UNIVERSITY of MARYLAND
SCHOOL OF MEDICINE

Curriculum Vitae

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Executive Director, Clinical Genomics; CLIA Laboratory Director, MGTDL
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Education

- 1978 to 1981- University of Bombay (Mumbai), Mumbai, India; BSc, Microbiology.
- 1981 to 1983 - University of Bombay (Mumbai), Mumbai, India; MSc, Microbiology.
- 1985 to 1994 - University of Delaware, Delaware, USA; PhD, Biological Sciences.
  Title of Thesis: Bacillus cereus beta-lactamase II: Identification of amino acid residues affecting substrate specificity (1993)
  Thesis Advisor: Jacques J. Pene, PhD.

Post Graduate Education and Training

- 1996 to 1998 - Post-doctoral Researcher; Department of Pathology, David Geffen School of Medicine at the University of California, Los Angeles (UCLA), Los Angeles, USA; Mentors: Steven Cederbaum, MD, & Wayne Grody, MD, PhD.
- 1996 to 1998 - Post-doctoral Researcher, Department of Pathology, David Geffen School of Medicine at UCLA, Los Angeles, California, USA; Mentors: Steven Cederbaum, MD.
- 1996 to 1998 - Fellow, Clinical Molecular Genetics; UCLA-Cedar Sinai Inter-Campus Medical Genetics Training program, Los Angeles, California, USA; Mentor: Wayne Grody, MD, PhD.
- 2000 to 2002 - Fellow, Clinical Cytogenetics; UCLA-Cedar Sinai Inter-Campus Medical Genetics Training program, Los Angeles, California, USA; Mentor: Nagesh Rao, PhD.

Certifications

- 1999 to present - Diplomate, Clinical Molecular Genetics; American Board of Medical Genetics & Genomics (ABMGG).
- 2002 to 2012 (expired) - Diplomate, Clinical Cytogenetics; American Board of Medical Genetics Genomics (ABMGG)

Employment History

Academic Appointments

- 1998 to 2000 - Assistant Researcher (junior faculty); Pathology & and Laboratory Medicine, David Geffen School of Medicine at UCLA, Los Angeles, California, USA.
- 2000 to 2004 - Clinical Assistant Professor; Pathology & and Laboratory Medicine, David Geffen School of Medicine at UCLA, Los Angeles, California, USA.
- 2006 to 2010 - Clinical Assistant Professor; Pediatrics & Communicable Diseases, and Pathology, University of Michigan Medical School, Ann Arbor, Michigan, USA.
- 2013 to 2019 - Assistant Professor; Obstetrics & Gynecology; Virginia Commonwealth University (VCU), School of Medicine (Inova Campus), Fairfax, Virginia, USA.
- 2023 – Interim Visiting Assistant Professor; Medicine, University of Maryland School of Medicine, Baltimore, Maryland, USA (*Note: Pending final approval of appointment as Associate Professor; Medicine*)

Other Employment

- 1983 to1984 - Quality Control Technician; Bharat Serums and Vaccines, Bombay, India.
- 1984 to 1985 - Research Associate; Hoechst Pharmaceuticals Ltd., Bombay, India.
- 1993 to 1996 - Co-founder & Research Director; ProteinGenesis Inc, Newark, Delaware, USA.
- 2000 to 2002 - Assistant Director, Molecular Pathology Laboratory; UCLA Healthcare, UCLA, Los Angeles, California, USA.
- 2000 to 2002 – Assistant Director, Molecular Pathology Laboratory; UCLA Healthcare, UCLA, Los Angeles, California, USA.
- 2000 to 2004 – Assistant Director, Clinical & Molecular Cytogenetics Laboratory; UCLA Healthcare, UCLA, Los Angeles, California, USA.
- 2002 to 2004 – Associate Director, Molecular Pathology Laboratory; UCLA Healthcare, UCLA, Los Angeles, California, USA.
- 2004 to 2005 - Assoc. Lab Director & Program Director, Molecular Diagnostic Laboratory/Clinical Operations; Myriad Genetics Laboratories, Salt Lake City, Utah, USA.
- 2005 to 2006 - Associate Director, Molecular Genetics & Cytogenetics Laboratories; Nationwide (formerly Columbus) Children's Hospital, Columbus, Ohio, USA.
- 2006 to 2010 – (Founding) Director, Molecular Genetics; Michigan Medical Genetic Laboratories (MMGL), University of Michigan Healthcare, Ann Arbor, Michigan, USA.
- 2008 to 2010 – (Founding) Managing Director, Pediatric Heart Network, Single Ventricle Reconstruction Extension study (PHNSVRII) Biorepository (NIH funded); University of Michigan, Ann Arbor, Michigan, USA.
- 2009 to 2010 – (Founding) Director, Michigan Institute for Clinical and Health Research (MICHR), Biorepository; University of Michigan, Ann Arbor, Michigan, USA.
- 2010 to 2011 - Program Manager, The Cancer Genome Atlas (TCGA) Project; National Cancer Institute, National Institutes of Health (NIH), Bethesda, Maryland, USA.
- 2011 to 2017 - Director, Clinical Molecular Genetics & Biobanks; (a member of the founding team at) Inova Translational Medicine Institute (ITMI), Inova Fairfax Hospital, Inova Health System, Fairfax, Virginia, USA.

