infrastructure for data storage
- GenASIs HyperSpectral platform provides the perfect solution for the un-mixing of multiplexed biomarkers performed on a single tissue sample, thus addressing the severe shortage of available tissue

Source: Applied Spectral Imaging

The GenASIs Capture & Analysis is an image capture station that supports a single slide stage for manual image acquisition. All of the GenASIs platforms accommodate 1" x 3" slides but differ in terms of slide handling capabilities. The Capture & Analysis platform can be upgraded to the GenASIs Scan & Analysis platform with the addition of a 9-slide motorized stage or to the High Throughput platform with the addition of the ASI Tray Loader.<sup>29</sup> Shiposh explains that the ASI Tray Loader "can handle 9 trays simultaneously which sums up to 81

slides." She adds that the trays can be loaded continuously without interrupting operation of the microscope allowing for a virtually endless slide capacity. While the Capture & Analysis platform is compatible with all brands of microscopes, the Scan & Analysis and High Throughput platforms are only compatible with the Olympus BX61, Olympus BX63, and Zeiss Axioimager Z2.<sup>28</sup>

Shiposh notes that while most labs deal with magnifications between 5x and 40x, the ASI solution "is not limited and can accommodate any magnification." GenASIs uses different "focus schemes" for capturing an image; the selected focus method is optimized based on the application and sample type. She elaborates further on the GenASIs focus capabilities: "Fast scanning typically works with a Z-map mechanism on selective grid points while other scans, like FISH or single cell high magnification capture, require accurate per-image focus." Because the ASI GenASIs platforms concentrate exclusively on the region of interest and not on the entire slide, there is never a need to re-scan a slide because of focus issues, a challenge commonly associated with WSI.

ASI also offers a patented multispectral imaging solution called GenASIs HyperSpectral, "of which there is currently not sufficient awareness." ASI believes that GenASIs HyperSpectral will ultimately become a common fixture in the pathology market as "multi-color kits graduate from the research laboratories to everyday clinical use."

ASI's GenASIs HyperSpectral platform "can cope with many dyes simultaneously, both in brightfield and fluorescent staining, and provide the perfect solution for the un-mixing of multiplexed biomarkers," unlike other imaging systems which cannot handle more than 2 or 3 dyes. Such multiplexing capabilities applied to single tissue samples address the severe shortage of available tissue which can limit the number of diagnostic tests performed, even in cases where additional diagnostics may benefit patient treatment.

GenASIs HyperSpectral's optical head features two modes: interferometer mode for hyperspectral image capture and direct view mode for capturing normal spectrum high-resolution images. This platform has a spectral range of 400 to 1000 nm and a typical image acquisition time between four and fifty seconds.<sup>32</sup> Shiposh explains that this “technology allows multiplexed biomedical imaging” and “has a broad and variable spectral range and resolution.” She adds that there is also “no polarization which translates into high photo efficiency of the platform.” There are two hardware upgrade options available for the HyperSpectral platform: the Scan & Analysis 9-slide motorized stage, and the High Throughput combination of the 9-slide motorized stage and ASI Tray Loader.<sup>32</sup>

As a whole, the various GenASIs platforms were designed to “assist pathologists with quantitative analysis and standardization of results for multiple tests and microscope types.” Shiposh describes instances in which the full value of ASI and its GenASIs platforms can be realized: “We excel in improving workflow efficiency, such as in instances where thousands of cells need to be analyzed and counted, or matching tissue between H&E and FISH slides.” She points to Tissue Match as an example of the tools provided by ASI that allow for increased efficiency: “With Tissue Match, pathologists use a brightfield H&E or IHC review to mark the exact region of interest for FISH scanning; thereby obtaining the clinically relevant FISH data in the shortest period of time.”

Shiposh says, “Our biggest competitor is the challenge to increase market awareness among pathologists of the value and importance of our solution in terms of workflow efficiency, economic justification and clinical results; meaning, that it is possible to enjoy the benefits of qualitative and quantitative analysis in a digital system without suffering from the expensive drawbacks of WSI or compromising workflow.” More specifically she notes that when it comes to computer aided scoring and data sharing, “there is a misconception that whole slide imaging platforms are the only solution.”

