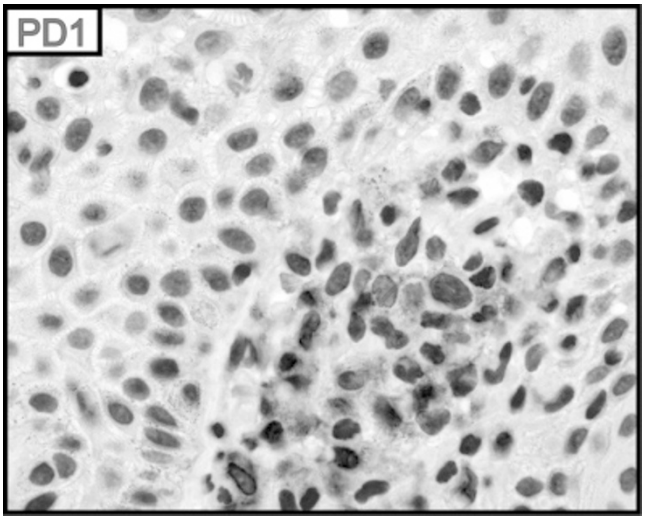
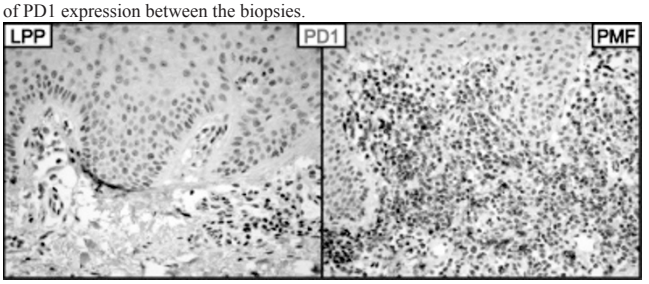


The percentage of PD1-positive lymphocytes was also consistently higher in tumor stage than in patch and plaque stage MF. Interestingly, in the case where there was overlap between LPP and early MF, the number of PD1-positive lymphocytes approximated that seen in patch and plaque stage MF. Moreover, one patient presented skin biopsies at different stages of disease evolving from LPP to PMF, with a concomitant increase of PD1 expression between the biopsies.



Conclusions: Upregulation of PD1 correlates with disease progression in ETCD ranging from minimal staining in prelymphomatous dyscrasias to significant staining amidst neoplastic cells in more aggressive disease, likely reflecting the effects of PD1 on inhibiting tumor surveillance regulatory T cell populations. This observation thus raises the possibility to target PD1 for immunomodulation in MF therapy.

533 Molecular Diagnosis of Cutaneous Leishmaniasis and Species Identification: Analysis of 54 Histology Negative Skin Biopsies.

L Yahya, M Hourieh, W Raslan, M El-Sabban, I Khalifeh. American University of Beirut, Lebanon; Tishreen University, Lattakia, Syrian Arab Republic; Aramco, Dhahran, Saudi Arabia.

Background: Cutaneous Leishmaniasis (CL) is endemic in the Middle East and North Africa and displays a wide spectrum of clinical manifestations. Confirming the diagnosis of CL histologically depends on the identification of the amastigotes, which may be inconclusive. The number of amastigotes may vary significantly depending on the strain type, host response & the disease stage. Accurate histological diagnosis is significant due to the requirement of targeted treatment.

Design: Skin biopsies from 122 patients from Lebanon, Syria, and Saudi Arabia with suspected untreated CL were reviewed. Clinical data includes age, gender, duration of the lesion, and biopsy type (shaved biopsy, SB versus punch biopsy, PB). Seven sections from each formalin fixed paraffin embedded skin biopsy (FFPE) were stained: 3 H&E, 1 Giemza, 1 AFB, 1 GMS & 1 PAS. All cases were reviewed by 2 pathologists and classified according to the modified Ridley's parasitic index (scale 0 to 6). DNA was extracted using a standard protocol from ribbons originating from the respective FFPE. PCR was performed using primers specific for the Leishmania ribosomal internal transcribed spacer 1 (ITS1-PCR). The digestion of the ITS1-PCR amplicons with the restriction enzyme *HaeIII* was performed for restriction fragment length polymorphism (RFLP) analysis and subsequent sub-speciation.

Results: Out of 122 skin biopsies, 54 cases (44.3%) showed a parasitic index of 0 to 1+ (no unequivocal amastigotes detected). Of the negative cases, 9 were SB and 45 were PB. The age ranged from 2 to 90 years (mean = 35 years, SD= 24.0 & males/females ratio is 6/5). The duration of the lesion ranged from 1 month to 60 months (mean= 10 months, SD= 14.6). ITS1 PCR was positive for all 54 cases (100% sensitivity). RFLP analysis identified *Leishmania tropica* sub-species in all cases.

Conclusions: Patients with clinically suspected CL, whose skin biopsies failed to detect Leishmania amastigotes, is a commonly encountered problem that represented 44.3% of the cases included in our study. The histologic confirmation of CL is crucial especially with the wide clinical manifestations and the availability of targeted therapy. In this study, we describe all stages of an optimized protocol from DNA extraction to sub-speciation by RFLP. According to our results, ITS1 PCR usage showed high sensitivity and specificity in confirming the diagnosis of CL where histology failed to detect Leishmania amastigotes.

534 Array Comparative Genomic Hybridization (aCGH) on Dermatofibromas (DF): Additional Evidence To Support a Neoplastic Process.

W Zhang, SS Osswald, SR Gunn, MP Fernandez. University of Texas Health Science Center, San Antonio; Combimatrix Molecular Diagnostics, Irvine, CA.

Background: There has been considerable debate over the pathogenesis of DF. Some believe they represent a fibrosing inflammatory process, while others maintain they are neoplastic in nature. Reports of metastasizing DF, and the recognition of DF variants with a tendency to recur have fueled this debate, and catapulted it into the realm of clinical relevance.

Design: A total of 10 cases were studied: 8 DF (6 ordinary DF, 1 aneurysmal DF and 1 cellular DF); 1 angiomatoid fibrous histiocytoma and 1 hypertrophic scar. All cases were formalin-fixed paraffin-embedded. aCGH analysis of the lesional genome was performed using a 3039 probe whole genome bacterial artificial chromosome (BAC) microarray. The presence of copy number changes was correlated with additional clinico-pathologic findings, such as involvement of the subcutaneous tissue.

Results: Four cases showed copy number changes: The cellular DF showed the most obvious abnormalities with loss of large portions of 5q and 6q. Three ordinary DF showed other genomic abnormalities: One showed monosomy 19, a second showed a 19p loss, and a third showed a 19p gain. No obvious copy number changes were seen in any of the other four DF, in the angiomatioid fibrous histiocytoma, or in the hypertrophic scar. Of the eight DF studied, four showed focal involvement of the subcutaneous tissue and the other four were limited to the dermis. The four cases with the above described genomic abnormalities coincided with those showing focal involvement of the subcutaneous tissue.