- 2014 to 2019 - Director, Inova Genomics Laboratory (IGL) [CAP#8035677; CLIA# 49D2071564]; Inova Health System, Fairfax, Virginia, USA.
- 2017 to 2019 - Vice-President; Inova Translational Medicine Institute, Inova Health System, Fairfax, Virginia, USA.
- 2020 to 2020 – Consultant; BODETECH Inc, Lorton, Virginia, USA
- 2020 to 2020 – Consultant; Dept of Pathology, University of Maryland, Baltimore, Baltimore, Maryland, USA.
- 2020 to 2021 - Molecular Scientist, Molecular Pathology Laboratory; Joint Pathology Center (JPC), Defense Health Agency (DHA), Bethesda, Maryland, USA.
- 2021 to present - Executive Director, Clinical Genomics; Institute for Genome Sciences, University of Maryland, Baltimore, Baltimore, Maryland, USA.

Professional Society Memberships

- 1986 to 2003 – American Association for the Advancement of Science
- 1996 to 2015 - American Society for Human Genetics.
- 2003 to present – (Fellow) American College of Medical Genetics & Genomics.
- 2004 to present - Association for Molecular Pathology.
- 2005 to present – American Association for Clinical Chemistry.
- 2013 to 2015 - American College of Healthcare Executives.
- 2012 to 2015 - American Society for Clinical Laboratory Sciences.
- 2012 to 2015 - International Society for Biological and Environmental Repositories

Honors and Awards

- 1992 to 1993 - University of Delaware, Competitive Research Fellowships
- 2000 - 8th International Congress of Inborn Errors of Metabolism, Competitive Travel Award
- 2001 - Howard Hughes Medical Institute, Frontiers of Science Award
- 2018 - Health and Life Sciences Innovator of the year Award, Greater Washington Innovation Awards™, Presented by the Northern Virginia Chamber of Commerce to Inova for the Medimap™ program.

Clinical Activities

Clinical Expertise

ABMGG Board-certified Clinical Molecular Geneticist

Clinical focus is in the area of genetics of disease, specifically the molecular genetic analysis of inherited and somatic disease, to aid diagnosis and prognosis.

Interests

- Clinical testing for inherited disorders, and cancer.
- Predictive testing, including Pharmacogenomics.
- Development of novel genetic assays and technologies.
- Development and operation of biorepositories.

Clinical Practice/Experience:

- 2000 to 2004 - Assistant/Associate Director, Molecular Pathology Laboratory, and Clinical Cytogenetics Laboratory, UCLA.
  - **Clinical Duties**: Provided Molecular Genetics and Cytogenetics clinical testing services to the UCLA and surrounding physician-patient populations. Interpretation and reporting of Cytogenetic and Molecular Genetic diagnostic test results, derived using methodologies such as karyotyping,

FISH, PCR, DNA sequencing and other methodologies. Performance of internal quality control assessments, helping with personnel and financial issues.
  - **Program Development activities**: Identification, development and operationalization of new clinical tests and technologies, development and troubleshooting of protocols, and bringing the tests online, Developed and operationalized clinical FISH testing that supported an international clinical trial (UCLA PI: Charles Sawyers, MD) that culminated in the approval of the first cancer biomarker-based, targeted therapy (Gleevac) for Chronic Myelogenous Leukemia.
- 2004 to 2005 - Associate Laboratory Director and Program Director, Molecular Diagnostics Laboratory & Clinical Operations, Myriad Genetics Inc.
  - **Clinical Duties**: Directly responsible for the efficient, error-free, and on-time operations of a high-throughput clinical sequencing laboratory. Directed a multi-functional QC and process evaluation team that performed quality and process evaluations, developed new quality control paradigms and protocols, and workflows that improved quality and productivity in the clinical production laboratory. Interpretation and reporting of informative of hereditary cancer risk clinical tests.
  - **Program Development activities**: Development (in collaboration with R & D) and implementation of new testing. Provided strategic insight, tactical input and technical assessments regarding potential new clinical service and research collaboration opportunities to upper management and executive leadership. Helped to develop and implemented strategies for employee recognition and retention including incentive plans, and educational opportunities.
- 2005 to 2006 - Associate Director, Molecular Genetics and Cytogenetics, Nationwide Children's Hospital.
  - **Clinical Duties**: Provided high quality, accurate Molecular Genetics and Cytogenetics clinical testing services for inherited disorder diagnosis, and cancer diagnosis and prognosis to physicians and other health care providers at NCH and surrounding hospitals, and private practices. Internal and external quality evaluations (including CAP/CLIA challenges). Personnel and project management. Interpretation and reporting of diagnostic test results for the Clinical laboratory. Interpretation and reporting of Acute leukemia risk stratification test results for the COG-ALL reference laboratory.
  - **Program Development activities**: Identification of new clinical tests and technology opportunities, development and troubleshooting of protocols, bringing new clinical tests online.
- 2006 to 2010 - Director, Michigan Medical Genetic Laboratories' Molecular Genetics Laboratory (MMGL-MGL), Department of Pediatrics and Communicable Diseases, University of Michigan.
  - **Clinical Duties**: Founded the CLIA/CAP-accredited Molecular Genetics testing laboratory at MMGL. Provided clinical testing services for the diagnosis and management of children and adults with inherited genetic conditions; a focus of this laboratory was development of testing for rare/orphan and esoteric disorders, that were often difficult to obtain otherwise. Interpretation and reporting of diagnostic test results in the molecular laboratory, as well as bone marrow FISH and karyotype cases in the Department of Pathology's Cytogenetics laboratory.
  - **Program development activities**: Developed a high-quality core service that provided DNA isolation, array-CGH and custom SNP typing to the UM research community. Co-developed the training curriculum for the ABMGG-accredited Clinical Molecular Genetics Fellowship program (Program Director, J. Innis, MD)
- 2014 to 2019 - Director, Inova Genomics Laboratory (IGL), Inova Translational Medicine Institute (ITMI), Inova Health System.
  - **Clinical Duties**: Founded the CLIA/CAP-accredited Molecular Genetics testing laboratory at ITMI. Provided Tumor Profiling testing that supported the Inova Schar Cancer Institute's Molecular tumor board (MTB), facilitating targeted cancer treatment for patients. Developed and operationalized a successful preemptive clinical pharmacogenomics testing program at Inova. Interpretation and reporting of diagnostic test results in the molecular laboratory.