ASI continues to provide significant benefits with its digital imaging platforms. Shiposh states that ASI “works with pathologists at a number of U.S. hospitals” to validate ASI’s platforms: “The feedback we received following the clinical studies was outstanding, with a very high concordance between our solution and pathologists.”

## Collaboration

ASI strongly believes that collaboration is very important in this field; in fact, ASI is actively working with several of the “largest players in the field.” Having built a strong reputation in the fields of cytogenetics and hyperspectral imaging for research applications, Shiposh explains that “Many of the world’s leading research institutions and universities are using ASI’s equipment and solutions.” She continues to elaborate on the beneficial nature of these collaborative efforts.

ASI sees “immense value” in its collaborative relationships and through these partnerships, ASI is constantly improving its applications and advancing its product offering: “We are working with multiple companies on developing companion diagnostics and next generation multiplex imaging for clinical applications.” Additionally, Shiposh outlines the unique benefits of such collaborations, including the ability to “bring a more complete offering to the market in a timely manner, while leveraging the skills, resources and expertise of specialists in complementary product partners.” She notes that while extremely beneficial, locating the perfect partners prior to initiating discussions with them, requires research and in-depth understanding of the market.

In December of 2013, ASI entered into a collaboration with Biocare Medical. The non-exclusive collaboration entrusts Biocare Medical with the North American distribution of ASI’s GenASIs HiPath, IHC and CISH imaging and analysis solutions.<sup>27</sup>

## Competitive Advantage

ASI's unique value proposition is based on superior image analysis technologies and the company's ability to facilitate a streamlined review process that allows labs to begin their workflow with a specimen slide and finish with a report. Shiposh explains that the value of ASI's solution is intuitive: "The advantages of our solution are essentially the disadvantages of high volume systems such as WSI."

ASI offers labs the opportunity to capitalize on the benefits of a digital pathology environment without the challenges typically associated with WSI. "ASI offers the right solution that does not require investing in expensive equipment or IT solutions," says Shiposh, "we continue to receive feedback that our solution is far more practical than WSI, as we fit perfectly into the pathologist's workflow and do not have a high data output." She goes on to elaborate on the significance of data output: "The issue of high data output is extremely important, as demonstrated by an instance where one lab that has already installed a WSI system is looking to purchase our solution because they are not able to handle the data overload and infrastructure requirements that WSI has brought them."

ASI allows end users to realize the benefits of digital pathology, offering tailored imaging solutions, computer aided scoring, remote access software, and Laboratory Information System (LIS) integration. Shiposh says that "it essentially comes down to cost efficiency and workflow integration; ASI gives labs both." Shiposh believes that, considering the continuous cost of IT and data storage associated with WSI, the cost of ASI's solution can be estimated at close to 1/15 the cost of WSI systems.

## Future Endeavors

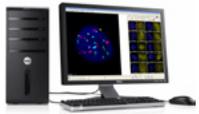
ASI is dedicated to maintaining close relationships with its customers to "accommodate the ever changing market needs and to develop new applications, tools and workflows to meet such needs." Shiposh states that ASI customers have expressed their desire for the company to expand "the available applications to include tools for H&E and other commonly performed tests." ASI is therefore actively working on adding such capabilities to its product portfolio. Speaking to this goal, Shiposh says, "We believe that this will allow ASI to offer pathologists an advanced solution that addresses a valuable majority of their diagnostic needs."

## Digital Pathology Outlook: Standardization and Perspectives

The establishment of standards in digital pathology is a recurring theme when companies consider their outlook on this field. Regarding the current lack of standards, Shiposh expresses her belief that "DICOM is an important step toward standardization and will enable easier integration between different components in the lab."

She cites shrinking reimbursement as the greatest challenge this field faces moving forward. Speaking to the future of digital pathology, she posits that "as labs struggle to stay afloat, the larger labs will gain power through acquisitions which will put more power in the larger labs and require them to improve workflow efficiencies."

