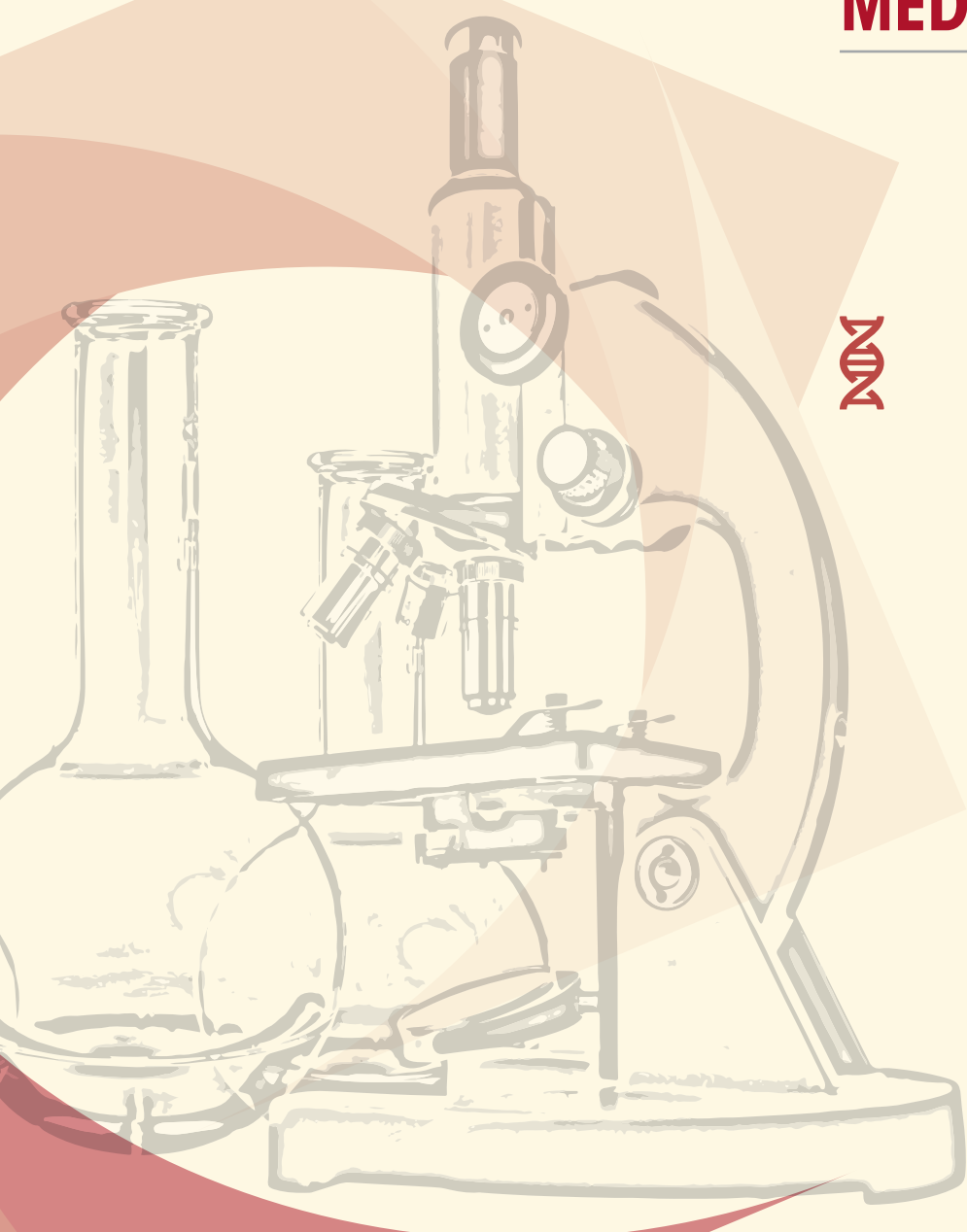


MEDICAL & TECHNICAL

ARUP Expertise | 2019





ARUP supports our clients' success by providing excellence and consistency in our delivery of services, by sharing knowledge, and by developing progressive laboratory technology.

ARUP LABORATORIES

ARUP believes in collaborating, sharing knowledge, and contributing to laboratory science in ways that provide the best value for the patient. We operate 24 hours per day, every day of the year, and are a one-stop shop. More than 99 percent of our test menu is performed in-house, providing greater efficiency and standardized test results.

ARUP offers one of the broadest test menus in the industry, encompassing more than 3,000 tests and test combinations, including highly specialized and esoteric assays. ARUP's Laboratory Test Directory contains complete, up-to-date test information, including methodology and reporting times, reference intervals, test notes, and CPT codes.

More than 100 medical consultants and experts—nationally and internationally recognized pathologists, subspecialty-qualified clinicians, and board-certified clinical scientists—are available for client consultation. These professionals hold faculty appointments at the University of Utah School of Medicine and make significant contributions in research and development. Many participate in care teams at the Huntsman Cancer Hospital and Primary Children's Hospital.

We are one of the most automated laboratories in the United States, and much of our automation is unique, existing nowhere else in the world. ARUP's automation would not perform with the intended quality if it were not for the carefully designed and engineered software that integrates separate components into one seamless system.



patients. answers. results.®

A laboratory test is more than a number; it is a person, an answer, a diagnosis.®



ARUP's Compliance, Quality, Privacy & Risk Department fosters a culture of excellence at all levels of planning and operation. To guarantee patient safety, ARUP requires all employees to perform reference laboratory services in accordance with current methods and medical standards, incorporating Lean and Six Sigma principles, as well as other performance metrics, to ensure the highest-quality patient care.

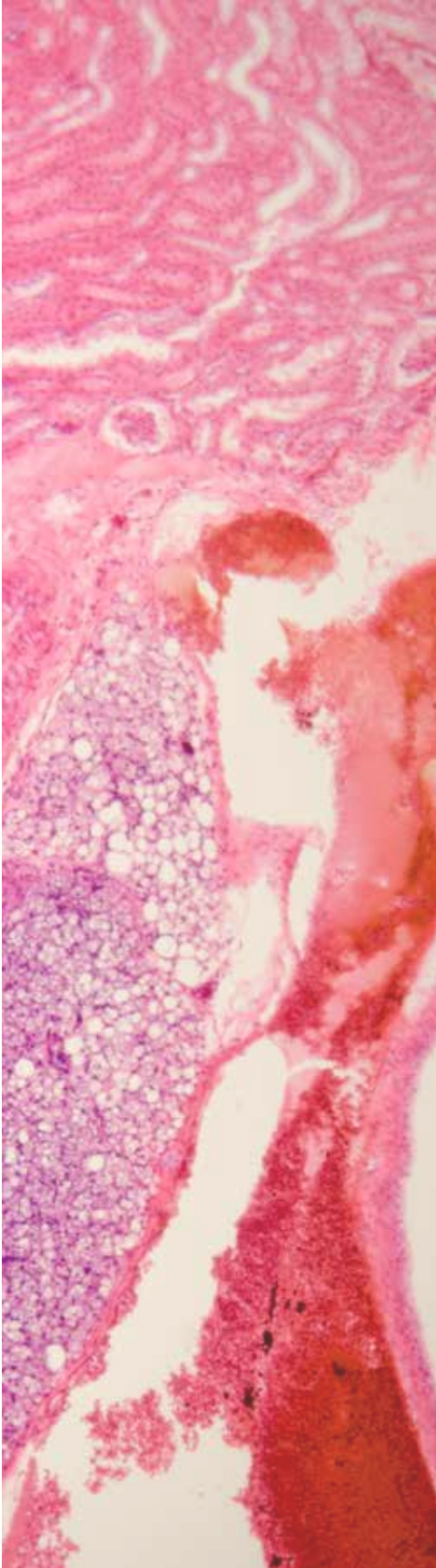
Utilizing Six Sigma allows management to assess where and how errors are happening, which prevents tampering and leads to proactive prevention rather than reactive correction. As a result of practicing and applying Lean and Six Sigma principles, ARUP was ranked among the nation's top healthcare providers in the 21st annual *U.S. News & World Report* survey of America's best hospitals.

ARUP's reputation for quality is supported by our ability to meet or exceed the requirements of multiple regulatory and accrediting agencies and organizations. ARUP participates in the CAP laboratory accreditation program and has CLIA certification through the Centers of Medicare and Medicaid Services. In December 2016, ARUP earned accreditation to the ISO 15189:2012 standard under CAP.



1	location
24	hours per day
99	% testing in-house
100	medical experts
365	days per year
3,000	tests & test combinations

CLINICAL & ANATOMIC PATHOLOGY



ANATOMIC PATHOLOGY AND ONCOLOGY

ARUP's Anatomic Pathology and Oncology groups—staffed by more than 50 full-time faculty members who provide high-quality diagnostic testing and consultative services—offer full-service pathology, from small biopsies to large resections, based on a diagnostic Centers of Excellence model encompassing a wide range of specialties.

The clinical practice of anatomic pathology is supported by several core laboratories providing a full range of services, including routine histology, immunohistochemistry (IHC), electron microscopy, and molecular diagnostics, as well as a large menu of IHC and special stains.

The Anatomic Pathology and Oncology groups continue to update their testing menu with various molecular techniques, such as next generation sequencing (NGS), pyrosequencing, and fluorescent in situ hybridization (FISH) for gene amplification and mutation detection involving *KRAS*, *EGFR*, *JAK2*, *CALR*, and other gene sequences of therapeutic interest. Research in anatomic pathology and oncology improves not only ARUP's ability to treat patients, but is also fundamental to understanding disease mechanisms.

CENTERS OF EXCELLENCE

ARUP's Centers of Excellence is a consortium of world-renowned pathologists, each contributing expertise in a particular subspecialty of pathology. Consultative and diagnostic services are available to assist clients in providing the highest-quality care for their patients. Currently, the ARUP Centers of Excellence is home to specialists in the fields of gastrointestinal pathology, oral and maxillofacial pathology, hematopathology, and molecular pathology.

ONCOLOGY

The oncology testing menu supplies a wide variety of testing designed to answer important clinical questions in the areas of prediction, diagnosis, prognosis, monitoring, and therapeutic triage of malignancies. The menu includes tests offered by different techniques based on diagnostic criteria and tumor type. Examples include comprehensive hematological disorder evaluation, including leukemia/lymphoma phenotyping by flow cytometry; chromosome analysis and molecular cytogenetics; hematopathology consultation; molecular pathology assays, including minimal residual disease evaluation by NGS; clonality assessment using several molecular and flow cytometry techniques; and tissue antigen assessment by IHC. There are also disease-specific assays and panels for disease evaluation, such as CLL and MM panel by FISH.

Tests are available for identifying many tumor-specific mutations or increased protein expression utilizing molecular techniques such as FISH, NGS, PCR, and pyrosequencing for different sample types, including qualitative and quantitative *JAK2* by PCR, *CALR* for polycythemia vera, and *ERBB2* (*HER-2/neu*) by FISH and IHC for increased expression in breast cancer. Diagnostic categories available include, but are not limited to bladder cancer, breast cancer, colon cancer, Ewing sarcoma, gastrointestinal stromal tumors, glioblastoma, hematologic disorders, neuroblastoma, oligodendroglioma, rhabdosarcoma, and synovial sarcoma.

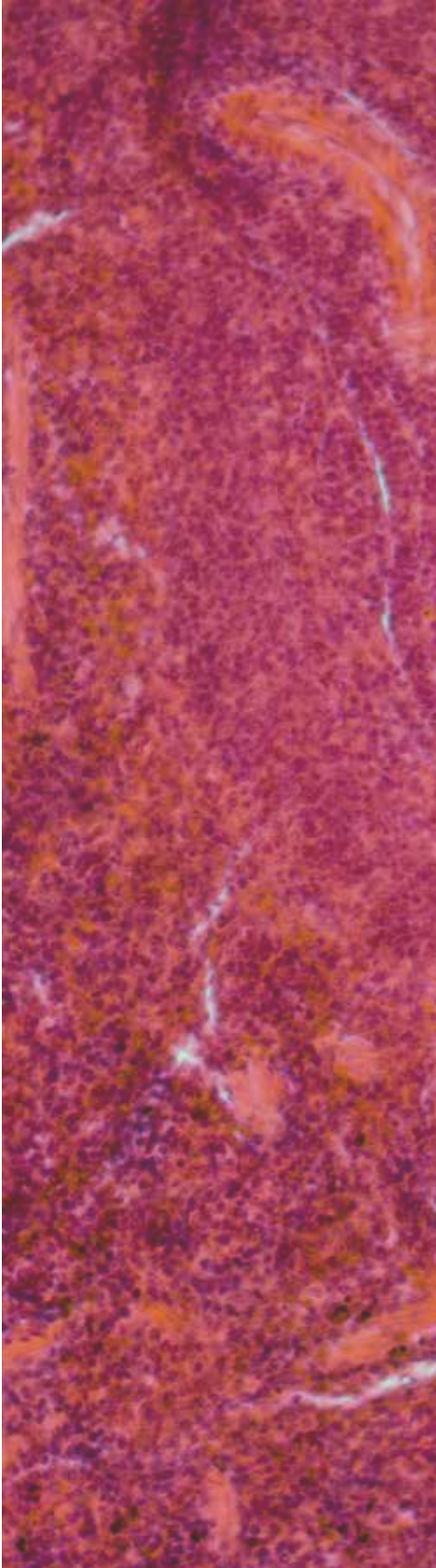
A large menu of established tumor markers is available, including traditional markers such as CEA, CA-GI, and CA 27.29. New esoteric tumor markers include vascular endothelial growth factor, which detects oncogenic transformation; alpha fetoprotein, total and L3 percent, for hepatocellular carcinoma; soluble mesothelium-related peptides specific for malignant mesothelioma; and inhibin B, used for ovarian granulosa cell tumor.