- **Program development activities**: Developed and provided a variety of genetic/genomic assays, to support clinical research and clinical trials in the Inova Schar Cancer center (ISCI), the Inova Heart and Vascular Institute (IHVI), Dept of Obstetrics & Gynecology, and Pediatrics. Participated in the planning and development of a Molecular Tumor Board (MTB) that facilitated the application of tumor profiling results to improve treatment and care of patients with advanced cancer.

- 2020 – Consultant, Department of Pathology, University of Maryland, Baltimore.
  - **Clinical Duties**: Helped in the development and operationalization of the CLIA-certified UMPA-IGS COVID-19 testing laboratory. Interpretation and reporting of COVID-19 test results.
- 2020 – Consultant, Bodetech Inc
  - **Clinical Duties**: Helped in the development and operationalization of the CLIA-certified Bodetech Inc. COVID-19 testing laboratory. Functioned as the CLIA lab director. Interpretation and reporting of COVID-19 test results.
- 2020 to 2021 - Molecular Scientist, Molecular Pathology Laboratory, Joint Pathology Center, DHA
  - **Clinical Duties**: Primary responsibility for ensuring smooth day-to-day operation of the clinical laboratory, to assure error-free, timely provision of clinical testing to clients across the military health system (MHS). Worked with IT to optimize LIMS and reporting systems, with QA to assure compliance with CLIP, CAP, ISO 15189, and other regulatory requirements, with administration to manage inventory, logistics and budgets. Provided guidance and technical expertise for the development, validation, and deployment of new assays.
  - **Program Development activities**: Initiated a process to develop a comprehensive staff education program including case reviews, journal clubs, and increased opportunities for scientific interactions at meetings. Participated as a subject matter expert in a working group that developed a congressionally-mandated report on rare cancer testing and personalized medicine opportunities in the MHS. (Briefly) Participated in a working group with a mandate to develop and deploy a Molecular Tumor Board at Walter Reed National Military Medical Center (WRNMMC).
- 2021 to present – Executive Director, Clinical Genomics, Institute for Genome Sciences, University of Maryland, Baltimore; Laboratory Director, Maryland Genomics Translational and Diagnostics Laboratory (MGTDL).
  - **Clinical Duties**: I have developed and my team has operationalized the CLIA-registered Molecular Diagnostics/Clinical Genomics laboratory, the Maryland Genomics Translational and Diagnostics Laboratory (MGTDL) within the Institute for Genomes Sciences, at the University of Maryland School of Medicine. This laboratory will provide state-of-the-art genomics testing services to support and enhance the practice of "Precision Medicine" to improve treatment and outcomes for patients at the University of Maryland Medical Center (UMMC), and Medical System (UMMS). In phase 1 of the clinical laboratory development project, the MGTDL is developing clinically validated assays for:
    - Comprehensive Genomic Profiling (CGP; aka Somatic tumor profiling) of solid tumors.
    - Non-invasive Prenatal testing (NIPT), a screening test for detection of certain fetal chromosomal abnormalities.
    - Pharmacogenomic (PGx) testing for clinically validated drug-gene pairs.
    - NGS-based testing (disease panels and whole exome sequencing) for patients with suspected genetic disorders.
  - **Program Development activities**:
    AT IGS, our goal is to facilitate the practice of "Precision Medicine" to improve treatment and outcomes for patients as well as throughout the University of Maryland Medical System (UMMS). We are fortunate to be able to build on an already existing strong foundation of excellent technological expertise and high quality next generation sequencing (NGS) infrastructure extant within the Maryland Genomics (MG) core at IGS to develop and implement relevant, state-of-the

art clinical genomics and molecular diagnostic testing. In this effort, I actively seek opportunities to create/improve channels of communication with physicians, scientists and other stakeholders at the University of Maryland, to increase knowledge of our capabilities and services, to identify unmet needs, and opportunities to fulfill such needs. I strive to work collaboratively with other clinical molecular diagnostic laboratories at UMB/UMMC/UMMS, such as the Translational Genomics Laboratory (TGL), to promote synergy, efficient use of resources, and to avoid detrimental intramural competition. By my endeavors, I expect to enhance our abilities to provide appropriate genomic testing services, facilitating the translation of novel research insights into innovative tests, better tailored to the analysis of disease states that may be overrepresented in, or unique to, the ethnically diverse patient population at UMMS, and to improve access to timely testing for patients. In addition to the enhancements in clinical genomic testing services, I believe that this augmentation of genomic services will contribute to improvement of clinical research and clinical trials competitiveness.

