

oncogenic, signaling proteins, and tumor suppressors. The expression of the 137 proteins were examined and compared in the four BRAF wild-type or V600E mutated melanoma cell lines.

Results: The result showed that there is a significant difference in protein expression in the BRAF wild-type cell lines versus the V600E mutated metastatic cell lines. Only 4 out of the 137 proteins are highly expressed in the wild-type BRAF cell lines (WM3862 and MeWo); whereas another 15 proteins are highly expressed in the BRAF V600E mutated metastatic cell lines (G361 and A2058). Taken together, BRAF wild-type and V600E melanoma could be characterized by these 19 proteins. Among the 15 genes highly expressed in V600E cells are p90RSK, an Erk inhibitor; p-GSK-3 α/β , apoptosis regulator; Bax, another key regulator of apoptosis, cyclin-dependent kinase 1, a cyclin partner, NF κ B, and other signaling proteins.

Conclusions: BRAF mutation has been shown to be one of these key players of metastatic melanoma, contributing to the uncontrolled cell proliferation, resistance to apoptosis, and poor prognosis. Our knowledge of its effect on cell signaling is limited. Here we demonstrate that BRAF mutation V600E results in a significant changes in protein expression (19 out of 137 proteins, 13.87%) of apoptosis and signaling transduction in metastatic melanoma. The result may help illustrate how BRAF mutation affects signaling and provide targets to inhibit its downstream partners.

Education

542 Correlation between USMLE Scores and Resident In-Service Examination (RISE) Scores: Should USMLE Scores Be Used as a Benchmark When Selecting Residents?

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Background: USMLE is an objective and numerical measure that allows unbiased comparison among candidates. Consequently, USMLE scores is an important criterion in selecting candidates for residency programs. It is often assumed that candidates with higher USMLE scores have superior academic skills and are more likely to perform better in RISE compared to their peers. The aim of this study was to assess if residents with higher USMLE scores performed better in RISE.

Design: All available USMLE and RISE scores of residents who have been training in our program from 2005 to 2015 were de-identified and tabulated. Residents who did not have USMLE scores (admitted via COMPLEX scores only) were excluded from the study. To investigate the relationship between USMLE scores and RISE scores, we calculated each resident's mean RISE score for PGY1/PGY2, PGY3/PGY4, and PGY1-PGY4. Linear regression analyses in R-project were performed to investigate the association between USMLE and these three RISE metrics.

Results: There were a total of 40 residents training in our program during the time interval of the study. Four were excluded as they did not have USMLE scores available. 112 RISE scores were available for evaluation. There was a statistically significant association between USMLE scores and PGY1/PGY2 mean RISE scores (p-value=0.01), but this association was not observed for PGY3/PGY4 mean RISE scores (p-value=0.07). There was also no significant association between USMLE scores and PGY1-PGY4 mean RISE scores (p-value=0.08).

Conclusions: While USMLE may be the only uniform numerical measure that could be used to compare resident candidates across the board, our results show that there is only correlation between USMLE scores and RISE scores in the first two years of training. As the residents become PGY3 and PGY4, the residents with lower USMLE scores perform similarly to those with higher USMLE scores. This suggests that RISE scores do not depend on USMLE scores in the long run. Therefore, we recommend reducing reliance on these scores in the selection process. Similarly, USMLE scores of incoming residents may not be a good metric to evaluate the success of the graduate medical education programs.

543 Fine Needle Aspiration Cytology (FNAC) Simulation Using Phantoms. University Teaching Experience

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Background: Fine needle aspiration cytology (FNAC) is a minimally invasive and extremely useful procedure with a low-risk of injury traditionally made by pathologists. The characteristics of pathology practices and limited equipment make teaching in this technique difficult, missing the opportunity to attract and recruit future pathologists. We therefore have introduced phantoms designed to perform FNAC in the educational process in our hospital.

Design: Phantoms are two life-sized hand-made anthropomorphic reproductions of a head & neck and a trunk, respectively, coated by silicone simulating skin with 8 inserted tumor areas (utility model ES1140059) in the cervical midline, retromandibular, supraclavicular, axillary (x2), breast, thigh and groin areas. They are inspired by other patents (US6485308, US5803746) and improved, including the whole FNAC process (palpation, puncture, aspiration, expel material on slide, and smear preparation), having human shape and being reusable. They allow performing FNAC, obtaining samples of cream material to be extended on slides. The practice was running in 2013/14 &

2014/15 academic years and consisted of obtaining an FNAC samples in a clinical context by each student individually, with a subsequent cytological correlation using whole slide imaging.

Results: 116 medical students, in their third year, from the University of Murcia, Spain, took part in the FNAC practice (16 groups: 66 women, 50 men). The success rate in the first attempt (puncture, aspiration of material, expelling and extending the obtained material on slides) was 96,5%. In Addition, 13 students from 10 other universities (national & international) conducted the same practice, referring to not having this opportunity in their places of origin and considering the practice to be valuable in an anonymous survey.

Conclusions: FNAC practices are easily implementable in the undergraduate curricula. There is no proper uniformity or standardization in the practices among different universities.

FNAC simulation provides students with greater knowledge and appreciation of our specialty.

544 Improving the Resident Selection Process

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Background: Residency Interviews require a substantial investment from a pathology department in the form of faculty time and departmental finances; in many cases including meals and / or hotels rooms. In an effort to decrease our overall investment, our residency program sought to increase the number of applicants per day and decrease the total number of interview days, keeping the remainder of the experience as stable from prior years as possible.

Design: We increased our number of applicants per day from 2.18 (average from past) weekday to approximately 10 per day on a Saturday morning. Other variables held constant included our paying for a hotel room for the night prior to interview, a dinner the night prior to interview, including "host" residents, 1 group introductory session, lunch the day of the interview, a tour of the facilities, two one-on-one faculty interviews, and a one-on-one closing with the program director or associate PD.

Results: We decreased our average number of interview days from 22 weekdays the year prior to 6 (3 Saturdays and 3 weekdays). We decreased our interviews from 48 (with 86 faculty interview hours, the year prior) to 33 (with 55.5 faculty interview hours). We ranked within the top 10 our NRMP list, an increase from our 40th position the year prior. Applicant feedback was very positive and included one comment stating that an applicant thought that the group interview made the position more desirable.

