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 believes in collaborating, sharing knowledge, and contributing to laboratory science. We operate 24 hours per day, every day of the year, and are a one-stop shop: more than 99 percent of testing 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 90 medical 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.

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 preventive action rather than reactive corrective action. 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.

<table>
<thead>
<tr>
<th>Tests &amp; Test Combinations</th>
<th>3,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days per Year</td>
<td>365</td>
</tr>
<tr>
<td>Medical Experts</td>
<td>100</td>
</tr>
<tr>
<td>Location Location</td>
<td>1</td>
</tr>
<tr>
<td>Hours per Day</td>
<td>24</td>
</tr>
<tr>
<td>% Testing In-House</td>
<td>99</td>
</tr>
</tbody>
</table>
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-125, 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 mesothelial-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
AUTOMATED CORE LABORATORY

The goal of the 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 is successful in automating many of its own esoteric tests, from endocrine hormones to tumor markers. Laboratory techniques used by this laboratory 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; 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.
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. Early identification of a metabolic disorder may prevent death or other serious health problems; thus, 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, such as 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 and/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 (NTD) 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 next-generation sequencing technologies. ARUP offers options for 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 next-generation sequencing 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 next-generation sequencing panels. Exome sequencing may determine the etiology of rare diseases in individuals where a specific diagnosis or cause remains elusive. Next-generation sequencing panels allow investigation of multiple genes simultaneously in situations where there is phenotypic overlap across disorders.
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 and immuno blotting, 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-specific allergens 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, anti-platelet and anti-neutrophil antibodies, immunogenicity to biologicals, PNH assessment, and autoimmune disease testing.
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, next generation sequencing, microorganism identification by sequencing, MALDI-TOF, and viral genotyping.

The Bacteriology Section 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 Section 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 Section 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 Sections. 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.
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 the following: 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.
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 Laboratory 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 or 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.

PHARMADEX

ARUP Laboratories’ 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/or 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, which meets FDA requirements for medical devices under 21 CFR part 820, for use with selected pharma-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.
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; 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’ 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 LABORATORY

The University Hospitals and Clinics Clinical Laboratory provides laboratory testing for University of Utah Health. Services provided by these laboratories include 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

MARTHA BALE, MS, MT(ASCP)
Vice President
Director of Technical Operations
Ms. Bale is responsible for technical operations at ARUP Laboratories. She has more than 40 years of laboratory experience; 20 years at ARUP previously serving as division manager over Infectious Disease, Molecular Pathology, Integrated Oncology, and Genetics at ARUP. She received her BS in medical technology from the University of Michigan and her MS in clinical laboratory sciences from the University of Utah.

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.

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. Prior to 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.

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.
JOHN R. PENROSE, BS
Senior Vice President, Chief Information Officer
Mr. Penrose has more than 30 years of experience in healthcare information technology and is a member of HIMSS (Healthcare Information and Management Systems Society) and CHIME (College of Healthcare Information Management Executives). He previously worked for Cerner Corporation, where he designed, developed, and implemented laboratory information systems. Mr. Penrose received a bachelor of science from the University of Central Missouri.

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.

SHERRIE L. PERKINS, MD, PHD
Chief Executive Officer
Dr. Perkins is a tenured professor at the University of Utah School of Medicine, and has been with ARUP and the University of Utah for more than 20 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. She also did a hematopathology fellowship at the University of Utah and has published more than 200 peer-reviewed articles and 70 book chapters.

ANDREW A. THEURER, CPA, BS
President
Mr. Theurer is president of ARUP. Previously, he served as CFO and Sr. Vice President, Finance, at ARUP. He is a certified public accountant and has more than 20 years of experience in accounting and more than 18 years of experience in healthcare. He is a member of several societies, including the American Institute of Certified Public Accountants and the Utah Association of Certified Public Accountants.

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.
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.

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.

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.

Daniel Albertson, MD  
**Medical Director, Surgical Pathology and Oncology; 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.

Erica Andersen, PhD, FACMG  
**Medical Director, 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.

