University of California, San Francisco

CURRICULUM VITAE

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EDUCATION

1988 - 1992	University of Delaware, Newark, DE	B.A.	Biological Sciences	
1992 - 2000	Mayo Medical School, Rochester, MN	M.D.		
1992 - 2000	Mayo Graduate School	Ph.D.	Biochemistry/Molecular biology	(David Toft, Ph.D.)
2000 - 2002	University of California, San Francisco	Resident	Pathology	
2001 - 2003	University of California, San Francisco	Resident	Laboratory Medicine	
2004 - 2004	University of California, San Francisco	Chief Resident	Pathology	
2004 - 2004	University of California, San Francisco	Surgical Pathology Fellow	Pathology	
2007 - 2007	University of California, San Francisco	Completed rotations from Molecular Genetic Pathology fellowship		

LICENSES, CERTIFICATION

2002	Medical licensure, California
2004	Board Certification, Anatomic and Clinical Pathology, American Board of Pathology

PRINCIPAL POSITIONS HELD

2005 - 2011	University of California, San Francisco	Assistant Professor of Clinical Pathology	Pathology
2011 - 2018	University of California, San Francisco	Associate Professor of Clinical Pathology	Pathology
2013 - present	University of California, San Francisco Clinical Cancer Genomics Laboratory	Medical Director	Pathology
2018 - present	University of California, San Francisco	HS Clinical Professor of Pathology	Pathology

OTHER POSITIONS HELD CONCURRENTLY

2006 - 2017	San Francisco General Hospital	Director of Surgical Pathology	Pathology
2017 - present	San Francisco General Hospital	Associate Chief of Pathology	Pathology

HONORS AND AWARDS

1987	National Merit Scholar	
1988	E. I. DuPont Distinguished Scholar, University of Delaware	
1990	General Honors Certificate, University of Delaware	
1991	Undergraduate Biology Research Fellowship, University of Delaware	
1992	Phi Beta Kappa	
1992	Summa cum laude, University of Delaware	
2017	Nomination, Henry J. Kaiser Award for Excellence in Teaching	UCSF School of Medicine

KEYWORDS/AREAS OF INTEREST

Surgical pathology, molecular pathology, molecular diagnostics, gastrointestinal tract, inflammatory bowel disease, liver pathology, gynecologic tumors.

CLINICAL ACTIVITIES

CLINICAL ACTIVITIES SUMMARY

UCSF Clincal Cancer Genomics Laboratory (CCGL): In 2013, I became the Medical Director of the CCGL, a clinical laboratory for cancer testing on the Mt. Zion campus. In addition to this leadership role in the laboratory, I regularly participate in molecular case signout for FISH, PCR-based and UCSF500 testing.

I led the recent CCGL application for CAP accreditation, in order to improve the quality of our processes and learn more about practices in other laboratories. We were inspected in April 2019 with very positive results: There were no deficiencies on any checklist after review by CAP. This was a major undertaking for me and the laboratory, and I am proud of our success. CCGL represents the only UCSF campus Pathology laboratory which currently is accreditated by the CAP, and our experience should be helpful in guiding other Pathology laboratories which seek this recognition.

One of my first responsibilities was the transfer of solid tumor PCR testing from the Molecular Diagnostics Laboratory at China Basin to CCGL, and this took place in November 2013. The transfer involved re-validation of all assays that had been performed at MDL, as well as consolidation of test methodologies for assays which had been performed at both sites using different techniques. Since the test transfer, I have overseen the introduction of several improvements at CCGL:

- Increased spectrum of detectable mutations in KRAS and BRAF to improve sensitivity
- Streamlined workflow by utilizing standard protocols with better assay reliability among different tests, thus shortening turnaround time.
- Validation of new assays for molar pregnancy testing, MLH1 methylation, and mutations in nine new genes. This new testing includes expanded RAS testing for colorectal carcinomas and a set of genes for targeting melanoma therapy.
- Development and implementation of specimen identification testing, which can help reduce patient misdiagnosis due to specimen mislabeling or contamination. This test is used several times a year to provide clarity in cases of ambiguous tissue origin.
- Currently, the laboratory is developing a multi-gene panel for rapid identification of some of the most common mutations in cancer to help determine patient diagnosis and treatment.

All solid tumor molecular testing was consolidated at CCGL starting in 2015 in order to have focused expertise at one location and bring molecular testing in close proximity to the Histology lab (for reduced specimen transportation). This process involved the transfer of FISH testing from MDL to CCGL, a process completed in January, 2016. I have implemented an scanning fluorescent microscope for FISH that allows remote viewing, annotation and analysis of captured images. It is currently under validation for computer-based slide scoring and remote case signout.