Conclusions: The finding of copy number changes in a proportion of the cases studied suggests that DF, at least in some instances, may indeed represent a neoplastic process. The presence of genomic abnormalities in the subset of DF showing focal extension into the subcutaneous tissue, including the cellular DF, provides further evidence to support this hypothesis. Complete excision of dermatofibromas should be considered in those cases involving the subcutaneous tissue.

535 Immunohistochemistry for IgG4 on Paraffin Sections for the Diagnosis of Pemphigus.

X Zhang, E Hyjek, K Soltani, V Petronic-Rosic, CR Shea. University of Chicago Medical Center, IL.

Background: Pemphigus is a group of autoimmune vesiculobullous diseases characterized by the presence of tissue-bound and circulating IgG antibodies directed against desmosomal adhesion proteins (desmoglein 1 and desmoglein 3) on the surface of keratinocytes. Both the IgG1 and IgG4 subclasses are produced, with IgG4 being predominant. Direct immunofluorescence (DIF) for IgG performed on fresh-frozen tissue plays a crucial role in diagnosing pemphigus. However, when paraffin sections of a biopsy specimen are histologically suspicious for pemphigus, frozen tissue may not be available to confirm the diagnosis. Immunohistochemical detection of total IgG performed on paraffin sections is of no diagnostic value because of the high background. In this study, we used immunohistochemistry for IgG4 performed on paraffin sections as a diagnostic test for pemphigus.

Design: Nineteen IF-proven pemphigus cases (12 pemphigus vulgaris, 6 pemphigus foliaceus, and 1 paraneoplastic pemphigus) were studied. Four normal skin specimens and 10 non-pemphigus vesiculobullous disease specimens served as controls. Paraffin sections of all cases were examined immunohistochemically for IgG4 expression. Positivity was defined as distinct, condensed, continuous immunoreactivity localized to the intercellular junctions of keratinocytes.

Results: The results were independently evaluated by three pathologists, with a 100% inter-observer agreement. Nine of 12 pemphigus vulgaris cases (sensitivity 75.0%), 4 of 6 pemphigus foliaceus cases (sensitivity 66.7%), and the paraneoplastic pemphigus case were positive for IgG4 immunohistochemical stain. The overall sensitivity was 73.7%. None of the control specimens showed IgG4 positivity (specificity of 100%), although non-specific staining was present in some cases. In the specimens demonstrating acantholysis, 8 of 10 pemphigus vulgaris cases (sensitivity 80.0%) and 4 of 4 pemphigus foliaceus cases (sensitivity 100.0%) were positive for IgG4. The overall sensitivity for specimens with acantholytic lesions was 86.7%.

Conclusions: Immunohistochemical labeling for IgG4 provides a sensitive and specific diagnostic tool for diagnosing pemphigus; it is likely to be particularly valuable in cases where frozen tissue is not available for DIF, and especially when active acantholytic lesions are examined.

Education

536 Clinical Relevance under the Microscope: Using Pathology To Stimulate Medical Student Motivation and Self-Regulated Learning in Histology.

SY Chang, I-P Tung, K Chin, RS Fraser, S Razack. McGill University Health Center, Montreal, QC, Canada; McGill University, Montreal, QC, Canada.

Background: Research suggests that medical students' motivation and interest for learning histology is low when it is not linked with relevant clinical applications. In this project, we studied the impact of an integrated teaching approach grounded in self-regulated learning (SRL) theory on student motivation and learning strategies in the histology laboratory. Using SRL as a theoretical framework, students are seen as active participants in constructing and assessing their own learning progress. The principal objective of this study was to determine how the use of an educational intervention

that is theoretically grounded in SRL and designed to promote clinical relevance by using pathology cases and images might influence student motivation and learning approaches for histology.
Design: First year medical students were randomly assigned into experimental (n=25) and control (n=22) groups. Throughout four histology laboratory sessions, the former received handouts (one per lab) that integrated clinico-pathological case presentations with their histology exercises. The control group's handouts focused solely on teaching normal histology. A mixed method approach was used to quantitatively and qualitatively assess changes in students' motivation and learning through self-reported questionnaires and open-ended questions after administering the educational intervention.
Results: From the self-reported questionnaires, the experimental group showed a significant increase in the following SRL processes: task value (i.e., general interest; p=0.028), mastery approach goals (i.e., focus on mastering the learning task and not the grades; p=0.001) and elaboration (i.e., a form of deep learning that connects different concepts; p=0.021). Through the open-ended questions, while 59% of the control group stated that their learning approach had not changed after the intervention, only 32% of the experimental group made similar comments. Both quantitative and qualitative data demonstrated that students in the experimental group gained greater use of several SRL processes compared to the controls.
Conclusions: Our findings suggest that the use of pathology based case material is a relatively simple and cost-effective method for improving students' self-regulated learning of histology. This study highlights the importance of integrated teaching in general and the use of pathology specifically as a way to scaffold SRL processes early in the medical curriculum.

537 Evidence-Based Medical Practice and the Outcomes of Education.

Y Choi, L Krause. Yale School of Medicine, Bridgeport, CT; Bridgeport Hospital, CT.
Background: The risks and increasing cost of blood products have lead to a heightened interest by the regulatory agencies to develop a blood management program for a safe and cost-effective use of blood products. Education to all level of the health care personnel is crucial in achieving the effective blood management program. Pathologists should play the forefront role in evidence-based transfusion services.
Design: We have conducted (1) ongoing in-service education, (2) retrospective and prospective audits and discussion with the clinicians for the appropriate usage, and (3) implemented the Computer Physician Order Entry (CPOE) with the guidelines. The guidelines were developed by reviewing published data and those used in various hospitals, and included many potential reasons for which clinicians may order blood products. Prior to implementing the CPOE, we sought feed back and decision support from multidisciplinary team. Prospective and retrospective audits were conducted to assess the degree of compliance, the frequency of bypass and overrides /"other reasons" with explanations. Then, the usage of blood products and the cost were analyzed.
Results: Of all orders during a 12 month period, "other reasons" were 0.9% (50/5043) for red blood cells (RBC), 19.0% (268/1399) for fresh frozen plasma (FFP) and 18.7% (206/1099) for platelets (PLT). A wide range of the indicators listed in the RBC CPOE has resulted in the low number of "other reasons" in the COPE indicators. "Other reasons" for FFP and PLT orders originated mostly from the patients with open heart surgery, minor invasive procedures, neurosurgery, bleeding from GI or other sources, and liver failure. Upon auditing, not always laboratory data substantiated the reasons for transfusion. In some "other reasons", it was necessary for medical director to have a lengthy discussion with the clinicians to modify the orders. Overall, there was about 5% reduction in the utilization of blood products and its associated cost during this period.
Conclusions: Evidence-based transfusion practices require ongoing education, continued audits of the orders and direct open dialogue with the clinicians, and prospective and front-end interventions targeted at the deciding provider. The CPOE implementation achieved consistency in ordering patterns and educational opportunities for the clinicians, and greater ease in monitoring transfusion appropriateness. Continued review of "other reasons" with the modification for patient-specific predictors in the CPOE has facilitated the compliance by the clinicians.