David W. Bahler, MD, PhD  
**Medical Director, Hematopathology**  
Dr. Bahler is an associate professor of pathology at the University of Utah School of Medicine. He is certified by the American Board of Pathology in clinical pathology, with an added qualification in hematology. Dr. Bahler received his PhD in immunology and his MD from the University of Rochester. His research interests include the role of antigen receptor stimulation in the development of lymphoid malignancies.

Adam Barker, PhD  
**Medical Director, Microbiology; Medical Director, Reagent Laboratory; Medical Director, R&D Special Operations; Director, ARUP Institute of Clinical & Experimental Pathology® (R&D)**  
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 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.

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.
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.

**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.

**HUNTER BEST, PHD, FACMG**
Medical Director, Molecular Genetics and Genomics
Scientific Director, NGS and Biocomputing Director, High Complexity Platforms—NGS
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.

**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.

**BARBARA E. CHADWICK, MD**
Medical Director, 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.

**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.

**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.
JOSHUA F. COLEMAN, MD
Medical Director, Molecular Oncology
Dr. Coleman recently joined the University of Utah School of Medicine as an assistant professor of pathology. 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 hematology and molecular genetic pathology. He is board certified in molecular genetic pathology, hematology, 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.

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.

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.

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.

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.

JULIO C. DELGADO, MD, MS
Chief Medical Officer, 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.
LYSKA L. EMERSON, MD
Medical Director, Gross Dissection Laboratory, Huntsman Hospital
Staff Pathologist, 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.

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 Cytology
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.

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 (NIR) 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.

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 MD 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.

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.

LARISSA V. FURTADO, MD
Medical Director, Molecular Oncology
Dr. Furtado is an assistant 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 Sáo 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.

JONATHAN R. GENZEN, MD, PHD
Medical Director, Automated Core Laboratory
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.
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.

EVELYN V. GOPEZ, MD  
Medical Director, Cytology

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.

ALLIE GROSSMANN, MD, PHD  
Medical Director, Surgical 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.

H. EVIN GULBAHCE, MD  
Medical Director, Surgical Pathology and Oncology

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 organ transplantation, and breast cancer risk factors, specifically risk factor for basal-like and triple negative cancers.

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.

KAREN A. HEICHMAN, PHD  
Vice President, Technology Assessment and Licensing; Director, PharmaDx Program

Dr. Heichman is an adjunct associate professor at the University of Utah School of Medicine. Her role at ARUP as the director of the PharmaDx program involves developing and managing collaborations with pharmaceutical companies. The PharmaDx team recently received FDA approval of two companion diagnostic tests developed and validated for use with the drug Gleevec. Dr. Heichman holds an AB in genetics from UC Berkeley and a PhD in biological chemistry from the UCLA School of Medicine. She trained as a postdoctoral fellow in the field of cycle control at the Fred Hutchinson Cancer Research Center in Seattle.

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.

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.
ELKE JARBOE, MD
Medical Director, Surgical 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 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*.

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.

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.

JOLANTA JEDRZKIEWICZ, MD
Medical Director, Gastrointestinal Pathology and FISH
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 Sinai 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.

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.

PETER E. JENSEN, MD
Chair, Department of Pathology and ARUP Board of Directors
Dr. Jensen received a BS in biochemistry from the University of Georgia in Athens and an MD from Vanderbilt University in Nashville. He completed his residency in anatomic pathology at the Washington University School of Medicine in St. Louis. Dr. Jensen joined the faculty of the Department of Pathology and Laboratory Medicine at Emory University in 1986, where he ultimately served as professor, vice chair, director of the Experimental Pathology Division, medical director of the Clinical Immunology Laboratory at Emory University Hospital, and director of the interdepartmental graduate program in immunology and molecular pathogenesis. He has broad interests in health care transformation, precision diagnostics, and the application of new technology in pathology and laboratory medicine.

JOLANTA JEDRZKIEWICZ, MD
Medical Director, Gastrointestinal Pathology and FISH
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 Sinai 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.

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.