Significantly, the laboratory accomplished a major milestone with the completion in April, 2015 of clinical validation for the UCSF500, a 480-gene panel for testing cancer. This assay has been used to help diagnose and determine therapy for cancer patients, including several with previously undiagnosed inherited cancer predisposition. CCGL has undertaken a study

comparing the performance of the UCSF500 to a widely-used competing assay (Foundation One), and our data show that UCSF500 reduces false positive calls and readily distinguishes inherited mutations from those occurring only in a tumor (manuscript in preparation). Currently, I am working with other CCGL faculty and colleagues from Oncology to summarize our findings from the first ~2000 UCSF500 cases for a manuscript. In May, 2020, we updated this panel to over 500 genes and incorporated microsatellite instability testing using only tumor samples to help guide immunotherapy. Additionally, intronic sequencing coverage was expanded to include over 70 genes to increase detection of gene fusions.

I have worked with the UCSF Histology laboratory and service directors in Pathology to develop and improve systems to shorten turnaround time, improve efficiency, and reduce errors in molecular test ordering. These include:

- Development and maintenance of the molecular section of the Surgical Pathology manual.
- Creation of all test menu content on the online CCGL test menu.
- Creation of documentation for recording and consenting for the use of cytology smears for molecular testing.
- Creation of automated ordering protocols for molecular test ordering.
- Review of testing practices to identify circumstances where DNA extraction can be performed by punching tissue from FFPE blocks rather than scraping of unstained slides, thereby reducing histology workload and improving DNA extraction throughput in CCGL.
- Addition of test name to recut slides to explicitly confirm to CCGL techs the testing ordered.
- Creation of standardized text for molecular test diagnoses to ensure uniformity of diagnostic reports and decrease case signout time.
- Creation of Pathology database searches to identify specimens that require subsequent molecular testing to notify pathologists that testing has not been ordered.

SFGH Surgical Pathology service: I am currently the Associate Chief of Pathology at SFGH. I represent the department at hospital-wide events when the Chief is not available, including the recent Joint Commission inspection of the department in July 2019. During that inspection, only one minor deficiency was identified. In the process of preparation for inspection and based on experiences during the inspection, I identified potential weaknesses in the department's procedures and conveyed them to the Chief and the department manager for improvement prior to the next inspection. I also played a central role in the department's planning and preparation for adoption of the Epic EHR (see Service below). I was the Director of Surgical Pathology at SFGH from 2006-2017. In that role I worked with the SFGH Histology laboratory and faculty pathologists to improve the quality of surgical pathology diagnosis at the hosptial. Activities that I have been involved with include:

- Development of new immunohistochemical stains including selection and evaluation of control specimens.
- Review of QA evaluations of staining performance by the College of American Pathologists.
- Training of physician assistants to help residents in handling of gross pathology specimens.
- Improvement of pathology report formatting on the hospital electronic medical record to increase readability and clarity.
- Implementation of routine second opinion review and its documentation in the pathology report.
- Implementation of consistent and routine documentation of physician notification of significant and critical diagnoses.

I participate in routine surgical pathology signout, which involves gross and histologic examination of tissues, including immunohistochemical and other special stains, and interpretation of these studies. I also perform intraoperative frozen section consultations for immediate surgical management, including on-call service coverage. My clinical interest is in

hepatic and gastrointestinal pathology, and I review all medical liver biopsies as well as many of the gastrointestinal biopsies performed at SFGH.

SFGH Autopsy service: I attend the SFGH Autopsy service during weeks of surgical pathology coverage. This involves review of medical records and gross and histologic examination of patients at autopsy. I am responsible for determination of cause of death and written communication of findings to a patient's clinicians.

Clinical Conferences:
UCSF Molecular Tumor Board: Weekly review of oncology cases that have undergone molecular testing at UCSF or elsewhere to determine the best therapeutic options for patients based on molecular results.
SFGH Interdisciplinary Tumor Board: Weekly review of pathology cases and presentation of findings for the purpose of patient management.
SFGH Gastrointestinal Pathology Conference: Weekly review of selected GI biopsies with the SFGH Gastroenterology service for clinicopathologic correlation.
SFGH MedSurg Conference: Weekly review (as needed) of patients from the Gastroenterology service who require further evaluation by the Surgery service.