538 Development of an Objective, Case-Based Measure of Pathology Trainee Performance: The Trainee Review Field.

JH Crow, F Schneider, R Kloehn, AS Lagoo, PJ Buckley, R Bentley. Duke University Medical Center, Durham, NC; University of Pittsburgh Medical Center, PA.
Background: The ACGME Outcome Project has mandated development of assessment methods to evaluate trainee competency; ideal assessment tools are useful, valid, and reliable. We describe the development of a simple, case-based tool (the Trainee Review Field) for objective evaluation of Pathology trainees' competence within areas of Anatomic Pathology. The field was designed to be simple and quick to complete, confidential, and mandatory.
Design: For each trainee case, the trainee's diagnostic report is scored on Accuracy, Difficulty, and Completeness using scales of 0-3 for accuracy and 1-3 for difficulty and completeness. The scoring is performed by the attending at the time of case sign-out and is required for verification of the case. Scores are compiled and presented monthly to each trainee and reviewed regularly by the program director. Anonymized data is presented periodically to the Education Committee for review of program performance.
Results: Through the first 24 months of implementation, 30,867 cases were scored. Seventeen trainees have data for both years, and eight trainees have data for only one year. The average scores for accuracy and completeness are lowest for first-year trainees and highest for fourth-year trainees and fellows. The percentage of cases with an incorrect diagnosis is highest for first-year trainees and lowest for upper-level trainees (fourth-year trainees and fellows), and the percentage of cases with a correct diagnosis increases with training level. Of the seventeen trainees with data from both years, fifteen show significant improvement in their yearly average diagnostic accuracy scores.
Conclusions: The Trainee Review field is a useful, reliable, and valid method for objective evaluation of the diagnostic skills of Pathology trainees (residents and fellows). The data generated is a valuable assessment of individual trainees as well as the training program. Continued use of the field will provide more robust data on trainee performance for each rotation and year of training.

539 Development of a Web Based Testing Interface for Pathology Trainees Using Digital Slide Sets.

B Dangott, G Sharma, T Harper, T MacPherson, L Pantanowitz, A Parwani. University of Utah, Salt Lake City; University of Pittsburgh, PA.
Background: Training in anatomical pathology requires the development of finely tuned visual pattern recognition skills that can best be obtained by experience. However, without the guidance of a faculty mentor it may be difficult for trainees to determine what histopathology is relevant and where the diagnostic pitfalls occur. The goal of this project was to build an internet deployed whole slide imaging testing interface that provides a pre-rotation assessment, a rotation study set, and a post-rotation test using digital slides.
Design: Digital slides (DS) and ancillary testing data such as flow cytometry, cytogenetic, and molecular reports were provided to pathology trainees via hyperlink in a Microsoft Access database (Microsoft, Redmond, WA). Each case could accommodate associated text (e.g. clinical history), an unlimited number of DS, and test questions (multiple choice or free text). A ColdFusion (Adobe, San Jose, CA) application was used to present the data in an organized webpage. Pathology residents and fellows begin their virtual rotation by taking the pre-rotation assessment. Their answers are automatically emailed to the rotation coordinator, who accordingly tailors which cases get selected for the subsequent rotation study set.
Results: A virtual test site employing digital slides has been successfully implemented at our institute. Multiple digital slide study sets have been generated to date including over 1500 digital slides. These efforts have permitted digital slide teaching sets to be generated for several subspecialty areas (genitourinary, head & neck, bone soft tissue, hematopathology, and pediatric) fields in anatomical pathology.
Conclusions: Creation of multiple DS teaching sets that are accessible via the internet can be leveraged to support a virtual rotation for pathology trainees. This solution also allows trainees to gauge their knowledge and permits faculty mentors to tailor training materials in response to the trainee's performance. Substantial content such as clinical case data and ancillary test results (e.g. flow cytometery histograms) can be linked with DS to enhance trainee education.

540 Transcontinental Distribution of Contributors to the WHO Classification of Tumor Series.

R Dewar, S Nair, S Gujral. Beth Israel Deaconess Medical Center & Harvard Medical School, Boston, MA; Christian Medical College, Vellore, TamilNadu, India; Tata Memorial Hospital, Mumbai, Maharashtra, India.
Background: The WHO classification of tumor series serves as an excellent comprehensive & globally affordable publication. Since diagnostic guidelines proposed by these series sets the practice standards for pathologists worldwide, it is important that the contributors to this series be representative and knowledgeable of pathology practices & available resources. Towards this, in this study we analyzed transcontinental distribution of the contributors.
Design: Data was collated from published contributors list within the recent available editions of 8 WHO Classification of Tumor Series. The surveyed series include: (1) Breast, (2) CNS, (3) Endocrine (4) GU & Prostate (5) Head & Neck (6) Hematolymphoid (7) Lung (8) Soft Tissue. The published contributor list was the primary source of data. The contributors were sub-classified according to the locations of their institutional affiliations into 5 major geographical continents: Africa, Americas, Asia, Australia and Europe.
Results: Most (87%; 953/1097) contributors to the WHO series were from Europe or Americas. The continent of Africa was not represented in 5 of the 8 series surveyed and Australia in 2 of the 8 series. Within the minority (non-Euro/US) continents, contributors were from mostly clustered in industrialized countries.

DISTRIBUTION OF CONTRIBUTORS (ALPHABETICAL)

BREAST	CNS	ENDOCRINE	GU& PROSTATE	HEAD&NECK	HEMATO-LYMPHOID	LUNG	SOFT TISSUE& BONE
0	0	0	1	3	0	0	1
36	30	78	65	47	54	80	75
7	9	13	7	29	12	37	13
2	0	1	2	0	2	2	3
91	35	61	47	50	72	78	54
136	74	153	122	129	140	197	146

ROWS (top to bottom): Africa; Americas; Asia; Australia; Europe; Total

Conclusions: Much of scientific progress in health care takes place in the Western World. The histopathological classification scheme of tumors is based on modern scientific evidence and available advanced techniques in western countries. Given that the World Health Organization serves the world, it is important that the classification scheme take into consideration the epidemiological profile of diseases and available resources, globally. Representative contributors from individual nations will provide insight into resources and diseases, and this will make the WHO series a practical and successful compendium of tumor classification, globally.

541 Evaluation of a Teaching System Based on Vertical Integration of Clinical Areas, Virtual Autopsy, Pathology Museum and Digital Microscopy for Medical Students.

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Background: Pathology is a fundamental science for a successful medical practice. The medical education in recent years has undergone profound changes with the development of a combined core curriculum. There has been a shift from discipline-based teaching towards problem-based learning in the clinical environment. On the other hand, the uses of advanced informatics technologies have also improved the learning process. We applied a teaching method based on the active combination of clinical problems given through informatics tools and gross pathology, histopathology and autopsy pathology with medical students at the Universidad de Santander, Colombia.

Design: Ninety four medical students were analyzed in two consecutive semesters. Students were randomized to receive the usual methodology or the new approach. The traditional teaching method (control group) comprised theoretical lectures in the classroom as well as practical lessons using a lab with light microscopes and a gross pathology museum. Students assigned to receive the new methodology (intervention group) were taught using the vertical integration teaching system which included theoretical and practical lessons using interactive clinical cases, autopsy features, gross pathology, and digital microcopy images through informatics devices in the same classroom.

