Data Deluge

Bioinformatics and the Age of Big Data

Screening for Cervical Cancer Using Data

Blueprint for LIS of the Future

April 2011
The pairing of genetic signatures, gene mutation analysis, expression profiling, and pharmacogenetics with cumulative data is paving an exciting new future for pathologists and laboratory professionals. As a result, our emerging practice will include consultative recommendations on risk assessment, therapeutics, disease monitoring, prognosis, and follow-up assessment. Laboratory information systems must integrate data in a meaningful way that allows ASCP members to practice in this new age of evidence-based laboratory medicine.

This cumulative data must include access to archival patient data that can help us assess and determine the “complete diagnosis” and its implications for the clinician to best manage the patient’s disease. LIS will need to bridge the firewall between anatomic and clinical pathology, allowing newer technologies such as molecular diagnostics to provide ASCP members with the tools for better diagnostic assessment.

With millions of laboratory tests being conducted in hospitals and laboratories across the United States each year, the data must be organized in a truly integrated fashion, allowing us to meaningfully assess relational diagnostic data. Only then can clinicians manage the laboratory’s personalized diagnoses using information derived from appropriately used laboratory tests and outcomes-based results.

ASCP is diligently working to design the backbone of these initiatives within its Center for Health Services Research. Ultimately, we intend to gather data from myriad laboratory sources and practices in the United States to ensure that clinical guidelines are based on sound scientific evidence, including well-documented evidence of positive patient outcomes.

As an ASCP member, you are the direct beneficiary of these activities. Over the next few years, you will be asked to participate in novel studies geared toward providing substantive solutions. Together, we will ensure the laboratory data we release drives optimal patient care.

In this issue of Critical Values, you will find articles centered on big data in clinical pathology by John E. Tomaszewski, MD, FASCP, and Ramy Arnaout, MD, DPhil. You will learn how data can be used to screen for cervical cancer, and how the data architecture of the future is visualized. Teresa Y. Harris, MT(ASCP)SBBCM, CQIA, CQA(ASQ), shares her insight on how laboratory professionals can help clinicians interpret new generation test results in the context of other traditional test results and focus their decisions on whether further testing is needed.

Jessica A. (Wieberg) Kozel, MD, gives residents advice about on how to “fit” into the healthcare team. On the global front, ASCP—in partnership with the College of American Pathologists and American Society of Clinical Oncology—is funding new telepathology equipment that is transforming patient care in Tanzania.

We appreciate your feedback and look forward to hearing from you. To reach me directly, feel free to e-mail me at blair.holladay@ascp.org. Thank you for your membership and your dedication to the future of our profession. We hope you enjoy reading this important issue of Critical Values. My best.

Dr. Holladay is Executive Vice President of ASCP.
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The Beauty of Being Different

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Bioinformatics and the Age of Big Data

The size of a task matters, at least when it comes to data. In our daily lives, we all live in a complex world that constantly bombards us with massive streams of information. We are encircled by layers of interpersonal interactions, traditional media, Internet connections, telecommunications, and synthetic products derived from all these communication tools, and the layers keep growing. Sorting our way through this ever-increasing barrage of information is not an easy task—particularly for those of us who still consider the Beatles the best band ever!

This “data dump” is also an increasingly large part of our lives as laboratory practitioners. In laboratory medicine, test menus expand constantly as new tests come on board, and few are retired. The variables that need to be combined into a test value continue to escalate geometrically. Informative data is sought from integrating test values over time as we look to mine test patterns longitudinally. Process maps for laboratory testing systems increase from dozens, to hundreds, to thousands of steps. Microarray data gives way to deep sequencing. Laboratory information systems jump from megabytes, to gigabytes, to terabytes, to petabytes of data seemingly overnight.

In anatomic pathology, the diagnostic classification systems always seem to become more complex, not simpler. Information from companion immunohistochemistry, fluorescence in situ hybridization, and molecular assays further enriches (or complicates) the diagnostic decision-making process. Synoptic reporting in surgical pathology offers the great advantage of a more complete and safer way for communicating critical information to clinicians, but the cost of data extraction is in time and the complexity of field sorting.

The digital conversion of glass by whole slide scanning technology takes the image data that has been handled in an analogue manner into the world of bits and bytes. We can now quantify image signals, move them around, parse them, and combine traditional hematoxylin and eosin histology with labeling data through histocytometry. In a world of virtual slides, every image is a potential target for a “computational special stain.”

Arguably, there have been very few tools that have yielded sea changes in diagnostic medicine over the last few hundred years:

- Gross anatomic dissection, which taught us about organ disease;
- Microscopy and histopathological diagnosis, which rewrote the classification systems for much of medicine;
- Biochemistry in the clinical laboratory, which brought physiology to patient care;
- Cultural and analytic techniques in microbiology, which attacked the age-old enemy of infection; and
- Molecular biology, which offers the promise of identifying specific therapeutic targets in disease states.

In the 21st century, however, above all these tools, the computer will be the most important diagnostic instrument used by pathologists and laboratory professionals.

Data gives rise to information, which in turn yields knowledge, and knowledge is our most powerful ally in fighting disease. The age of “big data”
is upon us. As we stretch to handle this data deluge, the field of bioinformatics is exploding. Medline citations with the keyword search “bioinformatics” numbered 177 in 2000. In 2010, that same search yielded 1,006 hits.

We have seen organizations focused on laboratory information proliferate, fuse, and grow even larger. The numbers of pathology informatics fellowships are growing. Laboratory information systems are no longer stand-alone systems but now must be integrated into hospital, health system, financial, and governmental data systems. The downstream and upstream computer systems through which laboratory information systems must pass data in support of a coherent patient-centered electronic medical record often number in the dozens.

All this is to say that how we rise to the challenge of handling “big data” will largely define the centrality of the pathologist and laboratory professional in 21st-century diagnostics. Seventy percent of the information used in patient care decision-making comes from the laboratories. Qualifying laboratory data, annotating laboratory data, parsing laboratory data, integrating laboratory data, creating predictive models from laboratory data, and communicating all this to the treating clinician is the value-added proposition that should be the work of our diagnostic community.

ASCP focuses on several components of these challenges. As we approach federally mandated discussions of health information technology, meaningful use, and the universal adoption of digital data into the fundamental languages of medicine, the education of pathologists and laboratory professionals in bioinformatics becomes an imperative. Through its educational programs and patient-centered advocacy, ASCP seeks to help all its members in this transition into the age of “big data.”

I welcome your thoughts. You may e-mail me at President@ascp.org.

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It is the information age, and nowhere is this more apparent than in the clinical laboratory, where laboratory professionals are collecting increasingly huge amounts of information. New tests are introduced every day, many of them more sensitive or more specific than traditional tests. While this is usually a good thing, some tests are so specific or so sensitive they create more work and yet provide fewer definitive answers.

This is true in my own area of specialty, blood banking, where automated and more sensitive methods may detect things that are not really clinically significant. Much of the data we gather must be evaluated against sets of parameters based on the equipment used, the test assay used, and the patient demographics. Then, all the data must be evaluated not only by the medical laboratory professional but also by the clinician. New and emerging molecular tests greatly increase the amount of information produced, thus exacerbating the “data deluge.”

Are Molecular Tests the Final Answer?

When a new test comes on board, we need to evaluate its worth. A very expensive test may not have good correlation with a patient
outcome. Or a simple screening test may quickly and inexpensively identify a subpopulation of patients who need more testing and evaluation. Deciding which test to perform in a particular situation, which tests to do in-house, which tests to send out to a reference laboratory, and which tests to avoid altogether depends on different and sometimes conflicting information.

