acceptance, particularly in laboratories for clinical diagnosis. Here we report the assessment of SOX10 expression of melanomas, carcinomas, mesenchymal neoplasms, nerve tumors, and mesotheliomas using rabbit polyclonal anti-SOX10 antibody.

Design: In this study, we evaluated this rabbit polyclonal anti-SOX10 for benign tissue cross-reactivity, neoplastic expression, sensitivity and specificity on whole tissue sections and tissue microarray by routine immunohistochemistry.

Results: The results are summarized in the table 1.

Table 1

Neoplasm	Positive cases/Total cases	Sensitivity (%)
Melanoma, conventional	37/39	95%
Melanoma, desmoplastic	11/11	100%
Melanoma, spindle cell (metastasis to lymph node)	3/3	100%
Schwannoma	8/8	100%
Malignant peripheral nerve sheath tumor	3/4	75%
Granular cell tumor	5/5	100%
Neurofibroma	20/20	100%
Carcinomas	0/153	0%
Lymphomas	0/21	0%
Mesenchymal tumors	0/16	0%
Mesothelioma	0/5	0%

Thirty seven of 39 conventional melanoma cases showed strong and diffuse nuclear staining with this antibody. All eleven desmoplastic melanoma cases and three spindle cell melanomas in lymph nodes were all positive for anti-SOX10. Most of malignant peripheral nerve sheath tumors (3/4) were strongly reactive for the antibody. All schwannoma, neurofibroma, and granular cell tumor were stained with the anti-SOX10. None of the 153 cases of carcinomas were positive, in which there were 47 breast ductal carcinomas and 43 colorectal carcinomas. No other carcinomas of GI, respiratory, genitourinary tract primaries were found positive for anti-SOX10. However, 7 cases of colorectal carcinoma showed weak cytoplasmic staining. All lymphomas, mesenchymal tumors, and mesotheliomas were negative. In normal benign tissue, the antibody stained benign melanocytes, nerve sheath cells, and myoepithelial cells in sweat gland, mammary duct and salivary gland. Prostate basal cells are not stained.

Conclusions: Rabbit polyclonal anti-SOX10 antibody is a reliable, ready-to-use, sensitive, and specific IHC biomarker for melanoma, especially desmoplastic and spindle cell melanoma, whether it be, in situ, invasive or metastatic. We have found it also useful in differentiating spindle cell neoplasms/peripheral nerve sheath tumor from other mesenchymal neoplasm and carcinoma.

515   Immunohistochemical Expression of Hormone Receptors in Melanoma of Pregnant Women, Non-Pregnant Women and Men: A Comparison Study
JH Zhou, KB Kim, P Fox, JN Myers, VG Prieto. University of Texas MD Anderson Cancer Center, Houston, TX.

Background: In melanoma, the significant survival advantage of female gender and reports of both accelerated progression and improved prognosis in pregnancy have lead to studies of the effect of hormones and hormone receptors, but the results have been inconclusive. We examined the immunohistochemical expression of Estrogen Receptor α, Estrogen Receptor β and Androgen Receptor in melanoma of pregnant women, non-pregnant women and men.

Design: Archival paraffin embedded melanoma tissue from 18 pregnant women, 18 non-pregnant women and 18 men at MD Anderson Cancer Center (MDACC) from 1996 to 2011 was used. The non-pregnant women and men patients were stage-matched and age controlled to the pregnant patients. All patients were 20–45 years old at the time of diagnosis. Follow-up was from the initial date of diagnosis to death or the last follow up at MDACC until the end of July 2012. The immunohistochemical study was performed using the Bond Max automated system of Leica Microsystems (Buffalo Grove, IL) according to the manufacture's protocol. The exact McNemar's test was used for the analysis of ERβ expression between the pregnant group and the control groups. Fisher's exact and Wilcoxon rank sum tests were used to assess the association between ERβ expression and Breslow thickness, primary tumor site, primary tumor or metastasis, and the stage of disease.

Results: There were 22 cases expressing ERβ: 10 (56%) of pregnant women, 7 (39%) of non-pregnant women, and 5 (29%) of men. The percentage of tumor cells positive ranged from 30% to more than 90%. Only 2 cases expressed ERα, one pregnant woman and one man. Both patients had acral lentiginous type melanoma in the toe. None of the cases expressed AR. Statistical analysis showed a trend that ERβ was more likely to be expressed in pregnant patients than in the male patients (p=0.073). There was no significant difference between pregnant and non-pregnant women (p=0.539). There was no association between ERβ expression and Breslow thickness, primary tumor site, primary tumor or metastasis, and the stage of disease.

Conclusions: Marginal evidence suggests that ERβ is more frequently expressed in pregnant patients than in male patients. The small sample size may have limited the statistical power of the study. A large-scale study is needed to look into the expression of ERβ in melanoma and its association with survival.