Results: There was no significant difference between the intervened students and the non-intervened ones ($p = 0.4$) at baseline. The average total knowledge score was significantly higher in the intervention group compared to the control group (3.9 vs 3.4, $p<0.05$). Students and tutors endorsed the benefits of integrated pathology and clinical learning. The acceptability of the training was very satisfactory scoring an average of 8.7 out of 10.

Conclusions: This study confirms that vertical integration based on informatics systems provides an excellent opportunity for the association of pathology, and clinical medicine into the early clinical training of medical students. This can be possible with the use of virtual microscopy, and clinical digital imaging correlation.

542 A Learning Experience; Pathology Resident Triaging of Laboratory Tests.

E Drinka, O Habeeb, K McKenna, M Cashin, P Schreckenberger, E Wojcik, S Kahn. LUMC, Maywood, IL.

Background: Many methods are used in the clinical training of pathology residents, the budgetary control of health care, and the improvement of laboratory test utilization. At Loyola University Medical Center, the practice of having pathology residents triage selected externally referred laboratory tests was implemented in an effort to train residents in laboratory management, enhance cost-effective test ordering, and improve laboratory utilization.

Design: Physician orders for externally referred tests with charges greater than $500 per patient are triaged every morning by an assigned resident. In addition, other selected tests (CSF viral PCR tests, such as HSV) are triaged by residents. For each referral test triaged the resident reviews the patient chart, clarifies the clinical indications of the ordered test, consults with a relevant pathology faculty member if necessary, and then decides whether to approve the test referral or discuss the order further with the ordering physician. For the purposes of this study, data on all tests triaged by residents from 7/1/2008 to 6/30/2010 (24 months) were compiled and evaluated. Collected data include the name of each test ordered by the clinician, test cost, and if the test was subsequently cancelled as a result of review of the medical record.

Results: A total of 1714 send out tests meeting triage criteria were investigated by residents over a 24 month period. A total of 397 tests were cancelled after consultation with ordering physician (23% of all tests triaged). The average charge of tests meeting triage criteria was $704, while the average charge of the tests cancelled was $493. The total cost of triaged tests over the 24 month period came to $1,199,521, and the total amount saved by triaging and cancelling unnecessary send out tests came to $193,307. This represents a total savings of 16%. The most frequently cancelled test was also the most frequently ordered test, HSV PCR ($171).

Conclusions: Triaging selected referred laboratory tests is effective in reducing testing and associated costs. It ensures that testing performed is medically appropriate. Involving residents in this process provides significant educational benefits. The resident pathologist gains valuable insight and experience as a laboratory director in training. This includes the use of evidence based medicine, and the implementation of clinical guidelines in the proper ordering of tests. The use of our resident based triaging system has proven effective in helping to reduce overall testing costs, can be a valuable learning opportunity for residents, and is a catalyst for open communication between the clinician and pathologist.

543 Sufficiency of Biosafety Education and Practice in AP Labs.

S Ehdaivand, K Chapin, DR Gnepp. Lifespan Academic Medical Centers, Providence, RI.

Background: Careful biosafety practice in labs is crucial to prevent unnecessary exposures. Chemicals, particularly formalin & xylene, are irritants to skin & mucous membranes, and biological hazards, such as TB & blood borne pathogens, can be transmitted from fresh, frozen or fixed tissue.

Regulatory agencies [CMS (via CLIA), CAP, OSHA & TJC] have general regulations regarding basic personal protective equipment & chemical exposures in order to maintain certification. Additionally, guidance agencies [CDC, CLSI & NIOSH] provide more rigorous guidelines including room specifications & work practices.

This study's aim was to see if actual practice mirrors these guidelines, and to observe if professionals' perceptions of biosafety in AP labs differs from actual practices. To this end, we developed an online survey designed for anatomic pathology (AP) professionals to assess their perceived education as well as routine practices.

Design: Current available regulations & recommendations for biosafety practices in AP labs were reviewed from regulatory and guidance agencies and used to construct a brief survey (www.surveymonkey.com/biosafetyinAPlabs) to poll Pathology attendings, residents, fellows & PAs to assess perceived knowledge of biosafety in AP labs & actual practices. The tool was validated to ensure it captured the intended data.

Results: 43 Pathology professionals from diverse institutions completed the survey. 45% of respondents ranked their overall training in AP biosafety as minimal to none. >40% of respondents felt their surgical pathology & autopsy biosafety training was insufficient (42 & 45%, respectively). 24% of respondents received no training in chemical exposures & an additional 24% felt only minimally trained.

At the beginning of the survey, 51% of respondents felt the risks of chemical & infectious disease exposures had been clearly explained to them; however, by the end of the survey, only 37% of those polled felt the risks of chemical exposures were clear.

50% of respondents reported having a needle stick or cut while in an AP laboratory & 60% reported formalin exposure by splash or prolonged direct skin exposure. 65% do not report all of their chemical exposures & 11% of respondents did not know to whom they should report accidental exposures.

60-70% of respondents wear a gown when handling tissue in the surgical pathology labs, <30% wear a face shield, & <5% wear goggles.

Conclusions: Greater emphasis needs to be placed on training pathology personnel on exposure risks in AP labs. This training must include education on personal protective equipment & the hazards of chemical exposures.

544 Development of an Objective Assessment of Broad Range Daily Competence and Progress of Pathology Residents in Anatomic Pathology.

MO Idowu, HD Massey, C Fuller, C Garrett, MM Grimes, CN Powers. Virginia Commonwealth University Health System, Richmond.

Background: The ACGME requires resident progress to be assessed in an objective, reliable and standardized manner. It is expected that Graduate Medical Education programs create tools to measure the six core competencies. We aim to demonstrate the utility of focused daily resident competency assessment.

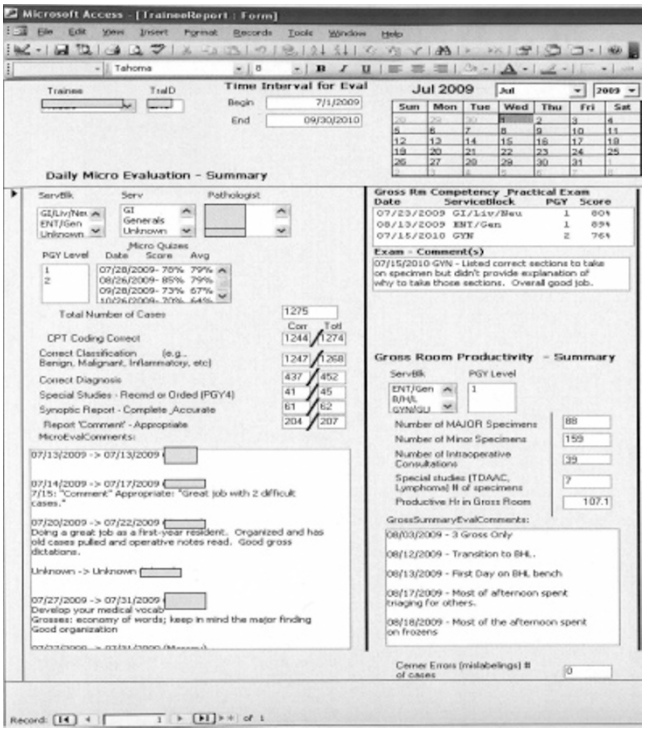
Design: A "Daily Microscopic Evaluation Form" (Figure 1) is completed at daily sign-out by faculty for residents in anatomic pathology. Communication skills and the clinicopathologic evaluations are assessed at sign-out, during residents' case presentation, and frozen section result communication. Written tests based on cases presented at conferences are given quarterly. A comprehensive resident competency assessment database was created to continuously collate data collected.