At times this information may be overwhelming. In some cases, the actual molecular result may not clearly identify the optimal way to treat a patient or handle a resource. For example, a blood donor may be genetically positive for a marker/gene but may not show or express any of the effects usually associated with that marker or gene. The lack of expression is due to another gene that controls the insertion of the end product into the red cell membrane. In this case, the donor has the Fyα gene, but his or her red cells lack the Fyα antigen. Thus, a patient needing Fy(b−) blood can safely receive blood from this donor. Undoubtedly, many readers could provide similar examples like this from their own areas of specialty.

Learning to Evaluate the Data

Laboratory professionals are skilled in data analysis and understanding complex testing modalities. We must also make sure, however, that we have the tools needed to effectively gather and manage the information needed to provide optimal patient care.

Commercial companies can serve as an important resource for laboratory professionals because they provide plenty of useful information. Of course, their goal is to make us want to purchase their tests, so the
Leadership Messages

Information may be biased. Also, some key points may be lacking. However, it still allows us to quickly gain the base knowledge needed to acquire further information. It also enables us to ask intelligent questions. We can then turn to professional societies such as ASCP to learn even more.

ASCP is a wonderful reservoir of knowledge and information. Much of it can be accessed by networking with other laboratory professionals. Much is made available through publications like the American Journal of Clinical Pathology and LabMedicine. In other cases, it is presented by top researchers and leading professionals through teleconferences, webcasts, and other educational offerings.

Opportunity for the Laboratory Professionals

Once we understand the test being evaluated, the real work of new test evaluation begins. We must assess things like test specificity, test sensitivity, patient outcomes, cost-effectiveness, equipment requirements, turnaround time potential, and staffing needs. In addition, we must become aware of what the public (translate this as patients) is seeing and hearing in the news and on the Internet. Part of our job may be to research information in the public domain to determine its source and reliability.

Thanks to the Internet and an increased focus on medical information, patients are more knowledgeable than ever. Thus, we must be prepared to effectively address patient questions and concerns. In some cases, we may also want to educate ourselves about tests that are not offered by our laboratory. Only then can we explain to patients or clinicians why one test has been chosen over another.

The laboratory professional’s job is not complete even after a new test is adopted. We should also be able to help clinicians understand what the new test results mean in the context of other test results and determine whether further testing is needed. The more frontline staff able to assist clinicians in this way, the more professional an image the laboratory conveys.

It is no longer appropriate for laboratory professionals to closet themselves behind laboratory doors. It is time for us to get out of the laboratory and let people see the knowledge we have and how much we can contribute to patient care.

I welcome any comments or questions. Please e-mail them to me at CLPChair@ascp.org.

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Finding Our Place on the Healthcare Team

As residents, we are shuffled back and forth through different rotations in a short three- or four-year training period. This switching around often makes it difficult to feel like “part of the team.” Depending on the particular program, rotations may last three months, four weeks, two weeks, or even one week. By the time we are comfortable with the intricacies of one service, we are whisked away to start another.

It can be difficult to become comfortable and delve into the deeper level of learning needed to grasp the important concepts on a new service. Some things, however, can help make the transition a little smoother. The following tips incorporate advice from more “seasoned” residents, including a few things I have personally learned during my own training.

Plan Ahead

One way to get the most out of a rotation is to avoid starting out behind the eight ball. A week or more before the rotation begins, do a survey of potential bumps or curves. Begin with a quick two-minute review of the goals and objectives for the rotation. Having a clear understanding of what is expected can save time and preserve your reputation.

Find out whether there are any required books or other reading materials you do not have. You may be able to borrow them from friends, from your department, or from the library at your institution. This is also a good time to talk to residents currently on the rotation. They can often provide valuable insights and advice about what to expect.

Think about things that might take a few days to set up or that will affect other aspects of your life. For example, find out whether you need to make parking arrangements or adjust your daily commute. Make sure you know when to arrive and how late you must stay. You need to know whether these times will affect things like transportation needs and child care.
Attitude Matters

Attempt to start each new rotation with a positive outlook. Every institution has its notoriously demanding rotations and attending physicians, but a good attitude fosters increased productivity regardless of the difficulties encountered. Motivational speaker Zig Ziglar said it like this: “Your attitude, not your aptitude, will determine your altitude.”

If negativity is pervasive on a service, avoid falling into the same trap by focusing on your own goals—to provide excellent patient-centered diagnostic services and to learn. I find it helpful to remember a motto I learned from some residents at Emory University: “Pump the positivity!”

Avoid getting involved in laboratory gossip or personal issues among team members. This is a huge time sink and a waste of energy. If others try to suck you in, quickly but politely say you have something else to do. After all, as a resident with only four short years to become a proficient pathologist, there is always something you could, and probably should, be reading or learning.

Communication

Good communication is critical. It not only eases the transition to a new rotation but also can make the whole experience better. On day one, find out when and where rounds, lectures, and other required events take place. If you have any questions, get them answered immediately.

Make sure your supervising attending physician and other personnel know how to reach you. Give them your pager number, and let them know you want to be paged whenever interesting cases or learning opportunities arise. Better yet, post your pager number on the laboratory bulletin board. It might surprise you how often you are called about cases.

Inform fellow team members as early as possible if you plan to be away—and remind them again shortly before you leave. No one wants to wait on someone who is never going to respond. Also, make sure team members know who is covering for you and how to contact that individual.

Give constructive feedback to your program director, program coordinator, or the supervising attending physician about how to make transitions smoother. Be sure to tell them what worked and what didn’t. There are some basic requirements for making you feel like part of the team—things like having a place to sit and use a microscope and having access to a computer and/or reference materials. Also important is a general understanding that the resident is an integral part of the team. If these things are lacking, let the responsible people know.

Away Rotations

I have had several opportunities to do subspecialty rotations at other institutions during my training. While these can provide valuable experience, they can also present some unique transitional challenges.

Most outside rotations must be planned at least six months in advance. Besides the usual concerns, you may need to consider things like short-term living arrangements, on-site travel needs, and licensure requirements. It is also critical that your program director and the host institution agree on the goals and objectives for your time away. To ensure this, ask the host institution to send you a “program letter of agreement” outlining how your time will be spent and who the supervising faculty will be.

I hope you find this information useful and effective. I welcome your feedback. If you have any questions, comments, or suggestions, please e-mail them to me at ResidentCouncil@ascp.org.

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Data Deluge
BIG DATA
in Clinical Pathology

The Age of Big Data

In the time it takes to read this sentence, the Large Hadron Collider, the world’s biggest-ever physics project, will output five gigabytes of data. Google will process more than a terabyte. And people working across all fields of human endeavor, from science to commerce, will combine to add about a petabyte of data—a million gigabytes—to the world.

In the same period of time, U.S. hospitals will run about 3,000 laboratory tests, and the world’s major genome centers will together sequence, as a rough estimate, the equivalent of about half a percent of a single human genome.1

There is no doubt that we have entered the age of big data. But what does this mean exactly, and in particular what does it mean for clinical pathology? What issues should clinical pathologists be aware of when it comes to big data? And what new data sets will emerge as essential to progress in this area of medicine? In order for clinical pathology to take advantage of the opportunities of this new age, questions like these will need answers. What follows is a framework for starting the conversation.
What Is “Big?”

Size is relative. For decades, the computing power available to consumers has doubled on average every two years, the famous trend known as Moore’s Law. In absolute terms, this ascent has revolutionized what people can do with computers.

But there is also something called Wirth’s Law, which tempers Moore’s. According to Wirth’s Law, software gets slower more rapidly than hardware gets faster. Wirth’s Law is why this year’s computer runs this year’s word processor no faster, or so it seems, than a computer from a decade ago ran that era’s word processor. In absolute terms, this year’s computer is far faster and more capable, with memory and storage measured in gigabytes, not megabytes. But software and data have gotten bigger and more complicated, too, and so in relative terms, little has changed. Wirth’s Law is the Red Queen of technology.