Related Professional Experience:

- 1983 to1984 - Quality Control Technician; Bharat Serums and Vaccines, India.
  - **Duties**: Sterility monitoring of production facilities. Assessment of quality of antigen and antibodies (tetanus, snake venom etc) for use in injectable toxoid and antibody production.
- 1984 to 1985 - Research Associate; Hoechst Pharmaceuticals Ltd, India.
  - **Duties**: Screening of soil samples from around the world for isolation of new antibiotic candidates. Isolation and purification of promising candidates, and their quality and safety assessment in animal models.
- 1993 to 1996 - Co-founder & Research Director; ProteinGenesis Inc, Newark, Delaware, USA. This was a venture capital funded company that sought to commercialize a mutagenesis technology developed by myself during my graduate work.
  - **Duties**: Development and operation of the R & D program, including personnel, project/program, and financial management. Generation of promising candidates (enzymes) for potential development into products with utility in environmental remediation and other applications. Identification and development of (potential) client relationships.
- 2008 to 2010 – Managing Director, Pediatric Heart Network, Single Ventricle Reconstruction Extension study (PHNSVRII) Biorepository; University of Michigan.
  - **Duties**: Developed, operationalized and managed a customized, and agile biorepository for the the NIH-funded, Pediatric Heart Network's Single Ventricle Reconstruction Trial II (PHN-SVRII) study. This biorepository coordinated the acquisition of biological samples by 15 collection centers across North America, and several other countries. Samples and derivatives were processed, stored securely, and disbursed as needed to researchers in the PHN consortium.
- 2009 to 2010 – Director, Michigan Institute for Clinical and Health Research (MICHR), Biorepository; University of Michigan.
  - **Duties**: Defined the initial scope of the service and was responsible for the development and implementation of infrastructure and protocols, and oversight of the facility. The biorepository was designed to collect, process, store and distribute large numbers of high-quality specimens, to support a myriad of research studies at the University of Michigan.
- 2010 to 2011 - Program Manager, The Cancer Genome Atlas (TCGA) Project; National Cancer Institute (NCI), National Institutes of Health (NIH).
  - **Duties**: Managed the external Biological Core Repositories (BCR) which procured and provided the high-quality tumor samples and derivatives needed for comprehensive genomic analysis (a key to the success of TCGA!). As part of the TCGA Project Team, participated in the design, development and enforcement of protocols and quality standards for optimal sample and data collection, facilitation of sub-projects for process and sample analysis and novel data generation, and reporting to scientific and executive advisory committees. As an NCI contracting officer's

technical representative (COTR), helped to coordinate the activities of other key components of this project including the Genome characterization and Sequencing centers, the Data Coordinating Centers, and the Genome Data Analysis Centers (GDACs). Helped to enforce timeline and financial markers of progress for this project.

- 2011 to 2019 - Director, Clinical Molecular Genetics & Biobanks/Vice-President, Inova Translational Medicine Institute (ITMI), Inova Health System, Fairfax, Virginia, USA.
  - **Duties**: Member of the founding management team of the ITMI. Involved in myriad aspects of this exciting effort including personnel, project/program, and financial management. Developed, operationalized, and managed a core laboratory and biorepository program, that included state-of-the-art instrumentation, a robust laboratory information system, highly trained technicians and the scientific and technical expertise, that supported ITMI's multi'omic studies on preterm birth, genetic and other congenital anomalies, early childhood health, and acquired conditions of later life. These infrastructure and services were an integral resource for the Inova Schar Cancer Institute (ISCI), as well as other destination programs such as the Inova Heart and Vascular Institute (IHVI), and the Inova Women and Children's Hospital.infrastructure, and enhanced the ability of Inova's physicians and scientists to be competitive for nationally and internationally competitive basic and applied research projects. Contributed to setting overall scientific and business strategy and direction for ITMI, by identifying opportunities for internal and external collaboration and funding and developing financial and operational projections for business planning. Served as a subject matter expert (SME) for the Inova Personalized Health Accelerator (IPHA), a business investment fund that focused on supporting the development and growth of innovative medical technology companies, while delivering superior returns to investors and strategic partners.

Administrative Service

Institutional Service

University of California, Los Angeles (UCLA)

- 2002 to 2004 - Member, Outreach Committee, Dept. Pathology and Lab Med, UCLA School of Medicine.
- 2003 to 2004 - Member, Equipment Sub-Committee, Dept. Pathology and Lab Med, UCLA School of Medicine

University of Michigan

- 2007 to 2008 - Member, Rare Disease Initiative, Clinical Research Sub-Committee.
- 2007 to 2009 - Member, Steering Committee, Center for Genetics and Human Medicine, University of Michigan.
- 2008 to 2010 - Alternate Member, Institutional Review Board, University of Michigan.
- 2009 to 2010 - Member, Diversity and Inclusion Committee, University of Michigan.
- 2009 to 2010 - Member, Expert Advisory Panel, for the "Presenting Diagnostic Results from Large-Scale Clinical Mutation Testing" study; PI: Dr. Richard Sharp, Cleveland Clinic Foundation.