Education

516   Intraoperative Consultation Rounds: A Pathologist Educational and Quality Assurance Initiative
J Babwah, S Raphael, C Rowsell. Sunnybrook Health Sciences Centre, University of Toronto, Toronto, ON, Canada.

Background: Intradepartmental rounds are an important means of pathologist education, quality assurance and promoting professional interaction. In a subspecialized department, traditional models where pathologists share difficult or interesting cases may

be of less utility and interest than in non-subspecialized departments. The Department of Anatomic Pathology at Sunnybrook Health Sciences Centre is subspecialized, but the area where all pathologists practices overlap is intraoperative consultation (IOC). We therefore decided to abandon our traditional interesting case rounds in favour of a model which focussed on IOC.

Design: IOC rounds commenced in September 2011 after a planning process involving the departmental executive committee and accreditation from the Royal College of Physicians and Surgeons of Canada. Rounds occurred weekly, and were limited to staff pathologists. Cases which had had IOC performed were selected by the Director of Surgical Pathology and slides were distributed 2-3 days in advance. The pathologist who performed IOC functioned as the presenter of the case, while the pathologist who signed out the final report was the discussant. Presentations focussed on various aspects of IOC, including history, gross findings, microscopic interpretation, and communication with surgeons.

Results: On average, 11 pathologists attended the rounds weekly. A range of 2 to 6 cases were presented per session. Evaluation forms were distributed at each rounds; 93% of responses were that the majority of cases were relevant to practice, and 100% indicated that the format was conducive to open discussion. Comments were positive, and highlighted openness and educational value. In a one year evaluation, all respondents indicated that the rounds provided new ideas for practice and enhanced their knowledge. 64% identified a practice issue which needed improvement. 82% indicated gynecologic pathology as the area where they would most likely ask for assistance of a colleague in IOC.

Conclusions: IOC rounds provided a non-threatening environment for discussion of challenges in IOC. Strong interest was maintained throughout the first year as evidenced by engagement and attendance. These rounds served as a springboard for developing policies improving intraoperative consultation practice and confronting systemic difficulties in providing this service in our hospital. We plan to measure effects on diagnostic discrepancy in IOC in the future to see the effects our efforts have had on patient outcome.

517   Team-Based Learning in Pathology Residency Training
TC Brandler, J Laser, AK Williamson, J Louie, MJ Esposito. Hofstra-North Shore LIJ School of Medicine, Lake Success, NY.

Background: Team-Based Learning (TBL) has been integrated into the undergraduate and medical education settings in many institutions to date. However, TBL has not been widely introduced into graduate medical education. Our study aimed to measure the effect of TBL on promoting learning and teamwork in the setting of pathology residency training.

Design: As part of the daily pathology residency training didactic series, four 2-hour TBL sessions were held on different days and facilitated by different attending pathologists. Topics included molecular diagnostics in lung cancer, interstitial lung disease, death certification and delayed hemolytic transfusion reactions. Individual and group readiness assurance tests were performed during each TBL session and scores were compared using wilcoxon matched-pairs signed ranks tests. After three of the four TBL sessions 11-16 residents and rotating medical students completed an 18 item validated and reliable team performance survey which measured the quality of team interactions on a scale of 0 (none of the time) to 6 (all of the time). Mean and standard deviation were calculated for each item.

Results: Scores on the individual versus group readiness assurance tests were found to be significantly different with P values of 0.001, <0.001, 0.003, and <0.001 for the first through fourth TBL sessions, respectively. The team performance survey received mean scores ranging from 5.3 ± 1.1 to 6.0 ± 0.0.

Conclusions: The use of TBL promotes teamwork and learning in a pathology residency setting. Residents scored higher on the readiness assurance tests when working in teams showing the power of team learning and achievement. There was a high quality of team interaction as shown by the high scores on the team performance survey. Additionally, the ACGME competencies of professionalism and interpersonal and communication skills are further enhanced by incorporating TBL into pathology residency training.

518   Knowledge Retention and Learning Benefits from Utilization of a Web-Based Learning Module Methodology for Pathology Training
BM Chung, JH James, JV Groth, J Lee, S Sontag, G Chejfec, EL Wiley. University of Illinois Hospital & Health Sciences System, Chicago, IL; Edward Hines, Jr. Veterans Association Hospital, Hines, IL.

Background: Recent trends in pathology education of medical students and residents has begun to progressively incorporate both passive and active learning digital technologies such as internet-based case studies, learning modules, and virtual microscopy. This trend is likely to continue with improvements in the capabilities of these technologies, the introduction of telepathology as a viable and more accepted diagnostic practice in clinical care, and greater-than-ever exposure with these technologies during post-graduate training. Pilot data from a previous study confirmed the utility of employing a web-based learning module format in resident training. However, whether repeated use of the same learning module by trainees confers additional expertise has not been studied.