The lesson for big data is this: What makes data big is not its absolute size, but its size relative to the tools available for making sense of it. Web browsers and search engines make the Web’s enormity less daunting; genome browsers and BLAST do the same for sequence data. A flashlight makes the darkness seem smaller. This is true for big data.

Tools for making sense of data generally have three components: hardware, software, and support systems. Hardware usually means computers, whether desktop machines, mobile devices, or a cloud. Software consists of data management routines for storing and retrieving data, algorithms for analyzing data, and user interfaces for interacting with it. Support systems include the elements that are necessary for gaining and maintaining access to data, including legal agreements and policies. Google’s massive data centers (hardware) run “spiders” that index the Web (software) subject to normative conventions and specific agreements with companies (support systems); the hospital’s data center (hardware) hosts electronic health records (software) that include results from the clinical laboratories, by convention and agreement (support systems).

A corollary to the lesson above is that when a data set seems big, it is because the available tools are too small for it. Consider a data set consisting of the health records of all the people living in the United States. In one tempting future, the data from these records is linked together, anonymously, to detect trends in diseases and treatment outcomes; these trends are then disseminated rapidly to clinicians and patients everywhere. What makes this a big-data problem is not the absolute size of the data set but the relative deficit of hardware, software, and support systems for handling it at present.

Contrast this to tomosgraphic studies in radiology, in which large sets of two-dimensional images are reconstructed, with substantial computing power, into detailed three-dimensional models of the body. This feat no longer feels like a big-data problem for the simple reason that there are tools, readily available, that solve it.

To paraphrase the old saying about bad weather and bad clothes, there is no such thing as big data, only small tools. What the era of big data means, then, is that we need better tools. And what it means for clinical pathology, in particular, is that we need to build and invest in tools—hardware, software, and support systems—especially in two areas: clinical informatics and clinical genomics.

Clinical Informatics

Clinical pathology is awash in data. The clinical laboratories at a fair-sized hospital generate millions of laboratory results each year. Complete blood counts and basic metabolic panels contribute heavily to the total, but results span the specialties, making clinical pathology a nerve center of the hospital. With the laboratories long accustomed to high volume and attuned to the importance of individual
measurements, results reporting, while imperfect, is today one of the most dependable processes in all of medicine. Certainly clinical pathology is not drowning in this data. But, to complete the metaphor, neither is it yet thirsting for the knowledge this data could provide. This should change. In its workflow, the laboratory traditionally treats each result as a separate entity—an isolated data packet on a one-way trip to the medical record. This is almost the minimum possible response to a fellow clinician's request for data: it is answering, "What is the thyroid stimulating hormone?" with "8.7 mIU/L." The reference interval, with perhaps a flag, is the only garnish. Once this data has been delivered, according to the traditional view, the laboratory has done its job.

But behind the request are deeper questions. Is my patient hypothyroid? What are competing diagnoses? Should I prescribe thyroid hormone replacement? What other data do I need? In the traditional view, interpretation is left exclusively to the treating clinician, who integrates the thyroid stimulating hormone (TSH) with clinical symptoms, physical examination, demographic information such as the sex and age of the patient, medication history, and, hopefully, the results of other tests (such as free thyroxine), to the best of his or her training and ability. The treating clinician compares the resulting picture to the mental impression of hypothyroidism formed during training and honed through practice, roughly weighs the odds of the patient benefitting from treatment, and takes action. The laboratory is mum. In the era of big data, we can do better. The millions of laboratory results produced each year constitute a data set of unparalleled value. Stretching back years, this data set might well contain tens of thousands of TSH measurements on thousands of patients, and similarly for other tests.

Since they are part of the larger medical record, these individual results can be correlated with sex and age, medication history, and other information and integrated with the patient’s other laboratory results. Then the patient

Much of the work of tool-building will be technical. This does not mean that clinical pathologists need to retrain as computer scientists.
can be compared quantitatively to other patients, and an interpretation of the TSH offered to the treating clinician with this enhanced context. The sixth sense of the good treating clinician can be supported by contextualized hard data from the clinical laboratories.

This is clinical decision support in the age of big data. Thematically, it is an extension of what clinical pathologists already do when interpreting serum protein electrophoreses and coagulation studies. But conceptually, it is different and far more powerful: it makes it possible to evaluate a given patient in the context of the clinical laboratory experience of the whole hospital, in an automated and scalable manner.

Software and support systems are another matter. Tool-builders will probably be able to adapt algorithms from the worlds of terabyte and petabyte data sets to perform the desired analyses on clinical data sets. But a quality user interface always requires the eye of an experienced designer. Connecting to hospital records will require contacts at multiple levels: the pathology department, IS, the internal review board, hospital leadership—and, of course, other clinicians.

Much of the work of tool-building will be technical. This does not mean that clinical pathologists need to retrain as computer scientists. But it does call for clinically trained individuals who understand the technical components well enough to lead the effort. Clinical pathology has a history of attracting dual-degree holders. In the age of big data—which is also the age of PhDs in systems biology—ever more of them will have strong computing backgrounds. Informatics fellowships will help swell the ranks of capable leaders in this key area.

In the end, the goal is simplicity. Clinical pathologists must build tools that distill, from gigabytes or more, those critical few sentences of clear clinical guidance. If we can do it for one hospital, we can do it for the country—an important step toward a nationwide learning health system. Clinical informatics will stop being a big-data problem and start being simply the way medicine is done.

Clinical Genomics

The same can be said, on the whole, about clinical genomics.

Genomics writ large is an engine for discovering new truths about fundamentals of biology; clinical genomics is an applied branch. Its promise rests on the tenets that genetic signatures (including expression patterns and chemical modifications) correlate better with health outcomes than conventional markers, that these signatures allow personalized health interventions, and that they are worth the time and money it will take to find them. If all this turns out to be true, clinical genomics will shape the future of clinical pathology.

In absolute terms, the raw human genome counts as big data. The diploid genome is about six billion bases, or roughly 3GB on a disk, without compression. But as with informatics, “big” gets smaller with the right tools. Any two genomes are about 99-percent identical. Storing just the differences (relative to an agreed-upon reference), plus where in the genome those differences are, reduces the size to 80MB. Further intelligent compression can reduce it to just 3MB—small enough to send by e-mail.
But even 3MB is too much for clinical genomics. The challenge for clinical pathologists is how to distill sequence into actionable information for our fellow clinicians. For example, should this patient receive a high dose of warfarin or not? It is a yes-or-no question. For warfarin, the answer depends on polymorphisms in genes involved in vitamin K generation (VKORC1) and warfarin metabolism (CYP2C9). But even 3MB is too much for clinical genomics. The challenge for clinical pathologists is how to distill sequence into actionable information for our fellow clinicians. For example, should this patient receive a high dose of warfarin or not? It is a yes-or-no question. For warfarin, the answer depends on polymorphisms in genes involved in vitamin K generation (VKORC1) and warfarin metabolism (CYP2C9). It is a separate issue that has also gained recent attention. The impact of CYP2C9 and VKORC1 genetic polymorphism and patient characteristics upon warfarin dose requirements: proposal for a new dosing regimen. Blood. 2010;106(7):2329–33.