National Cancer Institute

- 2010 to 2011 - Member, Technologies International Working Group, International Cancer Genome Consortium (ICGC)

Inova Health System

- 2012 to 2017 - Alternate Member, Institutional Review Board, Inova Health System.
- 2014 to 2015 - Member, Biobank Task Force, Inova Center for Personalized Health (ICPH).
- 2014 to 2019 - Member, Research Oversight Committee, Inova Schaar Cancer Institute (ISCI).

- 2016 to 2016 - Member, Personalized Health Task Force # 4; responsible for defining the personalized health aspects at ICPH.
- 2016 to 2019 - Member/Participant, Molecular Tumor Board, ISCI.
- 2017 to 2019 - Ad-Hoc Member, Institutional Review Board, Inova Health System.
- 2017 to 2019 - Member, Biorepository Working Group, Inova Fairfax Hospital.
- 2018 to 2019 - Member, Research Operations and Business Committee, Inova Research Center (IRC).

College of American Pathologists (CAP)

- 2017 to 2019 – Inspection team Leader & Laboratory Inspector for Molecular Pathology.
- 2023 - Laboratory Inspector for Molecular Pathology.

Joint Pathology Center, Defense Health Agency

- 2020 to 2021 – Member, Working Group for developing a congressionally-mandated 'Rare cancer and personalized medicine' report.
- 2021 – Member, Planning group for a Molecular Tumor Board at Walter Reed National Military Medical Center (WRNMMC).

Local and National Service

National Service

Journal Service - Ad-hoc Reviewer

• 2009	Journal of Medical Genetics
• 2005	Genetics in Medicine, Biochimica et Biophysica Acta
• 2003	Biochimica et Biophysica Acta, International Journal of Cancer
• 2003	European Journal of Clinical Nutrition International Journal of Cancer The International Journal of Biochemistry and Cell Biology Comparative Biochemistry and Physiology Biochimica et Biophysica Acta
• 2002	European Journal of Clinical Nutrition Genetics In Medicine
• 2001	Oncogene Cancer Research

Consulting

• 1992 to 1993	Research Corporation Technologies, Tuscon, AZ.
• 2000	Nanostream, Inc., Pasadena, CA.
• 2000	IBM (Health Informatics), New York, NY.
• 2002	Aventis Behring, King of Prussia, PA.
• 2003	Third Wave Technologies, Madison, WI.
• 2006	Bergburen Holdings, Los Angeles, CA.
• 2020	Bodetech Inc, Lorton, VA.
• 2020	University of Maryland – Department of Pathology, Baltimore, MD.

Teaching Service

Undergraduate Student Teaching

• 2001 to 2004	Mentored Yawei (Jenny) Yang, Undergraduate student, Neuroscience at UCLA, Howard Hughes Undergraduate Research Scholar, Beckman Undergraduate Research Scholar; daily contact for 3.5 years.

- 2000 to 2003 Mentored Esther Johnston, Undergraduate student, Molecular biology/Biochemistry at UCSD; daily contact every summer for 3 years.
- 2000 to 2003 Mentored Rosemarie Tsao, Undergraduate student, Biochemistry at UCLA; daily contact for 3 years.
- 2002 to 2004 Mentored Amandeep Gill, Undergraduate student, Neuroscience at UCLA; daily contact for 2 years.
- 2002 to 2003 Mentored Diana Libuda, Undergraduate student, Molecualr and Cellular Biology at UCLA; daily contact for 1 year.
- 2003 Lectured on "Cytogenetics" in Human Genetics (CM156) course, UCLA College, 150 – 200, 2nd or 3rd year undergraduate students, 1 contact hour/lecture, 2 lectures, + 4 1-2 hour long office hours for students.

Medical Student Teaching

- 2002 Lectured on "Web Genomics - Mapping the Human Genome", 50+ Medical students at the David Geffen School of Medicine at UCLA - 1 contact hour/lecture, 2 lectures.
- 2003 Lectured + lead an Interactive Lab session on "Web Genomics - Mapping the Human Genome", 25 Medical students at the David Geffen School of Medicine at UCLA – 2 contact hours/session, 2 sessions.
- 2003 Small Group Discussion leader and Tutor, Foundations of Medicine and Science (PBL), 5, 1st year medical students at the David Geffen School of Medicine at UCLA - 3-4 contact hours/week, 8 sessions/semester, 2 semesters/year (total 16 sessions).
- 2014 to 2019 Lectured on Clinical Genetics, Molecular Oncology, and Pharmacogenomics, 10-15, 3rd and 4th year VCU medical students, 2 contact hours/lecture, 3 lectures/year.