LIST OF SPECIALTIES

- Autopsy pathology
- Bone and soft tissue pathology
- Breast pathology
- Cardiovascular pathology
- Cytogenetics
- Cytopathology
- Gynecology
- Non-gynecology
- Fine-needle aspiration
- Dermatopathology
- Endocrine pathology
- Genitourinary pathology
- Gynecological pathology
- Head and neck pathology
- Hematologic flow cytometry
- Hematopathology*
- Hepatic and gastrointestinal pathology*
- Molecular pathology*
- Muscle and nerve pathology
- Neuropathology
- Ophthalmologic pathology
- Oral and maxillofacial pathology*
- Pediatric and placental pathology
- Pulmonary pathology
- Renal pathology
- Research and developmental pathology
- Special hematology
- Transplant pathology

*Denotes a Centers of Excellence specialty

CLINICAL & ANATOMIC PATHOLOGY



AUTOMATED CORE LABORATORY

The goal of ARUP's Automated Core Laboratory is to automate all facets of laboratory testing to provide improved turnaround time, efficiency, and quality. While automation is not new, ARUP has been successful in automating many of its own esoteric tests, from endocrine hormones to tumor markers. Automated Core Laboratory techniques include quantitative electrochemiluminescent immunoassay, quantitative spectrophotometry, colorimetric assays, and ion-selective electrodes.

This laboratory is staffed 24 hours a day, seven days a week, and testing is performed in a random access fashion as specimens arrive. Therefore, turnaround time can be as rapid as four to five hours from the time of receipt in the laboratory.

CHEMISTRY

The Chemistry Division performs a wide range of qualitative and quantitative analyses on body fluids, such as blood, urine, and pleural, interstitial, and spinal fluid, as well as other materials, including tissue, meconium, feces, and calculi. The laboratories comprising this division are defined by discipline or technology used. High-throughput, automated technologies are heavily used in the Automated Core and Automated Endocrinology laboratories. This is in contrast to the Trace and Toxic Elements, as well as Calculi and Manual Chemistry laboratories, which house both the high-throughput technology of ICP-MS and a lower-throughput of highly subjective FT-IR technique of calculi analysis.

Other laboratories within the Chemistry Division include Analytic Biochemistry, Clinical Toxicology, Manual Endocrinology, Electrophoresis Manual Endocrinology, Mass Spectrometry, and Special Chemistry.

CLINICAL PATHOLOGY

ARUP's clinical pathologists and laboratory scientists strive to identify the most important regulators of biological function and use this information to establish laboratory tests for medically relevant chemical compounds.

ARUP's clinical laboratories are supported by active research in the areas of human genetics, immunology, infectious diseases, endocrinology, biochemical metabolism, therapeutic drug monitoring, toxicology, oncology, hemostasis, thrombosis, and transfusion medicine.

New technologies, such as tandem mass spectrometry, ion-coupled plasma mass spectrometry, ion-trap mass spectrometry, nucleic acid sequencing, rapid light cycling for PCR, and robotic specimen delivery and storage, are aggressively investigated and used. The clinical pathologists at ARUP are available for, and enthusiastic about, consultation, and a pathologist is on-call at all times.

ENDOCRINOLOGY

Clients can request consultation for interpretation of endocrine laboratory results or to determine the appropriate tests needed to aid in the diagnosis of clinical endocrine problems. Services include pediatric and adult functional testing, adrenal cortical, water metabolism, pituitary secretion, gonad responsiveness, thyroid, pancreas, growth status, bone metabolism, endocrine uniformity, and vitamin status.

Laboratory techniques include immunoassays (i.e., radioimmunoassay, enzyme immunoassay, and chemiluminescent immunoassay), HPLC, cultured cell lines, extraction, chromatography, and tandem mass spectrometry.



CLINICAL & ANATOMIC PATHOLOGY



GENETICS

The Genetics Division at ARUP provides a comprehensive test menu to assist physicians in the diagnosis of patients with genetic disorders and offers testing in the disciplines of molecular genetics, genomics, cytogenetics, maternal serum screening, genomic microarray, and biochemical genetics. Committed to providing high-quality genetic testing, ARUP continually expands its test menu as new procedures and markers of clinical utility are identified. Medical directors and genetic counselors are available for pre- and post-test consultation and interpretation.

BIOCHEMICAL GENETICS

ARUP performs testing for many metabolic disorders that affect the body's ability to produce or break down amino acids, organic acids, and fatty acids. Because early identification of a metabolic disorder may prevent death or other serious health problems, the supplemental newborn screening and inborn errors of metabolism menu at ARUP includes tests for more than 30 metabolic disorders in addition to the initial newborn screen. For some of these disorders, such as MCAD, VLCAD, and galactosemia, DNA testing for causative mutations is also available.

CYTOGENETICS

ARUP performs chromosome analysis, FISH, and microarray for both constitutional and cancer diagnoses. Providers have multiple testing options for confirming a clinical diagnosis in their patients, with indications such as intellectual disability, autism, recurrent fetal loss, and multiple congenital anomalies. Patients with confirmed or suspected cancer diagnoses may use these tests to help determine the specific type of cancer present, or to predict disease course or treatment.

FISH

ARUP offers FISH technology as a complement to classical cytogenetic techniques for well-characterized microdeletion/microduplication disorders (e.g., DiGeorge syndrome), as well as for unique or family-specific imbalances identified by microarray. Testing of oncology specimens, whether the sample is blood, bone marrow, fresh tissue, or paraffin block, is available. Many disease-specific FISH panels, as well as individual probes, can assist in the diagnosis and monitoring of patients with cancer.

MICROARRAY

ARUP offers oligonucleotide and SNP-based microarray technologies as a complement to classical cytogenetic techniques. Both technologies identify unbalanced chromosomal abnormalities (loss or gain of DNA) in patients with unexplained abnormal phenotypes such as intellectual disability, dysmorphic features, congenital anomalies, and autism. The SNP-based array also identifies long contiguous stretches of homozygosity that may suggest an increased likelihood for a recessive condition or uniparental disomy. Also available are microarrays for patients with hematological malignancies, as well as prenatal microarrays for testing of amniotic fluid, chorionic villi (CVS), and products of conception specimens.

MATERNAL SERUM SCREENING

Maternal screening tests help identify pregnancies at increased risk for Down syndrome, trisomy 18, trisomy 13, sex chromosome abnormalities, and open neural tube defects (ONTD) such as spina bifida. These tests have been traditionally performed by biochemical analysis in the first and/or second trimester, often combining first-trimester fetal ultrasound measurements with measurements of biochemical markers in maternal blood to predict risk. Newer tests analyze cell-free fetal DNA in maternal blood using NGS technologies. ARUP offers first- or second-trimester screening tests such as integrated, sequential, and cf-DNA/NIPT.

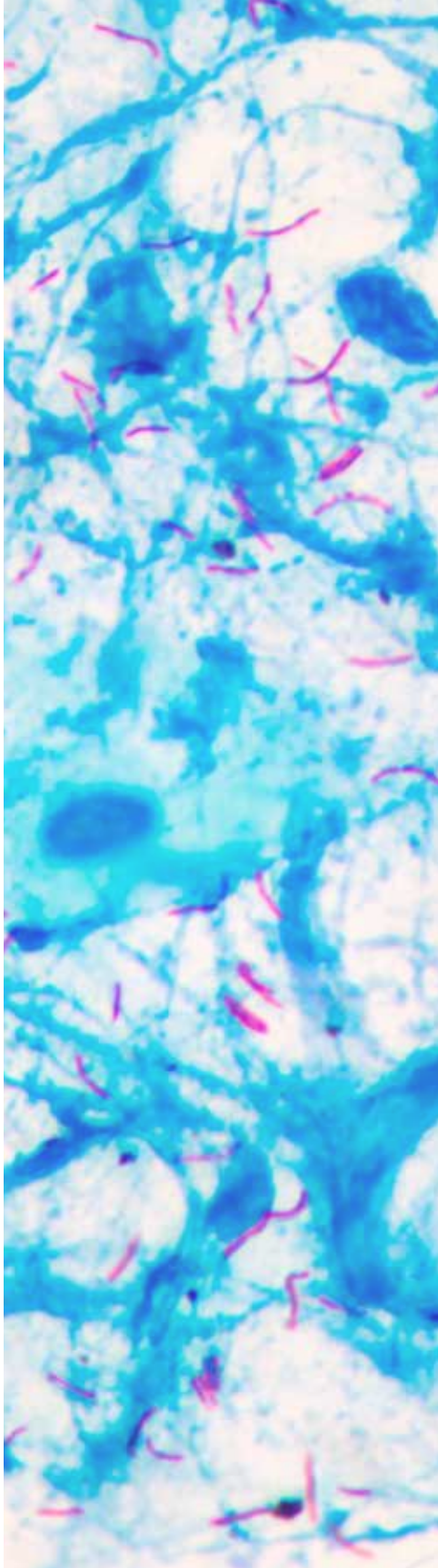
MOLECULAR GENETICS

ARUP offers more than 70 different DNA tests that can be utilized to diagnose genetic disorders in symptomatic individuals, determine carrier status, and identify patients at high risk of developing adult-onset conditions such as Huntington disease, hereditary cancer syndromes, arrhythmias, and cardiomyopathies. Full gene analysis is available for a range of conditions, including cystic fibrosis, beta globinopathies, and hereditary hemorrhagic telangiectasia. ARUP also offers several NGS multigene panels, as well as whole exome sequencing, for patients with complex phenotypes and an unknown genetic etiology. Once a mutation is identified in a family, family-specific mutation testing is available for at-risk family members.

GENOMICS

ARUP offers genomic testing, including exome sequencing and multiple NGS panels. Exome sequencing may determine the etiology of rare diseases in individuals where a specific diagnosis or cause remains elusive. NGS panels allow investigation of multiple genes simultaneously in situations where there is phenotypic overlap across disorders.

CLINICAL & ANATOMIC PATHOLOGY



HEMOSTASIS/THROMBOSIS

The Hemostasis/Thrombosis Laboratory at ARUP performs more than 35,000 assays per month, most of which are performed daily. Services include comprehensive testing for thrombotic and bleeding disorders; plasminogen and antithrombin; protein C, protein S, and APC resistance; factor assays; inhibitor studies; thrombotic risk panels; von Willebrand studies; factor VIII carrier studies; platelet aggregation studies; and serotonin release assay.

ARUP's Hemostasis/Thrombosis Laboratory actively develops and publishes protocols for coagulation testing. Interpretation with hemostasis consultation and expedited testing are also available upon request.

IMMUNOLOGY

ARUP's Immunology Division performs more than 500 immunologic tests used in the diagnosis of autoimmune and infectious disorders and immunodeficiencies. Methodologies include capillary electrophoresis, multiplex bead assay, Western blot and immunoblot, flow cytometry, nephelometry, chemiluminescent assay, indirect fluorescent assay, ELISA, and neutrophil or lymphocyte functional assays.

Services include, but are not limited to allergy testing (more than 300 IgE and IgG-specific allergens), adult and pediatric immunodeficiency testing, complement analysis, immunoglobulin and antibody testing/monoclonal gammopathies, cellular immunodeficiencies, serologic diagnosis (including bacterial, viral, mycoplasma, and parasitic infections), CD4 monitoring, antiplatelet and antineutrophil antibodies, immunogenicity to biologicals, PNH assessment, and autoimmune disease testing.

INFECTIOUS DISEASE

ARUP offers a complete infectious disease testing menu that complements the laboratory services of hospitals. With full-service analytical capabilities in the areas of antimicrobial susceptibility testing, bacteriology, mycobacteriology, mycology, parasitology, and virology, ARUP has the capability and expertise to perform an extensive range of testing, from the most routine bacterial cultures to the latest in molecular-based techniques, including real-time PCR, NGS, microorganism identification by sequencing, MALDI-TOF, and viral genotyping.

The Bacteriology Laboratory performs routine microbiology testing for local hospitals, as well as referral organism identification and pulsed-field gel electrophoresis for bacterial typing. Special Microbiology provides full-service mycobacteriology and mycology testing within a biological safety level BSL2+ suite, as well as specialized antimicrobial testing.