CLINICAL SERVICES

2005 - present	Attending physician, Surgical pathology service; Attending physician, Autopsy service, San Francisco General Hospital	1 week per month; plus all liver biopsies
2005 - 2015	Attending pathologist and director of FISH testing, UCSF Molecular Diagnostics Laboratory at China Basin	Signout of FISH and PCR-based cancer tests
2013 - present	Medical director and attending pathologist, UCSF Clinical Cancer Genomics Laboratory	Signout of UCSF500, FISH, and PCR tests; 26 weeks per year

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PROFESSIONAL ACTIVITIES

MEMBERSHIPS

1992 - 2000 American Medical Association

2000 - present United States and Canadian Academy of Pathology

2001 - present College of American Pathologists

2003 - 2006 American Society for Clinical Pathology

2007 - present Association for Molecular Pathology

2010 - 2013 South Bay Pathology Society

SERVICE TO PROFESSIONAL ORGANIZATIONS

1992 - 2000	American Medical Association Delegate to state/national meetings	
2019 - present	Laboratory inspector, College of American Pathologists	Team leader for laboratory accreditation inspections

SERVICE TO PROFESSIONAL PUBLICATIONS

2011 - present Ad hoc reviewer, PLOS One

2016 - present Ad hoc reviewer, Human Pathology Case Reports (Elsevier)

2016 - present Ad hoc reviewer, BMC Medical Genetics (Springer Nature)

2017 - present Ad hoc reviewer, Brain Pathology (Wiley)

2018 - present Ad hoc reviewer, Clinica Chimica Acta (Elsevier)

INVITED PRESENTATIONS - NATIONAL

2009	UCSF Current Issues in Anatomic Pathology, course lecture Microsatellite Instability: The Basics for Pathologists
2010	American Society for Clinical Pathology, 2010 Annual Meeting, lecture Molecular Diagnosis in Gastrointestinal Stromal Tumors

INVITED PRESENTATIONS - REGIONAL AND OTHER INVITED PRESENTATIONS

1998	3rd Midwest Stress Response and Chaperone Meeting, Chicago, IL; ATP binding by hsp90 and its role in p23 binding
2001	UCSF Pathology Mechanisms of Disease Presentation Gene expression profiles in breast carcinoma
2001	UCSF Laboratory Medicine Medical Technologist Continuing Education Antibody studies in thyroid disease
2002	UCSF Pathology Mechanisms of Disease Presentation Bioterrorism agents
2002	UCSF Pathology Mechanisms of Disease Presentation Pathogenesis of vitiligo
2002	UCSF Medicine Morbidity and Mortality Conference Appendicitis
2003	UCSF Pathology Mechanisms of Disease Presentation Mechanisms of action of immunosuppresive agents in solid organ transplantation

2003	UCSF Laboratory Medicine Medical Technologist Continuing Education Options for HIV testing
2004	UCSF Pathology Mechanisms of Disease Presentation The origin of the Gaucher cell
2004	UCSF Blood Bank Grand Rounds Transfusion-related Acute Lung Injury
2005	UCSF Radiology Grand Rounds: AFIP case presentations Presentation of pathologic findings from cases from the Armed Forces Institute of Pathology
2005	SFGH Medicine Morbidity and Mortality Conference Clostridium difficile colitis
2005	UCSF Pathology Mechanisms of Disease Presentation The role of e-cadherin in pathogenesis of gastric signet ring adenocarcinoma
2006	SFGH Medicine Morbidity and Mortality Conference Pancreatic mucinous cystadenocarcinoma
2006	SFGH Cardiology Catheterization Conference Cardiac amyloidosis
2006	SFGH Medicine Morbidity and Mortality Conference Destructive midline facial lesions
2007	UCSF Surgery Grand Rounds Tumors of the ampulla of Vater
2007	SFGH Medicine Morbidity and Mortality Conference Mycobacterium avium-intracellulare complex infection in the intestinal tract
2013	UCSF Liver Center Pathology Symposium: Director of symposium and presentation- Benign or malignant? Atypical hepatocellular neoplasms
2019	Association of Northern California Oncologists Precision Oncology Symposium: Tissue versus Liquid Biopsy

CONTINUING EDUCATION AND PROFESSIONAL DEVELOPMENT ACTIVITIES

present	CME courses at the Association for Molecular Pathology annual meeting (approximately 10 CME credits per meeting; attend every 1-2 years).
present	CME courses at the United States and Canadian Academy of Pathology annual meeting (approximately 10-20 credits per meeting; attend annually)
present	UCSF Current Issues in Anatomic Pathology. (approximately 10-15 credits; attend every 2-3 years)
present	Participation in the Performance Improvement Program developed by the College of American Pathologists (approximately 30-40 CME credits annually).

