



# Pittsburgh Regional Healthcare Initiative

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Naida Grunden, editor

## **Moving toward one-by-one processing at UPMC Shadyside**

### **Small improvements yield big results in pathology lab**

Ever wonder what happens to the tissue your doctor “sends to the lab?” A lot can be riding on the results, and the process may be more complicated than you think.

Here’s what happens:

Pathologist Assistants in the Gross Room examine the tissue, dictate notes about its condition, and decide from where to extract the sample(s). After cutting the samples into sections, the tissue is placed into one-inch-square cassettes, then batched for tissue fixation in a tissue processing machine which infiltrates the tissue with formalin. Conventional tissue processing can take up to 12 hours, primarily for larger specimens.

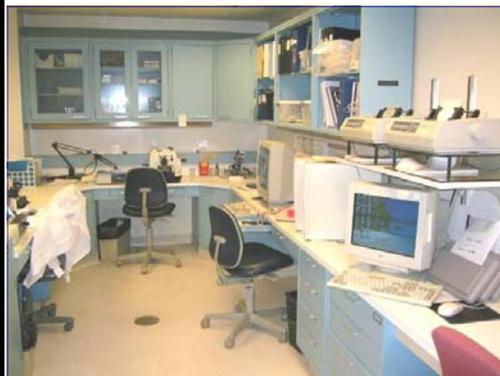
The samples then arrive in Histology, where histotechnologists orient the tissue samples in the cassette and embed them with paraffin wax. Once the paraffin is chilled and hardened, the embedded sample is ready to be sliced delicately into super-thin ribbons for application to a slide. The samples then go to another machine for staining. Only then are the slides ready for the pathologist to review, make a diagnosis, finish the dictation, and send the results to the clinician.

#### ***Histology: beginning in the middle***

Funded by a grant from the Jewish Healthcare Foundation, the Pathology Laboratory at UPMC Shadyside Hospital began to experiment with process streamlining just six months ago. Project principals include Jennifer Condel, SCT (ASCP) MT, Team Leader, Steven Raab, MD, Director, Center for Pathology Quality and Health Care Research, Chief of Pathology Shadyside Hospital and David Sharbaugh, Director of Informatics and Quality Improvement.

The basic premise was this: Process time is 24 to 48

hours. That’s one or two days for the clinician to wait and the patient to worry. *Why can’t we get results, at least for the small tissue samples, back to clinicians within 24 hours?*



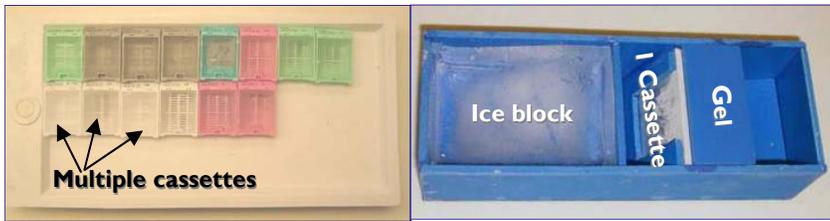
(Top, “before”) Lab arranged for batch processing.

(Center, “during”) Dr. Raab joins several other employees, and folks from PRHI, for an evening of “5S” cleaning and organizing.

(Bottom, “after”) Lab arranged for one-by-one processing. Each station represents the “next step” in continuous flow.



Photos courtesy  
UPMC Shadyside



Although error rates are extremely low, histotechnologists came to realize that batching samples (L) opened the door to mistakes. A custom-designed, single-cassette holder (R) keeps discrete cassettes chilled, ready for one-by-one processing.

Because the team would be using techniques adopted from the Toyota Production System (TPS), and because histology, the midpoint of the work, operated something like an assembly line, the decision was made to begin there. Eventually, the goal is to make the entire process—from the Gross Room to the pathologist’s interpretation—one continuous flow process.

As Team Leader, Condel’s first job was to reassure the histotechnologists. The lab already has a low error rate. “My role was to help them understand I had to tell them, ‘we aren’t changing your work, but with your help, we’ll be figuring out how to remove the extra steps and make you even more successful at your job. When you go home for the day, you’ll know for sure that the right samples got onto the right slides.’”

As a starting point, several people in the lab participated in Perfecting Patient Care™ classes offered by PRHI. The discussions and exercises described new ways to look at work, and ways to uncover and resolve problems that were hiding in plain sight—problems that drained their productivity and opened them to the potential for error.