What role should clinical pathology play in sequencing, informatics, and finding correlations? In one view, the genome is just another analyte. Therefore, when and how to assay for it, and how to interpret the results, fall naturally within the purview of the field. True, it is a complicated analyte. Indeed, “the” genome is actually a family of many genomes that includes the somatic germline genome (including the mitochondrial genome), epigenomes, cancer genomes, immunomes, and microbial metagenomes, all with varying expression patterns, and all but the germline varying by anatomic location and over time. As a result, educating clinical pathologists about genomics, and about genome-wide association and other techniques useful for interpreting results, will require a major national effort; fortunately, this has begun. (Agreeing on how to be paid for assays that might amount to querying a 3MB database is a separate issue that has also gained recent attention [J. Saffitz, personal communication].)

As with clinical informatics, it can be argued that clinical pathologists should lead the larger effort to develop tools to find correlations. The reason is, if we are to interpret genomic tests, we should design tools that produce the most useful data for interpretation. Done right, this will likely be at least a national effort. We owe it to our patients to try, to prepare ourselves for the age, and to help make big data no big deal.

References


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Screening for Cervical Cancer Using Data

The Papanicolaou (Pap) test was developed way back in 1923. We have come a long way since then. For the first 40 years after Pap test screening was implemented, cervical cytology results were reported using various terminologies. Many laboratories modified reporting to suit their own needs and used terms that did not correspond to current knowledge of cervical carcinogenesis.

The Bethesda System

Fortunately, a system for more uniform reporting of cervical cytology, known as The Bethesda System (TBS), was introduced in 1988; it was subsequently revised in 1991 and 2001. TBS was adopted as the standard of reporting Pap test results in the United States by the Centers for Disease Control and Prevention (CDC). Not only was there broad interdisciplinary participation in this consensus process, but the diagnostic categories of this system were later tied to evidence-based management algorithms and evidence-based outcomes.

In addition, use of TBS for cervical cancer screening (1) facilitates rapid electronic sign-out of Pap test reports by cytologists; (2) improves communication among cytologists, surgical pathologists, and healthcare providers; (3) promotes clear management guidelines; (4) facilitates data extraction, exchange, and analysis; (5) inspires multi-institutional studies; and (6) offers a mechanism for modification and reform.

When a Pap test (smear) is obtained and the procured material submitted to the cytopathology laboratory for processing and evaluation, traditionally very little accompanying data (e.g., patient age and last menstrual period) are used by most laboratories to aid with the interpretation of the cytomorphology. Some laboratories stratify their patients into high- and low-risk categories if they have additional clinical information (e.g., HIV-positive serostatus is high risk) or follow-up pathology results (e.g., biopsy proven cervical intraepithelial neoplasia or CIN).

The advantage is that Pap tests from individuals at high risk of having a squamous intraepithelial lesion (SIL) may be subject to extra screening. With the introduction of human papillomavirus (HPV) testing and vaccination, the evaluation of Pap tests has become increasingly more challenging. A patient’s HPV status from infection and/or protection through vaccination will certainly affect her risk stratification.

Pittsburgh Cervical Cancer Screening Model

In 2010, a unique Pittsburgh Cervical Cancer Screening Model (PCCSM) was introduced that computes quantitative cervical disease risk estimates for patients undergoing cervical screening. The PCCSM (see page 22) is a dynamic Bayesian network. Bayesian networks (also called probabilistic, belief, or causal networks) are acyclic-directed graphs that model probabilistic influences among variables. Bayesian networks like the PCCSM that model sequences of variables are called dynamic Bayesian networks. These networks are impressive tools that help model complex problems involving uncertain knowledge. Since a Bayesian network provides a model for variables and their relationships, it can be used to answer probabilistic queries about them.
The PCCSM employs 19 variables available in the laboratory information system (LIS). These variables include the patient’s HPV vaccination status, her prior Pap test results, high-risk HPV results, procedure data, and histopathologic results. In addition to using all these hospital data, this model incorporates TBS. The model was developed and tested by using large amounts of data obtained from more than 375,000 patient records and two unique computer programs called SMILE and GeNi, both developed in the Decision Systems Laboratory of the University of Pittsburgh and freely available in the public domain (http://genie.sis.pitt.edu/).

The PCCSM quantifies how multiple current testing and historic data variables together influence prospective risk for a histopathologic diagnosis of cervical precancer or invasive cancer. For example, this model can estimate the relative risk of biopsy proven CIN or cancer for patients, with each discrete Bethesda System category for their current Pap test result, and each possible current HPV test result. It turns out that the degree of cytologic abnormality seen on the Pap test is the largest positive predictor of histopathologic precancer or cancer risk, regardless of whether HPV test results are available.

However, the PCCSM is unique because it can estimate quantitatively the extent to which prior history alters current risk for histopathologic high-grade dysplasia or cervical cancer among patients with similar current Pap and HPV results. The PCCSM is also able to generate negative risk projections, estimating the likelihood of the absence of histopathologic neoplasia in screened patients over time.

Continuously updatable with current system data, the PCCSM provides a new tool for monitoring cervical disease risk. By leveraging technology to analyze large data sets, the PCCSM is an impressive example of how decision-support tools are bringing us one step closer to practicing personalized medicine.

Schematic image showing the PCCSM

References


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A Blueprint for Laboratory Information Systems: Lab Data Architecture of the Future

By Tanner L. Bartholow, Anil V. Parwani, MD, PhD, FASCP, and Michael J. Becich, MD, PhD
Advances in laboratory information systems (LIS) in the preceding decades have provided opportunities for pathologists and other clinical laboratory personnel to improve workflow in the domains of both anatomic and clinical pathology. With the implementation of these technologies, the digital storage of patient laboratory results and their dissemination to the appropriate care providers, regardless of location, has been greatly facilitated. Additionally, pathologists are now beginning to have access to more structured methodologies for reporting diagnostic and prognostic information related to patient care, ultimately resulting in faster turnaround times for the interpretation of pathology specimens.

As LIS and electronic medical records have become more widely distributed throughout academic medical institutions and integrated into routine clinical practices across the globe, additional uses for LIS technology have been proposed and developed. LIS technology has been used to create databases to optimize the study of pathology errors, providing an avenue to increase patient safety and assess quality control initiatives.\textsuperscript{1,2} Tools to aid pathologists in translational research have been proposed that allow the pathologist to more easily correlate tissue bank specimens with patient outcomes, molecular and cytogenetic data, and epidemiologic information.\textsuperscript{3} Research toward both of these ends has required expanding the traditional capacities of LIS and implementing them in a manner to address novel situations for the user base.

Along a similar vein, the clinical LIS of the future will need to adapt to meet the needs of the evolving face of diagnostic medicine and overcome the barriers that to date have limited their capabilities. With the projected development of personalized medicine in the coming decades, the focus of all medical reporting is likely to take on a more encompassing approach, spanning longer time periods and incorporating more aggregate data into each patient scenario.\textsuperscript{4,5}

In the current diagnostic model, laboratory values and histological interpretations are often reported in isolation. As medicine continues to move toward a more personalized approach, however, pathologists have the potential to take on a role beyond disease diagnosis that includes risk assessment, enhanced screening, therapy selection, progress monitoring, and prognosis assessment.\textsuperscript{6}

**Editor’s Note:**

This article is based upon information presented at the AP/CP LIS Integration workshop at the Pathology Informatics 2010 conference by Mr. Bartholow, Dr. Becich, and Dr. Parwani. To view the slides for this presentation, go to http://pathinfoarchives.dbmi.pitt.edu/apiii_archives/2010/Monday and click on 034-Becich.
To take a leadership role in this paradigm shift, pathologists of the future will have to realize that existing LIS are not adequate to encompass all these tasks and that future LIS engineering must be conducted with a forward-thinking approach to provide pathologists with the appropriate tool set. Pathology reporting of the future will be less likely to rely on single isolated laboratory findings but will instead necessitate a combination of traditional surgical pathology in conjunction with gene mutation analysis, gene expression profiles, and pharmacogenetics, cumulating in a “patient-disease” centric model.7

Moreover, whereas traditional pathology has often faced limitations because it has been largely restricted to diagnosis, future laboratory tests are being developed that will aid in guiding therapy selection and monitoring drug response and safety, providing opportunities for pathologists to be longitudinally involved in patient management, increasing the scope and depth of the specialty. Achieving this future, however, will require an LIS infrastructure that more readily facilitates the query and reuse of previous results from patients’ records over the course of their lifetimes.