While this area may face a number of challenges, there are many benefits associated with the continued growth and evolution of digital pathology. With the standardization of digital pathology practices, Shiposh believes that labs can look forward to an increase in the freedom they have to choose between different vendors.

<b>Table 5.2. ASI GenASIs Imaging Platforms Overview</b>				
<b>Platform</b>	<b>Microscope Compatibility</b>	<b>Camera</b>	<b>Slide Handling</b>	<b>Applications</b>
 Capture & Analysis*	All brands**	Basler Color or B&W Resolution: 1.3 MP	Single slide manual / automated stage, 9-slide automated stage for relocation	Karyotyping, FISH, multi- species karyotyping, manual Spot Counting, IHC, CISH, Tissue FISH
 Scan & Analysis	Capture & Analysis*	Basler Color or B&W Resolution: 1.3 MP	9-slide motorized stage	Karyotyping, FISH, automatic FISH (Tissue and Cytology), Metaphase Finder, Tissue Matching
 Review & Analysis	N/A	N/A	N/A	Supports the analysis and review of all GenASIs pathology, cytogenetics and research applications
 High Throughput	Olympus BX61, Zeiss Axioimager Z2	Basler Color or B&W Resolution: 1.3 MP	9-slide motorized stage with ASI Tray Loader (9 trays of 9 slides capacity)	Automatic Spot Counting, Metaphase Finder, Tissue FISH
 Hyperspectral	All brands	VDS or AVT VDS	Single slide stage	Spectral Karyotyping (Hi-SKY), General Spectral Imaging (SpectraView)

Source: Applied Spectral Imaging<sup>28-32</sup>

\* GenASIs platforms can be upgraded to support higher automation level

\*\* Single click FISH capture (controls shutter, cubes, filter wheel, focus) is supported on Olympus BX-61/BX-63/motorized BX-53, Leica DM 5500B/6000B, Zeiss AxioPlan2, Zeiss AxioImager M1/M2/Z1/Z2

## Interview with Limor Shiposh

CEO, Applied Spectral Imaging

### Company Background

**IPR:** Tell me about the evolution of digital pathology within ASI.

**LS:** The evolution to digital pathology was very natural, as we have already built a reputation with cytogenetic labs, which are performing karyotyping and FISH, as having excellent technology and being experts in workflow management. It was then only a matter of developing new pathology applications; as the fundamental platform, algorithmic know-how, database integration, workflow management and workflow management is already in our core domain. With the introduction of our application for IHC, CISH and tissue FISH, we can now offer pathologists a product which dramatically improves both workflow and clinical result analysis.

### Technologies

**IPR:** What type of clients do you typically cater to that benefit from the GenASIs platforms?

**LS:** GenASIs platform is really divided into two categories. There is the actual microscope where the slide is being captured, and then there are independent review stations which are able to work on and review the slide independent of the microscope. While there are thousands of microscopes running our technology, there are likely 4-5 times more review stations. And in this setup is one of the key attractions to labs: a lab can have an unlimited number of people working on the slides simultaneously. Or alternatively, a lab can have people from outside the lab working and consulting on slides via remote access software.

**IPR:** Why did you choose to focus on these technologies versus

higher volume technologies?

**LS:** Our unique selling proposition is our image analysis, algorithms for analyzing regions of interest, and a streamlined review process which takes a slide and finishes with a report. The advantages of our solution are essentially the disadvantages of high volume systems such as WSI. GenASIs integrates into the pathologist's existing workflow, whereas Whole Slide Imaging is slide focused and changes the lab and pathologist workflow. Furthermore, GenASIs has a relatively low data output per slide and requires no complex IT infrastructure for data storage. With that being said, GenASIs is capable of working in tandem with WSI systems by performing the analysis of scanned slides.

**IPR:** How do your platforms compare to your competitors considering technical specifications such as speed, capacity, and level of automation?

**LS:** While it may seem that the technical specifications of speed, capacity and level of automation are greater with WSI systems, the GenASIs platforms provide more efficient functionality as manage only the regions of interest, resulting in a significantly smaller data output as compared to WSI systems. When looking at overall clinical, economic and lab efficiency, GenASIs is undoubtedly a more prudent decision.