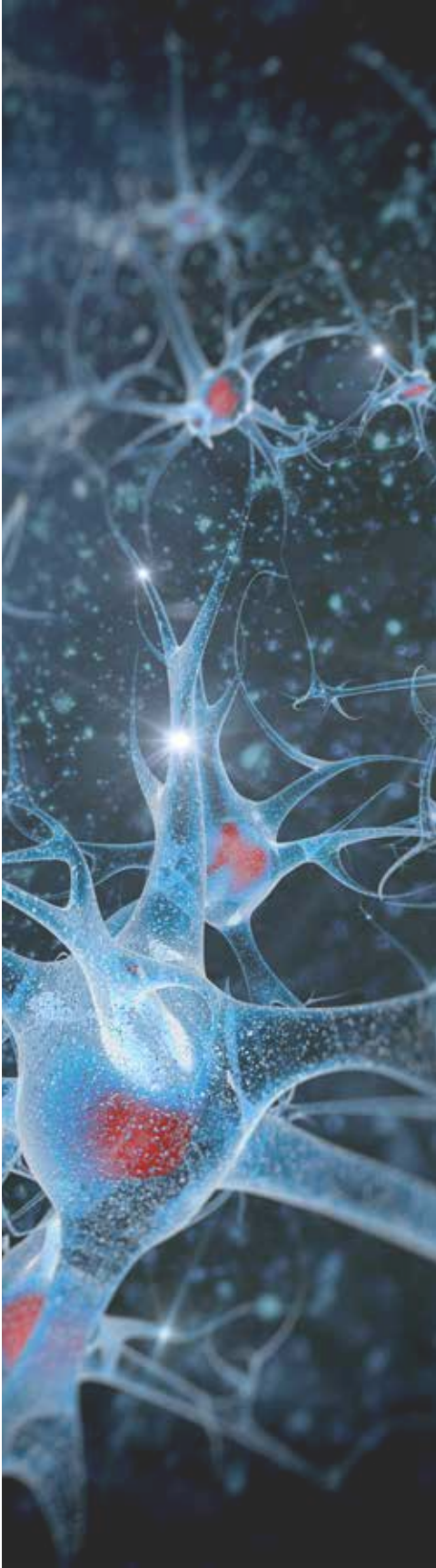
Virology offers isolation and detection of many cultivatable viruses and performs viral neutralization serologic tests for enteroviruses. The Parasitology and Fecal Testing Laboratory provides full-service parasitology examination and rapid antigen detection for a variety of pathogens, especially in the areas of enteric and parasitic diseases.

The Microbial Amplified Detection Laboratory provides molecular detection of sexually transmitted diseases and other testing for women's health diagnosis. Molecular detection of many pathogens and viral load monitoring are available in the Molecular Infectious Disease and Molecular Hepatitis/Retrovirus labs. The Sequencing Infectious Disease Laboratory provides viral resistance testing for HIV, HCV, CMV, and HBV, as well as organism identification by sequence analysis.

Laboratory consultation is available by medical directors and faculty from the University of Utah School of Medicine who have expertise in all areas of infectious diseases, parasitology, travel medicine, molecular diagnostics, virology, and mycology.



CLINICAL & ANATOMIC PATHOLOGY



MASS SPECTROMETRY

ARUP offers an ever-increasing menu of testing by tandem mass spectrometry technology. The Mass Spectrometry laboratories focus on liquid chromatography tandem mass spectrometry (LC-MS/MS) and house gas chromatography (GC/MS) instrumentation. Clinicians and clinical laboratories benefit from continued advances in mass spectrometry technology that provide for increased sensitivity, accuracy, and ability to replace immunoassay screening for drug classes with a single assay that detects many drug classes and the drugs within each class.

ARUP utilizes the most advanced LC-MS/MS instrumentation to provide assays that meet the needs of physicians who require high sensitivity to aid in their diagnosis. Where traditional immunoassays fall short, LC-MS/MS can provide increased sensitivity, lower detection limits, and low-level accuracy.

Examples of assays offered on this testing platform include thyroglobulin (serum or plasma), testosterone in women and children (serum or plasma), free testosterone by equilibrium dialysis, adrenal steroids (serum or plasma), thyroid hormones (free T3 and free T4, serum or plasma), estrogens (estradiol and estrone, serum or plasma), free estradiol by equilibrium dialysis, bile acids (serum), antifungal triazole panel, and vitamin D.

Mass spectrometry is also utilized to measure catecholamines (urine), metanephrines (urine), cortisol (urine), cortisone (urine and serum), and dexamethasone (serum), as well as in therapeutic drug monitoring for immunosuppressants (whole blood). Additional assays are in development.

NEUROLOGY

A broad test menu is available to assist in the diagnosis of myasthenia gravis, multiple sclerosis, other sensorimotor neuropathies, myositis, and paraneoplastic disease. A variety of test methodologies are employed, including isoelectric focusing, immunofixation electrophoresis, radioimmunoassay, enzyme immunoassay, immunoblot, radioreceptor assay, and IFA. Among the test-menu offerings are oligoclonal banding and antibodies to acetylcholine receptor, neuronal and neuronal nucleus, ganglioside-monosialic acid, striated muscle, myelin-associated glycoprotein, sulfate-3-glucuronyl paragloboside, and Purkinje cell.

PAIN MANAGEMENT

To ensure safe and effective pain therapy, current clinical practice guidelines recommend monitoring patients for adherence to prescribed pain medication with periodic drug tests. However, drug testing strategies and test methods are not well standardized, presenting challenges both to the selection of the right test and to the interpretation of test results. ARUP offers a complete suite of services focused on medically effective and cost-conscious test utilization. Clients may access professional and operational consulting services through our medical directors and laboratory staff.



SPECIALTY SECTIONS



AUTOMATION

ARUP is one of the most automated laboratories in the United States. Much of our automation is unique, existing nowhere else in the world, and is the direct result of our outstanding team of engineers, software developers, and managers. The main automated transport and sorting system includes a chain conveyor system that transports tubes from Specimen Processing workstations; interface robotic systems (binders) that read the tube barcodes and transfer the tubes from specimen transport carriers to pucks; MagneMotion transport track; thawing & mixing workcells; and high-speed sorters.

Other important automated systems include the ATS storage sorter, storage and retrieval system, and Sort-to-Light to provide a guided sort application for specimens that are not transported on the automated track system.

A key aspect of any automation is the use of information technology to optimize performance. ARUP's automation would not be as productive if it were not for the carefully designed and engineered software that integrates separate components into one seamless system.

CENTRAL SPECIMEN PROCESSING LABORATORY

ARUP's Specimen Processing receives and organizes all incoming samples using a workflow process known as "first-in, first-out." Specimens are incorporated into the workflow as they are received, and one person handles a specimen from its arrival at ARUP to its laboratory destination. This means that one person performs the entire specimen accessioning process—manifesting, test requesting, labeling, splitting, aliquoting, and placing the samples on the automated track.

Specimen Processing uses a rule-based computer software program known as Expert Specimen Processing (ESP). This program decreases order errors and improves turnaround time during processing. Specimen Processing also utilizes a computer system that automates the process of specimen storage and retrieval. This system maintains accurate records of the exact physical location of each specimen in Specimen Processing, enabling quick retrieval when necessary. It also maintains control parameters that determine the proper length of time a specimen should be retained by ARUP and manages the specimen-discard process.

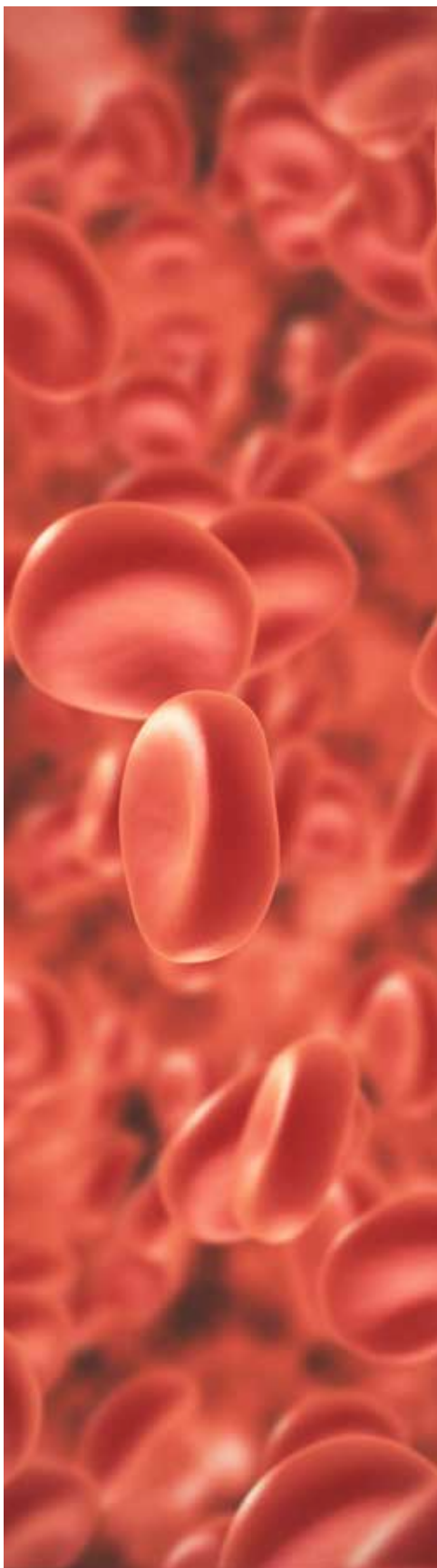
PHARMADx

ARUP's PharmaDx program provides customized test development and validation services, as well as clinical research and commercial testing, to meet the unique requirements of the pharmaceutical industry. Since its inception, PharmaDx has entered into numerous collaborative agreements with pharmaceutical companies to develop diagnostic tests and conduct laboratory testing for clinical trials. These collaborations have spanned various common and rare disease areas, including oncology, infectious diseases, and multiple genetic disorders.

PharmaDx projects can support many elements of pharmaceutical clinical development and post-marketing activities, including the development and FDA submission of companion and complementary diagnostics, assay development and laboratory testing for clinical trials, monitoring of therapeutic drug efficacy, and laboratory testing for rare diseases.

As part of the PharmaDx program, ARUP has developed and implemented an augmented quality management system that meets FDA requirements for medical devices under 21 CFR part 820 for use with selected pharmaceutical-sponsored programs. Under its design control program, PharmaDx has received FDA approval for two companion diagnostic tests for determining Gleevec eligibility in two oncology indications. These are the first laboratory-developed tests to be approved by the FDA under the humanitarian device exemption (HDE) program for rare diseases.

SPECIALTY SECTIONS



RESEARCH AND DEVELOPMENT

Created in 1996, the ARUP Institute for Clinical and Experimental Pathology® seeks to expand the quantity, quality, and utility of laboratory medicine. Since its inception, the institute annually develops approximately 50 tests that ARUP now performs in-house. Additionally, an average of 10 tests are validated each year that ARUP now performs in-house rather than continuing to refer them out. Moreover, ARUP research scientists have shared their knowledge, experience, and new developments with the scientific community by publishing more than 2,000 original peer-reviewed research publications in leading journals.

SPECIALIZED TECHNOLOGY AND MANUFACTURING

The Reagent Production Laboratory prepares reagents for in-house use and produces assay kits that may not be commercially available but are needed for patient testing, diagnosis, and management. This is especially true when new assays are in demand for patient care based on discoveries in diseases and techniques, but do not yet have any significant commercial benefit for the industry.

ARUP's Reagent Laboratory consists of two major areas: reagent production and tissue culture. The major function of the Reagent Production Laboratory is to prepare reagents and various gels for protein and DNA electrophoresis and to assemble assay kits, while the Tissue Culture Laboratory provides cells for virology and other uses.

The Specialized Technologies and Manufacturing Group at ARUP is also home to the Clinical Trials Department, which has more than 25 years of experience successfully supporting clinical trials. Projects are evaluated on a case-by-case basis to ensure the highest probability of success. ARUP supports studies in which testing is facilitated under CLIA/CAP regulations.

TRANSFUSION MEDICINE

ARUP Blood Services is a Utah-based blood-donation center and the sole provider of blood products for the University of Utah Hospital, Huntsman Cancer Institute, Primary Children's Hospital, and Shriners Hospital for Children. These facilities provide many unique services to Utah patients, including specialized surgical procedures, trauma care, cancer treatment, bone marrow transplants, organ and tissue transplants, and the only burn care center in the Intermountain West.

The Transfusion Services Department offers complete blood-banking services, including blood typing, screening, crossmatching, antibody workups, component modifications, and other laboratory testing for patients receiving blood products at these institutions.

The ARUP Immunohematology Reference Laboratory (IRL) is one of only 53 IRL laboratories in the United States accredited by the American Association of Blood Banks (AABB). AABB accreditation requires a high level of technical and medical expertise in resolving complex immunohematology cases and an extensive inventory of rare reagent red blood cells and antisera. The IRL assists with clinical consultation and test interpretation of antibody problems and provides recommendations for selection criteria for blood and blood components where appropriate. Services include the Donath-Landsteiner test, isohemagglutinin titers, resolution of warm and cold auto antibodies, multiple antibodies, clinically significant antibodies to high-frequency antigens, extended red cell phenotypes, ABO discrepancies, red cell phenotypes on cells with positive direct antiglobulin tests, prenatal antibody studies, and classification of polyagglutinable red blood cells.

UNIVERSITY HOSPITALS AND CLINICS, CLINICAL LABORATORIES

The University Clinical Laboratories provide testing for University of Utah Health, including hematology, hemostasis, special and general chemistry, STAT toxicology, therapeutic drug monitoring, limited microbiology, and urinalysis. Testing services are performed for local clients, as well as national ARUP clients.