**Barriers to New Technology**

Despite the advantages for the field in adopting this new perspective, several LIS barriers currently exist that will need to be addressed to achieve this future. At present, most LIS are designed on top of billing systems. As a result, they are not designed to handle the reutilization and query of previous laboratory information necessary for pathologists to adopt a continuous role in the care of an individual patient.

Additional problems with existing LIS are further echoed by the divisions themselves that have developed with the separation of pathology into anatomic and clinical branches. Most practicing pathologists currently devote most of their workday to anatomic pathology duties, and in many cases, this can serve to prohibit a fully integrated diagnostic approach. Most LIS infrastructure has been developed to mirror the clinical environment of the past in which it was used, and this has served to marginalize the newly developed subspecialties that exist as a hybrid of both anatomic pathology and clinical pathology, such as cytogenetics and molecular anatomic pathology.

By acknowledging these current barriers, developers of future LIS technology can anticipate the challenges that lie ahead and proactively design systems that provide practical solutions to these obstacles. To do so, it will be necessary to ensure that such systems feature the following key components for success: structured data, interoperable standards, and digital imaging and image analysis systems.

**Necessary for Success**

First, it is vital that the system have the ability to use standardized data, that is, data organized in a readily identifiable standardized manner. One example of standardized data already in existence is synoptic reporting, in which the pathologist provides a diagnosis using a standard format that allows for the data to be broken down into individual elements for future query. While a fully integrated information model for anatomic and clinical pathology data has yet to be developed, it can be by using Clinical Document Architecture (CDA).

Sponsored by Health Level Seven International (HL7; www.hl7.org), an organization devoted to creating interoperable standards in health information technology, CDA is a standard designed to specify the encoding, structure, and semantics of clinical documentation based on extensible markup language (XML), which renders the data machine-readable. CDA is especially useful for clinical documentation because it consists of both a mandatory textual part and optional structured parts to be processed by the software.8

This secondary structured part relies on the use of other coding systems—well-defined vocabularies and ontologies—so that the result features an interoperable semantic base for concept representation. Although these exist today, for example, the Systematized Nomenclature of Medicine (SNOMED) and the Logical Observation Identifiers Names and Codes (LOINC), they are not used in current LIS. It is through the use of these tools that a fully integrated model for pathology reporting can be realized.

Moreover, by using interoperable standards, such as the HL7 for text and the Digital Imaging and Communications in Medicine (DICOM) for images, the LIS of the future can be applicable to a wide user base, without the difficulties that exist with the current absence of a predominant standard.

Finally, future LIS architecture should include widespread support of digital imaging and image analysis systems, rapidly emerging technologies with the potential to directly affect clinical pathology workflow by using rapid image transmission and software-based diagnostic and quantitation algorithms to aid in specimen assessment.

**DICOM Working Group Addresses Obstacles**

To reach this goal, the DICOM Working Group 26 (WG26), comprising representatives of digital pathology vendors, has the specific task of addressing the barriers to using whole slide imaging in the DICOM standard.9 Among the proposals to make the DICOM standard more applicable to pathology is a methodology for overcoming the size barriers associated with digital slide storage and for accommodating the needs of pathologists to zoom and scan rapidly across different portions of a slide in the
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The digital slide as a whole can then be stored within DICOM size limits, and the pathologist subsequently has easy access to all portions of the slide at all supported levels of magnification. Future projects for the WG26 at this time include looking at ways to capture more detail during image processing, developing standards for scanner validation, improving LIS integration, and encouraging participation in the Integrating the Health Enterprise connect-a-thons to promote interoperability among vendors.10

Apart from the technological obstacles currently hindering new LIS development, pathologists should be prepared to meet resistance from other fronts that may be reluctant to embrace a change in existing LIS. Because many hospital chief information officers and chief medical informatics officers view pathology through the lens of the EMR, it may be difficult to displace current systems. To achieve widespread LIS changes, it will likely take an intense lobbying effort from pathology professional organizations in Washington and intense grassroots support from pathologists.

Furthermore, the current U.S. LIS market is saturated, with very few dominant vendors, and this greatly hinders both research and development and interoperability. Collaboration with foreign markets may provide an alternative route for development. Current talks with European partners have already begun between the Association for Pathology Informatics (www.pathologyinformatics.org) and Pathology Informatics 201X (www.pathinformatics.pitt.edu). Currently, the European market is more fragmented.

Applications Currently in Use

Moreover, pathologists will be best suited to work with vendors to influence their LIS development paths. As a successful example of this, Massachusetts General Hospital recently partnered with Sunquest Information Systems to add tissue banking to its LIS.11 Now, when tissue banking is selected as an option, the laboratory can take an aliquot of any specimen and achieve it. The results from the specimen then go into a clinical data repository, where an aliquot of any results can be imported and entered into the patient's medical record. The current U.S. LIS market is saturated, with very few dominant vendors, and this greatly hinders both research and development and interoperability. Collaboration with foreign markets may provide an alternative route for development. Current talks with European partners have already begun between the Association for Pathology Informatics (www.pathologyinformatics.org) and Pathology Informatics 201X (www.pathinformatics.pitt.edu). Currently, the European market is more fragmented.

Another example of such collaboration is the Laboratory Information Digital Data Exchange (LIDDEx), a partnership of vendors, academic institutions, and the government to increase the interoperable exchange of laboratory information among different institutions that are using the LIS of different vendors, each with their own interfaces and programming.12 At the 2009 Advancing Practice, Instruction, and Innovation through Informatics conference, a successful demonstration illustrated that the system could successfully exchange semantically coded lab results across five different vendor systems.

Flourishing examples of health information systems employing CDA and open EMR technology have already been established in other domains. One prominent example is the area of global health is Baobab Health, a 10-year ongoing initiative in Malawi that provides informatics support to HIV treatment clinics, managing more than 1.3 million registered patients among its sites.13, 14 Such a model demonstrates that a new informatics infrastructure can be instituted in almost any environment to improve patient care if there is the correct combination of dedicated personnel and resource availability to make it happen.

Conclusion

If the potential of this technology continues to be realized and the obstacles described here are faced with a resolute determination to ensure that pathologists both remain at the forefront of patient diagnostics and bridge the gap to becoming leaders in patient management, pathology as a discipline can only expand during the coming generations of U.S. health care. Doing so will take a concerted and organized effort, a willingness to adapt, and a desire to meet the needs of our patients with the technologies that exist within our professional domain.

References


Mr. Bartholow is a Doris Duke Clinical Research fellow, Clinical and Translational Science Institute pre-doctoral fellow, Clinical Scientist Training Program student, and medical student in training at the University of Pittsburgh School of Medicine, Pittsburgh.

Dr. Parwani is the Director of the Division of Pathology Informatics and an Associate Professor of Pathology at the University of Pittsburgh School of Medicine.

Dr. Becich is a Professor of Biomedical Informatics, Pathology, Information Science, and Telecommunications, as well as the Chairman of the Department of Biomedical Informatics, at the University of Pittsburgh School of Medicine.
From the government push for electronic medical records (EMRs) to portable technology like iPads used to retrieve clinical information, the integration of informatics to improve patient care is everywhere and growing exponentially. Recognizing a specific skill set and knowledge, the ASCP Board of Certification (BOC) established the qualification in laboratory informatics (QLI), providing its members with recognition and potential career advancement.