Conclusions: By changing our approach to the residency application process, we were able to decrease our departmental expenditures of time and money, and improve our overall result.

545 Pathology Knowledge Consumption Characteristics Online Using an Open Access Pathology Wiki

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Background: An open access wiki-based website was launched one year ago to deliver anatomic pathology information to pathologists, pathology residents and medical students, and build a greater pathology knowledge commons that is accessible and easy to use.

Design: Detailed website usage information was collected including: what visitors viewed, how long they visited the site, how they connected to the site (search engine, external web site or bookmark), and the entry and exit pages. The top viewed pages were categorized and editor activity analyzed. Informally, pathologists were canvased, and responses on the site's twitter feed were examined.

Results: In the preceding year, the site had 205,000 visits, 2.0 million page views and 3.3 million hits from over 100 domains/countries. Monthly, the site averaged 9,000 unique visitors. The highest traffic pages related to benign gynecologic pathology and dermatopathology. High traffic was also seen on articles relating to ditzels, stains and histologic findings. Pages that present an overview of a topic were more often accessed from within the website. The percent visitors spending less than 2 minutes, between 2-15 minutes and more than 15 minutes was 84%, 8% and 8% respectively. Monthly, there were 2.0 visits per (unique) visitor, and 9.4 page views/visit. The top 10 percent of unique visitors were responsible for over half the page views. Approximately 30% of visitors came from a search engine. The content of the tweet with the most response dealt with image annotations. Relatively little interest was seen in response to an offline version of the site; however, site editors were enthusiastic. Approximately 18% of page views was by mobile devices or tablets.

Conclusions: The usage patterns suggest that site visitors directed to the site by a search engine have focused questions and move on quickly. The overview pages are utilized by visitors spending more time on the site, and probably viewed by individuals actively learning pathology. The relatively high views of benign gynecologic pathology, dermatopathology and ditzels, suggests these may be "pathologist specific areas" that are not well addressed by other web resources. Image annotations are considered valuable by pathologist users. A significant portion of people seeking pathology information are using mobile devices or tablets.

546 Development of an Online Case Simulator as an Educational Tool in Anatomic Pathology

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Background: The use of simulated environments is increasing in medicine, as they allow one to reproduce practice-related scenarios and control elements of complex tasks for improved learning, research and competency assessments.

Design: We developed an online pathology case simulator (<http://librepathology.org/simulator>) on an open access wiki-based website (librepathology.org). The simulator included stepwise decision making which included: (1) seeking additional clinical history, (2) examining the case at higher magnification, (3) ordering ancillary tests (special stains, immunostains, molecular), and (4) seeking a consultation opinion of a colleague. Diagnoses were linked to relevant published references. We assessed the usage of the initial 75 cases available on the website over an 8 month period. Cases were contributed and developed through an online collaboration by four individuals with a range of computer skills at geographically separated institutions.

Results: A total of 117 virtual cases were created and sorted by subspecialty (Derm 9, GI 22, GU 25, Gyne 18, Head and Neck 8, Lung 6, Neuro 12, and others 17). Cases were further sorted by difficulty level (junior 60, senior 50, fellow 7). The initial 75 cases were viewed 5,097 times in 8 months. Individual cases were viewed on average 67.6 times (range 22-181). Cases classified as junior and senior/fellow were viewed on average 60.0 and 79.8 times, respectively. Informal feedback received from residents of three pathology programs, who were asked to use the simulator was positive.

Conclusions: The online simulator is a useful educational tool that allows a better understanding of the stepwise decision making in the pathology case workup, emulating a real life practice. We were able to illustrate and cover a range of diagnostic problems and scenarios in pathology using this online tool. The wiki platform allowed individuals with a range of computer skills to share information and effectively collaborate online. The ability to easily link to content within the wiki environment simplified the case development.

547 A Histologic Checklist for Appropriate Diagnosis of Melanocytic Lesions

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Background: Distinguishing a benign nevus from melanoma on superficial biopsy is a diagnostic situation with potentially profound clinical consequences. Here, we evaluate the ability to correctly classify nevi and melanomas using a histologic checklist.

Design: We collected 109 skin biopsies diagnosed as compound melanocytic nevus or superficial spreading melanoma. A dermatopathologist blindly reviewed a training set of 72 randomly selected cases (38 nevi, 34 melanomas) and assessed each lesion for atypical features (Table 1). Based on each histologic feature's sensitivity and specificity for melanoma, a scoring system was developed. Pagetoid scatter and cytologic atypia were each assigned 2 points, and the remaining atypical features were assigned 1 point. A 2nd year pathology resident blindly reviewed 37 randomly selected cases (16 nevi, 21 melanomas) that were distinct from the training set cases and assigned points to each lesion using the training set-derived scoring system.

Feature	Training Set		Test Set	
	# of Nevi (%)	# of Melanomas (%)	# of Nevi (%)	# of Melanomas (%)
Asymmetry	11 (28.9)	33 (97.1)	0 (0)	20 (95.2)
Size greater than one 4X field (with 10X ocular)	12 (31.6)	17 (50)	8 (50)	15 (71.4)
Poor circumscription	28 (73.7)	30 (88.2)	9 (56.3)	21 (100)
Pagetoid scatter	6 (15.8)	33 (97.1)	1 (6.3)	20 (95.2)
Shouldering	18 (47.3)	34 (100)	8 (50)	20 (95.2)
Cytologic atypia	4 (10.5)	34 (100)	0 (0)	20 (95.2)
Absent maturation	5 (13.2)	25 (73.5)	2 (12.5)	18 (85.7)
Dermal mitosis	0 (0)	5 (14.7)	0 (0)	6 (28.6)

Results: All melanomas in the training set had scores ≥ 5 , and all benign nevi had scores ≤ 4 (Table 2). Based on the threshold of 5 points indicating a potentially malignant diagnosis, the trainee's classification of benign or malignant concurred with the original diagnosis for 36 of 37 lesions (97.3%). One benign nevus was given a score of 5.