The Phlebotomy Department provides phlebotomy services for inpatient units and outpatient clinics at the Huntsman Cancer Hospital, University Hospital, University Neuropsychiatric Institute, and Madsen Clinic.

The Support Services Department encompasses client services, exception handling, and specimen processing for these same organizations. In addition, Phlebotomy and Support Services collects, processes, and ships numerous study specimens.

EXECUTIVE MANAGEMENT TEAM



JULIE ALTWIES

Chief Business Development Officer

Ms. Altwies has been with ARUP since 2010 and is currently ARUP's chief business development officer. Prior to this, she was the senior vice president of sales in ARUP's Sales and Marketing group. Before joining ARUP, Ms. Altwies spent more than 20 years in the healthcare industry, and has extensive experience in sales management, leadership training, strategic planning, and marketing. Prior to joining ARUP, Ms. Altwies spent several years at Byram Healthcare and two decades at Roche Diagnostics. She received a bachelor of science from the University of Kansas.



ANNE T. DALEY, MT, MS, CMQOE, CSSBB, CLC, DLM

Quality Officer

Ms. Daley is a nationally recognized leader in laboratory quality and process improvement. She is the founder and president of Daley Consulting, LLC and has provided a wide range of laboratory management consulting services at major national reference laboratories. Prior to her consulting, Ms. Daley held several executive operational management positions, including executive director of Technical Operations at Sonora Quest Laboratories. She holds several industry certifications, including American Society for Quality Six Sigma Black Belt (CSSBB) and Certified Manager of Quality/Operational Excellence (CMQOE) and has been a frequent presenter at major healthcare conferences.



NANCY ANDES, MBA, MT(ASCP)

Senior Vice President of Marketing

As senior vice president of marketing, Ms. AnDES is responsible for the Integrated Marketing Communications, Market Research/Analytics, Proposal/Contract, and Revenue Management teams. She has more than 40 years of laboratory experience in the hospital and reference laboratory setting, with 30 years of sales and marketing experience. Ms. AnDES received her BS in clinical laboratory science from the University of Utah and her MBA from the University of Phoenix.



JULIO C. DELGADO, MD, MS

Chief Medical Officer and Director of Laboratories Chief of the Division of Clinical Pathology

Dr. Delgado is an associate professor of pathology at the University of Utah School of Medicine. He received his MD from Universidad Industrial de Santander in Colombia and his MS degree in epidemiology from the Harvard School of Public Health, completing both his clinical residency training in clinical pathology and his research fellowship in immunology at the Harvard Medical School. He is board certified in clinical pathology and histocompatibility laboratory testing by the American Board of Pathology and the American Board of Histocompatibility and Immunogenetics. Dr. Delgado's research interests include immunogenicity to monoclonal antibody therapeutics and transplantation immunology.



ADAM BARKER, PHD

Director of the ARUP Institute for Clinical and Experimental Pathology®(R&D)

Medical Director, Microbiology

Medical Director, Reagent Laboratory

Medical Director, R&D Special Operations

Dr. Barker is an assistant professor at the University of Utah School of Medicine, joining in 2011. He received his PhD in microbiology and immunology at the University of Colorado Health Sciences Center and completed a postdoctoral fellowship in the Department of Microbiology and Molecular Genetics at Harvard Medical School. Dr. Barker is the recipient of the 2009 Outstanding Postdoctoral Award from the Harvard Medical School and the 2002 Excellence in Research Award from the University of Colorado Health Sciences Center. He is a member of the American Society of Microbiology, Biophysical Society, and Protein Society.



JONATHAN R. GENZEN, MD, PHD

Chief Operations Officer

Dr. Genzen is an associate professor of pathology at the University of Utah School of Medicine. He received his MD and PhD at the University of Chicago and completed his clinical pathology residency at Yale-New Haven Hospital/Yale University Department of Medicine, where he also conducted his postdoctoral research fellowship. He is board certified in clinical pathology by the American Board of Pathology and is a fellow of the American Society for Clinical Pathology and the College of American Pathologists. Dr. Genzen is a member of the American Association for Clinical Chemistry and the Academy of Clinical Laboratory Physicians and Scientists. His clinical and research focus involves laboratory automation and process improvement.



JONATHAN CARR, JD

Compliance Officer

Mr. Carr grew up in Pennsylvania, lived in Spain for two years, and then graduated from Brigham Young University with a bachelor's degree in biology. In 2009, he earned a law degree from Florida State University and practiced at a civil litigation defense firm in Tampa, Florida for about three years. In December 2012, Mr. Carr moved to Utah and began working with the New Technology Assessment & Licensing Department at ARUP before becoming director of Compliance, Quality, Privacy, and Risk in July 2014. Mr. Carr is a member of the Florida Bar, the Utah Bar, the U.S. Patent Bar, and the Health Care Compliance Association. In January 2015, he earned the Certified Information Privacy Professional (CIPP) designation from the International Association of Privacy Professionals.



KENT C. GORDON, CPA, MAcc

Chief Financial Officer

Before becoming ARUP's CFO, Mr. Gordon served in the controller position at ARUP and then as CFO for TriCore Laboratories. He is a certified public accountant with more than 25 years of experience in accounting and nearly 20 years of experience in healthcare. He has presented several lectures about the positive economic impact brought to the industry by the laboratory. Mr. Gordon earned his bachelor's and master's in accounting from Southern Utah University and is a member of the Utah Association of Certified Public Accountants.

**PETER E. JENSEN, MD****Chair, Department of Pathology and ARUP Board**

Dr. Jensen is a professor and chair of the Department of Pathology at the University of Utah and chairman of the board at ARUP Laboratories. He received a BS in biochemistry from the University of Georgia in Athens and an MD from Vanderbilt University in Nashville. At the Department of Pathology and Laboratory Medicine at Emory University, he was a professor, vice chair,

director of the Experimental Pathology Division, and medical director of the Clinical Immunology Laboratory at Emory University Hospital. He has broad interests in healthcare transformation, precision diagnostics, and new technology in pathology and laboratory medicine.

**ANDREW A. THEURER, CPA, BS****President, ARUP Laboratories**

Mr. Theurer is president of ARUP, where he previously served as chief financial officer and senior vice president of finance. He is a certified public accountant and earned his BS in accounting at the University of Utah. His experience in accounting and healthcare spans almost 30 years and encompasses many leadership roles, including oversight of facilities

management, safety, human resources, and the on-site health clinic. Mr. Theurer is a member of the ARUP Board of Directors and served as its secretary for more than 17 years. He has published articles on laboratory economics and is a member of several societies, including the American Institute of Certified Public Accountants and the Utah Association of Certified Public Accountants.

**SHERRIE L. PERKINS, MD, PHD****Chief Executive Officer, ARUP Laboratories**

Dr. Perkins, a tenured professor at the University of Utah School of Medicine, has been with ARUP and the University of Utah for more than 20 years and has served in numerous leadership positions, including director of hematopathology, interim department chair, Co-Chief for the Clinical Pathology Division, and, for the past eight years, a member of ARUP Laboratories'

executive management team. She is board certified in anatomic pathology, with a special qualification in hematology. Dr. Perkins received her PhD in biochemistry from the University of Miami, and earned her MD and completed her pathology residency at Washington University in St. Louis and did a hematopathology fellowship at the University of Utah. She completed her hematopathology fellowship under Dr. Carl Kjeldsberg at the University of Utah and has published more than 200 peer-reviewed articles and 70 book chapters.

**RUTH V. WATKINS, PHD****President, University of Utah**

Dr. Watkins began serving as the 16th president of the University of Utah on April 2, 2018. She previously served as the university's senior vice president for academic affairs. In that role, she provided leadership for the university's academic mission, guiding the campus on matters related to faculty, staff and students. She also helped set the university's strategic

direction and align its resources with academic priorities. Watkins is an advocate for advancing the success and impact of the University of Utah as a top-tier research university, including enhancing student success through degree completion and expanding research and creative activity. Dr. Watkins came to Utah in 2013 from the University of Illinois, where she spent 20 years in leadership and faculty roles. She earned a master's degree and a doctorate in child language at the University of Kansas; her scholarship focuses on communication development and disabilities in young children. Dr. Watkins' research and training endeavors have earned external funding and she has been recognized for excellence in teaching.

The executive management team's maturity and devotion to patient care, from both a medical and business perspective, sustain ARUP as a valuable asset to its clients and the lab industry. Executive management team members possess leadership and vision in their related areas of expertise, resulting in a better, stronger, and smarter laboratory.

MEDICAL DIRECTORS & CONSULTANTS



KAJSA AFFOLTER, MD

Medical Director, Anatomic Pathology

Dr. Affolter is an assistant professor of pathology at the University of Utah School of Medicine. She received her MD from the University of Kansas School of Medicine while completing her residency in anatomic and clinical pathology and fellowship in gastrointestinal, hepatic, and pancreatic biliary pathology at the University of Utah School of Medicine.

She is certified by the American Board of Pathology in anatomic and clinical pathology and is a member of the United States and Canadian Academy of Pathology, American Society for Clinical Pathology, College of American Pathologists, and the Gastrointestinal Pathology Society, among other professional organizations. Dr. Affolter has research interests that include the serrated pathway of colorectal carcinogenesis and predictive markers in inflammatory bowel disease.



ERICA ANDERSEN, PHD, FACMG

Section Chief, Cytogenetics and Genomic Microarray

Dr. Andersen is an assistant professor of pathology at the University of Utah School of Medicine. She received her PhD in genetics from the University of Wisconsin-Madison and completed a clinical cytogenetics fellowship at the University of Utah. She is an active member of the Clinical Genome Resource (ClinGen)

group's efforts to improve constitutional structural variant interpretation; her oncology research projects include improving the diagnosis and monitoring of myelodysplastic syndromes, and understanding the genetic etiology of rare histiocytic and dendritic cell neoplasms.



ARCHANA MISHRA AGARWAL, MD

Medical Director, Hematopathology and Special Genetics

Dr. Agarwal is an associate professor of pathology at the University of Utah School of Medicine. She received her MD at Delhi University in India and was a postdoctoral research scholar at the University of Iowa. She served as a pathology resident, a hematopathology fellow, and a molecular genetics pathology fellow at

the University of Utah School of Medicine. Dr. Agarwal is board certified in hematopathology, anatomic pathology, and clinical pathology. She is also a member of several professional societies, including the College of American Pathologists and the American Society for Clinical Pathology. Dr. Agarwal's research interests include red-cell enzymopathies, hemoglobinopathies, and molecular hematopathology.



PAUL BARTEL, PHD

Director, PharmaDx Program

Dr. Bartel is an adjunct assistant professor at the University of Utah School of Medicine. His role as the director of the PharmaDx program involves developing and managing collaborations with pharmaceutical companies. Before joining ARUP, Dr. Bartel held various positions at Myriad Genetics, Myriad Pharmaceuticals, and the Moran Eye Center. He received his PhD in

molecular microbiology from Ohio State University and trained as a postdoctoral fellow at the State University of New York at Stony Brook, where he helped develop the yeast two-hybrid system to detect protein-protein interactions.



MOUIED ALASHARI, MD

Pediatric Pathologist

Dr. Alashari is an associate professor of pathology at the University of Utah School of Medicine. He received his MD from Baghdad University College of Medicine, and completed residencies in anatomic pathology and general surgery at New York Medical College, a clinical pathology residency at Yale University, and a pediatric pathology fellowship at the Children's Hospital of

Pittsburgh. He is board certified by the American Board of Pathology in anatomic and clinical pathology and pediatric pathology. Dr. Alashari is a member of several professional societies, including the Society for Pediatric Pathology, the American Society of Clinical Pathologists, and the College of American Pathologists.



PINAR BAYRAK-TOYDEMIR, MD, PHD, FACMG

Medical Director, Molecular Genetics and Genomics

Dr. Bayrak-Toydemir is a professor of pathology at the University of Utah School of Medicine. She received her MD from the Ankara University School of Medicine in Ankara, Turkey, where she also received her PhD in human genetics. Subsequently, she completed her

fellowship in clinical molecular genetics at the University of Utah. Dr. Bayrak-Toydemir is board certified in medical genetics, and her research interests include inherited vascular disorders, specifically hereditary hemorrhagic telangiectasia; capillary malformation-arteriovenous malformation syndrome, lymphatic dysplasia, and aortopathies; and implementation of new technologies, such as next generation sequencing, in clinical settings.



DANIEL ALBERTSON, MD

Medical Director, Anatomic Pathology Section Head, Surgical Pathology Director, Genitourinary Pathology

Dr. Albertson is an assistant professor of pathology at the University of Utah School of Medicine. He received his MD from the University of Nebraska and completed his residency in anatomic and clinical pathology at Creighton University, followed by a surgical pathology

fellowship at the University of Utah. While at Creighton, Dr. Albertson served as the chief resident for two years and received the Hal Lankford Pathology Resident Award. He is a member of United States and Canadian Academy of Pathology and the College of American Pathologists. Dr. Albertson's special research interests include oncologic genitourinary pathology.