Resident and Fellow Teaching

- 2000 to 2004 Helped to mentor a postdoctoral fellow (H. Yu) in our "Arginase group" (Mentor of record, S. Cederbaum, MD), daily contact for 4 years.
- 2002, 2003 Supervised/conducted Cytogenetics laboratory rotation training for pathology Residents, 2-3, 2nd or 3rd year pathology residents - 40 contact hours/year
- 2002, 2003 Lectured on "Molecular Pathology" in the OSLER Pathology Board Review Course, 75-100, Pathology residents preparing for their boards, 2 contact hours/lecture, 2 lectures per year.
- 2003, 2004 Lectured on "Basic Cytogenetics", Board Review for UCLA pathology residents, 5-6, UCLA Pathology residents preparing for their boards, 1.5 contact hours/lecture, 2 lectures.
- 2003 Lectured on "Molecular Pathology", Board Review for UCLA pathology residents, 8-10, UCLA Pathology residents preparing for their boards, 2 contact hours/lecture, 2 lectures.
- 2003, 2004 Lectured on "Clinical Cytogenetics", Board Review for UCLA-Cedar-Sinai Genetics training program fellows, 4-5, fellows preparing for their boards, 2 contact hours/lecture, 1 lecture/year.
- 2003 to 2004 Mentored a ABMG Clinical Cytogenetics fellow (S. Brodie) in the ABMG-accredited training program (Program Director, D. Rimoin, MD), daily contact for 1.5 years.
- 2005 to 2006 Contributed to the training/mentoring of ABMG Clinical Molecular Genetics and

Cytogenetics fellows in the ABMG-accredited training program (Program Director, J. Gastier-Foster, PhD), 3 fellows, 1-3 contact hours/week, for 1 year.

- 2005 to 2006 Contributed effort to Molecular Genetics and Cytogenetics laboratory rotations for MFM, Pediatrics and Pathology fellows from OSU and Nationwide Children's Hospital, 8-10 fellows, 5-10 contact hours/fellow.
- 2006 Lectured on "Clinical Cytogenetics", to OSU MFM fellow and Graduate students, 12-15 fellows + graduate students, 1 contact hour/lecture, 3 lectures.
- 2006 Provided 3 lectures on Molecular Genetics, Cytogenetics, and Clinical lab operations respectively to Genetics fellows, 3 Fellows, 1 contact hour/lecture, 3 lectures.
- 2007 to 2010 Participated in Joint Medical Genetics Conference (Internal Medicine, Oncology, Pediatrics), 4-8, Internal Medicine and Pediatrics residents/fellows, Genetics Fellows, and Genetic counseling students, 1 contact hour/session, 1 session/month, 10-12 sessions/year; in 2007 lectured on "Array CGH" at this conference, 0.75 contact hour.
- 2007 to 2010 Contributed in Pre- and Post-clinical Pediatrics Genetics Teaching conferences at the University of Michigan Pediatrics Department, 2-6 Pediatrics residents/fellows, Genetics Fellows, and Genetic counseling students, 1.5 contact hours per session, 1-2 sessions per week; ~60 sessions/yr.
- 2009 Lectured on "Discovery of novel genomic variants by Chromosomal Microarray Analysis (CMA)", at University of Michigan Pediatrics Grand Rounds, faculty, residents and medical students, 1 contact hour/lecture.
- 2009 Lectured on "Beyond the Karyotype: Chromosomal Microarrays – current and future applications", St. Joseph Mercy Hospital's Pediatrics, Obstetrics and Gynecology Grand Rounds, physicians, fellows and residents, and staff, 1 contact/hour.
- 2008 to 2010 Mentored a ABMG Clinical Molecular Genetics fellow (W. Xu) in the ABMG-accredited training program (Program Director, J. Innis, MD), daily contact for 2 years.
- 2009 Supervised/conducted Molecular Genetics Laboratory rotation training for Pediatric Genetics Fellows, 2 fellows, 80 contact hours/fellow.
- 2009 Hosted Visiting Scientist, Conxi Lazaro, PhD (Head of the Program for Molecular Diagnosis of Hereditary Cancer Translational Research Laboratory (LRT2), Institut Català d'Oncologia, Barcelona, Spain); daily contact over 1 month.
- 2016 to 2019 Lectures on the Molecular Genetic testing and Pharmacogenomics to residents and post-doctoral fellows at Inova, + ITMI interns and staff, 3-4 resident and fellows + ITMI personnel, 1 contact hour/per lecture, 3 lectures/year.
- 2016 to 2019 Contributed to ISCI Molecular Tumor Board, 3-4 residents,1-2 contact hours/session, 10 sessions/year.

Post-Graduate Teaching

- 2000 to 2002 Co-chair, Coordinator, and Lecturer in "Molecular Mechanisms of disease" Graduate course, 8-10 graduate students and advanced undergraduate students, 2 contact hours/session, 9 sessions/year.
- 2001 to 2004 Helped to mentor 2 graduate students (P. Kim, J. Deignan) in our "Arginase group" (Mentor of record, W. Grody, MD), daily contact for 3 years.
- 2003, 2004 Coordinator and Lecturer in "Advanced Human Genetics" Graduate course, 10 -12

graduate students and advanced undergraduate students, 2 contact hours/session, 9 sessions/year.

- 2006 Lectured on "Genetic Testing", to University of Michigan Genetic Counseling students, 6 graduate students, 1 contact hour/lecture.
- 2009 Lectured on "Chromosomal Microarray Analysis", to University of Michigan Genetic Counseling students, 7 graduate students, 1 contact hour/lecture.
- 2019 Lectured on "Personalized Medicine in Oncology" in a George Mason University Bioengineering Graduate course, 14 Bioengineering Graduate students, 1 contact hour/per lecture.