**IPR:** In what ways can these platforms be "tailored" to meet the various needs that a partner/customer may have?

**LS:** We can tailor our products in different ways. The first will be a physical adaptation of the microscope. GenASIs supports manual and automatic microscopes, allowing us to work with robotic tray loaders and an automatic slide stage. GenASIs platform is scalable to work with any size lab or operation, and can grow with the lab. In addition, we work closely with our customers to better understand the needs of the market

and to develop new applications, tools and workflows to meet these needs. GenASIs is an open platform that accommodates probes and staining from any manufacturer. Should a new stain be developed, there will be no problem for a lab to adopt the test while still harnessing all the benefits of GenASIs.

With its flexibility and scalability, GenASIs platforms enable standardization of the workflow across Labs, even in multi-sties deployments.

**IPR:** Tell me about the GenASIs platforms and describe the workflow for which these platforms would be ideal.

**LS:** GenASIs is an innovative solution; capable of meeting the needs of any lab. The GenASIs platform can be used with any brand of brightfield or fluorescent microscope, and supports manual and automatic scanning for a wide range of pathology applications including quantitative IHC, CISH and FISH. So the platforms are essentially supporting different workflows (manual or automatic, brightfield or fluorescent) which best suits the lab's needs, size, and budget.

An additional platform is GenASIs Hyperspectral with our patented Hyperspectral imaging technology. GenASIs Hyperspectral is used by research labs for developing companion diagnostics and next generation multiplex imaging for clinical applications.

**IPR:** Which currently available products do you feel could be considered GenASIs platform competitors?

**LS:** Our biggest competitor is the challenge to increase market awareness among pathology labs of the value and importance of our solution in terms of workflow efficiency, economic justification and clinical results. Meaning, that it is possible to enjoy the benefits of qualitative and quantitative analysis in a digital system without suffering from the drawbacks of WSI or compromising workflow. For

many pathologists who are aware of computer aided scoring, there is a misconception that whole slide imaging platforms are the only solution.

**IPR:** Tell me about the technology and methodologies behind your imaging platforms including slide handling and scanning and focus approaches.

**LS:** We support a 1 slide motorized stage and 9 slide stage. We also have our own Tray Loader that can handle 9 trays simultaneously which sums up to 81 slides. As trays can be loaded and swapped while the microscope scans the slides, the Tray Loader actually enables endless trays capacity. GenASIs supports different scanning algorithms for optimizing the Lab workflow.

Our solution is based on tiling as this is the natural way to utilize existing microscopes. GenASIs has multiple focus schemes to match capturing an image. Fast scanning typically works with Z-map mechanism on selective grid points while other scans, like FISH or single cell high mag capture require accurate per-image focus.

**IPR:** What percent of the time is a slide re-scan necessary due to issues with focus?

**LS:** Unlike WSI systems which simply extract a digital representation of the slide to enable remote review and archiving, GenASIs platforms focus on a specific regions of interest, and therefore only need to be focused on the tumor area which is defined manually. Hence, there is never a need to re-scan the slide, which is another advantage of GenASIs system over WSI which has to deal with the entire slide. Studies show that WSI scan failure rate due to focus issues ranges between 5% for 20X to 20% for 40X magnification.

**IPR:** What types of analysis software are compatible with the

GenASIs platforms?

**LS:** GenASIs platforms provide a one-stop-shop for digital pathology that includes microscope capture and image analysis from a single, unified application. Whereas in whole slide imaging, it is often the case that there are two vendors (one for scanning and one for analysis).

GenASIs platforms are unique among all other existing technologies in that it allows labs to capture images with their own microscopes (this can be manual or automatic), and then provide a variety of tools for scoring and analysis for multiple probe technologies and tumor characteristics.

