ARUP® LABORATORIES

UNIVERSITY OF UTAH SCHOOL OF MEDICINE | Department of Pathology

ARUP LABORATORIES & THE UNIVERSITY OF UTAH DEPARTMENT OF PATHOLOGY

March 2012

what's inside

CONSISTENCY, SUCCESSS, EXPERIENCE

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CONSISTENCY, SUCCESS, **EXPERIENCE**

EXECUTIVE MANAGEMENT TEAM

The executive management team's maturity and devotion to patient care and leadership, from both the medical and business sides of health care, sustains ARUP as a valuable asset to its clients and the lab industry. Each member possesses great leadership and vision in his or her related areas, resulting in a better, stronger, and smarter laboratory.

MESSAGE FROM THE PRESIDENT & CEO

Edward Ashwood, MD
ARUP President and CEO

WE ARE A NONPROFIT ENTERPRISE OF THE UNIVERSITY OF UTAH AND ITS DEPARTMENT OF PATHOLOGY.

A national clinical and anatomic pathology reference laboratory, ARUP is unique in many ways. Because we are a nonprofit enterprise of the University of Utah and its Department of Pathology, we believe that our prime concern should be patient care, not short-term financial gains. Our clients value our "patient comes first" philosophy and are extremely loyal, providing us with stability in an unstable economy.

ARUP cares about its clients and its employees. We don't compete with our clients for physician-office business, choosing instead to support clients' existing test menus by offering esoteric, highly complex tests and accompanying consultative support, so that they can provide local and regional laboratory services in their communities.

With a focus on integrity and service, ARUP creates a culture of trust and respect for its employees, who are provided with training, support, empowerment, assistance in developing a healthy work/life balance, and a safe and progressive work environment. We offer an excellent, award-winning benefits package, including a free on-site health clinic and fitness center, profit-sharing retirement plan, and tuition reimbursement, and our employees regularly vote ARUP one of the best places in the state to work. We realize that every employee is an integral part of the ARUP family, and we remain dedicated to your success.

ARUP creates a culture of Trust & Respect.

ABOUT ARUP LABORATORIES

ARUP Laboratories is a national clinical and anatomic pathology reference laboratory and an enterprise of the University of Utah and its Department of Pathology. ARUP offers more than 3,000 tests and test combinations, ranging from routine screening tests to esoteric molecular and genetic assays. Rather than competing with its clients for physician office business, ARUP chooses instead to support clients' existing test menus by offering complex and unique tests, with accompanying consultative support, to enhance their abilities to provide local and regional laboratory services. ARUP's clients include many of the nation's university teaching hospitals and children's hospitals, as well as multihospital groups, major commercial laboratories, group purchasing organizations, military and other government facilities, and major clinics. In addition, ARUP is a worldwide leader in innovative laboratory research and development, led by the efforts of the ARUP Institute for Clinical and Experimental Pathology®.

Since its formation in 1984 by the Department of Pathology at the University of Utah, ARUP has founded its reputation on reliable and consistent laboratory testing and service. This simple strategy contributes significantly to client satisfaction. When ARUP conducts surveys, clients regularly rate ARUP highly and respond that they would recommend ARUP to others.

As the most responsive source of quality information and knowledge, ARUP strives to be the reference laboratory of choice for community healthcare systems. ARUP helps its clients meet the customized needs of their unique communities. Together, ARUP and its clients will improve patient care today and in the future.

ARUP CULTURE

More than 3,000 hospitals and laboratories nationwide trust ARUP enough to send their patient samples to us, and many of our laboratory sections are open 24 hours per day, seven days per week. Our dedication to these long work hours allows ARUP to provide the shortest turnaround times in the industry.

As a medical business, ARUP believes that our focus should be on patient care, not on short-term financial gains. Thus, the patient and the patient's hospital are more important to ARUP than the revenue we receive.