“I decided to become qualified in informatics through ASCP to prove my worth to my former organization,” said Tracey P. Boone, MT(ASCP)QLI, Senior Product Manager at Abbott Diagnostics Informatics. “I was promoted to a better position there as a result. At Abbott, the ASCP qualification in informatics was one of the key factors in obtaining my current position.”

Many laboratory professionals recognize that their informatics skills, beyond professional recognition and advancement, will change their role in health care.

“Through EMRs, we will communicate more directly with patients,” said Brian W. Toval, MT(ASCP)QLI, PMP Senior Systems Analyst/Programmer at Children’s Hospital in New Orleans. “We will have to do more to educate the community about the services we provide. Our language will have to explain more in layman’s terms to patients reading their test results online.”

Mr. Toval foresees a time when informatics will become as important in the laboratory as histology, microbiology, and the blood bank. At the same time, informatics will help move the laboratory and its processes and healthcare providers from its silo into the mainstream of health care, he said.

In Sioux Falls, S.D., Patrick J. McMahon, MT(ASCP)QLI, is involved in building more systems to link the original EMR system launched three years ago in Avera Health’s five regional centers to its clinics and rural hospitals. The large health system has facilities stretching from South Dakota into parts of Minnesota, Iowa, and Nebraska. Currently, the EMR system is available only to the healthcare providers. By early 2012, patients will have their own portal.

“Pathology reports are integrated with our laboratory results,” McMahon said. “Telepathology is in demand in our health system. I believe the need for informatics for pathology and laboratory results will continue to grow. Our information is so critical, and the patients will demand to see their own test results.”

Not only do patients want to view their tests, they also expect faster turnaround times, according to Lisa A. Wiegemann, MT(ASCP), who is a member of the BOC QLI Work Group.

“Informatics allows medical technologists to gather data much more quickly and learn from it rapidly,” said Ms. Wiegemann, Senior Engagement Leader at Cerner Corporation. “Turnaround time for many lab tests can be monitored nearly real time through tracking board technology. That means the laboratory team can deliver results to providers more quickly and, as a result, improve patient care outcomes. If a patient tests positively for an infectious disease, that result can be reported quickly, as required by federal law, to the health department through electronic submissions—cutting the delivery time from two days to half a day. That helps local, state, and federal agencies with the monitoring and reporting for the early outbreak of disease.”

Informatics is creating more opportunities for laboratory professionals to communicate with patients and move them from behind the scenes to the spotlight in health care.

To earn the ASCP QLI, applicants must demonstrate competency in laboratory informatics through completion of a project. The purpose of this qualification is to assess the competency of the examinee in the technical application of relevant laboratory informatics workflow. For more details on the project requirements, qualifications, and cost, go to www.ascp.org/QLI.
Fewer than 10 pathologists serve 42.5 million people in Tanzania, which limits the ability of doctors there to properly diagnose their patients’ diseases. New equipment that uses technology to digitally capture images of patients’ tissue and transmit them to pathologists in the United States is poised to change that scenario.

Three U.S.-based healthcare nonprofits—the American Society for Clinical Pathology (ASCP), College of American Pathologists (CAP), and American Society of Clinical Oncology (ASCO)—have joined forces to provide financial and expertise support for the provision of telepathology equipment to a hospital in Karatu, Tanzania, built by the Foundation for African Medicine and Education (FAME).

“The ability to produce high-quality images of cells and tissues will allow FAME to augment the training of its lab technicians, so that diagnoses of parasitic infections and dermatological and blood abnormalities will be more accurate and more consistent,” said Frank Artress, MD, a former cardiac anesthesiologist and now a general practitioner who cofounded FAME in 2002. “The collaboration between FAME’s laboratory staff and pathologists in the United States will provide a distance-learning opportunity unparalleled in Tanzania. The pathology equipment being provided will improve the medical care provided by FAME and will serve as a clear example of FAME’s vision in action.”

Medical care of all types is in short supply with one doctor per 25,000 persons in Tanzania. The incidence of cancer, especially cervical and breast cancer, has escalated, with approximately 35,000 new cases per year, and is one of the highest rates in Africa. The equipment allowing U.S. pathologists to help diagnose diseases correctly and at an earlier stage will be used to support an African cancer support site at a hospital in Karatu and has the capability to dramatically improve health care.
Additionally, it builds a diagnostic bridge between the U.S. and Tanzanian physicians caring for cancer patients.

"In this day and age, the ability of what we in the United States take for granted as common and accessible technology to have a significant, even quantum impact on medical practice in resource-limited settings is remarkable," said Mark H. Stoler, MD, FASCP, Immediate Past President of ASCP, who spearheaded the selection of equipment and funding from the three organizations.

When Dr. Artress approached various healthcare colleagues to solicit their help in improving the quality of microscopic imaging critical to his diagnostic and educational work, a partnership of ASCP, CAP, and ASCO quickly came together to meet this need for improving patient care at a time when state-of-the-art technology for both imaging and telepathology is a reality. According to Dr. Stoler, providing FAME with the ability to acquire, annotate, and transmit images for synchronous or asynchronous consultation and education is sure to have a significant impact on its mission.

FAME strives to combine technology and expertise from the developed world with the knowledge of tropical medicine found in Tanzania, according to Dr. Artress. He and his wife, Susan Gustafson, an educational psychologist, came to the African country after Dr. Artress almost died while climbing Mount Kilimanjaro. The couple reevaluated their lives and traded comfort and privilege in the United States for the altruism of serving patients in Tanzania. They haven’t looked back. Many of their former colleagues and friends also support and contribute to the mission of FAME.

"As professionals in laboratory and diagnostic medicine, we all work together, research together, and learn together," said Jennifer L. Hunt, MD, MEd, FCAP, President of the CAP Foundation. "It is a great pleasure to see our organiza-
On behalf of the College of American Pathologists, it is indeed a pleasure to witness the American Society for Clinical Pathology and the College of American Pathologists Foundation reach across the boundaries of our organizations to deliver a service that is good for the specialty of pathology,” said Charles Roussel, Chief Executive Officer of CAP. “We look forward to broader collaboration with the ASCP and other medical associations such as the American Society of Clinical Oncology to further the field of diagnostic medicine and care for patients.”

CMS Rescinds Physician Signature Requirement

ASCP and other members of the Clinical Laboratory Coalition successfully persuaded the Centers for Medicare and Medicaid Services (CMS) to rescind its recent proposed rule requiring a physician’s signature on requisitions for laboratory tests reimbursed under the Medicare clinical laboratory fee schedule. ASCP convincingly argued the CMS rule would adversely affect patient safety because laboratories could be forced to either not perform or delay urgent tests while trying to collect physicians’ signatures. In total, ASCP members wrote more than 2,000 letters in opposition to the rule first to let CMS know of their concerns directly and second to encourage members of Congress to contact CMS. As a result, 89 members of the U.S. House of Representatives and 30 U.S. Senators signed letters to the CMS opposing the proposed rule. www.ascp.org/RescindSigReq

ASCP Secures Win for Florida Cytotechnologists

In partnership with the American Society for Cytopathology, ASCP scored an important victory for Florida’s cytotechnologists. On Dec. 3, 2010, the Florida Board of Clinical Laboratory Personnel followed ASCP’s recommendations and unanimously ruled that licensed cytotechnologists may perform HPV and fluorescent in situ hybridization (FISH) testing. www.ascp.org/ePolicy1-11.