Design: 50 representative examples of normal esophageal epithelium, dysplasia (indefinite, low grade, or high grade), and carcinoma were selected by expert pathologists for inclusion in a self-directed, web-based esophageal dysplasia learning module. Residents accessed the training powerpoint and pre- and post-tests, each containing 25 snapshot images, on the Blackboard learning environment in 2011 and 2012. Average percent correct answers on pre- and post-tests from both years and p-values via student's t-test were calculated and analyzed.

Results: This study found a significant increase in diagnostic expertise, defined as average percent correct answers, in first time users (pre-test: 55%, post-test: 75%; p: 5E-4) compared to repeat users (pre-test: 86%, post-test: 82%; p: 0.211) of this module.

Repeat module users showed good memory retention and a significant increase in expertise from previous year's pre-test results (2011: 60%, 2012: 86%; p: 3E-6) but did not demonstrate added benefit from repeat use.

Conclusions: Results from this study would suggest that self-directed web-based learning modules are a valid and interactive methodology for pathology training. Our data supports that this method of training can result in retention of knowledge over time. However, we found that added benefit from repeat use of the same module is minimal or absent.

519   A Reusable iPad Application Framework for Anatomic Pathology Education
TC Cornish, AD Tatsas, B Kim, C Sandone, BJ Norman, RH Hruban. Johns Hopkins University School of Medicine, Baltimore, MD.
Background: Tablet devices such as the Apple iPad are changing the way we interact with media. Tablets feature high resolution screens, intuitive multitouch interfaces, and "app stores" for content distribution. These qualities make them ideal for delivering image-heavy content with richly-interactive features. To demonstrate the utility of tablets for teaching pathology, we created a reusable application framework for educational iPad "apps."
Design: The app framework includes four modules: an image atlas, an image-based quiz, flashcards, and an interactive teaching algorithm. The modules share a collection of images and a relational database containing image and quiz data. Additional features such as embedded video tutorials and medical illustrations are also used to enhance the educational value. The teaching algorithm is stored as XML in Property List files. The framework was designed for ease of reuse, and a new app can be created by recompiling the templated code base with a new set of image and data resources. The app framework was written in Objective-C using the Xcode4 IDE and iOS SDK v. 6.0. Data was authored using Microsoft Access 2010 and exported as a SQLite3 database.
Results: To date, two apps have been created using this framework. The first app, *The Johns Hopkins Atlas of Pancreatic Pathology,* contains 1479 images, covers 115 diagnostic entities, and provides 166 self-study questions. The app has been downloaded over 11,000 times in over 33 countries. The second app, *The Johns Hopkins Atlas of Pancreatic Cytopathology*, contains 703 images, covers 25 diagnostic entities, and provides 95 self-study questions. This app will be released in October 2012. Both apps are available in the iTunes store at no cost.
Conclusions: We have designed a reusable app framework and used it to produce the first comprehensive pathology atlases for the Apple iPad. We have demonstrated that tablet devices are uniquely suited for the delivery of educational pathology materials and can provide novel interactive features not seen in traditional print media.
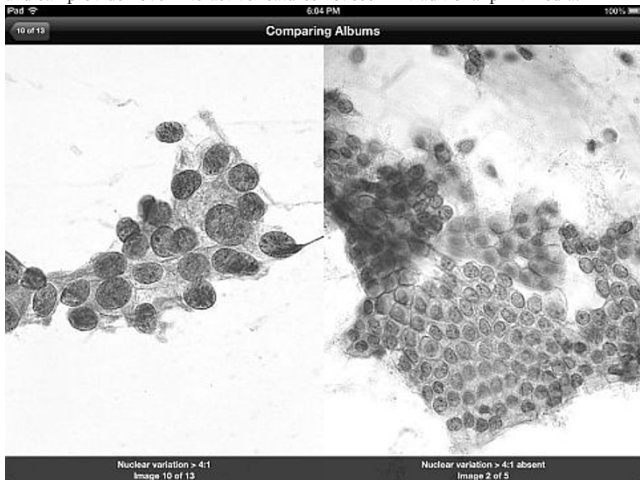
520   Improved Pathology Resident Performance in Critical Value Communication Using Simulation Based Communication Training
S Dintzis, S Mehri, J Struijk, D Luff, M Rendi, S Raab. University of Washington Medical Center, Seattle, WA.
Background: JCAHO reports that ineffective communication is a root cause for nearly 66 percent of all sentinel events reported; however, pathology residents receive little to no training in communication skills. We developed communication modules using simulated clinician-pathologist interactions, interactive group training in communication strategies and tools and checklists of 15-20 elements for resident performance evaluation.
Design: Trained simulated clinicians communicated with 21 residents through phone calls using scripted scenarios involving critical value handoffs. Scenarios were designed to include varying communication skills ranging from basic diagnosis, conflict resolution and error disclosure. Residents attended interactive didactic sessions based on TeamSTEPPS, a nationally implemented evidence-based strategy used for improving communication and teamwork skills among health care professionals. Audio recordings of their interactions with simulated clinicians were provided to them to enhance performance feedback.
Results: Performance on individual checklist basic elements such as patient, self and clinician identification and check-backs improved from an average score of 77% to 94% after simulation training. In addition, resident performance demonstrated improvement on more challenging checklist elements such as problem solving, clinician needs assessment and conflict resolution, improving from an average score of 76% to