Surgical Pathology Daily Microscopic Evaluation Form

Attending _____ (One attending per sheet) Resident Name _____ PGY (___) Service: (Circle individual or group below) (ENT Generals GI Liver Neuro (Gyn GU) Breast Heart Lung)	Monday (Date)	Tuesday (Date)	Wednesday (Date)	Thursday (Date)	Friday (Date)
Number of Cases (y)					
CPT Coding Correct (x/y)	___/___	___/___	___/___	___/___	___/___
Correct Classification (x/y) (e.g. Benign, Malignant, Inflammatory, Etc.)	___/___	___/___	___/___	___/___	___/___
Correct Diagnosis	___/___	___/___	___/___	___/___	___/___
Special Studies (x/y) (Recommended or Ordered (PGY4))	___/___	___/___	___/___	___/___	___/___
Synoptic Report – Complete and Accurate (x/y)	___/___	___/___	___/___	___/___	___/___
"Comment" Appropriate (x/y)	___/___	___/___	___/___	___/___	___/___
Comments (May also use back of sheet)					

"x" = number of correct cases; "y" = total cases reviewed

Results: The database allows for quick access to a broad range of competency measures including proportion of cases diagnosed correctly, correct CPT codes, and resident ability to work-up cases and generate complete accurate final reports. All comments and data are retrievable. Data summaries (Figure 2) on each resident are reviewed by faculty at a monthly meeting; as data is continually updated, this allows for easy tracking to demonstrate performance improvement or need for remediation. Residents are provided comprehensive feedback based on these data summaries and faculty discussions.



Conclusions: Daily focused assessment provides a more objective system to replace traditional subjective evaluations. Collation of data into a searchable database allows us to monitor real-time progress, easily view a snapshot of the range of core competencies, and record ongoing improvement or need for remediation. Our residents' awareness of daily assessment and documentation has improved their preparedness for sign-out and conferences. This system has been accepted as part of the daily routine and appreciated as an improved system for resident evaluation.

545 Educational Recuts on a Portable Hard Drive: A New Paradigm for Personal Slide Collections.

RE Lee, DS McClintock, CR Ponce, JR Gilbertson, AS Dighe, Y Yagi. Massachusetts General Hospital, Boston.

Background: Personal educational slide collections are a cherished tradition in pathology. Digital whole slide imaging (WSI) has become the *de facto* method of teaching histology and pathology in medical schools, but are not used extensively in residency. In this study we describe a system for managing large numbers of WSI slides on an inexpensive, portable hard drive. This approach obviates many infrastructure barriers of clinical WSI systems such as file storage servers, technical expertise, and network bandwidth overload, and can be used in a wide range of resident education applications.

Design: A diverse collection of 426 deidentified surgical pathology slides, comprised of both biopsies and resections, underwent WSI and the image files saved on an external, 320gb laptop hard drive connected to a standard laptop by USB cable. A Microsoft Excel spreadsheet was constructed that allowed annotation of diagnosis, comments, and a direct clickable link to the digital file. This method was vendor agnostic because file formats from different scanner vendors were used. A Likert survey was created and designed to assess system usability, preferences, and performance, as well as user technical expertise, concerns, desired uses, and benefits for such a system.

Results: In total, the digital slides took up 144gb of hard drive space, less than half of total hard drive capacity. Currently, a 320gb external laptop-sized hard drive costs less than $50 US. Bandwidth issues were limited to the speed of the external USB connection, resulting in faster performance than with network-based WSI systems. Lack of programming expertise was not an issue as Excel spreadsheets formed the backbone of the system. Initial impressions were strongly positive, with many requests for copies for studying at home. The formal Likert study is currently underway at multiple institutions and its results will be reported at a future date.

Conclusions: An all-digital version of the educational slide collection on a personal hard drive offers many compelling advantages. Although scanning hardware is required, traditional server and network infrastructure is not. Such a system introduces new dynamics within pathology education that have not been utilized to their maximum potential: slides are now retrievable and duplicated within seconds, and private collections can now include immunohistochemistry, FISH, special stains, and content from the clinical pathology realm, such as ANA's and ANCA's. This pilot study will lead to a more formal evaluation of the system.

546 Web-Based Virtual Microscopy To Teach Ophthalmic Pathology.

AY Lin. University of Illinois at Chicago.

Background: Ophthalmic pathology is a specialized area of both ophthalmology and pathology. Although a training requirement for ophthalmology residents, many have limited exposure to pathologic specimens because their departments cannot support an ophthalmic pathologist. Likewise, most pathology residents have little to no exposure to ophthalmic cases because the ophthalmic pathologist, most of whom are ophthalmologists, sees the cases.

Design: The goal of this project is to develop interactive, web-based cases in order to help residents recognize and understand the fundamentals of ophthalmic disease. Virtual slides were scanned using the Aperio ScanScope (Aperio, Vista, CA), and interactive cases were created using Digital SlideBox software (SlidePath, Dublin, Ireland). Each slide is annotated with key microscopic features of the case, and each case is accompanied by a narrative, which includes a clinical history, physical examination (ophthalmic) findings, and gross and microscopic description. Hyperlinks within the narrative can integrate clinical photographs, gross photographs, imaging studies, multimedia, and additional virtual slides or slide annotations to the case. Self-assessment quizzes help residents test their understanding.

Results: These interactive, web-based virtual microscopy cases were provided to ophthalmology and pathology residents in our teaching programs. Residents found these self-study cases useful in increasing their recognition and understanding of pathologic processes in ophthalmic diseases.

Conclusions: An interactive, web-based virtual microscopy case study set makes the field of ophthalmic pathology more accessible and inviting to both ophthalmology and pathology residents.

547 Simulation Based Medical Education (SBME) in Breast Fine Needle Aspiration (FNA) Cytopathology as a Means of Quality Improvement.

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Background: Traditionally, pathology residents are trained using an apprenticeship model in real practice settings. The effectiveness of high fidelity simulation education on the improvement and maintenance of resident diagnostic interpretation skills has not been measured in pathology training programs.

Design: For the interpretation of breast fine needle aspiration cytopathology, we developed a SBME composed of 550 modules of various case complexities, based on difficulty level and preparation quality. Following an assessment of baseline skills, we initiated daily tailored-by-skill training sessions for 10 residents using 5-set case modules. Based on previous resident performance, the individualized modules reflected real practice, focused on rapid diagnostic skill accrual and maintenance, and involved immediate feedback with self-assessed root cause analysis of cytologic criteria (n=21 criterion). We assessed competency and mastery (i.e., top 1% of practitioners) as 80% and 90% agreement, respectively, with expert performance. We tracked weekly performance using statistical process control charts and interval performance testing.