Total Score	0	1	2	3	4	5	6	7	8	9	10	Average Score	Score Range
Training set nevi	2	13	13	8	3	-	-	-	-	-	-	1.92	0-4
Training set melanomas	-	-	-	-	-	8	11	11	3	-	-	6.27	5-8
Test set nevi	-	7	7	1	-	1	-	-	-	-	-	1.81	1-5
Test set melanomas	-	-	-	-	-	1	1	-	5	11	3	8.57	5-10

Conclusions: Our data suggest that a non-dermatopathologist faced with a superficial biopsy of a melanocytic lesion with 5 atypical features (3 if both pagetoid scatter and cytologic atypia are present and 4 if one of these features is present) should consider deferring further classification to a practitioner with expertise in skin pathology. Further study is underway to assess the validity of this melanocytic checklist for potential broader educational and practical use.

548 Development of a Dynamic Leadership Curriculum to Enhance Residency Education in Pathology and Laboratory Medicine

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Background: With the increasing realization that leadership skills are essential for success as a physician, leadership goals were incorporated into the Pathology Milestones for residency training. We report the development of a leadership program to prepare residents to be effective in leadership roles early in their careers.

Design: Partnering with Health System leaders, we held focus groups with residents and faculty and then surveyed both groups on 15 recognized competencies for health care leadership to determine which were felt to be most important to learn during residency. We used the results of the survey to design our curriculum.

Results: We identified 9 competencies from the survey to include in the program and they fell into 5 broad categories of leadership skills: Leading, Standards and Accountability, Planning and Decision Making, Communication and Managing Relationships. Using external consultants and internal experts, we designed a program with workshops, lectures, panels, focus groups, and one-on-one sessions. Unique features of the workshops were training videos we developed and used as examples of best and worst practices. These videos were also used in teaching programs outside of Pathology, since the leadership skills were easily translatable. The Chair is actively involved and offers informal monthly 1 on 1 mentoring sessions, discussions with all residents and additional sessions for Chief Residents. We also meet with residents regularly to assess understanding and utilization of these skills. We are in our third year of program development and after introducing several topics the first year, we decided to highlight one major leadership topic a year interspersed with continuing education of 'core' skills building sessions for new residents and faculty. The initial highlighted topics were emotional intelligence, personal branding and communicating effectively. The focus for the next few years will be building and strengthening relationships and personal accountability.

Conclusions: We found an executive leadership commitment to support and sustain such a program is essential for programmatic success. Our goal is to use this leadership curriculum to build skills for residents and faculty for future success as well as foster a workplace culture for enhanced positivity and productivity.

549 Implementation of Resident Sign Out Application with Functions to Compare Resident and Attending Reports

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Background: In many anatomic pathology residency programs, residents gain diagnostic experience by formulating their own diagnostic report. Typically, the resident report is electronically passed on to the attending pathologist for final edits and sign out. However, most anatomic LIS systems lack a formal resident sign out procedure, and thus also lack an archive of resident reports. Therefore, it is difficult and time consuming for trainees to compare their interpretation to the attending interpretation unless manual steps were taken to print or save a copy of the resident report for future review. To address these issues, we developed a system for residents to maintain a record of their interpretation in addition to allowing very efficient report comparison and review.

Design: A resident sign out application was developed to allow full capture of the resident report without impacting the existing case workflow. Custom software was designed to interact with our anatomic LIS (PowerPath, Sunquest; Tucson, AZ) to store a copy of the report at "resident sign out". The interface emulates the steps taken during attending sign out. In addition, there is an option to flag a case for retrospective resident review which can be triggered by either the resident or attending.

Results: Tools were designed to allow integration of the resident report and the attending report. This allows residents to quickly review exactly how their version of the report differs from the attending report.

FINAL DIAGNOSIS:

A. Placenta, Cesarean section:

1. Fetal membranes: No acute inflammation identified.
2. Umbilical cord:
 - a. The umbilical cord has two arteries and one vein.
 - b. No vasculitis or funisitis identified.
3. Placental disc:
 - a. Third trimester maturation villi ~~with stromal fibrosis.~~
 - ~~b. Total obliteration of some of the vessels with inflammation.~~
 - ~~c. Focal infarct (less than 5%) is present.~~
 - b. No significant villitis or infarcts identified.

MICROSCOPIC: Microscopic examination is performed.

Conclusions: The resident sign out tool allows residents to gain experience committing to an "electronic signature" in a setting which emulates the real case sign out procedure. In addition, the retrospective review allows residents to refine their diagnostic reporting skills by highlighting changes between the resident and attending reports. These are useful tools which facilitate resident education and provide skills which help residents

transition to the attending practice environment. Future analysis may include aggregate comparison of resident reports by year to compare the number of changes based on resident experience.

550 Resident Incentive Program: Engaging Pathology Residents in Quality Improvement Projects through Financial Incentives

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Background: In 2013, a hospital-wide resident incentive program (RIP) was initiated to promote engagement in quality improvement projects among the 660 residents employed at our institution. In addition to the obvious benefit of improved patient care, RIP gave residents valuable experience with quality assurance, an increasingly important aspect of graduate medical education. Each residency program was asked to identify a quality metric, track and analyze data over three subsequent quarters, and was rewarded with \$500 per resident if the goal was met. Since the typical clinical quality measures of hand washing, hospital acquired infections, and readmission rates were not applicable to a pathology residency, the program was tailored to address specific quality metrics within our department.

Design: A quality improvement measure was selected by the residents and program directors, and approved by the hospital quality assurance officer each year. The chosen measures had obtainable and analyzable data, directly impacted patient care, and fell within the residents' responsibility and clinical duties. A baseline and goal were set, and the data was tracked and analyzed quarterly. If the goal was met at the end of the third quarter, each resident received a \$500 bonus.

Results: In 2013, tissue block reprocessing was chosen as our RIP. Block reprocessing due to inadequate fixation leads to additional costs in histology and extends specimen turn-around-time, and is often attributed to inappropriate resident grossing. Prior to the project, the average number of reprocessed blocks per month was 10.67. At the end of the third quarter, the average number of reprocessed blocks per month was 3.89, a 64% improvement rate.

In 2014, documentation of frozen section specimen receipt and call back time was chosen as our RIP. The lack of consistent data collection inhibited the department's ability to compare frozen section turn-around-time to those recommended by the CAP. Prior to the project, receipt and call back times were appropriately documented in 60% of cases. At the end of the third quarter, times were appropriately documented in 94.7% of cases.

Conclusions: The successful adaption of RIP proves that pathology housestaff can be readily and easily engaged through a modest financial incentive to enact significant change within the department and hospital. This program could easily be replicated within any pathology department to improve patient care and efficiency, while giving residents valuable quality improvement experience.