PHILIP S. BERNARD, MD

Medical Director, Molecular Oncology

Dr. Bernard is a professor of pathology at the University of Utah School of Medicine. He received his MD from and completed his postdoctoral training at the University of Utah and is certified in clinical pathology by the American Board of Pathology. Dr. Bernard's laboratory at the Huntsman Cancer Center utilizes comprehensive genomic analyses to identify and

translate biomarkers into clinical care for cancer patients. His work in gene expression classification of breast cancer led to the development of PAM50 (Prosigna), an FDA-approved diagnostic offered worldwide. His current research are in the development of liquid biopsies using ctDNA, CTCs, and exosomes for monitoring and early detection of cancer.

ARUP's medical directors and consultants are nationally and internationally recognized pathologists, subspecialty-qualified clinicians, and board-certified clinical scientists.

These professionals make significant contributions in research and development, and each holds a faculty appointment at the University of Utah School of Medicine.



HUNTER BEST, PHD, FACMG

Medical Director, Molecular Genetics and Genomics

Scientific Director, NGS and Biocomputing

Dr. Best is an associate professor of clinical pathology at the University of Utah School of Medicine. He received his PhD in molecular and cellular pathology at the University of North Carolina at Chapel Hill and completed a fellowship in clinical molecular genetics at

Vanderbilt University in Nashville. His research focuses on the genetics of pulmonary arterial hypertension.



BARBARA E. CHADWICK, MD

Medical Director, Anatomic Pathology and Cytopathology

Dr. Chadwick is an associate professor of anatomic pathology at the University of Utah School of Medicine. She received her MD at Loma Linda University in California where she also served as a pathology fellow. Dr. Chadwick completed her residency in anatomic and clinical pathology at the University of Utah

School of Medicine and was a cytopathology fellow at the University of Washington in Seattle. She is a member of the United States and Canadian Academy of Pathology, American Society of Cytopathology, and College of American Pathologists. Dr. Chadwick's research interests include the use of molecular markers in cytopathology, pancreatic and biliary cancer, and cervical cancer screening.



ROBERT C. BLAYLOCK, MD

Medical Director, University Hospital Transfusion Services and ARUP Blood Services

Dr. Blaylock is an associate professor of pathology at the University of Utah School of Medicine. He received his MD from the University of Utah School of Medicine and is board certified in clinical pathology by the American Board of Pathology, with special certification in blood banking/transfusion medicine. Dr. Blaylock co-authored *Practical Aspects of the Transfusion Service*.



FREDERIC CLAYTON, MD

Medical Director, Autopsy Service

Dr. Clayton is a professor of pathology and director of the autopsy service at the University of Utah School of Medicine. He received his MD from Washington University in St. Louis, and completed postgraduate training in anatomic pathology at Stanford and clinical pathology at the University of Utah. He has interests in inflammatory diseases of the alimentary tract, other eosinophilic disorders, and medical student teaching.



MARY BRONNER, MD

Division Chief, Anatomic and Molecular Oncologic Pathology

Dr. Bronner is a Carl R. Kjeldsberg presidential endowed professor of pathology at the University of Utah School of Medicine. She received her MD from the University of Pennsylvania and completed her pathology residency training and chief residency at the Hospital of the University of Pennsylvania. Dr.

Bronner's honors include her election as president of the GI Pathology Society and the award of the Arthur Purdy Stout Prize, recognizing her work as a surgical pathologist under the age of 45.



JOSHUA F. COLEMAN, MD

Medical Director, Molecular Oncology

Dr. Coleman is an assistant professor of pathology at the University of Utah School of Medicine. He earned his MD at Case Western Reserve University School of Medicine in 2007. Dr. Coleman subsequently completed his residency in anatomic and clinical pathology at the Cleveland Clinic (2011), followed by fellowships in hematopathology and molecular

genetic pathology. He is board certified in molecular genetic pathology, hematopathology, and anatomic and clinical pathology, practicing most recently at the Ohio State University (2013–16). Immediately prior to joining the University of Utah, Dr. Coleman served as the vice president of medical affairs with GenomOncology, LLC, in Cleveland, Ohio.

MEDICAL DIRECTORS & CONSULTANTS



JESSICA COMSTOCK, MD **Pediatric Pathologist**

Dr. Comstock is the director of autopsy at Primary Children's Hospital and an associate professor of pathology at the University of Utah School of Medicine. She received her MD from the University of Iowa and completed both a pathology residency and a pediatric pathology fellowship at the University of Utah. She is board certified in anatomic and clinical pathology with

a sub-certification in pediatric pathology. Dr. Comstock is a member of several professional societies, including the Society of Pediatric Pathology, College of American Pathologists, and the American Society of Clinical Pathologists.



IRENE DE BIASE, MD, PHD, FACMG **Medical Director, Biochemical Genetics and Newborn Screening**

Dr. De Biase is an assistant professor of pathology at the University of Utah School of Medicine. She received her MD and PhD in cellular and molecular genetics from Federico II University in Italy, and served as a postdoctoral fellow in molecular genetics at the University of Oklahoma Health Sciences Center and

in clinical biochemical genetics at the Greenwood Genetics Center. She was a recipient of the SERGG and SIMD student travel awards. Her research interests include lysosomal storage disorders and fatty acid oxidation disorders.



MARC ROGER COUTURIER, PHD, D(ABMM) **Medical Director, Microbial Immunology** **Medical Director, Parasitology and Fecal Testing** **Medical Director, Infectious Disease Antigen Testing**

Dr. Couturier is an associate professor of pathology at the University of Utah School of Medicine. He

received his PhD in medical microbiology and immunology with a specialty in bacteriology from the University of Alberta in Canada. Dr. Couturier served as a research associate/post-doctoral fellow at the Alberta Provincial Laboratory for Public Health and completed a medical microbiology fellowship at the University of Utah. His research interests include *Helicobacter pylori* diagnostics and population prevalence as well as advanced methods of enteric pathogen detection.



GEORGIOS DEFTEREOS, MD **Medical Director, Molecular Oncology** **Section Head, Molecular Oncology**

Dr. Deftereos is an assistant professor of pathology at the University of Utah School of Medicine. He received his MD from the University of Bari Aldo Moro in Italy. Prior to his pathology training, Dr. Deftereos completed a research fellowship focusing on HPV and gynecological malignancies at the University of

Washington. His residency was in anatomic and clinical pathology. Dr. Deftereos is board certified in anatomic pathology, clinical pathology, cytopathology, and molecular genetic pathology, and provides service in the areas of molecular oncology and cytopathology. His research interests include epigenetics of solid tumors and minimally invasive precision diagnostics, with emphasis on the use of molecular testing in cytopathology of solid tumors.

JULIE LEANA COX, PHD, FACMG **Medical Director, Cytogenetics**

Dr. Cox is board certified by the American Board of Medical Genetics and Genomics and is a diplomate in both clinical cytogenetics and clinical molecular genetics. Dr. Cox received master's degrees in human genetics and administrative science from Johns Hopkins University and a doctorate in human genetics from the University of Maryland at Baltimore. She completed a clinical cytogenetics and clinical molecular genetics fellowship at the University of Maryland, Division of Human Genetics.



LYSKA L. EMERSON, MD **Medical Director, Anatomic Pathology**

Dr. Emerson is an associate professor of pathology at the University of Utah School of Medicine. She received her MD from the University of Texas Health Sciences Center at Houston and served a residency in pathology at the University of New Mexico Health Sciences Center and the University of Texas Health Sciences Center. She completed her fellowship in general

surgical pathology at the University of Utah Hospitals and Clinics. Her current research interests include molecular characterization of the initiating mutations in lung cancer.



CHRISTIAN DAVIDSON, MD **Medical Director, Anatomic Pathology**

Dr. Davidson is an assistant professor of pathology at the University of Utah School of Medicine. After receiving his MD from Jefferson Medical College in Philadelphia, he completed his anatomic pathology residency training at Brigham and Women's Hospital and his neuropathology fellowship at Massachusetts General Hospital, both in Boston. Dr. Davidson is a

member of the American Association of Neuropathologists. In addition, he has a longstanding interest in molecular tumorigenesis of brain tumors, specifically the diffuse gliomas and NF2-related tumors.



KIMBERLEY J. EVASON, MD, PHD **Medical Director, Anatomic Pathology**

Dr. Evason is an assistant professor at the University of Utah School of Medicine and an investigator in the Department of Oncological Sciences at the Huntsman Cancer Institute. She received her MD and PhD through the Medical Scientist Training Program at Washington University in St. Louis. She served a residency and completed fellowship training in anatomic and

liver/gastrointestinal pathology at the University of California at San Francisco, followed by a post-doctoral fellowship mentored by Didier Stainier, Andrei Goga, and J. Michael Bishop. Dr. Evason's research and clinical interests are centered on gastrointestinal and liver pathology, with a specific focus on hepatocellular carcinoma. She is currently investigating molecular pathways and identifying drugs that influence liver tumorigenesis.



RACHEL E. FACTOR, MD, MHS
Medical Director, Anatomic Pathology and Cytopathology

Dr. Factor is an associate professor of pathology, director of breast pathology, and co-director of the Cytopathology Fellowship Program at the University of Utah School of Medicine. She received her master of health science from Johns Hopkins School of Public Health and her MD from the Albert Einstein College of

Medicine in Bronx, New York, followed by residency and fellowships at Brigham and Women's Hospital in Boston. Dr. Factor is board certified in anatomic pathology and cytopathology, and is a member of the College of American Pathology, the United States and Canadian Academy of Pathology, and the American Society for Clinical Pathology. Her research interests include the biology and prevention of breast cancer.



LARISSA V. FURTADO, MD
Medical Director, Molecular Oncology

Dr. Furtado is an associate professor of pathology at the University of Utah School of Medicine. She received her MD from UniFOA in Brazil and completed a medical genetics residency at the University of São Paulo. Dr. Furtado completed her residency in anatomic and clinical pathology at the University of Utah and ARUP Laboratories, where she was chief resident, and her molecular genetic pathology fellowship at the University of Michigan.

Dr. Furtado's research interests include genomic diagnostics in solid tumors and molecular diagnostic methods in oncology.



MARK FISHER, PHD, D(ABMM)
Medical Director, Bacteriology
Medical Director, Special Microbiology,
Antimicrobial Susceptibility Testing

Dr. Fisher is an associate professor of pathology at the University of Utah School of Medicine. He obtained a PhD in microbiology and molecular genetics from Emory University and a master of science in microbiology from Idaho State University. Dr. Fisher

subsequently completed fellowships in microbial pathogenesis at the Rocky Mountain Laboratories (NIH) and in medical microbiology at the University of Utah. He is board certified in medical microbiology, and his research interests include microbial pathogenesis and transmission of vector borne pathogens.



TRACY I. GEORGE, MD
Executive Director, Clinical Trials and PharmaDx
Medical Director, Hematopathology

Dr. George is a professor of pathology at the University of Utah School of Medicine. She completed her MD and residency training in anatomic pathology and laboratory medicine at the University of California San Francisco, with fellowships in hematopathology and surgical pathology at Stanford University. Dr. George is board

certified in anatomic pathology, clinical pathology, and hematology by the American Board of Pathology. Her research interests include mast cell disease and laboratory hematology. Dr. George has authored more than 100 publications, is vice president of Scientific Communications for the International Society for Laboratory Hematology, and co-editor-in-chief of the *International Journal of Laboratory Hematology*. She received the College of American Pathologists Lifetime Achievement Award in 2014.



ANDREW FLETCHER, MD, CPE
Medical Director, Consultative Services

Dr. Fletcher is a board-certified anatomic/clinical pathologist and certified physician executive with significant experience in leading quality across an organization and reducing clinical variation to effectively drive safety and value. He has a doctor of medicine degree from the Mercer University School of Medicine in Georgia and is currently pursuing his

MBA from the University of Massachusetts at Amherst. Dr. Fletcher has received numerous awards for quality and utilization, including research grants for blood utilization.



EVELYN V. GOPEZ, MD
Medical Director, Cytopathology

Dr. Gopez is a professor of pathology and associate dean in the Office of Inclusion and Outreach at the University of Utah School of Medicine. She received her MD at the University of Santo Tomas in Manila, Philippines, and completed her residency in anatomic and clinical pathology at the Berkshire Medical Center in Pittsfield, Massachusetts. She also completed a

fellowship in cytopathology and surgical pathology at the University of Pennsylvania and is board certified in cytopathology, as well as anatomic and clinical pathology. For seven years, Dr. Gopez served as residency program director at the University of Utah Department of Pathology. She assists ARUP's clients by signing out specimen cases while also teaching residents and fellows in training.



ELIZABETH L. FRANK, PHD, DABCC
Medical Director, Analytic Biochemistry
Medical Director, Calculi and Manual Chemistry
Co-Medical Director, Mass Spectrometry

Dr. Frank is professor of pathology at the University of Utah School of Medicine. She received her PhD in organic chemistry from the University of Colorado at Boulder, and completed postdoctoral fellowship training in clinical chemistry at the University of Utah

School of Medicine. Dr. Frank is certified in clinical chemistry by the American Board of Clinical Chemistry. Dr. Frank's research interests include measurement of biogenic amines, porphyrins, and vitamins using high-performance liquid chromatography and mass spectrometry.