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 joined the faculty in 2006, and completed a postdoctoral research fellowship in clinical chemistry at the Mayo Clinic in Rochester, Minnesota, where she further completed her postdoctoral research fellowship in pharmacogenomics. Dr. Johnson-Davis is board certified in both clinical and laboratory chemistry, 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 fellow of the National Association of Clinical Biochemistry and the Association of Clinical Scientists.
NEELIMA KANDULA, MD  
**Medical Director, Surgical 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.

KRISTIN HUNT KARNER, MD  
**Medical Director, Hematopathology**

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 hemopathology 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 hemopathology 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.

MAZDAK A. KHALIGHI, MD  
**Medical Director, Anatomic Pathology and Oncology**

Dr. Khalighi is an assistant professor of pathology at the University of Utah School of Medicine. He received his MD at Jefferson Medical College in Philadelphia and completed an internship in pediatrics at Stanford University. Dr. Khalighi completed a residency in anatomic pathology at UCLA, where he served as chief resident at the UCLA Medical Center, as well as fellowships in renal pathology at the University of Chicago and surgical pathology at the University of Utah. Dr. Khalighi is a member of various professional societies, including the Renal Pathology Society, American Society of Nephrology, National Kidney Foundation, and the International Society of Nephrology. His research interests include non-neoplastic kidney disease.

ATILLA KUMANOVICS, MD  
**Medical Director, Immunology Co-Director, Immunogenetics**

Dr. Kumanovics is an assistant professor of pathology at the University of Utah School of Medicine. He received his MD from the University of Pécs Medical and Health Sciences Centre in Hungary, and completed postdoctoral research fellowships at the University of Utah, University of Texas Southwestern Medical Center, and Howard Hughes Medical Institute. He also served as a clinical pathology resident, an immunology fellow, and a molecular genetic pathology fellow at the University of Utah. Dr. Kumanovics’s research is focused on primary immunodeficiency diseases.

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.

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.

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.
K. DAVID LI, MD
Medical Director, Hematopathology
Assistant Medical Director, Hematologic Flow Cytometry
Dr. Li is an assistant professor of pathology at the University of Utah School of Medicine. He received his MD from New York Medical College and completed a residency in anatomic and clinical pathology at the University of California, San Diego. Dr. Li also completed a fellowship in hematopathology at the University of Utah, and is board certified by the American Board of Pathology in anatomic and clinical pathology, with subspecialty boards in hematology.

TING LIU, MD
Director, Surgical Pathology
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.

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 biochemistry. 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.

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 pediatric 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.

ELAINE LYON, PHD, FACMG
Medical Director, Molecular Genetics and Genomics; Medical Director, Pharmacogenomics
Dr. Lyon is a professor of pathology at the University of Utah School of Medicine. She received her PhD in medical genetics from the University of Alabama at Birmingham and completed an ABMG fellowship in clinical molecular genetics at the University of Utah. Dr. Lyon’s responsibilities include validating methods for mutation detection under CLIA requirements, implementing them into clinical testing, and interpreting genetic/genomic results in a clinical context. She served as president of the Association for Molecular Pathology in 2014, and is a member of the board of the American College of Medical Genetics and Genomics. She participated in the ACMG/AMP/CAP Standards and Guidelines for the Interpretation of Sequence Variants and served as president of the Association for Molecular Pathology in 2014.

RONG MAO, MD, FACMG
Section Chief, Molecular Genetics and Genomics
Dr. Mao is an associate professor of pathology and co-director of the Clinical Medical Genetics Fellowship Program 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. 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.

GWENDOLYN A. MCMILLIN, PHD
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.
MARZIA PASQUALI, PHD
Medical Director, Biochemical Genetics and Newborn Screening
Section Chief, Biochemical Genetics
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. 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.

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.

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 of the American Society of Hematology, the Society for Hematopathology, and the United States and Canadian Academy of Pathology.

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.