Ten years ago, ARUP established a process called ATOP®, Analyzing Test Ordering Patterns™. ARUP clients receive ATOP reports that encourage them to utilize less, not more, of our services, thereby increasing efficiency and reducing costs. ARUP's "patient comes first" philosophy is valued by our clients, making them fiercely loyal. Their loyalty, in turn, gives us enormous stability in an unstable economy.

To keep at the forefront of laboratory medicine, ARUP's team of medical directors, researchers, and laboratory staff develops a wide array of new laboratory tests. These efforts lead to about 38 new test offerings each year. Each new and improved test is an opportunity for ARUP faculty to publish, and, in since the institute's inception, ARUP research scientists have published more than 1,300 original peer-reviewed research publications. Researchers worldwide cite these papers, a clear endorsement of ARUP's importance in advancing medical care.

ARUP serves as a training laboratory for medical technologists (both in the classroom and on the job), graduate students, pathology residents, and laboratory medicine fellows, all of whom are embedded in ARUP services.

ARUP is also committed to educating physicians about laboratory tests. ARUP Consult® guides physicians' selection and interpretation of laboratory tests, providing information on nearly 2,000 tests categorized into disease-related topics. ARUP Consult, which has won various awards, is available at no cost in both web and moblile-enhanced format and as an app in the App Store.

Not only has ARUP successfully created a business niche for itself, it has also established a psychologically healthy workplace with a focus on work/life balance. ARUP cares about its employees and provides a generous benefits package. ARUP's core values include integrity, service, and excellence. These values speak of ARUP's commitment to creating a culture of trust and respect for its employees, all of whom are provided with training, support, empowerment, and a safe and progressive work environment.

CLIENT COMMITMENT STATEMENT

ARUP SUPPORTS OUR CLIENTS' SUCCESS BY PROVIDING EXCELLENCE AND C

ABOUT *Excellence & Consistency* ARUP LABORATORIES

STAFF AND CONSULTANTS

Significant contributions in research and development are continually made by our medical directors and technical consultants, each holding faculty appointments at the University of Utah School of Medicine. These professionals support the medical community by providing consultation in all aspects of laboratory medicine, including surgical pathology and cytopathology, diagnostic problem solving, clinical interpretation of test results, and veterinary histopathology and cytology.

SHARING KNOWLEDGE

In addition to high-quality patient care, ARUP is dedicated to education and supports employees and clients in this endeavor. Our medical and technical staff author textbooks and journal articles, and present lectures, workshops, and symposia at national and international meetings. A video library of lectures covering topics in medicine, clinical laboratory science, and laboratory operations is maintained and available for client use. We also share methodologies and will assist our clients in setting up new laboratory procedures.

CLINICAL PATHOLOGY

The ARUP clinical pathology medical directors are nationally and internationally recognized scientists and clinicians. All of these dedicated professionals publish in peer-reviewed literature, and many serve as authors and editors of the most respected clinical pathology textbooks. These 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, nutrition, 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.

ANATOMIC PATHOLOGY

Understanding the relationships between tissue structure and disease is the basis of anatomic pathology. The subtle changes in tissue that are associated with disease allow the pathologist to render a diagnosis. Because precise diagnoses are necessary to select the optimal course of treatment, ARUP's research in anatomic pathology has centered on improving the accuracy of diagnoses, as well as understanding disease pathophysiology.

Traditionally, a major focus of pathology research has been the correlation of specific morphologic changes with specific diseases. With the advent of new technologies, the scope of research has increased considerably. The use of immunological reagents, such as monoclonal antibodies, now allows pathologists to see changes in tissue structure that were previously invisible. New sampling techniques, including fine-needle aspiration biopsies, allow smaller samples to be examined, greatly improving patient comfort and increasing the range of samples that can be evaluated.

In addition, computer technologies can improve the accuracy and speed at which diagnoses can be reached. ARUP's Anatomic Pathology Division continues to update its state-of-the-art menu by offering fluorescence in situ hybridization (FISH) techniques for detection of gene amplification involving HER-2/*neu*, EGFR, and other gene sequences of therapeutic interest. In addition, FISH is offered for investigation of a set of medically important trisomies. Research in anatomic pathology improves ARUP's fundamental understanding of disease mechanisms as well as our ability to treat patients.