Obama Signs One-Year Fix on Physician Payment

In December, Congress overwhelmingly passed the Medicare and Medicaid Extenders Act of 2010 (HR 4944), which delays for one year scheduled cuts to physician Medicare payments, including a 25-percent cut. The legislation also extends the technical component pathology “grandfather” provision through the end of 2011. The clause applies to services delivered to any hospital that used an independent laboratory for surgical pathology TC services as of July 22, 1999. www.ascp.org/ePolicy1-11#congress.

ASCP BOC Selects Joseph Baker as Manager of International Certification

Joseph Brendan Baker, MS, is the newly appointed Manager of International Certification Activities for the ASCP Board of Certification. Baker will provide support for International Advisory Board members, Ambassadors, and Regional Representatives and conduct international market research. He previously worked in the Indianapolis Mayor’s Office as the Assistant Director of International and Cultural Affairs, codirecting the mayor’s international agenda since March 2008, and was the policy director for the Indiana State Department of Health’s Office of Minority Health from February 2006 to March 2008.

Laboratory Technician Among 2011 Best Careers

According to US News & World Report, Laboratory Technicians are among the 50 Best Careers of 2011 and should experience strong growth over the next decade. Job growth is expected to be faster than average, with the number of clinical lab workers rising about 16 percent between 2008 and 2018, which would add about 25,000 new jobs, according to the U.S. Department of Labor. Even more opportunities will exist due to retirement and turnover. Note that the average age of a laboratory professional is over 50. The fastest growth is expected in private diagnostic labs and physicians’ offices. Laboratory managers are looking for more than technical competence. The soft skills they seek include job candidates with flexible schedules, those who are good team players and can work independently, and laboratory technicians who communicate well with physicians, nurses, and patients, according to US News & World Report. www.ascp.org/workforce

The three healthcare organizations are united in their desire to provide better patient care and train more local medical professionals to perform basic testing and diagnostic services in Tanzania.

Such ready access to well-trained pathologists will allow FAME to bypass the obstacle presented by the lack of in-country pathologists, so that doctors can diagnose a variety of conditions like cervical cancer in time to provide adequate intervention, according to Dr. Artress.

“Good cancer care begins with sound pathological diagnosis,” said Dr. Allen Lichter, CEO of ASCO. “Using technology in this unique setting extends the reach of physicians across borders to support cancer care in new ways. The American Society of Clinical Oncology is delighted to join our pathology sister societies in this project, and looks forward to future opportunities for the oncology and pathology communities to improve cancer care in resource-challenged environments.”

The telepathology equipment was delivered directly to Dr. Artress in Karatu on Feb. 2 by Marie Lehner, program director at ASCP. Several years ago, she lived in Tanzania for six months and was a patient of Dr. Artress.

“ASCP’s strategic initiative to provide international outreach that enhances patient care in resource-limited countries like Tanzania dovetails precisely with our opportunity to provide state-of-the-art equipment that will improve Dr. Artress’s pathology services and opportunity for educational training,” said E. Blair Holladay, PhD, SCT(ASCP)CM, Executive Vice President of ASCP.

Currently, Dr. Artress, his wife, and two other doctors treat 50 to 60 patients at the hospital each day. With the addition of the laboratory equipment that enables using the expertise of pathologists from the United States, he expects to care for more patients.

The three healthcare organizations are united in their desire to provide better patient care and train more local medical professionals to perform basic testing and diagnostic services in Tanzania.
ASCP Announces Call for Abstracts for 2011 Annual Meeting

The 2011 ASCP Annual Meeting/World Association of Pathology and Laboratory Medicine (WASPaLM) XXVI World Congress Call for Abstracts for pathologists, residents, and laboratory professionals is now open. In addition to traditional scientific abstracts, ASCP will accept for the first time laboratory practice abstracts, which present a summary or case study of a problem and its resolution. This year’s poster competition will have a wider variety of categories, such as “Best Poster by a Resident,” “Best Poster Submitted from Outside the United States,” “Best Lab Practice Poster,” “Best Scientific Poster,” and a unique “People’s Choice Best Poster,” which will be determined by attendee votes. Submission deadline is midnight (GMT-6) April 29, 2011. www.ascp.org/2011annualmeeting, and click on Abstracts.

View Lab Professionals Week Videos Online

ASCP’s “Take Center Stage” Online Video Contest encourages laboratory teams across the country to showcase the important role they play every day. This year lab teams were invited to submit short, original videos, essays, and PowerPoint presentations that demonstrated the ways that they go above and beyond their day-to-day responsibilities to achieve extraordinary goals or to provide outstanding levels of customer service. The videos, essays, and PowerPoint presentations are available for viewing at www.ascp.org/labweek and www.facebook.com/ASCP.Chicago, as part of National Medical Laboratory Professionals Week, April 24–30, 2011.

ASCP Grants Can Boost Careers

Each year, ASCP sponsors a grant program that encourages residents to travel outside their own institutions to study with experts in various fields of anatomic and clinical pathology. A total of $22,000 will be awarded for 2010–2011. Past recipients report these grants help them gain more knowledge, provide introductions to valuable new colleagues and institutions, and can help them succeed farther in their careers. The deadline for the next round of applications is Aug. 14, 2011.

ASCP-Siemens Scholarships to Combat the Laboratory Workforce Shortage

As part of the Society’s annual scholarship program and the continuing effort to combat the laboratory workforce shortage, ASCP in partnership with Siemens Healthcare Diagnostics is awarding $178,500 to 171 medical laboratory students for 2010–2011. ASCP received nearly double the number of applications this year compared to last year. This year’s recipients will be announced in early April 2011. ASCP began the student scholarship program to encourage the best and brightest students to pursue careers in the medical laboratory. Scholarships are awarded on the basis of academic achievement, professional goals, and leadership abilities. To be considered for scholarships in 2011–2012, the application process will begin in August 2011, and students need to apply by Nov. 15, 2011. www.ascp.org/scholarships

New Careers in the Lab Classroom Poster

A “comic-style” poster, aimed at middle and high school science students, reminds children that, “You don’t have to be a doctor or nurse to work in a hospital.” Download a PDF version, or order (sets of five) at www.ascp.org/ComicPoster. Other resources are available at www.ascp.org/CareerLinks.

ASCP Launches Career Center Tab on Facebook

For years, the ASCP Career Center has served as an interactive hub for job seekers, employers, and recruiters. Now, the same job postings can be found in the Career Center tab on the ASCP Facebook page, featuring daily postings of job opportunities directly from employers. www.facebook.com/ASCP.Chicago

Feeling Appreciated

I just read my first issue of Critical Values, and I was so impressed that I can’t wait for the next one to come out! Well done! Although I enjoyed all of the articles, I loved Dr. (Donna E.) Sweet’s article, “Clinicians Need Insight into Lab Quality” (Critical Values, July 2010, p. 18). It presented a clear and concise review of what we, as laboratorians, do day in and day out. We are truly an integral part of the team and are often underestimated and underappreciated. I loved that she provided the history of CLIA and the strict adherence to its rules that we take pride in following each and every day to provide clinicians with results that they can trust. Thanks again for a great magazine.

Autumn Reynolds, MT(ASCP)
Cedar Rapids, Iowa

Critical Values Inspires

I have been a cytotechnologist for 19 years and, unluckily, unemployed for nine months. I got a positive feeling from the January 2011 issue of Critical Values. I am considering migrating back home to the Philippines to explore new possibilities and the opportunity of opening a cytology laboratory service to help improve, contribute, and become more engaged as global partner. With the lack of cytology laboratory resources and U.S.-trained cytotechnologists, this is a “perfect storm” of opportunity for me and for the country. However, I have some concerns: I have no money, no microscope, and no staining supplies, but I have the willingness to pursue this in an exemplary manner. The time for action is now! Indeed, it will be a strong starting point and a challenge for myself! But I will not find out what it’s like until I do something about it. “Whatever path you follow, the journey begins with the first step. The only way to fail is to not try in the first place.” (“Career Options for Laboratory Professionals,” Critical Values, October 2010, p. 9). Thank you Critical Values for this encouragement.