2018 UCSF Department of Pathology Mechanisms of Disease lecture series (approximately 15-30 CME credits annually).

UNIVERSITY AND PUBLIC SERVICE

SERVICE ACTIVITIES SUMMARY

My service activities have expanded over the past few years from ones primarily focused on surgical pathology to include those related to molecular pathology and our Molecular Genetic Pathology (MGP) fellowship. I worked with members of the University's Genomic Medicine Initiative (GMI) starting with its 2014 inception, including GMI founding director Robert Nussbaum, to incorporate molecular testing to improve patient care. In 2018, the GMI was incorporated into the UCSF Health Center for Clinical Genetics and Genomics (UCCGG), led by UCSF's Chief Genomics Officer, Aleks Rajkovic. With the GMI, I helped create a plan to maintain current standard-of-care molecular testing in cancer as well as expand our capabilities and utilize new technologies that have greatly enhanced our understanding of patient malignancies and created opportunities for more specific therapy. The Clinical Cancer Genomics Laboratory (CCGL) owes its existence in large part to the support of the GMI. Since the creation of the UCCGG, I am working to increase the capabilities and utilization of molecular testing at UCSF for not only cancer, but all aspects of genetic disease. In my role as CCGL Medical Director, I work with UCSF Health leadership to develop a financial strategy for molecular testing in cancer patient care in order to ensure the continued availability and improvement of advanced testing for UCSF patients. This has required coordination with University experts in finance, compliance and clinical services as well at outside consultants. Testing performed at CCGL is complex and costly, and it has necessitated extensive budgetary planning and review of multiple strategic approaches both for expenses and for obtaining reimbursement. I also work closely with members of the UCSF Cancer Center to understand the clinical needs of oncologists and improve systems for communicating orders and results. This has included participation with the Precision Oncology user group to help plan the future Precision Cancer Medicine Building at Mission Bay, and using a pilot program for testing GI cancers with the UCSF 500 panel to develop indications for testing and workflows for test ordering. Other work with the Cancer Center has involved assessment of specific testing needs among the different oncology subspecialties to improve CCGL's billing strategy and revenue predictions. I recently participated in the launch of UCSF's The Campaign to help lead a session on the genetics of cancer and explain to a lay audience how molecular changes identified in a tumor can link to therapies designed to exploit those changes. I wrote the CCGL content and laboratory manual on the UCCGG homepage to explain cancer molecular testing available at CCGL and facilitate test ordering from UCSF and outside physicians.

I continue to be active in improvement of both the patient care and clinical teaching. I had previously designed a multimedia conference room at SFGH for tumor boards and remote lecture viewing for residents. As part of the Pathology departmental Resident Teaching Conference Working Group, I worked with other faculty on similar telecommunications systems to optimize resident education at multiple clinical sites in preparation for the opening of the Mission Bay Hospital. We also work on integration of teaching with the clinical service needs at multiple resident sites. I am the chair of the MGP fellowship Clinical Competency Committee, and was a member of the Anatomic Pathology residency Clinical Competency Committee until 2017, both of which work to ensure that trainees have developed competency in all clinical areas outlined in ACGME guidelines. As MGP CCC chair, I created new fellow evaluation forms and instructions to make the ACGME guidelines more clear and to provide

examples of how the guidelines could be met. For the MGP fellowship, I also serve on the Program Evaluation Committee, which regularly reviews the program to continually identify opportunities for improvement. From 2006-2013, I coordinated the Mechanisms of Disease lecture series for the Departments of Pathology and Laboratory Medicine, which is a CME-accredited series given by the residents of the two departments. In 2013, I handed that responsibility to another faculty member, but continue to provide mentorship for speakers.

On a hospital level, I am a member of the SFGH PIPS committee, where we evaluate and work to improve hospital performance and patient safety. I present patient safety data from Pathology to the PIPS committee on a regular basis. In 2013, I performed a QA study evaluating notification of clinicians by the pathologist for new malignant diagnoses. Since then, I have helped incorporate clinician notifications into routine practice at SFGH. As Chair of the SFGH Tissue Committee, I review data pertaining to tissue samples at the hospital and am currently working to improve the clinical data and contact information provided by submitting physicians. As a result of working with the operating room staff on this project, we recently reduced the number of specimens lacking clinical history from approximately 12% in 2014 to <1% in 2016. My most recent focus has been to improve specimen handling in the ORs and clinics to ensure adequate formalin fixation, which is essential to high quality diagnostic pathology slides. I am currently working with the SFGH clinical leaders and the Pathology gross room to improve staff training on formalin fixation by the clinical services, and tracking of formalin data within Pathology.

SFGH recently went live with a new Epic electronic health record. During the planning and implementation of this EHR, I was the subject matter expert for surgical pathology for the department. This involved many meetings with providers from different settings (outpatient clinic, inpatient, OR) to understand their protocols for obtaining and ordering pathology examination, and how our results in the form of pathology reports are received and acted upon. The information I obtained helped to inform how Epic should be set up for placing orders for pathology in order to ensure the department has all necessary information for optimal specimen evaluation, including clear designation of site for each specimen in the requisition and on the specimen container, and adequate clinical history. I also learned about potential sources for missed communication which will help the department develop practices to ensure that critical and other important results are reliably conveyed to the appropriate person.