Results: In a 1 month rotation, all residents had achieved diagnostic competency with 50% of residents achieving a master level of performance. Most residents (90%), including residents with no prior FNA experience, had achieved competence at two weeks. Initial resident errors exclusively involved cases of fibroadenoma, well differentiated ductal carcinoma, lobular carcinoma, and bloody, scirrhous, or low cellular specimens. Immediate feedback and root cause analysis involving assessment of cytologic features showed that residents misinterpreted small cellular groups (10% of errors), stripped nuclei (7% of errors), necrosis (5% of errors), and minimal nuclear atypia (5% of errors). Achieving mastery level required dedicated practice involving increased numbers of specimens demonstrating these criteria and poor quality specimens.

Conclusions: We conclude that resident competence in diagnostic interpretation of breast FNA may be achieved using SBME in less than one month with a resident spending approximately one hour per day in a practice of concetrated work and feedback. Mastery level may be achieved with dedicated practice and self assessment. We determined that tailored skill-based programs assist residents in mastering weaknesses in diagnostic interpretation.

548 Improving Resident Performance of Fine Needle Aspirations with a Step-Wise Assessment Tool.

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Background: Most residents learn the technique of performing a fine needle aspiration (FNA) in a non-standardized way. They are rarely exposed to the technique until they rotate on to the cytology service and their exposure is typically restricted to the cases which are aspirated during their tenure on the service. Furthermore, the instruction on FNA technique they receive can vary greatly depending on different faculty members they work with. In this study, we developed a step-wise checklist as a teaching tool to standardize and improve resident performed FNAs.

Design: We developed and pilot tested a step-wise checklist to assess competency in FNA technique. Residents who had minimal or no experience in the performance of FNA participated in a hands-on practical "wet-lab" in which they practiced FNAs on mock specimens. After a faculty demonstration of the technique, residents performed FNAs under direct observation of instructors. Each step of the procedure was graded either as performed well, performed poorly, or not performed. Different practical labs were organized with increasing levels of difficulty and complexity including: basic aspiration techniques, targeting palpable lesions of varying sizes, and aspiration of cystic lesions. The results of the checklist and areas for improvement were reviewed with the resident, with or without video footage of their performance.

Results: Residents from all levels of training showed improvement in their performance of FNAs after reviewing and practicing their technique step-by-step in a low pressure setting. Specific areas that were frequently performed poorly by residents included expressing aspirated material onto slides and creating optimally smeared slides.

Conclusions: By using a step-wise checklist, the residents received more standardized instruction regarding the proper technique of FNA. The residents became familiar with the steps and technique of the procedure and gained competency with the mechanical

skills required for FNA. We feel this will lead to greater resident confidence, a better educational experience, and a reduction in the number of unsatisfactory or borderline samples when these residents perform FNAs on live patients in a clinical setting.

549 A "Virtual Slide Box" Using Whole Slide Imaging for Reproductive Pathology Education for Medical Students.

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Background: Whole slide imaging (WSI) is starting to become utilized in diagnostic pathology and in pathology resident education. Given that the traditional glass slide sets provided to medical students can break and fade over time, in addition to being lost in storage, we investigated the feasibility and educational value of using WSI for teaching sets for medical student education in a reproductive pathology course.

Design: A teaching set of 39 deidentified glass slides used for medical student education in reproductive pathology at the University of Pittsburgh School of Medicine, were used for WSI using the Aperio ScanScope CS scanner, and then uploaded into a Google based viewer on the medical school's academic website, Navigator LMS. A web-based digitized "virtual slide box" was created and implemented at our institution using Microsoft Internet Information Services as the web server and Python as the programming language. In addition, annotated answer keys were provided. During laboratory sessions for viewing the slides, students were given the option to use microscopes with glass slides, or laptops with projection screens to view the virtual slides. The number of hits that the "virtual slide box" received during the course was recorded using the traffic report function and compared that to the number of microscopes used.

Results: The web site is available at: http://navigator.medschool.pitt.edu/34_viewPage.asp?pageID=302498504. This link is part of the medical school's academic website, which requires a log in for secure access. The students can see the "virtual slide box" with the other course materials, and view them from any site. In comparison to the glass slides, the virtual slides were used more commonly by the students with a total of 86 hits on the "virtual slide box", compared to about 5 or fewer microscopes being used during the laboratory sessions. Students worked in small groups looking at the virtual slides together using the laptops and projection screens. Virtual slides were also used during some lectures. WSI was praised in the post-course review by the students.

Conclusions: The implementation of WSI in medical student teaching was extremely successful in that it was utilized more than glass slides, and received very positive reviews. Virtual slide technology can also be helpful for large group teaching during lecture and in small group education. We hope to expand the "virtual slide box" feature in the future with expanded functions, and in more courses.

550 Virtual Microscopy as a Surrogate for Glass Slides in Neuroblastoma Pathology Central Review, Educational Training, and Research.

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Background: Neuroblastom(NBL) is the most common extra-cranial solid malignancy of childhood with 650 cases annually enrolled in Children's Oncology Group treatment protocols. Each tumor is centrally reviewed and diagnosed according to the International Neuroblastoma Pathology Classification, as histology is essential to patient risk and treatment protocol stratification. The INPC involves complex pattern recognition and consistent, accurate implementation accomplished only after significant training and case-based experience. Since pediatric pathologists are few in number with many institutional responsibilities,virtual microscopy practices may allow for expedited case review, e-training, image analysis, and establishment of a digital teaching set. Our initial goal was to compare the efficacy of a digital pathology system for the histopathologic classification of neuroblastic tumors compared to the standard method, whilst training young investigators.

Design: After a multidisciplinary team was assembled, slides from each NBL patient enrolled on a COG study were scanned at 40x magnification. With viewing software and an internet connection, images were reviewed at near real time. The VIPER software allows pathologists to review digital images and pathology reports, complete online review forms, and submit review results electronically to the Biopathology Center. VIPER can provide a "slide conference" environment in which multiple pathologists can simulataneously view fields of interest, annotate salient features, and discuss findings.

Results: Following one in-person training session and four digital slide conferences led by Dr. Shimada, inter-pathologist agreement was excellent, with minor discrepancies, related to the mitotic-karyorrhectic index. Through discussions among the pathologists, this discrepancy was likely due to nuclear staining characteristics.

Conclusions: Central review of neuroblastic tumors using digital pathology is accurate, more efficient, and cheaper than traditional review due to elimination of shipping and travel expenses. We are proceeding to a multi-phase project directly comparing the diagnostic accuracy of glass and virtual slides. Side-by-side comparison of glass and digital images may improve inter-observer variability of MKI. Furthermore, virtual microscopy may represent the future of pathology central review for all tumors enrolled in investigational studies.

551 Improving Quality in Graduate Pathology Education at University of Miami – Implementation of a One Year Curriculum.

CE Parra-Herran, CK Petito. U Miami Jackson Memorial Hosp, FL.

Background: Participation in conferences and didactic sessions with faculty and guest speakers is a valuable component of resident training in pathology. In order to be successful, the organization of these activities should be done through strategic thinking and planning, considering the strengths and diversity of the trainers and the constantly changing needs of the trainees.