Other Teaching activities

- 2003 Mentor, Los Angeles School High School Senior Summer Research Training Program, 2 Seniors, daily contact for the summer.
- 2004 to 2005 Developed and implemented a well-received, Genetics lecture series on basic and clinical genetics topics for diagnostic lab staff at Myriad Genetics, 20-30 staff, 1 contact hour/lecture, ~1 lecture/month, total of 10 lectures.
- 2018, 2019 Lectured on "Genetics and Personalized Medicine" to seniors at T.C Willliams High School, Alexandria, VA, 30-40 high school seniors, 1 contact hour/lecture, 1 lecture/year.
- 2014 to 2019 Organized and conducted Journal clubs for ITMI lab staff, 10-12 staff, 0.5 comtact hours/session, 10-12 sessions/year.

Grant Support

Completed Grants:

- 2000 to 2003 (Co-PI, 20%); PI; W. Grody
  "Construction of mutation samples for human molecular genetic testing"
  Center for Disease Control (CDC).
  Annual Direct Costs: $100,000
  Total Direct Costs: $300,000

- 2001 to 2002 (PI, 20%)
  "Arginine decarboxylase and agmatinase - a novel, alternate pathway for polyamine biosynthesis in mammals: roles in cell proliferation and cancer."
  Howard Hughes Medical Institute (HHMI)
  Annual Direct Costs: $100,000
  Total Direct Costs: $100,000

- 2000 (PI, 15%)
  "Ribozymes for DNA repair models"
  Ataxia Telangiectasia Medical Research Foundation (ATMRF)
  Annual Direct Costs: $50,000
  Total Direct Costs: $50,000

- 2003 to 2006 (Co-PI 15%; role ended May 2004) PI: W. Grody
  "A novel proliferative determinant in prostate cancer"
  DOD; PC020651

Annual Direct Costs: $115,000
Total Direct Costs: $345,000

- 2001 to 2006 (Co-I 25%; role ended May 2004) PI: Stephen Cederbaum
  "Human arginase and arginase deficiency"
  NIHCD; P01 HD006576
  Annual Direct Costs: $242,837
  Total Direct Costs: $1,092,766.50

- 2003 to 2008 (Key Personnel 5%) PI: J. Doe
  "Children's Oncology Group Acute Lymphocytic Leukemia Reference Laboratory"
  National Childhood Cancer Foundation/NIH/NCI; U10-CA98543
  Annual Direct Costs: Not known to me
  Total Direct Costs: Not known to me

- 2008-2010 (Co-Inv 10%; Managing Director, Biorepository) PI: M. Russell
  "PHN-SVR II Biorepository Laboratory"
  Pediatric Heart Network, Single Ventricle Reconstruction Extension study (PHN-SVR II)
  Annual Direct Costs: $70,000 (+ supplies from a central facility)
  Total Direct Costs: $105,000 (+ supplies)

- 2015 (Co-Inv 10%; Director, Genomics Core lab and biobank) PI: S. Shankar
  "Pharmacogenetics of Tumor Response and Treatment Outcomes in Pediatric Osteosarcoma"
  Hyundai's Hope on Wheels
  Annual Direct Costs: $150,000
  Total Direct Costs: $150,000