For the past several years I have been involved in the selection of Pathology residents through applicant interviews, and since the initiation of the Molecular Genetic Pathology fellowship, I interview applicants for that program as well. During national meetings, I represent the department during fellowship recruitment events. I have also been involved on university searches for faculty in both the Departments of Laboratory Medicine and Pathology, most recently as chair of the search committee for new faculty in Molecular Pathology.

Since 2009, I have been the Director of the Pathology Core at the UCSF Liver Center. This role involves providing pathology services, consultation and interpretation to Liver Center members for their research. I am also a member of the Liver Center Internal Executive Committee, which plans strategies for providing optimal services, funding and education to members and prepares for the center's annual symposium, external review and funding application. Highlights of my work with the Center are included under Research Awards.

In 2018, I began involvement with the UCSF Global Cancer Program, in particular its association with Muhimbili University of Health and Allied Sciences in Tanzania. In this service, I reviewed grant applications for research funding and mentored a pathology trainee.

I review papers for several journals, mainly focusing on genetics of disease and molecular diagnosis.

UCSF CAMPUSWIDE

-	UNIVERSITY SERVICE:	
2009 - present	UCSF Liver Center	Director, Pathology Core; Internal Exectutive Committee
2013 - 2018	Genomic Medicine Initiative	Advisor
2017 - 2017	UCSF The Campaign launch	Presentation lead for Genes: Your Prescription for Cancer Care
2018 - present	UCSF Global Cancer Program	Grant reviewer, mentor
2018 - present	UCSF Health Center for Clinical Genetics and Genomics	Advisor, laboratory director
-	HOSPITAL SERVICE:	
2006 - present	SFGH PIPS committee	Member
2012 - present	SFGH Tissue Committee	Chair
2018 - present	SFGH Epic EHR Implementation	Subject matter expert

DEPARTMENTAL SERVICE

2006 - 2006	Upgraded SFGH Pathology multimedia classroom for teaching and clinical presentations	Consultant
2006 - present	Quality Assurance review of gastrointestinal biopsy diagnoses	Expert reviewer
2006 - present	Mechanisms of Disease lecture series, UCSF Departments of Pathology and Laboratory Medicine	Coordinator 2006-2013 Mentor 2013-present
2007 - present	Quality Assurance reviews of immunohistochemistry, SFGH	Reviewer
2008 - present	Wrote sections on gastrointestinal and molecular pathology for UCSF surgical pathology manual	Author
2008 - 2012	Search committee member for faculty in Departments of Pathology and Laboratory Medicine	Member

2008 - present	Pathology residency and Molecular Genetic Pathology fellowship interviews (approximately 4-6 per year)	Interviewer
2011 - 2013	Co-authored SFGH Surgical Pathology Manual for residents	Author
2012 - 2014	Resident Teaching Conference Working Group	Member, SFGH representative
2013 - 2016	Quality Assurance review of clinician notification of new malignant diagnoses	Reviewer
2013 - 2017	Clinical Competency Committee, Anatomic Pathology residency program	Member
2013 - present	Clinical Competency Committe, Molecular Genetic Pathology fellowship	Chair
2013 - present	Program Evaluation Committee, Molecular Genetic Pathology fellowship	Member
2016 - 2018	Search committee for Molecular Pathology faculty position	Chair

CONTRIBUTIONS TO DIVERSITY

CONTRIBUTIONS TO DIVERSITY

I have been an attending pathologist at San Francisco General Hospital since I joined the UCSF Department of Pathology in 2005. The hospital serves a highly diverse patient population, including many patients with extreme financial hardship, recent immigrants from disadvantaged parts of the world, and individuals marginalized from much of society. I am aware of the unique conditions from which they have come, the challenges this brings to providing them care, and the types of illnesses which they may be more susceptible to. At SFGH, we keep these points in mind to be sure to consider diseases such as unusual infections that may not be typical considerations in other parts of the country or even in other parts of San Francisco. I am proud to work in this institution dedicating to providing care for all who need it.

In 2018, I became involved in the UCSF Global Cancer Program and though that program work to promote clinical research and improve healthcare in under-resourced parts of the world. These activities are described in the Mentoring and Service sections.

As part of my leadership of the SFGH Tissue Committee, I have recently started collection and analysis of appendectomy data to look for any trends in this procedure for patients based on gender, race/ethnicity or language. We are asking questions such as: How do the demographics of appendectomy patients compare to those of the overall hospital patient population? How does this compare to published data on this subject? For patients undergoing appendectomy, how does the false positive rate (i.e., no appendicitis identified on histology) compare among different groups? This has the potential to identify groups who are under-treated or over-treated for suspected appendicitis.