Design: Academic activities in the academic year 2009-10 were planned in a monthly basis. The main concerns of faculty and residents during that period were the lack of continuity in the topics presented and systems-based learning, frequent cancellations or rescheduling of sessions and small number of interactive anatomic pathology (AP) slide sessions. Accordingly, we developed a one year anatomic and clinical pathology systems-based curriculum before the start of the academic year. We compared the number and type of learning sessions between the 2009-10 and 2010-11 periods, as well as attendance and cancellation rate for the first two months.

Results: Changes in the number and type of academic sessions between the periods 2009-10 and 2010-11 are shown in Table 1.

COMPARISON CURRICULUM 2009-10 AND 2010-11. DEPARTMENT OF PATHOLOGY UNIVERSITY OF MAIMI

		2009-10		2010-11	
		NUMBER	%	NUMBER	%
No. ACTIVITIES	AP	64	58	90	45
	CP	46	42	110	55
	TOTAL	110		200	
AP SESSIONS	LECTURE	43	67	42	47
	SLIDE SESSIONS	21	33	48	53
	TOTAL	64		90	
CP SESSIONS	LECTURES	46	100	96	87
	CP ROUNDS	0	0	14	13
	TOTAL	46		110	

The number of academic sessions increased in 81.8%. The number of CP activities increased as a result of adding formal CP rounds and lab management sessions. Furthermore, the number of didactic sessions with slides and case review increased for both AP and CP. Resident attendance during the first two months improved from 78% in 2009 to 90% in 2010. During this period, cancellation rate by faculty went from 20% in 2009 to 9.5% in 2010.

Conclusions: A one year systems-based curriculum is a model of a well structured, more effective way to deliver high quality education to pathology residents while, at the same time, facilitating faculty involvement. Giving structure and diversity promotes attendance and participation and eventually enhances both teaching and learning experiences.

552 Development of an Online Training Module for Resident Education in Surgical Pathology Billing and Coding.

MS Ryan, ML Smith, FG La Rosa, SS Raab. University of Colorado, Aurora.

Background: In many pathology training programs, residents have little to no formal didactic education and do not actively participate in billing and coding of surgical pathology reports in daily practice. To fill this educational void, we developed and tested an online training educational module in CPT® billing and coding.

Design: We designed a three-part introduction to billing and coding for residents. First, we created an online pre-test module, including 10 surgical pathology reports that the residents coded. Secondly, we developed a billing and coding Powerpoint presentation as part of a weekly didactic lecture series, which was then also uploaded to the online module for later reference. Third, the residents took an online post-test module consisting of 35 surgical pathology reports which had to be appropriately coded and billed. On both the pre- and post-test there were two questions regarding the cost of surgical pathology codes and questions about each resident's self-assessment of their level of knowledge and the helpfulness of the module.

Results: A total of 19 residents (PGY1=8, PGY2=3, PGY3=4; PGY4=2, PGY5=2) participated in the online pre-test. Out of a total of 33 possible billing codes, the residents missed from 9 to 32 CPT® codes (mean 14.5, median 12). Of the residents who completed the first 10 cases of the post-test module, 2 to 17 codes were missed (mean 7.6, median 7), with correctly-coded improvements ranging from 5 to 23. The residents who completed all 35 post-test reports had a mean pre-test score of 46.1% correct (range 3-72.7%) and a mean post-test score of 74.7% (range 61.3-93%) correct with improvments ranging from 8.3 to 60.6%. On the pre-test every resident selected the wrong amount billed for the codes 88305 and 88342; all selected choices were less than the amount actually billed. On the post-test, one of the questions regarding the amount billed was unanimously answered correctly and 42% of the residents answered the second question about the amount billed correctly. All of the residents felt that the training module greatly helped to clarify the basics of billing and improved their self-assessed level of understanding of the topic. Unanimously, all participants answered that residents should have more responsibility in coding.

Conclusions: An online module with surgical pathology reports and an associated lecture are effective in improving residents' understanding of CPT® billing and coding and providing them with a stronger grasp of the financial aspects of the business of pathology.

553 Assessment Tools of Baseline and Expert Levels of Pathologist and Trainee Competence in Diagnostic Breast Cytology.

SB Sams, ML Smith, P Vielh, C Marshall, K Councilman, HN Mack, SS Raab. University of Colorado, Aurora; Institut Gustave Roussy, Villejuif, France.

Background: The establishment of baseline and expert levels of competency in diagnostic interpretation skills has an important bearing on the successful completion of training, pathology boards, day-to-day practice, medical-legal affairs, and hospital credentialing. We developed a standardized and validated method of performance assessment in diagnostic breast cytology.

Design: We developed, validated, and pilot tested glass slide and on-line tools for competency assessment in breast cytology. The tools identify specific weaknesses in individual and group performance related to criteria assessment, cognitive thinking,

and evaluation of flawed specimens. The tools may be implemented through off-site preliminary assessment or in depth testing using on-site observations of skills and cognitive processes. Depending on the type of assessment, the tools contain between 10 and 50 cases representing cases of differing complexity, quality, and difficulty. We developed the modules by selecting exemplar cases from a pool of over 3,000 cases and validating expertise using blinded concordance of two internationally expert cytopathologists and clinical-histopathologic follow-up. We established the baseline performance of 10 pathologists (3 practicing pathologists and 7 trainees) on expert-based modules and performed root cause analysis to determine error source and areas of improvement for each pathologist. Performance modules for expert, competent, and novice practices were developed.

Results: In using expert-based performance modules, baseline scores (20%-70%) correlated with level of training. Practicing board-certified cytopathologists showed baseline levels of competency (50%), and no pathologist scored as an expert (>90%). Root cause analysis showed that diagnostic errors for practicing pathologists were more common in poor quality specimens and for specific lesion types (e.g., lobular carcinoma). Specific areas of weakness were identified for specific practicing pathologists (e.g., tubular carcinoma or fat necrosis). Pathology resident weaknesses correlated with year of training and generally were related to cognitive failures in synthesis rather than assessment of criteria.

Conclusions: We conclude that our competency assessment program for breast cytology is able to stratify pathologists and trainees by level of performance. We are able to identify errors and their causes for improvement purposes.

554 Systematic Prediagnostic Review of Endoscopy Reports Significantly Enhances Resident Performance during Slide Preview.

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Background: Gastric biopsy specimens are frequently diagnostically challenging, particularly for pathologists-in-training. However, an advantage of GI pathology is the routine availability of a detailed gross impression provided by the concomitant endoscopy report. We hypothesized that systematic combined review of the endoscopy report together with the glass slide will improve diagnostic accuracy of residents.

Design: Classic biopsy cases of gastric pathology were selected, including normal, gastritis, polyps, and neoplasia. 50% of our resident population diagnosed this study set, once without any knowledge of the endoscopic findings and then again at least 2 weeks later together with the full text of the endoscopic reports. The accuracy of each resident's diagnoses was compared with the staff diagnosis and scored as acceptable, partially acceptable or unacceptable. The unacceptable category was in particular used when either the biopsy was completely negative and the resident had assigned any pathology or the biopsy showed pathology but was called within normal limits by the resident.