87% after training. Overall baseline resident performance on all checklist elements improved from an average score of 75% to 93% after course completion. Residents subjectively reported increased confidence in their ability to communicate in difficult situations post training and reported using TeamSTEPPS strategies in actual critical value communications.
Conclusions: Simulated resident-clinician communication scenarios provide residents with real time performance evaluation and improve resident communication skills as measured by both objective and subjective criteria. Addition of formal communication training in residency would benefit training programs and decrease the incidence of less than optimal hand-offs.

521   A Retrospective Analysis of Consultation Activities in Clinical Pathology: Implications for Transformation and Resident Training
CA Garcia, RL Schmidt, J Panlener, BR Jackson, ER Ashwood, JW Hussong. University of Utah, Salt Lake City, UT.
Background: The future role of pathologists has been the focus of increasing attention and there is a developing consensus on the need for pathologists to develop, expand and solidify their roles as consultants and active contributors to the patient's health care delivery team. Unfortunately, the consultative role of pathologists is not well documented. A better understanding of pathologists' roles and activities would provide an evidence base for discussions of change and for the design of residency training.
Design: We retrospectively reviewed our database of clinical consultation requests received by ARUP Laboratories for a one year period (9/2011-9/2012). 500 randomly selected cases were reviewed by two authors and classified by test performing lab and by reason for the consultation request (test selection, interpretation, performance characteristics, other).
Results: 3820 Consultation requests were received over the one year period. Residents handled 56% of these calls. The majority of requests were classified as chemistry (24.8%), microbiology (29.2%) and immunology (12.7%) as shown in Table 1. The major consultation topics were test interpretation (52%), selection (31%), and performance characteristics (21%), as shown in Table 2.

Distribution of Consultation Requests by Test Category

Test Category	Percent
Chemistry	24.8
Coagulation	1.3
Endocrinology	7.8
Genetics/Molecular	6.9
Hematopathology	0.9
Immunology	12.7
Microbiology	29.2
Other	6.4
Toxicology	10.0

Distribution of Cases by Consultation Topic

Consultation Issue		Percent of Cases*	Percent of Category**
Test Selection		31.0	
	Selection of proper tests		39.5
	Sequencing and or timing of tests		16.0
	Recommendations concerning follow-up testing		35.0
Test Interpretation		52.0	
	Interpretation of results		87.0
	Analysis of unexpected results		10.1
Test Performance		20.6	
	Analysis and communication of reference ranges		21.8
	Influences of analytic and biologic factors on results		31.8
	Test evaluation (performance characteristics, methods, workload, cost)		44.5
Other		11.6	
	Specimen handling		53.2
	Report Issues		40.3

*Some cases involved multiple issues and therefore the percent of total cases is greater than 100.
**Only major issues listed and therefore sum is less than 100.

Conclusions: Clinical consultation activities at our institution provide trainees with a broad and balanced exposure across a range of disciplines and consultation issues. As the frequency topics and issues change over time, documentation of these changes will allow for targeted and timely revision of trainee education.

522   Confidence, Knowledge, and Skills at the Beginning of Residency: A Survey of Pathology Residents
CM Hsieh, NJ Nolan. George Washington University, Washington, DC.
Background: In medical school, pathology is not a core clerkship. Elective experiences can be highly variable, which may lead new residents to feel underprepared for pathology residency. To assess this, we created a survey to document the pathology experiences residents had prior to starting pathology residency, and to determine how confident they were with various skills and knowledge.
Design: We designed an online survey utilizing SurveyMonkey software and e-mailed the link to all pathology residency program directors in the United States. We requested that interested program directors forward the survey link to their residents. Survey participation was anonymous and voluntary. Data was obtained on pathology electives, grossing experience, and frozen section experience. Likert scale questions assessed confidence level in knowledge and skills. For analysis, we considered an answer of very or extremely to be "confident" and an answer of slightly or not at all to be "not confident".
Results: 170 pathology residents responded (32.5% first year, 24.8% second year, 22.9% third year, and 19.7% fourth year). Prior to starting residency, 15.7% were confident in their surgical pathology (SP) knowledge. 118 reported doing a SP elective in medical school, 21 did a non-specific Anatomic Pathology elective, which may have included time on SP, and 31 did not do either. Of the people who did a SP elective of at least

four weeks (91), less than four weeks (27), or did not do a specific rotation (52), 21.1%, 7.6%, and 9.4% felt confident in their SP knowledge, and 64.4%, 37%, and 53.5% felt confident in their understanding of resident duties on SP. In regards to grossing small cases, 8.6% of people who never grossed, 9.8% who only observed, 36.2% who only grossed small cases, and 84% who grossed both small and large cases felt confident, while 8.7%, 1.7%, 2.1%, and 44% felt confident grossing large cases. Of those with no experience, who only observed, and who actually cut frozen sections, 11.4%, 10.2%, and 58.6% felt confident they could cut frozen sections.