TEACHING AND MENTORING

TEACHING SUMMARY

1. Resident and fellow education: I am heavily involved in teaching surgical pathology and molecular diagnosis to residents and fellows. For surgical pathology, I teach junior residents how to evaluate gross specimens, document findings, and evaluate histologic sections. This takes place in the specimen grossing room, the frozen section room and at the microscope. I cover gross and microscopic findings, and explain the terminology for describing them. I share techniques to better document three-dimensional gross findings on the two-dimensional glass slide. For more experienced residents, I focus on diagnostic and communication skills. This involves discussions of differential diagnoses, tumor grading and staging, and emphasis on providing useful information to clinicians. Additionally, I participate in slide conferences for the residents and fellows. Lectures for the residents and fellows in Pathology include those on the gastrointestinal tract that are a part of their core lecture curriculum. Since 2011, the molecular laboratories have been a required rotation for Pathology and Laboratory Medicine residents, giving me the opportunity to work with all of our residents to prepare them for this ever-expanding field of pathology. In the CCGL, residents rotate for one month during which I introduce them to molecular diagnostic testing in pathology, and mentor research and test validation projects which they may be involved in. This interaction includes lectures on molecular cancer testing and hands-on experience in FISH, PCR and next-generation sequencing diagnosis. The Department of Pathology began a Molecular Genetic Pathology fellowship in 2009, and I teach the fellows significance and interpretation of molecular diagnostic tests, through both informal signout sessions and lectures, as well as help guide research projects that they undertake. Fellows also undertake test validation projects to give them hands-on experience with test development, and I help them with plans for validation and documentation. Outside of the Pathology Department, I perform ad hoc review of patient findings for residents and their attendings from other departments. I also run a weekly Gastrointestinal Pathology conference with the residents, fellows and attendings on the SFGH Gastroenterology Service. I was honored to be nominated for the Henry J. Kaiser Award for Excellence in Teaching for 2016-2017.

2. Medical student education: With the recent revisions in the medical school curriculum at UCSF, there has been a shift toward small group instruction in the Ground School and Bridges blocks for 1st year students. I have taught in several of these small groups, introducing new medical students to such concepts as inflammation, ischemia, autoimmunity, and solid and hematopoietic malignancy. This has been the most rewarding teaching I have done in the medical school, as it has allowed me to spend an extended period of time with a consistent group and learn to work with them as they piece through the patient scenarios that make up the focus of these sessions. There is an interaction that takes place that does not happen in the lecture hall environment. In response to the superior environment of the small groups, I have made a concerted effort to improve my teaching skills in recent years, and this has been rewarded with strong student evaluations. Prior to the curriculum changes, I lectured to students on cancer in the M3 and Prologue blocks. These lectures dealt with the clinical and pathological features of cancer, the terminology used to describe it, and the techniques used to diagnose it.

We are fortunate to have several medical students each year who spend time in the Department of Pathology through elective rotations. Many of these students are interested in a career in pathology, and for these students I focus on the same goals as I do for junior residents. However, many elective students have plans to pursue other fields of medicine. I feel it is important for them to understand the role of the pathologist in the larger world of

medicine, how to best utilize the expertise of the pathologist, and to learn how to properly interpret the reports of pathologist.

3. Clinical Laboratory Scientist (CLS) education: In order to maintain licensing, CLS technologists at CCGL require continuing education. To help support their ongoing training and the education of new CLS techs as part of the CCGL's CLS training program, I have given CE lectures on molecular testing and its relation to clinical care. I also give lectures to trainees in CCGL's CLS molecular training program to teach them how their laboratory results are interpreted and used to help determine patient diagnosis and treatment.

INFORMAL TEACHING

2005 - present Histologic slide review at the microscope with SFGH Pathology residents

2006 - present Frozen section slide review for SFGH Pathology residents. Monthly unknown session with "live" review of frozen section slides to simulate real frozen section diagnosis.

2009 - present Review of molecular diagnostic cases (FISH, PCR and next-generation sequencing) with Anatomic Pathology and Laboratory Medicine residents and Molecular Genetic Pathology fellows

2012 - 2015 Unknown slide session on GI/Liver for all UCSF Pathology residents

MENTORING SUMMARY

My most rewarding mentoring has been of our Molecular Genetic Pathology fellows. In addition to teaching them the clinical practice of signing out molecular testing, I also emphasize the importance of communication with the clinicians ordering testing. This is especially crucial when the results of molecular tests can have subtleties that must carefully be expressed in our reports. I have also worked with fellows on their validation projects to help develop new tests to be performed in the molecular laboratory. Finally, I have provided career guidance for these trainees as they prepare for post-fellowship employment.