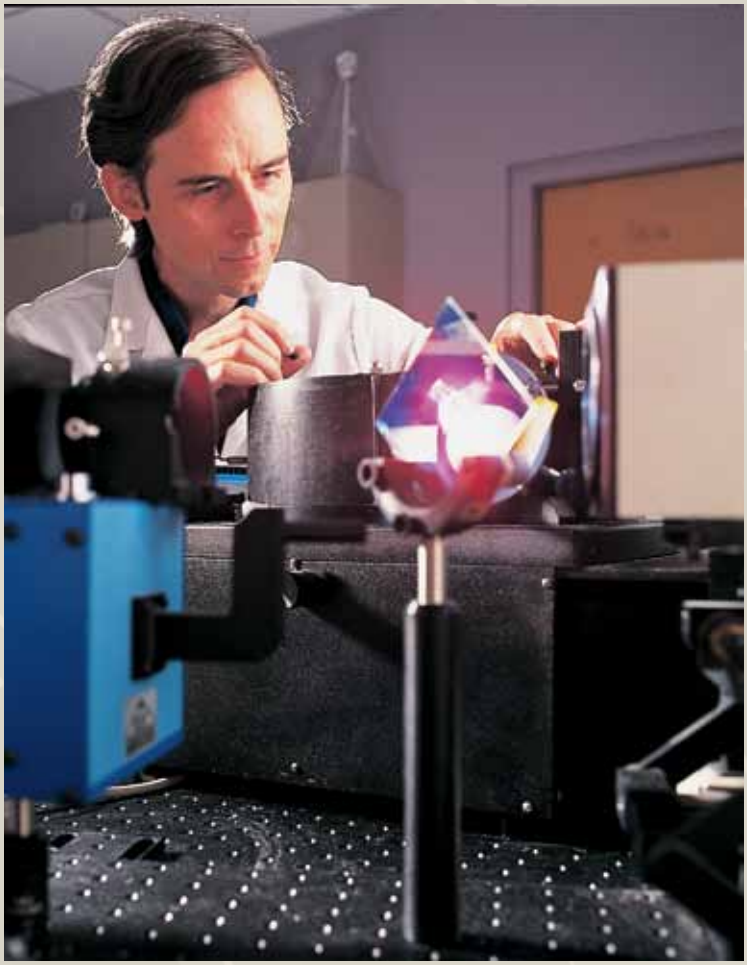
ACCREDITATIONS AND LICENSURE

ARUP Laboratories maintains a current CLIA number with the U.S. Department of Health and Human Services Centers for Medicare & Medicaid Services (CMS), is accredited by the College of American Pathologists (CAP), and holds all other necessary state licenses. For additional information or copies of our certificates, please visit our website at www.aruplab.com or call Client Services at (800) 522-2787.

CONSISTENCY IN OUR DELIVERY OF SERVICES, BY SHARING KNOWLEDGE,
AND BY DEVELOPING PROGRESSIVE LABORATORY TECHNOLOGY.

INVENTED THE LIGHTCYCLER®

culture of innovation: CARL WITTWER'S STORY



Carl Wittwer, MD, PhD, working on the original LightCycler.

CULTURE OF INNOVATION

ARUP Laboratories and the ARUP Institute for Clinical and Experimental Pathology create an awareness and interest in developing improved analytic methodologies. Numerous faculty members participate in this effort using their broad training in disciplines ranging from microbiology, immunology, and chemistry to computer science. One example of the research projects this faculty conducts is provided by the work of Carl Wittwer, MD, PhD.

In 1988, Dr. Wittwer became an assistant professor at the University of Utah Department of Pathology and started a research project that would involve integrating new technology into clinical practice. In addition to his medical degree, Dr. Wittwer holds a PhD in biochemistry and is a self-described "techno-junkie." As he recalled later, "I was looking through *Science* magazine and read this article about PCR (polymerase chain reaction) and thought this technique could replace a number of very labor-intensive assays in the clinical lab." The trouble was that there were no commercially available PCR machines at that time.