551 Resident In-Service Exam Review Series

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Background: The resident in-service exam (RISE) is a valuable tool used nationally to assess trainee's progress throughout residency and has correlated with board examination performance. As such, many programs seek strategies to improve resident performance. We describe our experience with a month-long review series, instituted in 2013, designed to highlight important high-yield concepts in each subspecialty.

Design: Aggregate program RISE performance data was gathered for three years prior to and following initiation of the review series. Additionally, mean USMLE Step scores for residents participating in each RISE were obtained to control for test-taking ability. Linear models were used to evaluate differences in average RISE performance prior to and following the review series while controlling for relevant covariates.

Results: There was notable improvement in RISE performance following the review series. Statistically significant improvement was noted in the grand total, anatomic pathology section average, clinical pathology section average, and transfusion medicine section. Interestingly, worsening, although not statistically significant, was noted in hematopathology, molecular pathology, and the special topics section average.

RISE Component	Pre-Review Mean Percentile	Post-Review Mean Percentile	Change in Percentile	p value
Grand Total	58.5	71.5	13	0.007
Cytology	54.4	70.4	16	0.095
Forensic Pathology	74.6	83.6	9	0.230
Surgical Pathology	45.2	53.2	8	0.211
AP Average	58.1	69.1	11	0.021
Chemistry	53.6	68.6	15	0.080
Hematology	54.8	59.3	4.5	0.685
Microbiology	61.9	70.9	9	0.296
Transfusion Medicine	58.9	72.8	13.9	0.040
CP Average	57.3	67.9	10.6	0.006
Hematopathology	73.7	70.0	-3.7	0.751
Lab Administration	74.7	82.7	8	0.386
Molecular	80.9	71.4	-9.5	0.119
Special Topics Average	76.4	74.7	-1.7	0.739

Conclusions: Institution of a month-long RISE review series demonstrated improved overall performance. Additionally, improvement was noted on most sections excluding hematopathology and molecular pathology. Furthermore, the review series has been

well received by trainees and attendings, with most sessions emphasizing high-yield material in a fun, interactive environment. This success could easily be replicated in any training program without disruption to an annual didactic series.

552 Impact of Pathologist Involvement in Sarcoma and Rare Tumor Patient Support Groups on Facebook: A Survey of 541 Patients

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Background: Patients with rare tumors have difficulty finding information about their disease. Facebook (FB) patient support groups (FBSGs) allow patients to learn from one another. Our soft tissue pathologist has participated in some of these groups. No study has investigated how these patients view the value of a pathologist's input in their FBSG or the role of pathologists in patient care.

Design: Survey links were posted in 6 FBSGs with an active pathologist member (FBSGp: angiosarcoma, epithelioid hemangioendothelioma, epithelioid sarcoma, dermatofibrosarcoma protuberans (x2), desmoid fibromatosis) and 6 FBSG without one (FBSGx; aggressive angiomyxoma, chondrosarcoma, Ewing sarcoma, leiomyosarcoma, liposarcoma, osteosarcoma).

Results: 541 patients responded (FBSGp: 262; FBSGx: 279). Of FBSGp, 90% agreed that the pathologist in the group helped them better understand their disease, 77% agreed the pathologist's posts relieved some of their disease-related anxiety, and 98% agreed that having a pathologist involved in their group was a good thing. Of FBSGx, 77% wanted to have a pathologist involved in their group; of FBSGp, 83% wanted more pathologists involved in their group. Many also wanted medical doctors from other specialties to be involved in their support groups (FBSGp 69%; FBSGx 63%). The majority of both groups know that pathologists make the final diagnosis of cancer (70% FBSGp; 69% FBSGx) and that pathologists are doctors (80% FBSGp; 81% FBSGx). However, significantly more individuals in FBSGp than in FBSGx strongly agree or agree that "pathologists are an important part of the patient care team for patients with cancer and other rare tumors" (93% FBSGp vs 85% FBSGx; p=0.0085).

Conclusions: This study is the first to evaluate the impact of a pathologist's interaction with FBSGs and to assess perceptions about the specialty of pathology held by a large group of patients with rare tumors. We found that pathologist involvement in these groups likely had a positive influence on how patients viewed the importance of pathologists. We also found that 63-83% desired more pathologists and other physicians to be involved in their FBSGs. We hope these data will encourage more physicians, especially pathologists, to actively participate in Facebook patient support groups.

553 Development of a Web-Based Question Database

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Background: There are relatively few sources of practice questions for the Clinical Pathology (CP) certification examination as compared to the Anatomic Pathology exam. Many existing tools are in written format, which does not lend itself to frequent update, and the cost of online tools may limit widespread use. Rapid change in disciplines like Molecular and Hematological Pathology has created the need for study materials that can be readily and easily updated.

Design: To augment CP study materials, our residency program started a resident-driven "CP Question of the Day" series 2 years ago; however, these questions were archived electronically in separate files, precluding efficient use for later study. Our goal was to develop a web-based question bank based on these questions that would be accessible from anywhere.

Results: Our site is modeled on existing question banks for the United States Medical Licensing Examination and allows users to specify a number of questions selected at random from the regularly updated "Question of the Day" database. The software defaults to previously unanswered questions, and questions can be restricted to specific subjects. Results are recorded so that users can review questions with which they have had difficulty. Residents have the capability to reset the question bank, allowing them to repeat questions as many times as they would like. The software package was designed for easy installation and implementation by other programs. We used a customized software platform written in PHP: Hypertext Preprocessor. The front-end graphic user interface was developed in Bootstrap, which allows for dynamic scalability and compatibility with mobile devices and personal computers.

Conclusions: We successfully developed a working web-based question bank of CP questions that can be accessed from any location, including mobile devices. We plan to seek feedback from residents following Resident In-Service Examinations and from graduating residents upon completion of the CP board examination as to whether or not they felt it was an effective study tool. Refinements being considered include a dedicated companion application for mobile devices, built-in timed test simulations, detailed score reports, and addition of Anatomic Pathology questions. This platform could serve as a model for programs interested in developing their own databases and promote sharing of questions between programs. Limitations include the need for local administrators with programming knowledge and access to web hosting services.