LAUREN N. PEARSON, DO, MPH
Medical Director, University of Utah Health Hospital Clinical Laboratory
Dr. Pearson received a 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 Association of Medical Laboratory Immunologists, the Clinical Immunology Society, the American Association for Clinical Chemistry, and the American Society for Microbiology.

JAY L. PATEL, MD
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.

SHERRIE L. PERKINS, MD, PHD
Chief Executive Officer
Dr. Perkins, CEO of ARUP Laboratories and a professor of pathology at the University of Utah School of Medicine, has been with ARUP and the University of Utah for over 25 years and has served in numerous leadership roles. She is board certified in anatomic pathology and holds a special qualification in hematopathology. She has authored over 200 peer-reviewed journal articles and 70 book chapters in hematopathology. She 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. She completed her hematopathology fellowship under Dr. Carl Kjeldsberg at the University of Utah.

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.
MARIA PLETNEVA, MD, PHD
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.

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.

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.

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. 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.

MONICA PATRICIA REVELO, MD, PHD
Medical Director, Renal and Cardiovascular Pathology
Dr. Reveo 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. Reveo 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.

GEORGE M. RODGERS III, MD, PHD
Medical Director, Hemostasis/Thrombosis
Dr. Rodgers is a professor of medicine and pathology at the University of Utah School of Medicine. He received his PhD in pharmacology and his MD from the Tulane University School of Medicine and is certified in internal medicine by the American Board of Internal Medicine and in hematology by the American Board of Pathology. Dr. Rodgers is the co-editor of Wintrobe’s Clinical Hematology.

WADE SAMOWITZ, MD
Medical Director, Anatomic Pathology
Dr. Samowitz is a professor of pathology at the University of Utah School of Medicine and in hematology by the American Board of Pathology. Dr. Samowitz is the co-editor of Wintrobe’s Clinical Hematology.

JUAN ROSAI, MD
Consultant, Surgical Pathologist
Dr. Rosai received his MD at the University of Buenos Aires School of Medicine in Argentina, and completed his pathology residency at the Hospital Regional Mar del Plata in Argentina and at the Washington University School of Medicine and Barnes Hospital in St. Louis. Dr. Rosai’s awards include the USCAP President’s Award in 2012 and the IAP Pathology Gold Medal for outstanding contributions in international pathology education and research in 2010. He is the primary author of Rosai and Ackerman’s Surgical Pathology, the world’s preeminent textbook of surgical pathology.

MONICA PATRICIA REVELO, MD, PHD
Medical Director, Renal and Cardiovascular Pathology
Dr. Reveo 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. Reveo 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.
JOHANNA SAVAGE, MD
Medical Director, Anatomic Pathology
Dr. Savage is an assistant professor of pathology at the University of Utah School of Medicine. She received her MD from the University of Iowa Carver College of Medicine and completed a residency in anatomic and clinical pathology, as well as a surgical pathology fellowship, at the University of Iowa Hospitals and Clinics. She subsequently went on to complete a two-year fellowship/junior faculty position in gynecologic pathology at The Johns Hopkins Hospital in Baltimore, Maryland. Dr. Savage is board certified by the American Board of Pathology and is a fellow of the College of American Pathologists and the American Society of Clinical Pathology.

ROBERT SCHLABERG, MD, DR MED, MPH
Medical Director, Microbial Amplified Detection, Virology, and Fecal Chemistry
Assistant Medical Director, Molecular Infectious Disease
Dr. Schlaberg is an assistant professor of clinical pathology at the University of Utah School of Medicine. He received his MD and doctor medicæ 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. Schlaberg 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
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.

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.

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.

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.

JOSEPH 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.
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 ABMGG 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.

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. Prahl 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.

JOEY STRASESKI, PHD, MS, MT(ASCP), DABCC
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.

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.

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 in Alabama. Dr. Tebo continued her training with a clinical immunology fellowship at the University of Utah School of Medicine, the American College of Rheumatology, Immunologists, the American Association of Clinical Chemists, and the American College of Rheumatology.

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.

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.

BENJAMIN L. WITT, MD
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.
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.

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.

TATIANA YUZYUK, PHD  
**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.

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.