In 2018, I started a new mentoring experience as part of the UCSF Global Cancer Program, working with a Tanzanian pathology resident from Muhimbili University of Health and Allied Sciences to develop a research project and write a grant proposal for it. This forced me to look beyond my immediate circumstances and consider the practice of medicine in resource-poor areas of the world. It also made me more aware of potentially significant differences in population characteristics around the world that could make practices and studies in the United States inapplicable to other environments. Our grant proposal addressed assessment of HER2 overexpression on gastric cancers for potential targeted therapy, and it was successfully funded in May 2018.

RESEARCH AND CREATIVE ACTIVITIES

RESEARCH AND CREATIVE ACTIVITIES SUMMARY

My primary research interests are in the areas of gastrointestinal and liver pathology, as well as in the use of molecular testing in pathologic diagnoses including cancer. Recent studies have included:

Molecular analysis of uterine mesenchymal tumors. This work with Drs. Rebecca Wolsky and Patrick Devine uses the UCSF500 NGS panel to analyze these uncommon mesenchymal tumors of the GYN tract that may share similar histology despite different molecular pathogenesis, prognosis and treatment. We found that certain genes such as TSC1/TSC2 and ATRX can be very specific identifiers of mesenchymal tumor types (PEComa, leiomyosarcoma). This work has been presented at USCAP.

Molecular characterization of goblet cell carcinoid. This uncommon appendiceal tumor has histologic features of both neuroendocrine tumors as well as adenocarcinoma. Recently, these tumors have been shown to be more aggressive than their appearance would suggest, and they tend to behave in a manner more typical for adenocarcinoma. I am working with Dr. Sanjay Kakar to characterize these tumors using next-generation sequencing to identify driver mutations in this unique category of tumors. This work has recently been published in Human

Pathology.

Molecular genotyping of triploid pregnancies with normal morphology. This is a project with Dr. Joe Rabban to look at products of gestation which are histologically normal but were identified as triploid by clinical array CGH testing. Triploid pregnancies may be molar pregnancies, which carry a risk of persistent or malignant trophoblastic disease, or they may be digynic triploid pregnancies which do not carry this risk. We genotyped these to determine the origin of triploidy and found that some of these specimens are hydatidiform moles, despite the absence of typical morphologic features. This has clinical implications in that all cases of triploidy by CGH should be called out to the pathologist for subsequent genotyping, since they may be missed if genotyping is only performed on histologically abnormal specimens. This work was presented at USCAP.

Effects of dietary composition on hepatic lipid metabolism: I have a longstanding collaboration with UCSF Liver Center director Dr. Jackie Maher (UCSF Gastroenterology) to look at lipid metabolism in mouse models of steatohepatitis and the effects of diet on biochemical and histologic markers of fatty liver injury. Thus far, our work has shown that the carbohydrate and lipid content of the diet can have a significant impact on the manifestation of fatty liver disease in the mouse. Indeed, our recent work shows that calorie-equivalent diets of different carbohyrdrate and lipid composition can have very different levels of de novo lipogenesis. The findings may provide insight into how diet influences development of fatty liver disease and how dietary changes may be able to modulate injury in steatohepatitis. This work has been presented at meetings and resulted in multiple publications.

Molecular and immunohistochemical evaluation of breast cancers treated with neoadjuvant therapy. This is a study with Drs. Yunn-Yi Chen and Gregor Krings to look how HER2 protein expression and gene amplification may be altered by neoadjuvant therapy. Our initial work has shown that HER2 positive tumors treated with the anti-HER2 antibody Herceptin can revert to a HER2 negative immunophenotype while retaining HER2 gene amplification by FISH. These findings may have important relevance for interpretation of HER2 IHC and FISH following neoadjuvant treatment, as well as subsequent treatment selection for these patients. This work has been presented at USCAP.

Indentification of BRAF mutations in histiocytic malignancies: This project with Dr. Andrew Horvai looks at uncommon histiocytic tumors (Langerhans cell histiocytosis, LCH) for the presence of BRAF and MAP2K1 mutations in a large cohort of LCH cases. BRAF mutations have recently been identified in a number of hematopoietic malignancies including hairy cell leukemia and Erdheim-Chester disease, and LCH is known to harbor mutations in BRAF and other Ras-Raf-MAPK pathway members. Histiocytic lesions may be difficult to differentiate histologically from benign histiocytic inflammation, and the presence of BRAF or MAP2K1 mutation can help confirm a malignant diagnosis. Mutation carriers may also benefit from targeted BRAF or MEK inhibition. We found that approximately half of cases of LCH harbor BRAF mutation, and 10% had MAP2K1 mutation, but these mutations did not predict behavior. These tumors are being further evaluated by UCSF 500 to identify non-Ras-Raf-MAPK mutations that may be linked to aggressive clinical outcome. This work has been presented at USCAP.