Dr. Wittwer came up with the idea of using hot air and capillary tubes to perform PCR. It was an idea that has grown into a major clinical assay system. Using his expertise in enzyme kinetics and fluorescence-detection methodology, Dr. Wittwer invented the LightCycler, a machine for extremely rapid PCR that can be monitored in real time. The LightCycler is currently sold worldwide by Roche Molecular Biochemicals, based in Switzerland. This instrument is the basis of a number of new diagnostic tests that promise to greatly increase the speed of genetic testing as well as dramatically reduce assay costs.

"If I were in any department other than pathology, my instruments would never have been made," says Dr. Wittwer. "As a pathologist, I recognized a clinical need. Because I was located within a cutting-edge research environment, I had access to the basic techniques I needed."

"If I were in any department other than pathology, my instruments would never have been made," says Dr. Wittwer. "As a pathologist, I recognized a clinical need. Because I was located within a cutting-edge research environment, I had access to the basic techniques I needed."

WITTWER

Carl Wittwer, MD, PhD, is a medical director and technical vice president of the Advanced Technology Group and the General Flow Cytometry Laboratory at ARUP.

Department members were eager to try out early versions of the PCR machine and to provide important feedback. Most importantly, however, Dr. Wittwer states that "the department provided me with the seed money and encouragement to pursue my idea, regardless of how unconventional it seemed at the time."

As to the future, Dr. Wittwer is enthusiastic: "We are currently using the LightCycler at ARUP Laboratories to do genetic testing for factor V mutations, but what we have is a generalized platform for rapid fluorescence analysis of very small samples. Fluorescence is a very exiting area for new assay development and analytical techniques, and we intend to be pioneers in that area as well."

Dr. Wittwer is a self-described **"techno-junkie."**

Making ARUP the **most automated** clinical laboratory in North America

HAWKER

Charles Hawker, PhD, MBA, FACB, is the scientific director of Automation and Special Projects at ARUP.

"I feel very fortunate that ARUP's executive team recognized that automation would enable us to keep up with growth and improve our quality and performance, and that I was given the freedom to think outside the box and find unique solutions to unique problems. My colleagues at ARUP have also added to my ideas, resulting in systems that work well and achieve our objectives."