Publications

https://www.ncbi.nlm.nih.gov/myncbi/1hUGjjlWx-vk6/bibliography/public/

Peer-reviewed journal articles

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35. Wong WSW, Solomon B, Bodian D, Thach T, Iyer R, Vockley J, Niederhuber. New insights on human de novo mutation rate and parental age. American Society of Human Genetics, 64th Annual Meeting, October 2014, San Diego, CA, USA.
36. Thach D, Ahmad M, Sulkowski GN, Penta A, Chahine J, Kallaury B, Niederhuber J, Iyer R, Deeken J. High rate of TP53 mutations in HPV-positive (HPV+) recurrent/metastatic head and neck cancer (RMHNC) patients. American Society of Clinical Oncology Annual Meeting, May-June 2015. Chicago, IL, USA. Citation: J Clin Oncol 33, 2015 (suppl; abstr e17094).
37. Sulkowski GN, Ahmad M, Thach D, Chahine JJ, Kallakury B, Niederhuber JE, Iyer RK, Deeken JF. Identification of HPV16 genetic subtypes and sublineages in patients with HPV-positive head and neck cancer (HNC). American Society of Clinical Oncology Annual Meeting, May-June 2015. Chicago, IL, USA. Citation: J Clin Oncol 33, 2015 (suppl; abstr e17097).
38. Khromykh A, Solomon BD, Bodian DL, Iyer RK, Ascher D, Huddleston KC, Baveja R, Vockley JG, Niederhuber JE. Diagnostic Utility of Genomic Sequencing in Congenital Disease. American College of Medical Genomics Annual Meeting, March 2015, Salt Lake City, UT, USA.
39. Khromykh A, Solomon B, Bodian B, Baveja R, Iyer R, Ascher D, Garcia S, Vockley JG, Niederhuber JE. A Trio-Based Whole-Genome Sequencing Approach to Congenital Heart Defects. Pediatric Academic Societies Meeting, April 2015, San Diego, CA, USA.
40. Cherukuri PF, Vilboux T, Kothiyal P, Black A, Eley G, Huddleston KC, Iyer RK, Solomon BD, Vockley JG, Niederhuber JE. Prevalence of Ebola viral entry resistance in a diverse population. American Society of Human Genetics, 65th Annual Meeting, October 2015, Baltimore, MD, USA.
41. Bodian DL, Klein E, Iyer RK, Wong WSW, Kothiyal P, Stauffer D, Huddleston KC, Gaither AD, Remsburg I, Khromykh A, Baker RL, Maxwell GL, Vockley JG, Niederhuber JE, Solomon BD. Utility of whole-genome sequencing for population newborn screening. American Society of Human Genetics, 65th Annual Meeting, October 2015, Baltimore, MD, USA.
42. Clemency N, Wong WS, Klein E, Provenzano M, Iyer R, Niederhuber JE, Hourigan SK. Collection of Stool on Fecal Occult Blood Cards Is Effective for Fecal Microbiome Studies in Children. Pediatric Academic Society Meeting, May 2016, Baltimore, MD, USA.
43. Ulyanov A, Shah P, Vockley J, Efimov I, Iyer RK, Phillips S, Koppel AC, Singh R, Brumback B, Vilboux T, O'Connor C, Niederhuber JE. Myocardial RNA Sequencing Reveals Critical miRNA-mRNA Interactions that Mediate Heart Failure. Scientific Sessions 2016, November 2016, New Orleans, LA, USA.
44. Tantry US, Ulyanov A, Ahmad M, Bliden K, Shah P, Iyer R, Gurbel PA. Plasma MicroRNA Sequencing in Subjects With and Without Hypercoagulability. Scientific Sessions 2016, November 2016, New Orleans, LA, USA.
45. Ulyanov A, Shah P, Vockley J, Iyer RK, Phillips S, Vilboux T, O'Connor C, Niederhuber JE. Plasma MicroRNA Sequencing Reveals Novel MicroRNA Biomarkers of Systolic Heart Failure. Scientific Sessions 2016, November 2016, New Orleans, LA, USA.
46. Clemency NC, Kinneman L, Wong WS, Solares A, Tokarz K, Zacharias-Andrews K, Jane't K, Kou M, Ascher D, Iyer R, Niederhuber JE, Hourigan SK. Determining Most Effective Method of Sample Processing for Pediatric Urinary Microbiome Studies. Pediatric Academic Society Meeting, May 2017, San Francisco, CA, USA.
47. Muskett J, Ahmad, A, Hachad, H, Heisey, J, Jo G, Zacharias K, Niederhuber, J, Solomon, B, Iyer R. Genotypic and phenotypic data for 7 established pharmacogenes in 2000 newborns from a diverse population. American College of Medical Genetics, Annual Clinical Genetics Meeting, March 2017, Phoenix, AZ, USA.
48. Mitchell A, Ahmad A, Hachad H, Heisey J, Huddleston K, Jo G, Muskett J, Niederhuber J, Shah M, Solomon B, Iyer R. Clinical implementation of novel, preemptive pharmacogenetics testing for newborns delivered in a community hospital system. American College of Medical Genetics, Annual Clinical Genetics Meeting, March 2017, Phoenix, AZ, USA.

49. Tokarz K; Vilboux T; Iyer R; Thach D; Ahmad M. Quality deep-sequencing miRNA data from matched fresh and FFPE cells for expression analysis profiling. American Society of Human Genetics, 67 th Annual Meeting, October 2017, Orlando, FL, USA.
50. Thach D, Sulkowski G, Ahmad M, Iyer R, Deeken J. Detection of viral sequences and integration sites in HPV-positive (HPV+) recurrent/metastatic head and neck cancer (RMHNC) patients. American Society of Human Genetics, 67 th Annual Meeting, October 2017, Orlando, FL, USA.
51. Lawrence GN, Muskett JA, Mitchell AG, Jo G, Brown K, Iyer R. Genetic variation and drug phenotype data for 4647 newborns that completed pharmacogenetic testing. International Society of Nurses in Genetics (ISONG) meeting, November 2017, Reston, VA, USA.
52. Mitchell A, Hachad H, Jo G, Lawrence G, Muskett J, Iyer R. Case Report: Pharmacogenomics and Medication Response in a Patient with Major Depressive Disorder and Rare Genotype. American College of Medical Genetics and Genomics, Annual Clinical Genetics Meeting, April 2018, Charlotte, NC, USA.

Invited/Oral Presetations

1. Arginase AI and AII, arginine and the AI deficient mouse. Session 42 (The Urea Cycle:Its Metabolites and Defects), American Society of Human Genetics, 50th Annual Meeting, October 2000, Philadelphia, PA, USA.
2. A mouse model for human Arginase deficiency. Urea Cycle Defects session (Chair - Dr. Mark Batshaw) Eighth International Congress of Inborn Errors of Metabolism, September 2000, Cambridge, United Kingdom.
3. Web Genomics and Proteomics: How scientists and providers are beating new paths to the molecular diagnostics laboratory. Edutrak Session 3302 (Chair - Dr. Bruce Friedman, America Society of Clinical Chemists, Annual meeting, July 2001, Chicago, IL, USA.
4. Web Genomics and Proteomics; Moderator & presenter; Workshop presented at the AACC Annual Meeting, July 2002, Orlando, FL, USA.
5. Studies in the Arginase AI knockout mouse: a role for arginase in neuronal proliferation and differentiation. Annual UCLA Mental Retardation Research Center Retreat, November 2003, Lake Arrowhead, CA, USA.
6. Arginine metabolism: Effects on cell proliferation and differentiation. Department of Laboratory Medicine and Pathology, University of Minnesota, January 2004, Twin Cities, MN, USA.