Conclusions: Prior to beginning residency, most people are not confident in their SP knowledge and skill set, such as grossing and cutting frozen sections. The length of a SP elective appears to have a beneficial effect on confidence in SP knowledge when it is at least four weeks long. The effect of the elective length on the understanding of resident duties on the SP service is less clear. For improving confidence in specific skills, hands-on experience is beneficial, but observation alone is similar to having no experience at all.

523 Facilitating Multi-Disciplinary Expertise on Esophageal Dysplasia Via a Sharable Content Object Reference Model (SCORM) Course

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Background: Barrett's esophagus is complex, with well documented inter-observer variability in diagnosis among clinicians and pathologists. While previous studies have focused on intra-disciplinary diagnostic accuracy, patient care is demonstrably improved by recognition of inter-disciplinary challenges and advances. This pilot study proposes that an e-learning course, using SCORM, can serve an significant role in self-directed learning of multi-disciplinary approaches to esophageal dysplasia.

Design: The SCORM e-learning course utilized three modules, each with a distinct perspective: Gastroenterology, Pathology, and Case Based Review. Designed in Articulate Storyline with 180 interactive elements and 80 endoscopic, microscopic, and gross images, the course was brief, visually dynamic, and easily accessible. Each module had 6-7 questions which controlled course progression. The course was hosted online (http://esoph.articulate-online.com/6236556581) and on Blackboard, with data collected on course duration, question response, and interactions with learning material.
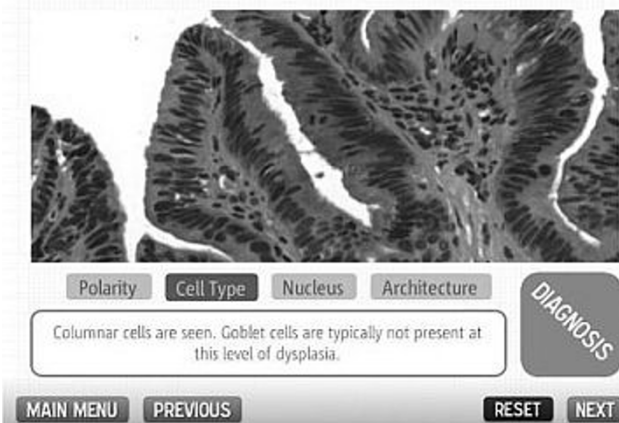
Results: The course was taken by pathology attendings (26), fellows (2), and residents (17), as well as medical students (14), an oncologist, and a Physician Assistant (PA). Completion of the full course correlated with experience - pathology attendings received the highest scores (76%) in the least time (20 min), while medical students achieved the lowest scores (70%) in the most time (30 min). Pathology residents and medical students had the highest engagement with optional interactive learning elements in the course.

Conclusions: This study demonstrates that an e-learning SCORM course can accurately assess multi-disciplinary knowledge in experienced and junior clinicians. More significantly, it indicates that junior clinicians will actively seek out and engage with learning content in a dynamic, image-driven, meaningful medium. The high level of course interaction among non-pathologists further emphasizes the potential of using SCORM based e-learning strategies to improve multi-disciplinary expertise for clinicians and beyond.

524 The Integration of Pathology in Medical Education; a Global Perspective

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Background: In recent years, medical educators have placed greater emphasis on an integrated approach to medical teaching where pathologists and clinicians work together. The Clinical Pathophysiology and Therapeutics (CPPT) curriculum at the University of Chicago is a four-month long course that integrates pathology, pathophysiology, clinical therapeutics, and introduction to clinical medicine. As part of the global health initiative, this concept is being introduced to medical teaching institutions in China, Nigeria, Chile and Pakistan. From 2008-2012, the University of Chicago (UC) provided technical assistance to Wuhan University (WU) Health Sciences Center in Wuhan, China to reform their medical school curriculum to meet international standards. Herein we report on the progress and results of outcome evaluations with the integration of pathology

and clinical medicine in the Wuhan University reform curriculum in the CPPT course.