Antonino De Dios, CT(ASCP)
Vallejo, Calif.
Dr. Rizzo

**Loves to:**
Hike, walk outdoors, and ride horses.

**Favorite movie:**
"Star Wars" trilogy: "A New Hope"; "The Empire Strikes Back"; and "Return of the Jedi"

**Ideal vacation spot:**
Cities in Italy: Florence, Rome, Capri, and Milano
Recognizing Milestones: Determined to Succeed

ASCP Member for Five Years: Kathryn A. Rizzo, DO, PhD, FASCP

During the summer before ninth grade, Kathryn Rizzo, DO, PhD, FASCP, decided it was time to choose her career. Research at her local library convinced the teenager that she liked everything about being a pathologist. The young Dr. Rizzo even researched the educational degrees she needed to become this specialized doctor and built her subsequent study plan on achieving those goals.

Several years later, she showed similar initiative in starting the program to earn a doctor of osteopathic medicine and doctorate in molecular biology at the University of Medicine and Dentistry of New Jersey. “I was really excited about understanding and investigating more about diseases at the molecular level,” Dr. Rizzo said.

Her double degree program kicked off with two years of medical school, shifted to four years of research work for the doctorate degree, and finished with the final two years of medical school. Dr. Rizzo structured the research portion through a lab at the National Institutes of Health (NIH) in Bethesda, Md., with supervision from a research physician at the NIH.

“I have always wanted to understand the how and why of diseases, so I can understand and make the right diagnoses,” she said. “This program gave me the foundation that I wanted as a pathologist.”

Her learning has continued after gaining her two advanced degrees and completing Fellowships at the NIH in cytopathology and hematopathology. Through ASCP, Dr. Rizzo has continued to learn more about medicine and pathology, and become part of a pathology-based community.

“We are all striving to increase our knowledge and become better pathologists,” she said. “The educational courses I’ve taken have been clinically based, straightforward, and very useful.”

Every day in her work teaching residents, fellows, and medical laboratory scientists, as well as providing clinical diagnoses for patients at the Indiana University School of Medicine in the Pathology Department, Dr. Rizzo has found the stimulating career she desired. Based in Indianapolis, the Indiana University Hospital serves the community, with a wide-ranging patient base from children to adults to veterans.

“I like to teach. I continually learn from my students and the clinical work I do,” she said. “My career is a good balance of the two.”

On the personal side, Dr. Rizzo is married, and her husband works for the U.S. Department of Agriculture in Indianapolis. The couple met during her pathology residency in Washington, D.C.

Ms. Patterson is Communications Writer for ASCP.
Arts in Culture
The Beauty of Being Different

Anatomical differences are beautiful and show how each of us is an individual, according to artist Laura Ferguson. Since the 1990s, she has created art based on an inside-out anatomy that showcases the beauty of her medical condition of scoliosis. Her artwork has been shown nationwide and collected by public and corporate organizations such as the National Library of Medicine, National Museum of Health and Medicine, and New York University Langone Medical Center.

To create The Visible Skeleton Series, Ms. Ferguson started with medical images of her skeleton, including a three-dimensional spiral CT scan made in collaboration with radiologists and orthopedists. To produce the work on paper, her original technique is to use thinned oil paints blended with bronze powders. She floats them on water, where they form crystalline networks of color. Ms. Ferguson lays paper on the water’s surface and transfers the floating image to paper, repeating the process to form layers of different colors. Afterward, she uses charcoal, colored pencil, pastel, and oil crayon to sketch on top of the layers of oil paint. Her artwork appears to take its shape from the bones, blood, and veins of the body’s interior.

While her primary audience is patients, many doctors have been moved by her artwork. One is retired pathologist J. Bruce Beckwith, MD. “Over the centuries, the link between anatomy and art has been a close and essential symbiosis, enhancing both art and medicine,” he wrote. “But few artists have succeeded as well as Laura Ferguson in depicting in a single image both the anatomy of the lesion and its impact upon the patient. Her marvelous figures bring life and emotion into the traditionally cold science of clinical anatomy. … Ferguson presents an outside-in view of herself, which is of course the way most humans expect to be observed.”


By Sara S. Patterson, MSJ
The Intriguing Art of a Patient

The following summarizes an interview with Ms. Ferguson about how she decided to create her unique artwork and its impact on physicians.

Q: Why do you find the combination of art and medicine so fascinating?
A: I originally became interested because of my scoliosis. I had surgery to fuse my spine at age 13, which required 12 months of recuperation at home in a plaster cast. After my recuperation from surgery, I thought that I would be fine. However, in my early 30s, I started having pain at the point of the spine below where the fusion occurred.

To understand what was happening to my body, I began learning about anatomy. My anatomy teacher had a real human skeleton, and she invited me to draw it once a week. I drew it over and over again at different angles. The more I drew, the more fascinated I became with anatomy.

That was the beginning of making art, where my subject happens to be the inside of the body. My scoliosis helped me to realize all our bodies are individualized. There's as much character inside a person as outside.

Q: How did you decide to focus your art on your scoliosis?
A: For a person with scoliosis, there's a big push toward having spinal surgery. Although the orthopedic surgeon may present it as a medical necessity, there is an underlying aesthetic issue: to have your spine look “normal.” However, I saw a beauty in the curving spine. I learned the lesson: If you didn't think of it as a deformity, you could find it beautiful. I wanted to show the beauty and create the effect of re-thinking scoliosis for those who view the artwork.

Q: How does this focus on a patient who has a medical condition and an artist help to humanize medicine?
A: Many doctors have embraced my work, which surprised me. Art is a way for them to get those insights about how it feels to be a patient. To the extent that the medical world has embraced this artwork, it may have a small effect on how doctors see patients.

Q: Why is it important for human beings to humanize conditions?
A: Medical conditions or diseases may make us less than perfect, but they are an important part of who we are as individuals. Empathy is very central to what I try to do in my work as an artist. There's always a story about how we got to be this way, and how we have incorporated our medical conditions into our lifestyle.

Q: How did you become appointed as the artist-in-residence at New York University School of Medicine?
A: In the late 1990s, I was looking for a three-dimensional medical imaging technology that would help me to visualize my skeleton. In 2000, I wrote a letter to Dr. Andrew Litt at New York University (NYU) School of Medicine and sent him examples of my work. He agreed to my request for a three-dimensional spiral CT scan and assigned an imaging specialist to work with me. I did a whole new series of drawings in three dimensions with a higher level of anatomical detail. After developing relationships with people at NYU, I proposed establishing an artist-in-residence position, where I would have access to the anatomy laboratory, and could engage in dialogue and share my artistic process with medical professionals. It has been a fabulous opportunity.

Q: What have you learned from working with medical students?
A: I learned that we all relate to the body through ourselves. I asked my medical students to draw their own hands, including the bones, because drawing yourself is different from drawing anyone else. It's the little things that make us different. One student had a scar on her thumb from a dog bite, and she created a remarkable drawing.

Q: Will you continue using your own body in your artwork?
A: Through the last decade, I’ve thought more about aging and the changes in my body. I will try to bring the same kind of perspective: to see aging not as something bad, just something different, with its own visual aesthetic.

Ms. Patterson is Communications Writer for ASCP.
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