ALLIE GROSSMANN, MD, PHD
Medical Director, Anatomic Pathology and Molecular Oncology

Dr. Grossmann received a PhD and MD from Oregon Health Sciences University, where she studied tyrosine kinase substrate specificity with Brian J. Druker, MD. She completed both a residency in anatomic pathology and a research fellowship in molecular medicine at the University of Utah. Her postdoctoral work in the

laboratory of Dean Y. Li, MD, PhD, focused on the role of small GTPases in melanoma invasion and metastasis. Most recently, Dr. Grossmann completed a fellowship in molecular genetic pathology at ARUP Laboratories.

MEDICAL DIRECTORS & CONSULTANTS



H. EVIN GULBAHCE, MD

Medical Director, Gross Dissection Laboratory Medical Director, Anatomic Pathology

Dr. Gulbahce is a professor of pathology at the University of Utah School of Medicine. She received her MD from Hacettepe University in Ankara, Turkey, and completed a residency in anatomic and clinical pathology and a surgical pathology fellowship at the University of Minnesota. Her research interests include

pulmonary complications of solid organs, hematopoietic stem cell transplantation, and breast cancer risk factors, specifically risk factor for basal-like and triple negative cancers.



DAVID R. HILLYARD, MD

Medical Director, Molecular Infectious Diseases

Dr. Hillyard is a professor of pathology at the University of Utah School of Medicine. Dr. Hillyard received his MD from the Columbia University College of Physicians and Surgeons. His training was in anatomic and clinical pathology, with fellowships in medical microbiology and microbial genetics.



TIMOTHY HANLEY, MD, PHD

Medical Director, Hematopathology

Dr. Hanley is a pathology instructor at the University of Utah School of Medicine. He received his MD and a PhD in microbiology from Boston University School of Medicine and is certified by the American Board of Pathology in anatomic and clinical pathology, with eligibility for subspecialty certification in hematology. His research interests include HIV-1 infection of

macrophages, the contribution of viral infections to lymphomagenesis, and the role of innate immune receptor signaling in adult and pediatric non-Hodgkin lymphomas. Dr. Hanley is a member of the Society for Hematopathology, the College of American Pathologists, and the United States and Canadian Academy of Pathology.



JUDITH HOBERT, PHD

Medical Director, Biochemical Genetics and Newborn Screening

Dr. Hobert is an assistant professor in clinical pathology at the University of Utah School of Medicine, where she served as both a fellow and instructor in biochemical genetics. Dr. Hobert received a PhD from the University of Chicago and completed a postdoctoral fellowship at the Cleveland Clinic

Foundation, Genomic Medicine Institute. She is board certified in clinical biochemical genetics, a diplomate of the American Board of Medical Genetics and Genomics, and a member of the Society for Inherited Metabolic Disorders. Her research interests include newborn screening, lysosomal storage disorders, and autism spectrum disorders.



KIMBERLY E. HANSON, MD, MHS

Medical Director, Mycology Section Chief, Clinical Microbiology

Dr. Hanson is a board certified physician in adult infectious diseases and medical microbiology. She has specialized expertise in the diagnosis and management of opportunistic viral, fungal, and mycobacterial diseases. Her primary clinical focus is transplant and cancer chemotherapy-related

infections. Dr. Hanson has authored over 60 scientific papers, book chapters, and review articles with a focus on transplant-related infectious diseases and clinical diagnostics. As the Medical Microbiology Fellowship Program director, she is also actively involved in the training of medical students, residents, and fellows within the University of Utah School of Medicine.



BO HONG, MD, FACMG

Medical Director, Cytogenetics and Genomic Microarray

Dr. Hong is an assistant professor of pathology at University of Utah School of Medicine. She received her MD at Beijing Medical University in Beijing, China, and completed her residency in internal medicine and hematology at People's Hospital, Beijing Medical University, and fellowship in clinical cytogenetics at

the University of Utah. She is board certified by the American Board of Medical Genetics and Genomics and is a fellow of the American College of Medical Genetics and Genomics. Her academic interests include cytogenetic profile of hematologic malignancies, particularly childhood leukemia.



HARRY R. HILL, MD

Medical Director, Cellular and Innate Immunology

Dr. Hill is a professor of pathology, pediatrics, and internal medicine at the University of Utah School of Medicine. He received his MD from the Baylor College of Medicine and completed a clinical residency and work in immunology at the University of Washington in Seattle. He has published more than 275 peer-reviewed articles and 163 review articles (438) and has been

included on the Best Doctors in America list since 1993. His research lab, which was funded by NIH for 40 years, is investigating the role of cytokines in inflammation and disease, as well as the molecular causes of primary immune deficiencies. He sees mostly adult patients with primary immune deficiencies and is the medical director of the Cellular and Innate Immunology Laboratory.



BRIAN R. JACKSON, MD, MS

Medical Director, Business Development, IT and Support Services

An associate professor of pathology at the University of Utah School of Medicine, Dr. Jackson directs informatics efforts at ARUP, including ARUP Consult®, charting, and software product management. He received his MS in medical informatics and his MD from the University of Utah, and completed a clinical

pathology residency at Dartmouth-Hitchcock Medical Center. Dr. Jackson's research interests include economic analysis of diagnostic testing and corporate social responsibility in healthcare.



ELKE JARBOE, MD

Medical Director, Anatomic Pathology and Cytopathology

Dr. Jarboe is an associate professor of pathology at the University of Utah School of Medicine. She received her MD from and completed her anatomic pathology residency training at the University of Colorado School of Medicine. Subsequently, she completed fellowships in women's and perinatal pathology and cytopathology at Brigham and Women's Hospital in Boston. Her primary subspecialty and research interest is in gynecologic pathology. Dr. Jarboe is a member of the editorial board for the *International Journal of Gynecological Pathology* and the cytopathology section editor for the *American Journal of Clinical Pathology*.



KAMISHA L. JOHNSON-DAVIS, PHD, DABCC

Medical Director, Clinical Toxicology

Dr. Johnson-Davis is an associate professor (clinical) at the University of Utah School of Medicine. She received her BS in biochemistry from the University of California, Riverside, and her PhD in pharmacology from the University of Utah. She was a postdoctoral research associate at the Center for Human Toxicology and completed a postdoctoral fellowship in clinical chemistry at the University of Utah Department of Pathology. Dr. Johnson-Davis is board certified in clinical chemistry and toxicological chemistry. She is a diplomate of the American Board of Clinical Chemistry and a fellow of the National Association of Clinical Biochemistry and the Association of Clinical Scientists.



JOLANTA JEDRZKIEWICZ, MD

Medical Director, Anatomic Pathology

Dr. Jedrzkiewicz is an assistant professor of pathology at the University of Utah School of Medicine. She obtained her MD from Poznan University of Medical Sciences in Poland. She completed her anatomic and clinical pathology residency at the University of Utah, followed by an oncologic surgical pathology fellowship at the MD Anderson Cancer Center in Houston and a gastrointestinal fellowship at the Mount Saini Hospital in Toronto. She is certified by the American Board of Pathology in anatomic and clinical pathology and is a member of United States and Canadian Academy of Pathology, as well as the College of American Pathologists. Dr. Jedrzkiewicz has research interests in oncologic gastrointestinal pathology and appendiceal neoplasms.



NEELIMA KANDULA, MD

Medical Director, Anatomic Pathology

Dr. Kandula is an assistant professor of pathology at the University of Utah School of Medicine. She received her MD from the NTR University of Health Sciences, Guntur Medical College in Guntur, India. She completed her residency in anatomic and clinical pathology at the Creighton University, followed by a cytopathology fellowship at the University of Utah. While at Creighton, Dr. Kandula served as the chief resident. She is certified by the American Board of Pathology in anatomic and clinical pathology and cytopathology. She is a member of the United States and Canadian Academy of Pathology, College of American Pathologists, American Society of Cytopathology, and International Society of Urological Pathology. Dr. Kandula has subspecialty interests in cytopathology, genitourinary pathology, and their related research.



YUAN JI, PHD, DABCP, FACMG

Medical Director, Molecular Genetics and Genomics

Medical Director, Pharmacogenomics

Dr. Yuan Ji is an assistant professor of pathology at the University of Utah School of Medicine. She received her PhD in molecular pharmacology and experimental therapeutics at the Mayo Clinic in Rochester, Minnesota, where she further completed her postdoctoral research fellowship in pharmacogenomics. Dr. Ji is board certified in both clinical pharmacology and medical genetics and genomics. Dr. Ji's major clinical and research focus is in pharmacogenomics, i.e., identifying novel pharmacogenomics markers and accurately testing, interpreting, and reporting pharmacogenomic variants.



KRISTIN HUNT KARNER, MD

Medical Director, Hematopathology

Medical Director, Molecular Oncology

Director, Hematopathology Fellowship Program

Dr. Karner is an assistant professor of pathology at the University of Utah School of Medicine. She received her MD from the University of Nebraska and completed her anatomic and clinical pathology residency at the University of New Mexico. She also completed hematopathology and molecular genetic pathology fellowships at the University of New Mexico and is board certified by the American Board of Pathology in anatomic and clinical pathology (AP/CP), as well as hematopathology and molecular genetic pathology. Dr. Karner's areas of focus include both lymphoid and myeloid malignancies, and her current research interests include genetic aspects of myelodysplastic syndrome and other myeloid malignancies.



LISA M. JOHNSON, PHD, DABCC

Medical Director, Clinical Chemistry

Dr. Johnson is an assistant professor (clinical) at the University of Utah School of Medicine. She received her BA in chemistry from the University of Minnesota, Morris, and her PhD in chemistry from the University of Wisconsin, Madison. She was a postdoctoral research associate at UCLA and completed a postdoctoral fellowship in clinical chemistry at the University of Minnesota Department of Laboratory Medicine and Pathology. Dr. Johnson is a diplomate of the American Board of Clinical Chemistry and a member of the American Association for Clinical Chemistry.



DANIELLE KAUFFMAN, PHARM D, MBA

Senior Pharmacy Consultant

Dr. Kauffman received undergraduate degrees in computer information systems and business administration, her MBA from Rensselaer Polytechnic Institute, and her PharmD from The State University of New York at Buffalo. She is a member of the American Society of Health-System Pharmacists (ASHP) and Healthcare Information and Management Systems Society (HIMSS). She has the Apexus Advanced 340B Certificate and completed certification in clinical applications of pharmacogenomics at the University of Florida. Dr. Kauffman's primary area of focus is pharmacogenomics and the ways in which appropriate laboratory testing can positively influence therapeutic drug monitoring (TDM). Other research interests include population health, opioid and antibiotic stewardship, and the effect of lab/pharmacy collaboration on service line workflows.

MEDICAL DIRECTORS & CONSULTANTS



NORIKO KUSUKAWA, PHD

Vice President

Director, Innovation & Strategic Investments

Dr. Kusakawa is an adjunct associate professor of pathology at the University of Utah School of Medicine. Her role at ARUP is to locate new technologies and organize collaborations with like-minded organizations with the goal of bringing those technologies into the clinical laboratory setting. In addition to laboratory

experience, Dr. Kusakawa has more than 20 years of business-development experience. Prior to her position at ARUP, Dr. Kusakawa was a technical director of FMC Corporation, overseeing the Research and Development and Compliance and Quality Systems departments. Dr. Kusakawa received her PhD from Kyoto University in Japan.



TING LIU, MD

Medical Director, Anatomic Pathology

Director, Anatomic Pathology Clinical Trials

Director, Surgical Pathology Fellowship Program

Dr. Liu is a professor of pathology at the University of Utah School of Medicine. Dr. Liu received her MD from Beijing University of Chinese Medicine and her MS in pathophysiology from Peking Union Medical College. She completed AP/CP residency training at Drexel

University College of Medicine, a fellowship in hematology at Drexel University College of Medicine, and an oncologic/surgical fellowship at Memorial Sloan-Kettering Cancer Center. Dr. Liu is an AP/CP and hematopathology-boarded pathologist. Her current research interests include oncologic clinical research.



ALLEN N. LAMB, PHD, FACMG

Section Chief, Cytogenetics and Genomic Microarray

Dr. Lamb is a professor of clinical pathology at the University of Utah School of Medicine. He received his PhD from Wesleyan University in molecular biology and biochemistry. He completed fellowships in clinical cytogenetics in the Department of Pediatrics at the University of North Carolina and in clinical molecular

genetics at Harvard Medical School. Dr. Lamb is a founding fellow of the American College of Medical Genetics and Genomics and is certified by the American Board of Medical Genetics and Genomics in clinical cytogenetics. His primary clinical areas of interest are in prenatal and postnatal chromosome and genomic microarray diagnosis; his research interests include the association of neurodevelopmental features with specific copy number changes.



NICOLA LONGO, MD, PHD

Chief, Medical Genetics Division; Medical Director, Biochemical Genetics and Newborn Screening

Dr. Longo is a professor of pediatrics and an adjunct professor of pathology at the University of Utah School of Medicine. He received his MD and PhD in molecular biology and pathology from the University of Parma Medical School in Italy and trained in medical and biochemical genetics at Emory University in Atlanta.

Dr. Longo is a member of the Society for Inherited Metabolic Disorders, for which he served as president, the American College of Medical Genetics and Genomics, and other professional societies. He is board certified in medical genetics and clinical biochemical genetics. His research interests are focused on the study of membrane transporters and fatty acid oxidation. He is also conducting several clinical trials for novel treatments of metabolic and storage disorders.