Design: We designed, administered, and analyzed surveys regarding CPPT for students and faculty at WU. The surveys consisted of closed-ended Likert scale questions, free response questions, and knowledge-based questions. Paper surveys were administered to 50 reform students during May 2012 at WU. This Survey data were transcribed into a single database and analyzed using SPSS. Descriptive statistics and univariate analysis were generated for each variable. Free response questions were translated, transcribed, and coded using constant comparative method.

Results: 40/50 students in the reform curriculum completed the survey. In general, students had a high level of satisfaction with the CPPT course. 92% felt that the course was a success overall and that it was well taught, and 80% felt that the course was well organized, despite the large number of faculty collaborators. A commonly cited course strength was that 'the application of the clinical cases in basic sciences freed students from traditional learning through rote memorization and trained students to think like doctors early on' (15 of 40 students).

Conclusions: CPPT at the University of Chicago was successfully modified, adapted, and implemented at WU in Wuhan, China. The key elements in the adaptation were strong leadership throughout the process from the Dean and course leaders at WU. We found a high level of need for better integration of basic science and clinical medicine among faculty and students in Wuhan, and a high level of satisfaction with the preliminary implementation of the CPPT course in 2011-2012.

525 Mock Gynecologic Cytology Proficiency Testing as a Training Tool for AP Residents

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Background: The Clinical Laboratory Improvement Amendments (CLIA) of 1988 mandated national proficiency testing for gynecologic cytology. Annual proficiency testing (PT) began in 2006. All pathologists who sign-out Pap tests are required to pass an annual ten-slide PT.

Design: At our institution we introduced mock PT into the cytology curriculum in 2007 as a quantitative measure of anatomic pathology (AP) resident progress in learning gynecologic cytology and to prepare residents for annual PT when they enter practice. AP residents are given three PT sets consisting of 10 slides each of ThinPrep®, Surepath™, and conventional Pap tests. These test sets are administered at three time points: 2nd quarter of PGY1, 4th quarter of PGY1, and 2nd quarter of PGY2, and are scored using the standard PT scoring grid for pathologists. The following parameters are evaluated: 1) performance differences between ThinPrep®, Surepath™, and conventional test sets; 2) performance across test sets; 3) performance before and after the initiation in 2009 of one-on-one teaching sessions with cytotechnologists; and 4) quality of the test slides.

Results: Overall scores did not differ significantly between ThinPrep®, Surepath™, and conventional slide sets (81.38, 80.64, and 79.96 points, respectively). Residents showed a statistically significant improvement in performance between test sets 1 and 3 (76.66 vs. 88.89, p value <0.001), and test sets 2 and 3 (76.53 vs. 88.89, p value <0.001). The average score for the first test set was significantly higher for residents who received formal training by a cytotechnologist as compared with those who did not (80.22 vs. 72.47, p value = 0.004). By the third time point, there was no significant difference in performance between the two groups (88.67 vs. 89.58, p value=0.780). Overall, 16/90 slides were misclassified by 40% or more of residents. 3/16 (19%) had a negative point-biserial correlation coefficient (RPBI) indicative of poor question quality. 8/16 (50%) exhibited glandular abnormalities, including adenocarcinoma undercalled as negative/reactive and benign endometrial cells overcalled as atypical glandular cells/adenocarcinoma.

Conclusions: The mock proficiency tests have confirmed the effectiveness of individual teaching sessions by cytotechnologists. They have also helped to identify an area of gynecologic cytology – glandular cell abnormalities – that residents have difficulty with, thus allowing us to target our teaching curriculum to provide better instruction on this topic.

526 The Value of Tracking Forms in a Pathology Residency Program To Improve Resident Self-Reflection

E Shaw, J Stepp, K Jones, A Rao. Scott & White Healthcare, Temple, TX.

Background: Self-reflection is crucial to increasing performance for medical residents and in particular enhances performance in pathology residents. Few systems exist to ensure that pathology residents are self-reflecting and show documented performance increases. The Scott & White Pathology Residency Program implemented the use of tracking forms as a means to increase self-reflection and document changes in performance. A questionnaire was distributed to the residents to measure the success of the Surgical Pathology Tracking Forms.

Design: A case based tracking form was introduced to the Pathology residents in 2011 to record cases and document minor, major, or no discrepancy in their final report compared to their supervising staff pathologist's final report. Specific comments about the discrepancies were also recorded. The discrepancies ranged from errors in diagnosis for newer residents to dictation style for advanced residents. The residents were and are expected to maintain copies of these forms and review them. After two months of use with the tracking forms a questionnaire was given to the 12 participating pathology residents. Six questions were asked to determine if residents felt they experienced improvement in their performance and if there was improvement in staff pathologist feedback. On the questionnaire, the resident was given the following choice of responses: major decrease, minor decrease, no change, minor improvement and major improvement. The residents also provided comments on its value.