554 Introducing a Virtual Reality Experience in Anatomic Pathology Education

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Background: Grossing a myriad of surgical specimens is fundamental in anatomic pathology (AP). The majority of trainees start residency without prior grossing skills, and it is widely accepted for senior personnel to guide them in how to properly handle specimens. Unfortunately, this method often falls short of being complete or

standardized. We propose a system to enhance grossing education by introducing a high-definition (HD) video training library, with instructional audio voice-overs, viewable on 2-dimensional (2D) and 3-dimensional (3D) platforms.

Design: Two HD camcorders synchronously recorded the complete gross examination of a brain, a lumpectomy, and a uterus. The video files were edited to an average length of 255 seconds and then converted to stereoscopic 3D with audio voice-overs. Nine junior residents viewed the videos in 2D on a 22" HD monitor and in 3D on a 5.7" HD smartphone display housed in a virtual reality headset. Participants were alternatively assigned to either viewing experience, and self-reported motion sickness was evaluated by the standardized Simulator Sickness Questionnaire (SSQ). The educational value, level of interest, utility, and opinions of the different technologies were assessed on a Likert scale.

Results: The baseline SSQ value for all participants was 7.9. After watching the first set of videos, the SSQ value increased to 10.4; after the second set of videos it further increased to 15.4. Of the respondents, 100% would use a grossing video library in preparation to examine a new specimen type; 55% stated they would access the videos during the gross examination of a previously encountered specimen type; 78% would like to access the videos from a personal device. When asked about 3D technology, 67% claimed to be interested in its application to pathology education, while 55% believed 3D improved the overall viewing experience.

Conclusions: Standardization of gross examination training is critical for residents' education and ultimately patient care. Our novel 2D and 3D HD videos provide the foundation to create a robust virtual library, focused on the fundamentals of grossing. The SSQ analysis suggests that motion sickness was not encountered in either viewing experience. Incorporation of voice-overs provides processing guidance while highlighting clinically relevant aspects. AP is inherently a visual discipline, and by building on the strengths of available grossing texts, our training method allows viewers to appreciate and learn the procedural actions and nuances involved in specimen processing.

555 An Interactive Online Unknown Conference with a System for Ordering Immunostains and Molecular Genetic Studies

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Background: Traditional anatomic pathology unknown slide conferences are carried out either with microscopic glass slides, slide images, or virtual slides, which are available several days in advance, allowing the resident to review, study and formulate a diagnosis or differential diagnosis. The cases and their respective ancillary studies (typically immunostains or molecular studies, which are not provided beforehand) are discussed during the conference to reach a diagnosis. With this system, the residents do not gain experience on how to appropriately work up cases. We utilized a previously developed interactive web system to allow the ordering of immunostains as well as molecular studies in the context of soft tissue malignancies.

Design: Using HTML, PHP and Javascript the online unknown slide conference system allows the resident to view H&E images of a case and order and view immunostains and molecular studies pertinent to each case. The entry form is AJAX-enabled for autocompletion from all possible stains and other studies recognized by the system, including the FISH probe sets. For the case-appropriate FISH study, an image of FISH from an actual case is shown; if an irrelevant probe set is chosen, an image of normal FISH for that set is shown. Other studies such as karyotypes, sequencing, RT-PCR, and microarrays are included as available with result images. Two function keywords are included: "cheat", which guides the resident on what relevant studies to order for each case, and "presentation", which displays the final diagnosis and the key pathologic information including the molecular aspects of the disease.

Results: The system was presented to the residents during a soft tissue tumor conference at our department. Cases included Ewing's sarcoma, well-differentiated liposarcoma, epithelioid sarcoma and 13 others. The system was highly received by residents as it allowed them to fully exercise the ability of not only getting a differential diagnoses with the H&E slides, but also reach a final diagnosis by ordering appropriate studies and getting immediate results. Sample cases are available: <http://drdoubleb.com/softtissueunknowns/>

Conclusions: The interactive online unknown conference system with special studies should help to build habits for lifelong learning and improve diagnostic skills. More widespread use of this system could make for an effective learning tool and could be applied for other class of tumors such as hematopoietic malignancies.

556 CyTEST- A Pan European Project for Training & Testing in Cytopathology

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Background: There is an urgent need for more flexible ways to provide education across borders towards a unified approach in teaching and quality assessment. CyTEST focuses on Cytological Training at European Standard through Telepathology. This Project, approved and funded in 2014 by EU within the ERASMUS+ Program, is composed of 6 leading university Institutions (University of Turin, COREP, University of Padua, Imperial College of London, IPATIMUP/University of Porto and University of Graz) and benefits from collaborations with European Organizations (EFCS, Eurocytology, Omero).

Design: Cy-TEST is based on exploitation of the Virtual Slide technology thus allowing Open Access transfer and navigation of scanned cytological slides. Slides are scanned at 40X, uploaded and catalogued in Omero (a virtual microscope system), where they undergo tagging and editing with annotations by drawing regions of interest (ROIs).

Results: The system is accessed from a dedicated website with free registration where users are asked to log in. The educational offer is subdivided into "training cases" and "test area". In both scenarios users are enabled to dynamically view the specific slide with selected ROIs. The slide is completely integrated within the open source e-learning platform Moodle that allows to create interactive exercises, the upload of educational material, the user management and tracking. A specific highly interactive tool enables the users to click on cells and details of interest and double check their performance in real time. A specific area of the system is dedicated to the European quality assessment (QUATE) examination with Mock test and practical session with virtual slides. This is propaedeutic to the final development of an e-QUATE test, i.e. the electronic version of QUATE, thus reaching a popular, cheap and efficient impact.

Conclusions: CyTEST is paving the way to a more homogeneous training and testing of cytotechnicians and pathologists working in the fields of cytology and may lead to the development of a similar system offered to pathologists in training for histopathological diagnosis and consultant histopathologists. The System, which will be an integral part of EFCS activities so as to guarantee its sustainability, represents a move towards a technically-based improvement of quality level assurance, which is what patients request.

557 The Creation and Implementation of a Points-Based System for Distributing Specimens to Residents at a Tertiary Care Academic Residency Program

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Background: Recent work hour restrictions mandated by the Accreditation Council for Graduate Medical Education (ACGME) require residency programs to ensure trainees' work hours stay within limits delineated to ensure safe patient care. Despite the need to monitor the work hours of trainees, pathology residency leadership, especially at tertiary care centers with high volumes, have no way to determine how specimens correlate to time grossing. In order to create a system to determine the time needed to gross specimens and therefore the hours worked, our training program created a points-based system that quantifies the time trainees spend processing specimens.