Results: Overall diagnostic accuracy was excellent with 80-85% of diagnoses falling into acceptable or partially acceptable categories, whether or not an endoscopy report was available. Importantly however, when considering the critical distinction between resident diagnoses that were unacceptable after preview and those that were at least partially acceptable, 60% of residents showed improvement after having read the endoscopy report and thus did not make a critical mistake. Resident performance improved most significantly with cases that exhibited subtle pathologic changes that would have been missed, but were diagnosed correctly when an endoscopy report describing a mild abnormality was available. >90% of residents enjoyed the preview experience and felt more confident when an endoscopy report was available compared to a glass slide with limited or no clinical information.

Conclusions: GI pathology demands that the pathologist be able to incorporate all endoscopic and other clinical findings related to the patient's biopsy to render optimal diagnoses. Routine incorporation of endoscopy reports into pathology resident education and independent slide preview enhanced diagnostic accuracy and boosted individual confidence for making diagnoses. Our results support the notion that residency education will be improved by routinely making endoscopy reports available during preview of GI biopsies in addition to the standard limited information provided on the requisition sheets.

555 Development of a Comprehensive Surgical Pathology Website for Teaching and Self-Assessment at the Resident and Clinical Practice Level.

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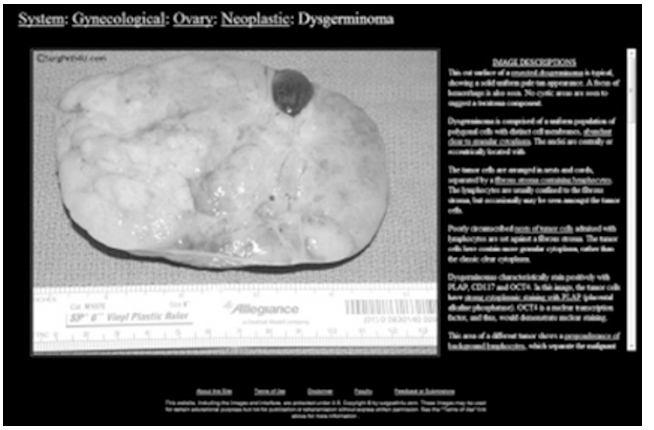
Background: Mastery of surgical pathology is daunting for pathology trainees and clinicians in other specialties. Traditional learning methods rely on cumbersome and expensive textbooks as well as glass slides with faculty teaching, which is not always available. Review of the currently available on-line pathology resources revealed no comprehensive and well designed site tailored to the resident level and above. We built an on-line learning tool at SurgPath4U.com to showcase pathology images and information in an intuitive format. We hypothesized that learning pathology using this website provides more efficient learning compared to currently available on-line sources and textbooks.

Design: 14 Ob/Gyn residents at UNM were randomly divided into two groups (traditional learning versus our website) within their year of training. All were given a 32 question pre-test followed by a list of study topics. The traditional group then studied using textbooks and the internet, without access to SurgPath4U.com. Our website group exclusively used SurgPath4U.com to view cases.



A post-test of identical questions to the pre-test was given after two hours. To eliminate bias, all test questions and images were generated by a pathologist not familiar with the content of SurgPath4U.com.

Results: The overall pre-test score 36.4%, and post-test score was 50.9%. When separated by the learning method, the traditional group scored 37.5% in the pre-test and 45.1% in the post-test, with an improvement of 7.6%. The website group scored 35.4% in the pre-test and 56.7% in the post-test, with an improvement of 21.3%. The increase in post-test scores in the website learning group was significant (p=0.027).

Conclusions: To facilitate pathology education in all disciplines of medicine, we developed SurgPath4U.com, an user-friendly pathology website. Analysis of pre- and post-test of Ob/Gyn residents comparing traditional learning methods versus web-based learning demonstrated that residents using SurgPath4U.com learned more effectively. We conclude that SurgPath4U.com is a dynamic and innovative way to learn pathology.

Endocrine

556 Biomarker Expression in Pancreatic Endocrine Tumors.

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Background: Pancreatic endocrine tumors (PET) represent 1-2% of all pancreatic neoplasms. Complete surgical resection is the most successful treatment for patients with PETs; however, some patients present with advanced disease for which few treatment options exist. Somatostatin therapy can ameliorate clinical symptoms and perhaps induce tumor growth stabilization, but PETs have poor or short-lived rates of response to conventional chemotherapeutic agents [Gastroenterology 2008, 135:1469] and novel therapeutic strategies are needed.

Design: We assessed 67 PETs from 44 patients for immunohistochemical expression of biomarkers targeted by novel therapeutic drugs currently under development in other forms of cancer. A tissue microarray of 67 formalin-fixed, paraffin-embedded tissues with each tissue represented as a triplicate of 0.6mm cores were evaluated. Primary neoplasms from 41 of these patients were included in the data. The markers include insulin-like growth factor 1 receptor (IGF1R), transforming growth factor-ß receptor 1 (TGFBR1), heat shock protein 90 (Hsp90), somatostatin receptor subtypes 2A and 5 (SSTR2A and SSTR5), platelet-derived growth factor alpha (PDGFA), *O*6-methylguanine DNA methyltransferase (MGMT), epidermal growth factor receptor (EGFR), vascular endothelial growth factor receptor 1 (VEGFR1), and mammalian target of rapamycin (mTOR).

Results: All of the assessable PETs stained positively for IGF1R, TGFBR1, Hsp90, SSTR5, SSTR2A, and PDGFRA, with 98% positivity with EGFR, VEGFR1, and mTOR. 24% of the PETs were negative for MGMT (predictive of a favorable response to temozolomide therapy [Clin Cancer Res 2009:15:338]), and 52% were weakly staining for MGMT. Proteins for which the largest number of PETs exhibited the strongest staining level (score of 3) were VEGFR1 (80% of PETS), and TGFBR1 (69%), PDGFRA (65%), SSTR2A (55%), SSTR5 (55%), and IGF1R (47%).

Conclusions: High immunohistochemical expression of VEGFR1, TGFBR1, PDGFRA, and IGFR1 is encouraging of additional research into the role played by these proteins in PET growth. Lack of MGMT immunohistochemical expression in some PETs suggests that temozolomide might be a useful therapeutic agent.

557 Immunohistochemical Staining of Thyroidectomy Specimens for PTEN Can Aid in the Identification of Patients with Cowden Syndrome.

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Background: Cowden syndrome (CS) is an autosomal dominant disorder with germline mutation of *PTEN* characterized by the development of multiple hamartomas and carcinomas of the thyroid, breast and uterus. Recognition of CS is important so that cancer screening and genetic counseling can be initiated. Pathologic findings in thyroidectomy specimens suggestive but not specific for CS include multiple adenomatous nodules and follicular adenomas, with or without follicular carcinoma or papillary thyroid carcinoma. The aim of our study was to determine if immunohistochemical staining for PTEN could aid in the identification of CS in patients with these pathologic findings.

Design: We studied 24 thyroidectomy specimens from patients with a known history of CS or with pathologic findings that raised the possibility of CS. Immunohistochemistry for PTEN was performed on all cases (rabbit monoclonal antibody, clone 138G6,