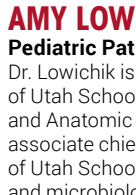


ESZTER LÁZÁR-MOLNÁR, PHD, D(ABMLI)

Medical Director, Immunology; Director, Histocompatibility and Immunogenetics

Dr. Lázár-Molnár is an assistant professor at the University of Utah School of Medicine. She received her PhD in biological sciences from Semmelweis University in Hungary and completed a postdoctoral

fellowship at the Albert Einstein College of Medicine in New York. She was the recipient of a Cancer Research Institute postdoctoral fellowship, the 2009 Belfer Outstanding Postdoctoral Research Award, and the Clinical Immunology Society Travel Award to the 2015 Primary Immunodeficiency Diseases Summer School. Her research interests include cellular immunology, immunotherapy, and transplantation immunology.



AMY LOWICHIK, MD, PHD

Pediatric Pathologist

Dr. Lowichik is clinical professor of pediatric pathology at the University of Utah School of Medicine. She is also the director of Autopsy Service and Anatomic Pathology at Primary Children's Medical Center and the associate chief of the Division of Pediatric Pathology at the University of Utah School of Medicine. Dr. Lowichik received her PhD in zoology and microbiology at Tulane University and her MD at the University of Michigan in Ann Arbor. She served as a pediatrics resident at the Children's Medical Center of Dallas and a pediatric pathology fellow at the University of Texas Southwestern Medical School. Dr. Lowichik is board certified in pediatric pathology, clinical pathology, and anatomic pathology, and is a member of the Society for Pediatric Pathology.

Dr. Lowichik's research interests include pediatric gastrointestinal pathology and medical education.



CHRISTOPHER M. LEHMAN, MD

Medical Director, University of Utah Health Hospital Clinical Laboratory

Dr. Lehman is an associate professor of pathology at the University of Utah School of Medicine. He received his MD from the University of Utah and is board certified in clinical pathology, blood banking, and transfusion medicine by the American Board of Pathology. Dr. Lehman is a member of the College of

American Pathologists, the American Society for Clinical Pathology, and the AABB.



RONG MAO, MD, FACMG

Section Chief, Molecular Genetics and Genomics

Dr. Mao is an associate professor of pathology at the University of Utah School of Medicine. She received her MD from Capital University of Medicine in Beijing and her MS in molecular pathology from Beijing Union Medical College. Currently, she serves as the co-chair of the ClinGen Clinical Domain Metabolic Diseases Working Group. Her research interests include the

genotype-phenotype correlations in inborn errors of metabolism and genetic diseases in the RAS/MAPK pathway; she is also involved with implementing next-generation sequencing techniques into molecular diagnostics.



ANNA P. MATYNIA, MD

Medical Director, Solid Tumor Molecular Diagnostics

Dr. Matynia is an assistant professor of pathology at the University of Utah School of Medicine. She received her MD from the Jagiellonian University in Kraków, Poland, and completed her residency in pathology, as well as fellowships in hematopathology and molecular genetic pathology, at the University of Utah and ARUP Laboratories. Dr. Matynia is certified by the American Board of Pathology in anatomic and clinical pathology, with subspecialty certification in hematology and molecular genetic pathology. Her academic interests include molecular diagnostics of hematolymphoid and solid tumor malignancies.



KAREN A. MOSER, MD

Medical Director, Hemostasis/Thrombosis

Dr. Moser is an assistant professor of pathology at the University of Utah School of Medicine. She received her MD from Saint Louis University and subsequently served as a pathology resident and hematopathology fellow at the University of Utah School of Medicine. She is certified by the American Board of Pathology in anatomic and clinical pathology, with subspecialty certification in hematology. Dr. Moser is a member of several professional societies, including the College of American Pathologists (for which she serves as a member of the Standards and Coagulation Resource Committees), American Society for Clinical Pathology, and International Society on Thrombosis and Hemostasis. Her primary research interest is in laboratory hemostasis and thrombosis testing.



GWENDOLYN A. MCMILLIN, PHD

Scientific Director, Mass Spectrometry Medical Director, Toxicology Medical Director, Pharmacogenetics

Dr. McMillin is a professor of pathology at the University of Utah School of Medicine. She received her PhD in pharmacology and toxicology from the University of Utah and is certified by the American Board of Clinical Chemistry in clinical chemistry and toxicological

chemistry. She is a member of ARUP's R&D Executive Committee, and is actively involved in professional associations such as the International Association of Therapeutic Drug Monitoring and Clinical Chemistry (IATDMCT), the American Association for Clinical Chemistry (AACC), and the College of American Pathologists (CAP). Her primary interests include detection of neonatal drug exposures, pain management, and clinical applications and implementation of pharmacogenomics.



CHERYL ANN PALMER, MD

Medical Director, Neuropathology

Dr. Palmer is a professor of pathology and the director of the Pathology Residency Program at the University of Utah School of Medicine. She received her MD at West Virginia University and served as a resident in neurology and postdoctoral fellow in neuropathology at the University of Utah, where she also completed internships in internal medicine and pathology. She

is a fellow of the American Academy of Neurology, recently served as the vice-president of the American Association of Neuropathologists, and sits on the editorial board of *Case Reports in Pathology*. Dr. Palmer's research interests include neuropathological parameters of epilepsy, relationships between histologic and molecular genetic findings in brain tumors, and pediatric neuropathology, with special emphasis on epileptogenic disorders and brain tumors.



RYAN METCALF, MD, CQA(ASQ)

Medical Director, ARUP Blood Services and Immunohematology Reference Laboratory

Dr. Metcalf is an assistant professor of pathology at the University of Utah School of Medicine. He received his MD from the University of California at Davis School of Medicine and completed his pathology residency, along with a blood banking/transfusion medicine fellowship, at Stanford University. He is board

certified in blood banking/transfusion medicine, as well as anatomic and clinical pathology via the American Board of Pathology. Dr. Metcalf's research focuses on data-driven approaches to quality management in transfusion medicine and patient blood management.



MARZIA PASQUALI, PHD

Section Chief, Biochemical Genetics Medical Director, Biochemical Genetics and Newborn Screening

Dr. Pasquali is a professor of pathology and co-director of the fellowship training program in biochemical genetics at the University of Utah School of Medicine. Dr. Pasquali earned her degrees of doctor in pharmaceutical chemistry and technology and

pharmacy doctor at the University of Parma School of Pharmacy in Italy. She trained in biochemical genetics at Emory University and is board certified in Clinical Biochemical Genetics. Her research interests include newborn screening, lysosomal storage disorders, and disorders of carnitine.



RODNEY R. MILES, MD, PHD

Section Chief, Hematopathology Medical Director, Hematologic Flow Cytometry Medical Director, Immunohistochemistry Medical Director, Histology

Dr. Miles is an associate professor of pathology at the University of Utah School of Medicine. He received his MD and a PhD in cell biology from the University of Nebraska and is certified by the American Board

of Pathology in anatomic and clinical pathology, with subspecialty certification in hematology. His research interests include biological subtypes of adult and pediatric non-Hodgkin lymphomas. Dr. Miles is a member the American Society of Hematology, the Society for Hematopathology, and the United States and Canadian Academy of Pathology.



JAY L. PATEL, MD, MBA

Medical Director, Molecular Oncology and Hematopathology

Dr. Patel is an associate professor of pathology at the University of Utah School of Medicine. He received his MD from the University of Arizona, completed a residency in anatomic and clinical pathology at the University of Utah, and was a hematopathology fellow at Stanford University. He is certified by the

American Board of Pathology in anatomic and clinical pathology, with subspecialty boards in hematology. Dr. Patel's clinical and research interests are broad and include all aspects of hematopathology, especially next generation sequencing technologies in the diagnosis and prognostication of hematolymphoid malignancies.

MEDICAL DIRECTORS & CONSULTANTS



LAUREN N. PEARSON, DO, MPH **Medical Director, University of Utah Health Hospital Clinical Laboratory**

Dr. Pearson received her medical degree and master's degree in public health from Touro University, California. Her interests include community health, quality management systems, quality control, and instrumentation. Dr. Pearson is an active member of the College of American Pathologists, serving as vice chair of the Instrumentation Resource Committee.



THEODORE J. PYSHER, MD **Chief, Pediatric Pathology and Electron Microscopy**

Dr. Pysher is professor of pathology, adjunct professor of pediatrics, and chief of the Pediatric Pathology Division at the University of Utah School of Medicine. He is also head of pathology and Director of Laboratories at Primary Children's Hospital. Dr. Pysher received his MD from the University of Chicago, and trained as a pathology resident at Cleveland Metropolitan General, pediatrics resident at Rainbow Babies Children's Hospital, and pediatric pathology fellow at Children's Hospital of Los Angeles. He is a former president of the Society for Pediatric Pathology.



LISA K. PETERSON, PHD **Medical Director, Immunology**

Dr. Peterson is an assistant professor of pathology at the University of Utah School of Medicine. She received her PhD in experimental pathology from the University of Utah and completed a postdoctoral fellowship in the Department of Immunology at National Jewish Health and the University of Colorado School of Medicine in Denver. Dr. Peterson continued her training with a

clinical immunology fellowship at the University of Utah. Her research interests include cellular immunology and autoimmune immunology, with a focus on autoimmune neurology. Dr. Peterson is a member of the Association of Medical Laboratory Immunologists, the Clinical Immunology Society, the American Association for Clinical Chemistry, and the American Society for Microbiology.

DENISE QUIGLEY, PHD, FACMG **Medical Director, Cytogenetics**

Dr. Quigley received her PhD in molecular and medical genetics at Oregon Health Sciences University and completed post-doctoral fellowships in clinical cytogenetics and clinical molecular genetics at the University of North Carolina, Chapel Hill. She is board certified in clinical cytogenetics and clinical molecular genetics by the American Board of Medical Genetics and Genomics and Genomics. Dr. Quigley is a member of the CAP Cytogenetics Resource Committee and past-president of the American Cytogenetics Conference. Her research interests include integrated cytogenetic and molecular genetic testing algorithms in hematological disease for accurate diagnosis, prognosis, and guided therapy.



MARIA PLETNEVA, MD, PHD **Medical Director, Anatomic Pathology Director, Surgical Pathology Resident Rotations**

Dr. Pletneva is an assistant professor of pathology at the University of Utah School of Medicine. She completed the Medical Scientist Training Program and earned her MD and PhD degrees from Johns Hopkins University School of Medicine. She completed residency in anatomic and clinical pathology, as

well as fellowships in hematopathology and surgical pathology with concentration in gastrointestinal pathology at University of Michigan. Her research interests include improvement of diagnostic tools for graft-versus-host disease and novel diagnostic approaches and predictive factors for lymphoproliferative neoplasms.



ANTON RETS, MD, PHD **Medical Director, Hematopathology**

Dr. Rets is an assistant professor of pathology at the University of Utah School of Medicine. He received his MD and PhD at Perm State Academy of Medicine in Russia. He served as an anatomical and clinical pathology resident at State University of New York Health Science Center at Brooklyn and a hematopathology fellow at the University of Utah School of Medicine. Dr. Rets is board certified in hematopathology, anatomic pathology, and clinical pathology. He is also a member of several professional societies, including the College of American Pathologists and the American Society for Clinical Pathology. Dr. Rets' professional interests include red blood cell disorders, non-neoplastic hematology, and precursor lymphoid neoplasms.



ANGELICA PUTNAM, MD **Pediatric Pathologist**

Angelica R. Putnam, MD, is an associate professor in the Division of Pediatric Pathology at Primary Children's Hospital. She received her medical school and residency training at the University of Utah School of Medicine, and completed fellowship programs in general surgical pathology at the University of Colorado at Denver and Health Sciences Center and

pediatric pathology at the University of Utah School of Medicine. She is board certified by the American Board of Pathology in anatomic, clinical, and pediatric pathology. Dr. Putnam focuses on surgical pathology and teaching medical students, residents, and fellows.



MONICA PATRICIA REVELO, MD, PHD **Medical Director, Renal and Cardiovascular Pathology**

Dr. Revelo is a professor of pathology at the University of Utah School of Medicine. She received her MD from the Central University of Ecuador School of Medicine and her PhD in pathology from the Federal University of Minas Gerais in Brazil. Dr. Revelo completed her residency and a fellowship in renal pathology at Vanderbilt University Medical Center and is certified by the American Board of Pathology. Her research interests include mechanisms of chronic allograft and antibody mediated-rejection in kidney, heart, and pancreas transplants, mechanisms of glomerular diseases and molecular mechanisms of prostate carcinoma development and progression.



JENNA RYCHERT, PHD

Medical Director, Microbial Immunology

Dr. Rychert is an adjunct assistant professor in the Department of Pathology at the University of Utah School of Medicine. She received a BS in mathematics from Boise State University and a PhD in microbiology, immunology, and parasitology from the Louisiana State University Health Sciences Center in New Orleans. Dr. Rychert served as a post-doctoral fellow at Massachusetts General Hospital and Harvard Medical

School where she studied CD4 T-cell immunology in persons with acute HIV infection. She completed a clinical microbiology fellowship at Massachusetts General Hospital and is board certified in medical microbiology (ABMM). Dr. Rychert is a member of the American Society for Microbiology.