Design: A survey was created and distributed to residents that solicited information about their year in training, grossing speed and time required to gross typical and unusual specimens from all organ systems. These data were considered by faculty and pathologists' assistants in creating a points-based system for assigning cases to trainees.

Results: Based on the data collected from residents and assessed by faculty and staff, different specimens are assigned point values (assignments range from 1-7 points per specimen). One point is equivalent to 15 minutes of grossing. Additional points are allocated for subsequent margins and greater complexity. We are able to apply this estimation of grossing time into our hybrid 1 day and 3 day cycle system. Trainees are assigned specimens within a point cap using an online data base that is designed to limit grossing to 3 hours for residents during the 1 day cycle where they are also signing out and reviewing on the same day and 9 hours for residents during the 3 day cycle on a day that is spent entirely grossing.

Conclusions: The points-based system created and implemented at our training program serves as a foundation for determining the work hours required by trainees to gross different specimens and allows for flexibility when specimens are complex/unusual and trainees with different experience levels. This system can be applied in any training program, regardless of organizational system used, as it quantifies the hours required to gross specimens. The system continues to evolve with ongoing feedback and insights gained since implementation. In the setting of increasing accountability for work hours, our points-based system serves as a useful tool for residency program leadership to understand the time required to gross specimens and therefore the hours worked by trainees.

558 Fellowship In-Service Hematopathology Examination (FISHE) Predicts Success on the American Board of Pathology Hematology Subspecialty Certifying Examination (ABP-HE)

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Background: The FISHE, developed by the American Society for Clinical Pathology and the Society for Hematopathology, is the in-training examination for hematology pathology fellowship programs. It is administered biannually (fall & spring). We examined whether FISHE performance predicted success on the first attempt of the ABP-HE.

Design: FISHE results from fall 2009 through spring 2013 were pooled. Matched pass/fail outcomes for the ABP-HE were added. Logistic regression was used to evaluate if the total percentiles on the FISHE predicted whether fellows would pass the ABP-HE.

Results: Sixteen of 441 fellows (3.6%) who took the spring FISHE failed the ABP-HE as did 7 of 265 (2.6%) who took the fall FISHE. The dataset is somewhat enriched with better performers since the first-time overall ABP-HE failure rate for this period was higher (6.9%). Spring FISHE percentiles, but not fall FISHE percentiles, were significant but weak predictors of passing the ABP-HE (OR 1.05, $P < .01$). Based on the logistic regression model, the probability of passing the ABP-HE increased as the FISHE percentile increased; for example, the predicted probabilities of passing the ABP-HE for fellows whose spring FISHE percentiles were 5, 15 and 30 were 85%,

90% and 95%, respectively. Subdividing into 4 groups also helps to conceptually show an increasing ABP-HE pass rate as spring FISHE performance improved (0-25th, 26-50th, 51st-75th, >75th percentile): 90.3%, 96.5%, 98.2%, 100%. However, 6 of 16 (38%) fellows who failed performed above the 25th percentile.

Conclusions: Spring FISHE performance is a modest predictor of ABP-HE outcome. Although low performers were more likely to fail, most still were able to pass the ABP-HE and, in contrast, almost 40% of those who failed were within the 26-75th percentiles on the FISHE. Although not specifically examined, the findings also suggest that those who take the FISHE may do better than those who do not. Whether the modest impact which the FISHE score had on the ABP-HE passage rate reflects the possibility that those who did poorly on the FISHE became motivated to study and make up for their deficiencies is uncertain. The major purpose of the FISHE remains a self-evaluation tool that can highlight specific areas of weakness prior to fellows practicing independently.

559 Broadening Our Scope: A Conceptual Framework for a Curriculum in Bioethics and Professionalism for Pathology Trainees

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Background: Despite mandates from the Accreditation Council for Graduate Medical Education and American Board of Pathology, little formal guidance is available for educating pathology trainees on bioethics and professionalism. Here, we describe the development and preliminary implementation of a pathology-specific curriculum in bioethics tailored to pathology trainees.

Design: A literature review was performed using Pubmed and Science Direct search engines for published literature on unique issues of ethics and professionalism in the practice of pathology and pathology ethics curricula. Additional topics of relevance to pathology trainees were sought using an electronic survey of trainees and faculty in our program. A second literature review was performed referencing the Pathology Milestones ACGME Reporting Worksheet relevant to ethics and professionalism. Results were utilized to develop a curriculum for bioethics and professionalism for pathology trainees. A pre-test and post-test will be administered for each session to evaluate retention of content and skills.

Results: A pathology-specific case-based ethics and professionalism curriculum was developed for Emory University pathology trainees. Quarterly session, led by a multidisciplinary team of faculty from our department of pathology and Center for Ethics, consist of didactics followed by case-based discussions.

FIGURE 1: Broadening Our Scope Pilot Curriculum Quarterly Session Framework

Time (min.)	Activity
0 - 5	Pre-test
5 - 20	Introduction didactic to topic (Moderator)
20 - 30	Case 1 Small group discussions, led by faculty moderators
30 - 35	Reconvene: large group discussion of the case
35 - 45	Case 2 Small group discussions, led by faculty moderators
45 - 50	Reconvene: large group discussion of the case
50 - 55	Summary of session's key concepts (Moderator)
55 - 60	Post-test

Participants learn applications of the principles of bioethics as they pertain to pathology .

FIGURE 2: Broadening Our Scope Pilot Curriculum Sample Session Topics

Introduction to the core principles of clinical bioethics, concepts in professionalism
The pathologists role in diagnostic error disclosure
The "safe" diagnosis versus the correct one
Public image of physicians in specialties with indirect patient care
Tumor banking and tissue ownership
Informed consent in post-mortem examination, fine-needle aspiration, and therapeutic hematopheresis
Laboratory management concerns and impact on patient care
Emerging laboratory test results with uncertain clinical implications
Allocation of scarce blood bank resources in critically ill patient populations and medical futility
Colleague impairment and/or incompetence
Pathology trainee education and HIPAA compliance

At the completion of each session, results of pre and post tests will be tallied.
Conclusions: Ethics and professionalism education is essential to pathology training but formal curricula are lacking. Our innovative case-based curriculum may serve as an educational model for other departments. Assessment of the impact of our efforts is forthcoming.