Use of molecular markers to predict behavior of thyroid tumors: This project with Dr. Lisa Orloff of Otolarygology and Dr. Mieke van Zante studies a large series of throid tumor resections from UCSF. Many thyroid cancers, papillary thyroid carcinoma in particular, harbor BRAF mutations. The percentage of tumors with mutation vary considerably in the literature and this is likely related to tumor subtype. Some studies have indicated that BRAF mutation is associated with more aggressive behavior. In our study, BRAF mutation status was evaluated

to determine the mutation rates of different thyroid tumor subtypes. Mutation status was then compared with risk factors for aggressive behavior (such as extrathyroidal extension). Eventually, we hope to follow these patients to determine final outcomes in relation to BRAF status. This study has been published.

RESEARCH AWARDS - CURRENT

1. P30 DK026743 Core Director 10% % effort Maher (PI)
   NIDDK 06/01/2009 05/31/2023
   UCSF Liver Center Pathology Core $ 10% salary support total

   Dr. Grenert will supervise the core facility and its services. He ensures that the needs for the Liver Center members are met, checks on the quality and quantity of the work, and prioritizes projects at times of high volume. He will provide expertise on light and ultrastructural pathology, consult with core users regarding experimental approaches and image interpretation, and serve as the interpreting pathologist for the Center. Finally, he will oversee the record-keeping of the Core use and prepare quarterly and annual reports. Dr. Grenert will devote 10% effort to the Core.

   I have been the Director of the UCSF Liver Center Pathology Core since 2009. During that time, the Core has changed from a small Liver Center-operated laboratory providing histology work for members to a "virtual" core utilizing outside service providers to allow for a more broad range of available services. This has involved evaluation of potential service providers and negotiation of agreements between the Center and the providers. I initiated an agreement with the UCSF Tissue Technology Core (TTC) to provide new services for the Center, thus expanding the Center's capability without the extensive capital and labor investment that would have been necessary to make independently. As a result of this effort, the Core has recently been able to expand beyond basic histology services into more technologically advanced processes including molecular in situ hybridizations and advanced image analysis. The TTC has also provided specimen biobanking services for Center members to add our clinical researchers. Additionally, teaming up with a commercial clinical histology lab has reduced wait times for histology services from a typical 2-week turnaround to 2 days. I serve as a consultant to Center members on pathologic specimen handling and preparation, histologic processing and protocols, photomicroscopy, and slide interpretation. I have had multiple research collaborations with fellow Center members, resulting in several publications. I review grants submitted to the Center for various funding opportunities for liver researchers and help organize the Center's annual research symposium as well as directed a mini-symposium on liver pathology. Finally, I participated in the successful renewals of the Center's grant in 2012 and 2017.

RESEARCH AWARDS - PAST

1. 444881-29664 Co-Investigator Somsouk (PI)
   UCSF Center for AIDS Research 04/01/2010 03/31/2011
   Colorectal Neoplasia and Cancer Among Patients with HIV Infection $ 5% salary support direct/yr 1

This study looks at the clinical, pathological and molecular characteristics of colorectal neoplasia in HIV positive individuals compared with age-matched HIV negative individuals. Dr. Grenert performed histological analysis of these tumors and studied molecular features of the tumors, including kinase mutations, microsatellite instability, and loss of heterozygosity.

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NON-PEER REVIEWED PUBLICATIONS

1. Grenert JP, Nassos PS, and Haller BL. Human immunodeficiency virus: Diagnostic testing at the start of the 21st century. Clinical Lab News. 28: 18-20, 2002.

BOOKS AND CHAPTERS

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SIGNIFICANT PUBLICATIONS

1. Wen KW, Grenert JP, Joseph NM, Shafizadeh N, Huang A, Hosseini M, Kakar S. Genomic Profile of Appendiceal Goblet Cell Carcinoid Is Distinct Compared to Appendiceal Neuroendocrine Tumor and Conventional Adenocarcinoma. Hum Pathol. 2018 Apr 07. PMID: 29634977

   Histologic review. Molecular data analysis and interpretation. Manuscript review.

2. Kline CN, Joseph NM, Grenert JP, van Ziffle J, Yeh I, Bastian BC, Mueller S, Solomon DA. Inactivating MUTYH germline mutations in pediatric patients with high-grade midline gliomas. Neuro Oncol. 2016 May;18(5):752-3.

   Development of concept. Molecular data analysis and interpretation. Manuscript review.

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