Results: 100% of respondents identified progress and case sign-out accuracy as minor or major improvement. 83% reported an improvement in feedback from staff pathologists. 50% reported improvement in assessing their case sign-out speed. 17% saw minor improvement in assessing the accuracy of their grossing skills. All residents answered

no change to assessing their grossing speed. As a result of the positive feedback, the program is introducing a similar tracking form for Clinical Pathology.

Conclusions: Our results show that all participants felt greater satisfaction in identifying progress, sign-out accuracy and feedback from the staff pathologist. This implies an increase in self-reflection and therefore the potential for improved performance. We believe, in the long term, this tracking form will allow for continued resident self-reflection, inspire residents to seek out additional learning opportunities, and allow for meaningful discussion between the Program Director and resident concerning self-reflection and improvement.

527   Effectiveness of Training in Gross Image Disease Recognition and Technical Skills Using Simulation Based Medical Education (SBME)
A Simmonds, S Rath, S Mehri, SM Dintzis, SS Raab. Eastern Health and Memorial University, St. John's, NL, Canada; University of Washington, Seattle, WA.
Background: Knowledge of gross tissue disease and proper technical gross examination skill is important for patient safety. Current residency training in gross tissue examination generally is dependent on daily practice volume and case type and learning gross skills on unusual diseases or atypical patterns of presentation is challenging. We developed and tested the effectiveness of a gross tissue disease SBME system.
Design: From institutional image files and from internet images, we developed an intestinal and an ovarian database of gross tissue cases consisting of 250 cases each. Cases represented a spectrum of common to rare disease types and of common to unusual presentations (graded on a 1(easy)-4(difficult) Likert scale). Multiple images of all major diseases were included (e.g., 32 cases of Crohn's disease). We also developed a gross tissue examination question bank that queried gross technique skills based on institutional protocols (e.g., how many sections would you take of this lesion?). We tested the gross disease identification and technique skills components on 10 and 5 residents, respectively. We used a skills-checklist to determine the number of images required to reach successful mastery of gross diagnosis (2 consecutive scores of Likert-4 cases provided randomly) and the number of images required for successful mastery of gross technique (based on all correct responses per case type).
Results: For gross technique, residents reached mastery of reporting the appropriate grossing protocol after a mean of 2.2 challenges, range 1-5, depending on experience level. For gross tissue diagnosis, residents rapidly improved in their correct identification of common diseases. PGY1 and PGY2 residents generally examined 1-2 (mean 1.5) images at Likert difficulty 1 and 2, prior to diagnosing the disease accurately. More experienced residents correctly diagnosed most diseases without prior challenges at Likert difficulty 3. All residents were challenged on rarer diseases for even Likert difficulty 1 or 2 cases.
Conclusions: In our SBME training, residents quickly and accurately learned to report grossing protocols for all case types. All residents also quickly established accuracy for diagnosing moderately difficult cases (Likert 3) of common diseases and many reached mastery level. We hypothesize that SBME training is a highly useful training tool that augments traditional training methods.

528   Emergency Frozen Section: Development of a Standardized Teaching Module for Residents
NE Sunderland, MD Hyrcza, CB Gilks. University of British Columbia, Vancouver, BC, Canada; Vancouver General Hospital, Vancouver, BC, Canada.
Background: Emergency frozen section is likely the most demanding and stressful task facing a pathologist, yet this aspect is rarely systematically addressed by residency programs. Residents may go through an entire residency without experiencing after-hours frozen section due to their low frequency. Moreover, the emergent frozen sections are likely to involve a distinct set of specimens from surgical procedures for conditions not typically encountered on routine frozen sections. To fill this gap in the current curriculum of the Anatomic Pathology residency training program at the University of British Columbia, we identified thematic categories of surgical specimens submitted for emergency frozen sections at our institution and created a teaching module centered around these categories.
Design: Retrospective analysis of the emergency frozen sections performed on weekends for non-neuropathology cases at large teaching hospital between June 2010 and Aug 2012 revealed eighteen cases representing four major types of specimens with distinct clinical implications and diagnoses. Through consultation with surgeons and pathologists we developed a teaching module centered around the four themes. The module explains the typical clinical scenario, the differential diagnoses likely to be involved, and information required by the surgeon at the time of frozen section. Each module includes digitally scanned original frozen section slides (40x, Aperio scanner) made available to residents online utilizing the Aperio Spectrum server associated with the local pathology learning center. The module was presented to the residents in years 2-5 of training during a one-hour teaching session.
Results: Residents were asked to complete the initial test set of 18 cases by providing diagnoses and appropriate feedback to the surgeon. Following the test, the didactic portion was presented with four themes: acute general surgery cases, spinal cord compression, head and neck masses with acute neurologic deficits, and mediastinal masses causing SVC syndrome or cardiac symptoms. Additional related cases were presented. Objective measures of improvement in responses from pre- and post-tests as well as participants' feedback will be reported.
Conclusions: Pathology resident training in the area of emergency frozen sections is currently sporadic and random. We have developed a teaching module to help fill this gap in residency training and to develop confidence in a difficult and uncertain area of practice.