### **Current condition**

Before streamlining began, samples were batched for a single 12-hour run in the tissue processor. Then the entire batch was fixed in wax, then sliced, then placed on slides, then stained. There’s a paradox in this batching, however. Small tissue samples require only about 3 hours in the tissue processor, but require more time to embed and cut. Big tissue samples take the full 12 hours in the processor, but less time to embed and cut. Nevertheless, all samples were processed for 12 hours; the batch was run each night; and each morning, processing began en masse.

“Batching” also extended to the work. Workers would cluster, with everyone working on every step

along the process.

Soon staffers discovered some of the inherent problems with batching: “Why should the sample for Patient 1 have to wait for Patient 50’s sample to be done before I pass that work down the line?”

“Why do I have all these cassettes stacked up when I can only work on one at a time anyway? If I try to work on two at once, I could get them mixed up.”

Another problem facing the lab in the beginning was that while they ran short on some materials, others were overstocked and set to expire. It wasn’t for lack of effort: the person in charge of ordering expected to spend 8-hours a week cataloguing, inventorying, and ordering supplies. Still, people would forget to report a needed item, sometimes resulting in a costly “stat” order. The problem was in the system.

### **One by one**

The group decided to experiment with one-by-one processing. To do so, the lab had to be reconfigured for continuous work flow. One evening, a group of hospital and PRHI employees performed a 5-S exercise in the lab.\* It’s a disciplined way to clean and organize the work space (sort, set in order, shine, standardize and sustain).



With visual cues, there’s no doubt about where things are, or where they go. Cupboards are color coded, with contents posted on the outside. The lab as a whole, and this arrangement in particular, won praise from inspectors from the College of American Pathologists (CAP).

Once the work space was redesigned, the group decided to begin processing the samples one by one. But batching just “feels” more efficient, and at first, it seemed as if one-by-one lengthened the turnaround time. Technologists began to notice that processing one by one really didn’t take any more time, and there was an added bonus: by focusing on one sample at a time, they caught and avoided errors.

“Ideally, the tissue processor would run the samples one by one. There is such a machine, and maybe we will eventually be able to justify purchasing it,” said Sharbaugh.

One problem resulted in a major innovation. Cassettes need to stay cold during processing. Cold trays answered the need when they were batching 10 or 20 samples, but single processing created the need to keep each cassette cold. Histotechnologist Mary Clancy, with help from her father and fiancé, fabricated a device that holds a small block of ice, cooling gel, a space for just one cassette and a space for the corresponding slide(s). It worked so well that hospital carpenters fabricated 30 more.

“I didn’t realize we would be so involved in changing our work,” said Clancy. “This just seemed like we would be told *how to do* our work, and so I held back. But we’re being told, ‘Design your own work, design it from scratch,’ and they mean it. It’s liberating.”

The group decided to experiment with the small tissue samples to see if they could reduce turnaround time. Now each morning at 9 a.m., a small batch of small tissue specimens run for 3 hours, and are quickly available for reading. What was once a one- or two-day process now has same-day turnaround, and more work can be processed in a day. Furthermore, using the principle of “leveling” the work load, the techs now process small and large tissue samples

interchangeably, resulting in better flow.

### Ordering

Clancy also designed *kanban* cards, little inventory cards used as ordering reminders. Almost every item in the lab now has one, so when an item runs low, co-workers put the card on a hook as a visible signal to re-order. Instead of consuming one 8-hour shift, ordering takes just a few minutes per day. Orders are not batched, but take place as needed.

Since the *kanban* system was introduced, stock-outs have been rare, even though inventory has been reduced by 50-80%. Costly “stat” shipping has been eliminated, as has been wasted material past its expiration.

### Next stop on the line

Pathologist Stephen Raab has championed the process improvements. Fellow physicians, accustomed to reading large batches of slides, are just beginning to become accustomed to a steady work flow. Dr. Raab is acquainting them with the principle of one-by-one.

“Eventually we hope to create a continuous flow, one-by-one processing throughout the whole pathology pathway,” says Condel. “It will decrease errors, time, waste, and cost, and make the work more satisfying to the staff.”

### On the front line of improvement

- ✧ Debbie Mills, HT(ASCP), Lead Histotechnologist
- ✧ Mary Clancy, MLA(ASCP) HT
- ✧ Kelley Knizner, HT(ASCP)
- ✧ Susie Lackey, Associates Specialized Technology, ASCP Eligible
- ✧ Barbara Schuster, HT(ASCP)



When the supply runs low, the *kanban* card (L) is removed and hung on the ordering hook (R). Ordering is continuous, and takes just minutes instead of one 8-hour work-day per week of a professional’s time.