ROGER SCHULTZ, PHD, FACMG

Medical Director, Cytogenetics and Molecular Cytogenetics

Dr. Schultz received a master of science in biology at Wayne State University in Detroit and a PhD in genetics at Michigan State University. He completed a postdoctoral fellowship at Stanford University School of Medicine and a cytogenetics fellowship with subsequent American Board of Medical Genetics and Genomics board certification at the University of Texas Southwestern Medical Center in Dallas. Dr. Schultz is a member of several professional societies, including the American Society of Human Genetics and Association of Molecular Pathology. His research interests include chromosomal basis of human disease and development, DNA repair and cancer, and chromosome and genome stability in cancer.



WADE SAMOWITZ, MD

Medical Director, Anatomic Pathology

Dr. Samowitz is a professor of pathology at the University of Utah School of Medicine. He received his MD from SUNY Downstate, and completed residency training in anatomic pathology at the University of Chicago and fellowship training in gastrointestinal pathology at Johns Hopkins Hospital. His clinical and research focus is gastrointestinal pathology and the molecular genetics of colorectal cancer.



DEEPIKA SIROHI, MD

Medical Director, Molecular Oncology

Dr. Deepika Sirohi is an assistant professor of pathology at the University of Utah School of Medicine. Her MD is from Armed Forces Medical College in Pune, Maharashtra, India and her residency was in anatomical and clinical pathology at University of Texas Health Science Center at San Antonio, where she served as co-chief resident. She is board

certified by the American Board of Pathology in anatomical and clinical pathology, and has research interests in genomic alterations in urologic malignancies, viral oncogenesis and application of next generation sequencing to solid tumors.



ROBERT SCHLABERG, MD, DR MED, MPH

Medical Director, Microbial Amplified Detection, Virology, and Fecal Chemistry Assistant Medical Director, Molecular Infectious Disease

Dr. Schlberg is an assistant professor of clinical pathology at the University of Utah School of Medicine.

He received his MD and doctor medicinæ degrees at the Julius-Maximilians-University in Wuerzburg, Germany and his master of public health at the Mailman School of Public Health at Columbia University in New York City. Dr. Schlberg trained in clinical pathology at the Columbia University College of Physicians & Surgeons, where he was the chief clinical pathology resident.



PATRICIA R. SLEV, PHD

Section Chief, Immunology Medical Director, Serologic Hepatitis and Retrovirus

Medical Director, Immunology Core Laboratory Co-Medical Director, Microbial Immunology

Dr. Slev is an associate professor of pathology at the University of Utah School of Medicine. She earned her PhD in immunology and laboratory medicine from the

University of Florida, Gainesville and completed a fellowship in clinical chemistry at the University of Utah. Dr. Slev's research interests are in immunogenetics and pathogen interactions, particularly HIV and viral hepatitis.



ROBERT SCHMIDT, MD, PHD, MBA

Director, Center for Effective Medical Testing Director, Quality Optimization Medical Director, Huntsman Cancer Hospital Clinical Laboratory

Dr. Schmidt is an associate professor of pathology at the University of Utah School of Medicine. He received his MD, MMED in clinical epidemiology and graduate diploma in biostatistics from the University of

Sydney, an MBA from the University of Chicago, and a PhD in operations management from the University of Virginia. He is board certified in clinical pathology and clinical informatics. His research and clinical activities focus on statistical and economic analysis in laboratory testing. He has published over 100 peer reviewed articles, is a frequent presenter at national meetings, and is on the editorial board of several journals.



KRISTI J. SMOCK, MD

Medical Director, Hemostasis/Thrombosis

Dr. Smock is an associate professor of pathology and associate program director of the Pathology Residency Program at the University of Utah School of Medicine. She completed her medical degree, residency, and fellowship training at the University of Utah. She is currently vice president of the North American Specialized Coagulation Laboratory Association

(NASCOLA) and an editorial board member for *Research and Practice in Thrombosis and Haemostasis*. Dr. Smock's primary research interest is laboratory coagulation medicine.

MEDICAL DIRECTORS & CONSULTANTS



JOSHUA A. SONNEN, MD **Medical Director, Anatomic Pathology, Oncology, and Neuropathology**

Dr. Sonnen is an associate professor of pathology at the University of Utah School of Medicine. He received his MD from the Keck School of Medicine, University of Southern California, completing his residency at the University of Arizona, Tucson, and his neuropathology fellowship at the University of Washington, Seattle.

He is a member of the College of American Pathologists and American Association of Neuropathologists. Dr. Sonnen's research interests include dementia, Alzheimer disease, chronic traumatic encephalopathy, and other neurodegenerative diseases.



ERIC A. SWANSON, MD **Medical Director, Anatomic Pathology and Oncology**

Dr. Swanson is an assistant professor of pathology at the University of Utah School of Medicine. He received his MD from Rush University in Chicago and completed pathology residency in anatomic and clinical pathology at the University of California, Los Angeles, where he also served as chief resident. He then went on to

complete a fellowship in gastrointestinal and liver pathology at UCLA. Dr. Swanson is a member of the Rodger C. Haggitt Gastrointestinal Pathology Society, United States and Canadian Academy of Pathology, Society for Cardiovascular Pathology, and College of American Pathologists. His research interests include neoplastic and non-neoplastic gastrointestinal diseases and cardiovascular physiology.



STEVEN STEINBERG, PHD, FACMG **Medical Director, Clinical Molecular Genetics**

Dr. Steinberg received a PhD in biochemical genetics from the University of London and completed a fellowship in the Department of Neurology at Johns Hopkins University, where he was also an ABMG trainee in clinical biochemical and molecular genetics through the Johns Hopkins Institute of Genetic Medicine. His research interests include exploring

the metabolic and molecular bases of inherited disorders, improving diagnostic approaches to these disorders, and developing strategies for screening chemical libraries to identify candidate therapeutic molecules.



ANNE E. TEBO, PHD **Medical Director, Immunology**

Dr. Tebo is an associate professor of pathology at the University of Utah School of Medicine. She received her PhD from the Eberhard Karls Universität Tübingen in Germany and completed postdoctoral training in immunology at the University of Birmingham at Alabama. Dr. Tebo continued her training with a clinical immunology fellowship at the University of

Utah School of Medicine. She is a member of the Association of the Medical Laboratory Immunologists, the American Association of Clinical Chemists, and the American College of Rheumatology.



JOELY A. STRASESKI, PHD, MS, MT(ASCP), DABCC **Section Chief, Chemistry**

Medical Director, Endocrinology
Medical Director, Automated Core Laboratory

Dr. Straseski is an associate professor of pathology at the University of Utah School of Medicine. She received her PhD in pathology and laboratory medicine from the

University of Wisconsin-Madison, where she also served as a postdoctoral associate in the Department of Pathology. Dr. Straseski completed a postdoctoral fellowship in clinical chemistry at the Johns Hopkins Medical Institutions in Baltimore, Maryland. She is an active member of the American Association for Clinical Chemistry and American Society for Clinical Pathology, a fellow of the AACC Academy, and the chair of the board of editors for *Clinical Laboratory News*. Dr. Straseski is board certified in clinical chemistry by the American Board of Clinical Chemistry.

WEIMIN SUN, MD, PHD

Medical Director, Clinical Molecular Genetics

Dr. Sun obtained her MD from Fudan University (Shanghai Medical University) and PhD degree from University of California, Davis. She subsequently completed a clinical molecular genetics fellowship at UCLA. She served as a director for several molecular diagnostics laboratories, including Quest Diagnostics Nichols Institute. She is certified by the American Board of Medical Genetics and Genomics as a clinical molecular geneticist, and is licensed in the states of California and New York as a laboratory director.



REHA TOYDEMIR, MD, PHD, FACMG **Medical Director, Cytogenetics and Genomics**

Dr. Toydemir is an assistant professor of pathology at the University of Utah, School of Medicine. He was a fellow in cytogenetics at ARUP Laboratories and a previous postdoctoral associate in the Human Genetics Department at the University of Utah. He completed his PhD in genetics at the University of Utah and his MD at the University of Ankara, School of

Medicine in Turkey. Dr. Toydemir was the recipient of the 2007 James W. Prah Award for Outstanding Contributions by a Graduate Student in the biological or biomedical science at the University of Utah, and is a member of the American Society of Human Genetics and Turkish Society of Medical Genetics.



BRYAN TRUMP, DDS, MS **Medical Director, Anatomic Pathology**

Dr. Trump is an assistant professor at the University of Utah School of Dentistry, as well as an adjunct professor of anatomic pathology at the University of Utah School of Medicine. He received his DDS from Virginia Commonwealth University School of Dentistry and completed his oral and maxillofacial pathology residency, as well as a master's in biomedical sciences,

at Texas A&M University Baylor College of Dentistry. His research interests include head and neck pathology, with a focus on Sjögren's syndrome, salivary gland neoplasms, and oral squamous cell carcinoma.



KARL V. VOELKERDING, MD, FCAP
Director, Molecular Pathology Fellowship
Medical Director, Genomics and Bioinformatics

Dr. Voelkerding is a professor of pathology at the University of Utah School of Medicine and past president of the Association for Molecular Pathology. He is also chair of the College of American Pathologists' Genomic Medicine Resource Committee. Dr. Voelkerding received his MD from the University of

Cincinnati College of Medicine and is board certified in clinical pathology and molecular genetic pathology. His applied research focuses on the translation of genomics technologies into clinical diagnostics.



XINJIE XU, PHD, FACMG
Medical Director, Cytogenetics and Genomic Microarray

Dr. Xu is an assistant professor of pathology at the University of Utah School of Medicine. She received her PhD in genetics from the University of Wisconsin-Madison, and completed a clinical cytogenetics fellowship there and a clinical molecular genetics

fellowship at Boston University. Dr. Xu is board certified by the American Board of Medical Genetics and Genomics in both clinical cytogenetics and clinical molecular genetics. She is a member of the Board of Directors for the Cancer Genomics Consortium. Her research interests include the identification of novel molecular markers in cancer and the development of novel diagnostic tools for genetic testing.

MICHAEL WARD, MD
Medical Director, Anatomic Pathology

Dr. Ward is an assistant professor of anatomic pathology at the University of Utah School of Medicine. He earned his MD from the University of Texas Health Science Center at San Antonio in 2008. Dr. Ward went on to complete his residency in clinical and anatomic pathology at ARUP Laboratories/University of Utah, where he also completed surgical pathology and cytology fellowships. He is board certified by the American Board of Pathology in anatomic and clinical pathology and has served as a medical editor for *Diagnostic Pathology: Hospital Autopsy*.

YIFEI YANG, PHD, DABCC
Medical Director, Toxicology

Dr. Yang is an assistant professor of pathology at the University of Utah School of Medicine. She received her PhD in pharmacology from Yale University and subsequently completed a postdoctoral fellowship in clinical chemistry at the University of Chicago Medicine. She is a diplomate of the American Board of Clinical Chemistry in clinical chemistry and toxicological chemistry. Dr. Yang's clinical and research interests are focused on developing and validating new diagnostic assays in therapeutic drug monitoring and proteomics biomarkers.



BENJAMIN L. WITT, MD
Medical Director, Anatomic Pathology
Section Head, Cytopathology

Dr. Witt is an assistant professor of anatomic pathology at the University of Utah School of Medicine, where he serves as the residency rotation director for cytopathology. Dr. Witt received his MD at the University of Colorado Denver and completed his AP/CP pathology residency at the University of Chicago

(NorthShore), where he served as the chief resident during his last two years, and a cytopathology fellowship at the University of Utah and ARUP Laboratories. His research interests include studies related to fine-needle aspiration and head and neck pathology.



TATIANA YUZYUK, PHD, FACMG
Medical Director, Newborn Screening and Biochemical Genetics

Dr. Yuzyuk is an assistant professor of pathology at the University of Utah School of Medicine. She received her PhD in biochemistry and molecular biology at SUNY Upstate Medical University and completed a fellowship in clinical biochemical genetics at the University of Utah. Her research interests include

seizure disorders caused by inborn errors of metabolism and fatty acids function in health and disease. Dr. Yuzyuk is board certified in clinical biochemical genetics.



CARL T. WITTWER, MD, PHD
Medical Director, Immunologic Flow Cytometry

Dr. Wittwer is a professor of pathology at the University of Utah School of Medicine. He is an associate editor of *Clinical Chemistry* and is best known for developing techniques in rapid PCR, real-time PCR, and DNA melting analysis. Dr. Wittwer received his MD from the University of Michigan School of Medicine and his PhD in biochemistry from Utah State University. He

is board certified in anatomic and clinical pathology by the American Board of Pathology and signs out cases in flow cytometry and molecular genetics.



HOLLY ZHOU, MD, MS
Pediatric Pathologist

Dr. Zhou is an associate professor of pathology at the University of Utah School of Medicine. She received her medical degree from Fujian Medical College of China, where she also completed an MS in endocrinology. Subsequently, Dr. Zhou completed a research fellowship in endocrinology at the University of Maine, and both an AP/CP residency and a pediatric

pathology fellowship at New York University. She is board certified by the American Board of Pathology in both anatomic and clinical pathology and pediatric pathology. Dr. Zhou is a member of the United States and Canadian Academy of Pathology and the Society for Pediatric Pathology. Her research interests include pediatric bone and soft tissue tumors.



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