529   Cytology of the Week Cases (COWs): Impact of a Longitudinal Educational Intervention on Cytopathology RISE Scores
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Background: The ACGME program requirements for anatomic pathology require that residents examine 1,500 cytology specimens over the course of residency training. In the era of duty-hour limitations and continually expanding medical knowledge, attainment of this goal is increasingly challenging for residency programs.
Design: To increase the number of cytology specimens for residents, our program instituted a longitudinal program, cytology of the week cases (COWs), in 2010. Images of 2-5 cases with a corresponding line of clinical information are sent to residents on a weekly basis by a cytopathologist. Cases are housed on a secure department server. In addition, a direct link to the cases is on the password-protected departmental website, to enable off-site access. Residents are given one week to respond via email with diagnoses. Correct answers to the cases are emailed to residents and published on the departmental website weekly. COWs participation is entirely voluntary. Collaboration and use of ancillary materials to arrive at a diagnosis is allowed. Rise scores were de-identified for analysis.
Results: An increase of 445% in mean points attempted (PA) was seen between the first and second year of the program (14.7 to 77.7).

Table 1: Participation

Academic Year	N = Participants	Mean Points Attempted (PA)	SD	Range (pts)
2010-2011	17/23	14.7	15.2	2-64
2011-2012	23/26	77.7	44.0	4-145

Dummy variables were created for PA below mean (0-77) and above mean (78-145) participation. Multiple regression analysis of 2012 PA on the cytopathology RISE percentile scores demonstrated an estimated mean RISE percentile score 33% higher for residents with above average participation in COWs compared to those with below average participation (p=.006, t=3.03, CI=11-56%). We controlled for year of training and for residents committed to a cytology fellowship in the regression analysis. The program's RISE national percentile score in cytopathology increased by 7% from 2011 to 2012; however, the difference is not statistically significant.
Conclusions: Participation in a longitudinal COWs program correlates with an increase in RISE cytopathology scores. COWs is a feasible educational intervention from a program perspective, and residents participate voluntarily. Pathology residency training programs can utilize COWs to meet ACGME training requirements and to effectively enhance cytopathology teaching. Additionally, data collected from COWs can be used to identify global areas of diagnostic weakness among residents for future intervention in cytology and may have applications in other areas.

Endocrine

530   Pathology of Prophylactic Thyroidectomies in Patients with Germline Mutations Affecting the Extracellular Cysteine-Rich and the Intracellular Tyrosine Kinase Domains of the RET Protein
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Background: Approximately 25% of medullary thyroid carcinomas (MTC) are due to germline mutations in the *RET* proto-oncogene leading to an abnormally active transmembrane RET tyrosine kinase receptor, and are associated with either multiple endocrine neoplasia-2 (MEN2A and MEN2B) or familial MTC (FMTC). Nearly 98% of the MEN2A patients harbor a point mutation affecting the extracellular cysteine-rich domain, whereas all MEN2B patients, and some MEN2A and FMTC patients harbor mutations affecting the intracellular tyrosine kinase domain of the RET protein. In this study we compare the pathological features in prophylactic thyroidectomies for mutations affecting the extracellular cysteine-rich domain and the intracellular tyrosine kinase domain of the RET protein.
Design: We reviewed 14 prophylactic thyroidectomies with central lymph node dissection performed for known germline mutations in the *RET* proto-oncogene.
Results: *RET* proto-oncogene mutations involved codons 618 (n=2) and 634 (n=4) affecting the cysteine-rich domain (group 1), and codons 804 (n=7) and 790 (n=1) affecting the tyrosine kinase domain (group 2). The findings are summarized in the table. Five thyroids harbored a single focus of MTC (micro-MTC, size range 0.1 - 0.8 cm) limited to the thyroid gland. There were no MTC >1 cm and no vascular invasion. Central lymph node dissection, performed in all patients in group 1 (6/6) and in five patients in group 2 (5/8) were negative for metastasis.

	Cysteine-rich	Tyrosine kinase
Number of cases	6	8
Age range in years (median)	1.5-9 (1.5)	8-52 (14)
Sex	4M, 2F	6M, 2F
Micro-MTC	3/6	2/8
C-cell hyperplasia (nodular and/or diffuse)	5/6	5/8
Multifocal C-cell hyperplasia	2/6	2/8
Chronic lymphocytic thyroiditis	None	2/8

Conclusions: Patients with mutations in the cysteine-rich domain were younger. Micro-MTCs and C-cell hyperplasia were more frequent in cysteine-rich domain mutated thyroid specimens. Male sex predominated in both groups of patients with prophylactic thyroidectomies for germline mutations in the *RET* proto-oncogene.