**IPR:** What is the typical resolution of an image captured by your platforms?

**LS:** The GenASIs solution fits the need of the lab's workflow; allowing labs to choose any magnification which is the most optimized and efficient for their clinical needs. While a typical lab does stay within the 5X, 10X, 20X and 40X range, our solution is not limited and can accommodate any magnification.

**IPR:** In which applications will the end user see your various platforms really excel?

**LS:** GenASIs assists pathologists with quantitative analysis and standardization of results for multiple tests and microscope types. We excel in improving workflow efficiency, such as in tests where thousands of cells need to be acquired and analyzed, or matching tissue areas between brightfield and FISH slides. Tissue Match is an example of a tool for locating and marking and copying a suspected area from brightfield tissue (H&E, IHC) to FISH stained tissue in order to ensure that FISH scan and analysis is performed on the right region.

**IPR:** What limitations do you see with these platforms?

**LS:** The challenge, but also the advantage, is that we are not a walk-away solution. We take advantage of the existing workflow; microscopes and automated analysis - to give pathologist data which is relevant and objective while also being economical and efficient.

**IPR:** What are the benefits of these platforms?

**LS:** Instant analysis of large amounts of data (thousands and more cells) from specific regions of interest to build accurate and quantitative results.

**IPR:** How did you validate your platforms?

**LS:** We work with pathologists at a number of U.S. hospitals. The feedback we received the clinical studies were outstanding, with a very high concordance between our solution and pathologists.

**IPR:** What are the greatest challenges you have encountered while developing your imaging technologies?

**LS:** Our biggest challenge is raising awareness on the value and importance of our solution in terms of workflow efficiency, economic justification and clinical results.

**IPR:** Why do you feel there are so few multispectral imaging platforms currently available? Why did you choose to develop spectral/multispectral imaging technologies?

**LS:** Multispectral imaging consists of hardware that requires training to operate. GenASIs HiSKY is an example of the use of this technology in the cytogenetic market, where we enable the visualization of all chromosomes at one time and hence the accurate identification of chromosomal aberrations that play an important role in the diagnosis, treatment and prognosis of human malignancies as well as in pre and postnatal diagnosis. We believe that GenASIs Hyperspectral will become

a common fixture in the pathology market once multi-color kits will graduate from the research laboratories to everyday clinical use.

**IPR:** What are the challenges you've encountered in developing a multispectral platform?

**LS:** Special optics, large amount of storage and speed.

**IPR:** What is your competitive advantage with this platform?

**LS:** Patented, over twenty years of experience and company-made probes for research use. High spectral and spatial resolution performance while keeping simplicity of user operation.

**IPR:** What are the greatest benefits associated with the GenASIs HyperSpectral platform?

**LS:** The technology allows multiplexed biomedical imaging (cell protein expression map and drug development), the technology has broad and variable spectral range and resolution, and there is no polarization which translates into high photon efficiency of the platform.

**IPR:** How does the HyperSpectral platform compare to brightfield/fluorescent platforms in terms of cost and capabilities? How does it compare to other currently available multispectral imaging technologies?

**LS:** ASI's HyperSpectral platform was designed for both brightfield reflectance and transmittance as well as fluorescent illumination. It is very competitively priced. Unlike other imaging systems which cannot unmix more than 2 or 3 dyes, ASI's HyperSpectral platform can cope with many dyes simultaneously, both in brightfield and fluorescent staining, and provide the perfect solution for un-mixing of multiplexed biomarkers.

**IPR:** What advantages does spectral imaging provide over brightfield

and fluorescent whole slide imaging?

**LS:** Each system provides advantages in a different domain. The whole slide imaging systems typically simply extract a digital representation of the slide to enable remote review and archiving. The GenASIs Hyperspectral system is typically used for a more selective field of view in which it provides qualitative and quantitative data that otherwise remains hidden.

### Collaboration

**IPR:** What is your view on the importance of collaboration in the development of digital pathology technologies and the space as a whole?

**LS:** We believe that collaboration is very important; especially considering the points mentioned above about the advantages that we offer to pathology labs. We are actively collaborating with a number of the largest players in the field.