560 NDER: A Novel Web Application for Teaching Histology to Medical Students

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Background: Medical students require a strong foundation in normal histology. However, current trends in medical school curricula have markedly diminished time devoted to histology. Thus, there is a need for a more efficient method of teaching histology to medical students. Our team has developed a novel software program (NDER) that uses annotated whole-slide images (WSI) to teach normal histology. With a robust compilation of normal histology images, NDER dramatically improves medical students' ability to recognize normal histology.

Design: WSI of a wide variety of tissues chosen from the University of Washington pathology database were annotated to outline regions of interest (ROI) exemplifying normal histology. The ROI were validated by an experienced pathologist. Still images (240 images) measuring 2000 by 2000 pixels were extracted and transferred to the interactive and adaptive NDER web application. In NDER, an image was displayed initially for 4 seconds before the user was forced to identify the tissue type. The display time adapted based on cumulative accuracy (increased accuracy led to decreased display time) to challenge the user and maintain user attention. 120 second year medical students at the University of Washington School of Medicine (UWSOM) completed a 30 minute NDER module featuring a 20 question pre-test, a 200 question NDER normal histology module, a 20 question post-test, and a student evaluation.

Results: The NDER module, lasting approximately 20 minutes, improved medical student accuracy and confidence in correctly identifying normal histology. Surveys showed a significant increase in confidence from pre-module (0% extremely confident, 4% very, 47% somewhat, and 49% not) to post-module (9% extremely confident, 57% very, 32% somewhat, and 2% not), p<0.0001. Accuracy increased from 72.6% pre-test to 95.7% post-test (p<0.002). The effect size (Cohen's d = 1.33) was very large, where 0.2 is a small effect, 0.5 moderate, and 0.8 large. 96% of students would recommend NDER to other medical students and 98% would use NDER to further enhance their histology knowledge.

Conclusions: NDER drastically improved medical student accuracy in classifying normal histology and improved medical student confidence. Additional study is needed to determine knowledge retention, but NDER has great potential for efficient teaching of histology given the curriculum time constraints in medical student education.

561 Pathologists in Gross Anatomy? - Strategies for Curriculum Integration

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Background: Traditional anatomy courses frequently have focused on memorization and recall. However, lengthy lab sessions with proscribed dissection instructions seldom foster independent inquiry, a cornerstone for critical thinking and experiential learning. Here we report work showing that an investigative pathology activity, coupled with traditional dissection, motivates learning, enhances comprehension, better meets accreditation standards for active learning, addresses several core medical competencies, and increases student exposure to pathology early in preclinical education.

Design: In the gross anatomy course, each dissection team (n = 35 teams composed of 5 students) was required to record their observations on autopsy diagrams, and obtain seven biopsies from the donor's cadaveric remains for the Department of Pathology to process. Pathologists were present during normal laboratory sessions to assist with biopsies and to answer questions about gross findings. Teams reviewed their slides with a pathologist during a 15-minute consultation and subsequently, had access to microscopes equipped with cell phone mounts, enabling students to document their findings, and to share their photomicrographs with fellow students and faculty advisors. The effectiveness of the project was assessed with an anonymous online survey containing 41 questions (complete results not shown due to space constraints).

Results: The investigative proficiency of each dissection team was assessed by completion of a graded capstone project at the end of the module. Each team drafted a one-page abstract and gave a 15 minute presentation of their findings. The abstracts and presentations were configured as a biomedical conference and were graded by at least three faculty members. Students enjoyed the experience evidenced by a reported Likert score of 4.73 (4 agree, 5 strongly agree) to the question "I enjoyed the experience of trying to determine the cause of death of out donor."

Conclusions: Evaluation of the faculty assessments and an online survey of students indicate that this endeavor:

- Was an enjoyable method for students to become familiar with pathology and pathology faculty
- Firmly grounded the learning of anatomy and histology in its clinical context.
- Provided first-year medical students with opportunities for self-directed learning that was in compliance with accreditation standards.
- Strongly motivated students to explore their interests and become lifelong learners.

562 Quantitative Assessment of Competency in Surgical Pathology: Initial Promising Roll-Out Results at the UNM Department of Pathology

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Background: Quantitative assessment of microscopic diagnostic skills in surgical pathology is not commonly performed. Compared with qualitative assessment, it may enable more precise monitoring of resident progressive performance and may allow for systematic evaluation and targeting of specific weak areas in the curriculum, among other potential benefits.

565 Four Years of Virtual Pathology Teaching Using “SlideAtlas”, a Web-Based Open-Source Digital Pathology Platform Supporting Multi-Touch Interaction

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Background: There are significant advantages to using whole slide images (WSIs) for resident education. We have developed and deployed a web-based open digital pathology system for virtual pathology to teach dermatology and pathology residents for the past four years.

Design: We developed a web-based open-source digital pathology platform SlideAtlas (<https://slide-atlas.org>) that supports automated upload of scan files from multiple scanners. The high performance interactive image viewing experience on both desktop (Mac and PC) and mobile devices approximates the use of glass slides. Access control, search features and annotation tools are built into the system and readily accessible. A new embedded PowerPoint-like presentation function displaying WSIs is now used for board review-type sessions.

Results: WSIs have been used for more than four years to teach dermatopathology to residents and fellows. The database currently contains approximately 8,000 dermatopathology-related images. For dermatology residents ~10-40 dermatopathology images are selected and posted for weekly resident preview prior to an attending-led interactive session. Images are archived weekly for later reference (~600 images for the last academic year). WSIs have been used for over a year to teach surgical pathology to residents and fellows. ~10-15 surgical pathology images are posted twice a week for attending-led “unknown” conference. Images are archived post session for later resident self-review (~1000 images in 15 months). In addition, subspecialty digital slides sets for resident self-teaching have been recently introduced. Resident satisfaction with the digital interface, responsiveness of image navigation over standard (hospital and wireless) networks and the image quality remains high. The annotation features, boards-style reviews and multi-touch interaction are all popular.

Conclusions: There is continued support and enthusiasm from dermatology and pathology residents for using WSIs and SlideAtlas for their pathology education. The development of a vendor neutral and platform independent open source digital pathology system helps provide a relatively low cost and flexible option for resident education.