**IPR:** What academic institutions do you currently work with?

**LS:** ASI operates in a number of fields aside from pathology, such as cytogenetics and Hyperspectral imaging for research applications. Many of the world's leading research institutions and universities are using our equipment and solutions.

**IPR:** Do you feel these collaborative efforts further your competitive advantage? If so, in what way?

**LS:** We believe our partnerships to be of immense value. We are constantly improving our applications and are working with these companies on developing companion diagnostics and next generation multiplex imaging for clinical applications.

**IPR:** What are the benefits and challenges of partnering?

**LS:** The benefits are clear that we can bring a more complete offering

to the market in a timely manner, while leveraging the skills, resources and expertise of specialists in complementary product partners. The challenges of course are in locating the perfect partners, which requires research and in-depth understanding of the market.

### Competitive Advantage

**IPR:** How do the GenASIs modular platforms differ from other currently available digital pathology technologies and whole slide scanners?

**LS:** GenASIs integrates with the lab's existing microscope, and provides greater functionality. GenASIs is not a whole slide scanner, it does not scan the whole slide but rather only the field of interest (e.g. the tumor area), the data output of GenASIs is considerably smaller than WSI. So we are able to approach labs and tell them that we give them essentially all of the benefits of WSI and more, without any of the disadvantages of high volume systems such as WSI. They don't need to invest in an expensive equipment or IT infrastructure solutions. In addition, they are not burdened with irrelevant data. GenASIs fits exactly into their workflow, providing image capture and computer aided analysis which is geared exactly for the clinical setting.

**IPR:** What type of feedback have you received from partners/customers? What improvements would they like to see?

**LS:** The feedback from pathologists has been terrific. We continue to receive feedback that our solution is far more practical than WSI, as we fit perfectly into the pathologist's workflow and do not have a high data output. In fact, the issue of high data output is extremely important, as demonstrated by an instance where one lab that has already installed a WSI system looking to purchase our solution because they are not able to handle the data overload and infrastructure requirements that WSI

has brought them. Many of the requests for improvement revolve around expanding the available applications to include new tools for H&E and other commonly performed tests.

**IPR:** How does the cost of your scanners compare to your competitors?

**LS:** Considering the continuous and recurring investment that labs need to make in IT and data storage, I believe that the cost of ASI's solution is estimated at close to 1/15 the cost of WSI systems.

**IPR:** If I were a potential partner or customer, why should I choose ASI for my digital pathology needs?

**LS:** ASI offers labs all the benefits of digital pathology. We have computer aided scoring, remote access software and connectivity with the Laboratory Information System (LIS). And we do all of this with a low price tag and without the complex IT infrastructure and data storage demands of whole slide scanning. So it essentially comes down to cost efficiency and workflow integration. ASI gives labs both.

### Future Endeavors

**IPR:** What are your future goals for further improving your whole slide imaging technologies?

**LS:** Our focus now is on releasing new tools for H&E and other commonly performed tests, and expanding the clinical coverage of existing applications. We believe that this will allow ASI to offer pathologists an advanced solution that addresses a valuable majority of their diagnostic needs.

**Digital Pathology Outlook: Standardization and Perspectives**

**IPR:** Are you working with any organization geared towards establishing standards in digital pathology?

**LS:** Not at the moment.

**IPR:** How are you handling the lack of standards in the area of digital pathology? Have materials such as the DICOM Supplement 145 been important to the progression of your work and/or the digital pathology space as a whole?

**LS:** I think that DICOM is an important step toward standardization and will enable easier integration between the different components in the Lab.

**IPR:** What do you believe are the greatest challenges this field will face?

**LS:** As of now it appears that shrinking reimbursement is the greatest challenge. As labs struggle to stay afloat, there will be an increase in M&A activity which will put more power in the larger labs and require them to improve workflow efficiencies. As the number of medium sized labs, which should be the biggest potential for revenue, shrinks, a lot of the companies serving this sector will find themselves with fewer opportunities. Eventually this will result in less innovation.

**IPR:** What do you believe the greatest benefits of standardizing digital pathology practices will be?

**LS:** More freedom for labs to choose between different vendors.