566 Big Data: Bioinformatics Education during Residency Demonstrates Immediate Value

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Background: Bioinformatics education is becoming increasingly recognized as an important component of physician training. Although bioinformatics as a field encompasses many different subsets, the ability to effectively analyze big data sets to uncover trends, efficiency correlations and create new pathways is an essential component of the value based healthcare system. Education of residents in this field is difficult with few active learning resources available. We have begun implementation of formalized bioinformatics education for residents through quality projects that serves to actively introduce concepts of big data analysis, and simultaneously provide quality data to improve efficiency, utilization and treatments. We hypothesize that this active learning will give residents familiarity with vocabulary, data analysis tools and databases.

Design: A preliminary survey is administered to junior residents to assess familiarity with big data topics. Junior level residents are assigned simple projects that allow them to learn spreadsheet formulae and data base development that eliminate the tedious and potentially error ridden process of manual data analysis. Senior level projects are graduated to complex concepts such as multifactorial laboratory cost analyses for the integration of potential new technologies. Competency of senior residents’ project results are evaluated by staff during a multidisciplinary conference.

Results: Of the 11 residents in the program only 1 has familiarity with bioinformatics and big data analysis. After introductory education in big data analysis concepts, residents are able to rapidly analyze large sets of data to answer simple questions. Senior residents are able to engage in complex problem solving requiring management and application of multiple seemingly unrelated resources, and successfully present those results. Additionally, several utilization projects to demonstrate overutilization of repeat chemistry tests have resulted in ordering practice changes in the electronic medical record (EMR).

Conclusions: Through step-wise education beginning with basic data analysis concepts, residents become increasingly secure in managing big data and progressively more competent through the milestones progression. The ability to understand, analyze and manage big data is of growing importance in demonstrating the value of pathology in a value based healthcare system, and formalized resident education in bioinformatics can better prepare residents for this future while providing immediate and valuable quality services to their institution.

567 Multidisciplinary Tumor Board: A Ready-Made Tool for Competencies, Professionalism and Capturing Medical Student Interest in Pathology

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Background: Medical educators are expected to build action plans to address new core competencies, including interprofessional education and core entrustable activities for entering residency, in an already full medical school curriculum. We hypothesized that early medical student (MS) exposure to a pathology run multidisciplinary tumor board (MDTB) could provide a practical means of addressing core objectives without adding

to the current curriculum. We also proposed the additional benefit of capturing MS interest in pathology. This is an important aim given the dire combination of the aging of our specialty and the trend towards decreased applicants to pathology residencies.

Design: As part of their 8-week integrated course entitled Nutrition, Metabolism and the Gastrointestinal System (NMGI), first year MS were given the opportunity to attend one of four patient care MDTB sessions that occurred during the course. Participation was voluntary and limited to 15 students per MDTB session. All four of the offered MDTBs were related to gastrointestinal oncology/disease and therefore innately covered topics taught in the NMGI course. A single pathologist who served as both an instructor in the NMGI course as well as an active clinical member of the MDTB team served as the liaison for these sessions. This faculty met with the students for 15 minutes prior to the MDTB to discuss the process and team players involved in a MDTB as well as issues of professional conduct. The faculty member then accompanied the students to the MDTB, immediately followed by a 15 minute debrief session where questions could be addressed in a separate small group setting. All other members of the patient care MDTB team were made aware of both visiting dates and learning objective of the MS visitors from the NMGI course.

Results: Each of the four volunteer sessions filled to capacity. MDTB was cited as one of the strengths of the course by student evaluations and the student education group course review report. Several student evaluations of this course also noted the field of pathology when addressing the MDTB sessions: “it made me consider a field of medicine that I previously thought would be a bad fit for me.”

Conclusions: The MDTB is a premade medical education tool that brings clinical relevance to classroom material while providing opportunities to address competencies such as professionalism and interprofessional team-based patient care. An additional benefit of engaging medical students in MDTBs at this stage is early exposure to pathologists as physicians.

Endocrine Pathology

568 Prospective Experience with Routine SSTR2A Immunohistochemistry in Neuroendocrine Epithelial Neoplasms

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Background: Neuroendocrine epithelial neoplasms (NENs) express high levels of somatostatin receptors, the basis of octreotide therapy and somatostatin receptor imaging (SRI). In the fall of 2014 we began routine immunohistochemistry (IHC) testing of neuroendocrine tumors (NETs) for SSTR2A, using the monoclonal antibody UMB-1. Cases are scored based on criteria proposed by Korner and Reubi (*AJSP* 2012). We also test neuroendocrine carcinomas (and, rarely, other tumors) upon request. Herein, we report our first year’s prospective experience with the UMB-1 monoclonal antibody.

Design: We searched the pathology database for all SSTR2A IHC orders. Most stains (>90%) had been interpreted by a single pathologist in the context of routine care. The following clinicopathologic data was obtained: SSTR2A result (positive, indeterminate, probably negative, negative), SSTR2A H-score (extent*intensity), age, gender, anatomic site, differentiation (well, poor), WHO 2010 grade (G1-3), SRI results, prior somatostatin analogue treatment.

Results: We performed 214 IHC in 203 patients (M:F, 1:1; mean/median age 57/59). The H-score in positive and indeterminate cases was 209 (mean) and 279 (median). In 11 tested matched primary-metastatic pairs, there was 100% concordance (all positive). Detailed results are presented in the Table.

	Total # of cases	SSTR2A Positive
Anatomic Origin:		
Lung	24	(8) 33%
Pancreas	44	(40) 90%
Stomach	6	(5) 83%
Duodenum	6	(5) 83%
Small bowel	86	(84) 98%
Colon	3	(3) 100%
Rectum	11	(10) 90%
Appendix	14	(13) 93%
Unknown	14	(8) 63%
Differentiation:		
WD	193	(175) 91%
PD	18	(4) 22%
Grade:		
I	85	(77) 91%
II	97	(87) 90%
III	29	(14) 48%
SRI:		
Positive OctreoScan	64	(68) 94%
Negative OctreoScan	25	(16) 64%
Positive DOTA scan	19	(17) 90%
Negative DOTA scan	6	(2) 33%
Prior Somatostatin analogue treatment:		
Yes	135	(124) 92%
No	58	(37) 64%
Gender:		
M	99	(85) 86%
F	104	(83) 80%