TURNING TOMORROW IMPROVING TODAY INTO TODAY

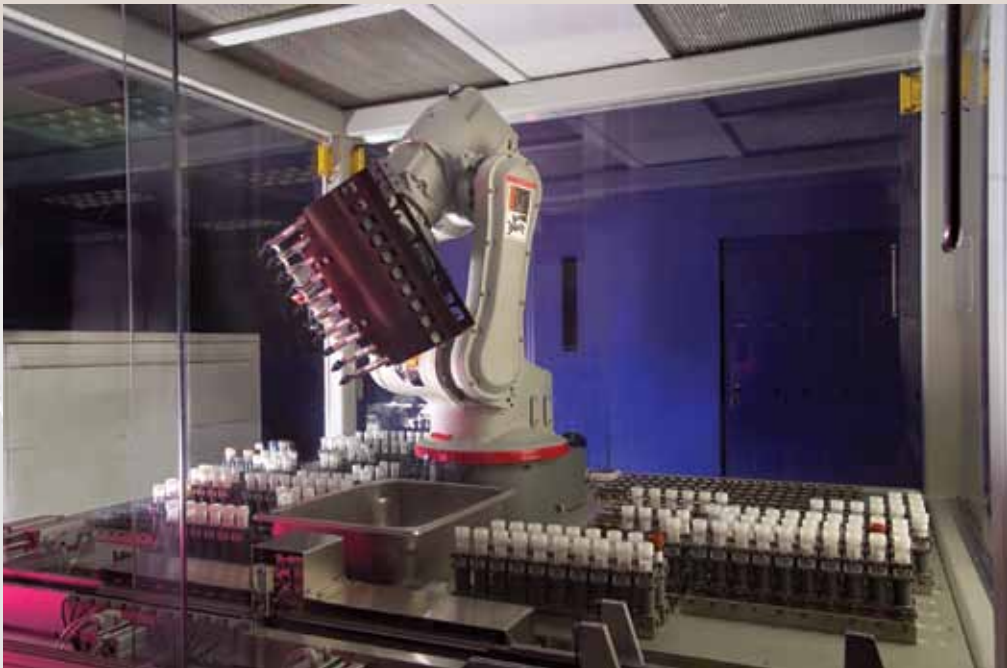
ARUP'S AUTOMATION INITIATIVE

ARUP Laboratories is the most automated laboratory in North America. This automation has contributed significantly to ARUP's quality, turnaround time, efficiency, and profitability. Lost specimens have been reduced by 80 percent to near Six Sigma levels; turnaround times have been reduced by 30 percent; and productivity in laboratory sections served by the automation has more than doubled.

An 1,100-foot transport and sorting system, with a capacity of more than 5,000 specimens per hour, transports specimens to eight automated sorters, each of which can sort 1,000 specimens per hour into 30 different sort groups. Two automated storage sorters load finished specimens into storage trays, and a two-story automated storage and retrieval system (AS/RS) is housed in the largest clinical laboratory freezer in the United States. The AS/RS capacity exceeds 2.3 million specimens, and individual specimens are robotically retrieved in less than 2.5 minutes.

ARUP utilizes the world's first robotic thawing and mixing workcell, a collaborative effort involving Motoman and the University of Utah's College of Engineering. There are two such systems connected to ARUP's automation, and each can thaw and mix up to 1,000 specimens per hour, replacing a time-consuming manual process that was not uniform.

A new Storage AutoSorter custom system is the first of its kind in the world; it is capable of storing 4,000 specimens per hour and ensures that ARUP can keep up with current volumes and expected new growth.



The automated thawing and mixing workcell was a three-year collaborative effort of ARUP scientists, the Motoman Corporation, and engineers at the University of Utah's College of Engineering.

UNIQUE Education, RELATIO

ARUP AND THE UNIVERSITY OF UTAH DEPARTMENT OF PATHOLOGY

ARUP provides financial support to further the mission of the University of Utah Department of Pathology and the University of Utah School of Medicine. Faculty members from multiple departments in the medical school act as medical directors and consultants for ARUP's individual laboratory divisions. Department of Pathology faculty members also provide a full range of pathology services to the Huntsman Cancer Institute, Primary Children's Hospital, University Hospital, and the Emma Eccles Jones Medical Research Building.

Department of Pathology faculty members train medical students, residents, fellows, and graduate students in broad areas of pathology disciplines, including cell biology, immunology, molecular pathology, infectious diseases, clinical chemistry, cancer biology, and hematopathology. The department has a strong PhD program in experimental pathology, offering postgraduate and residency programs designed to mentor trainees in anatomic and clinical pathology and to train physicians for successful careers in academic pathology or community practice. Fellowship programs offer subspecialty training in a variety of areas, including molecular genetics, surgical pathology, pediatric pathology, clinical chemistry, immunology, medical microbiology, and hematopathology.

Through the ARUP Institute for Clinical and Experimental Pathology, department faculty members focus on the development of cutting-edge diagnostic assays, with the goal of improving patient health through more effective diagnosis and disease management.

Teaching is a significant part of the Department of Pathology's mission. The scope of our curricula has increased over the years and now includes teaching and training of medical students, residents, medical and postdoctoral fellows, PhD students, dental students, nursing graduate students, physician assistants, graduate students, and undergraduate students in medical laboratory science, nursing, and pharmacy, as well as supporting a variety of continuing-education programs.

A major goal of research in the Department of Pathology is to extend our knowledge of the mechanisms of disease, especially at the molecular level, and to apply advances in knowledge to improve disease diagnostics, treatment, and prevention.

Research, & Service

NSHIPS

ARUP INSTITUTE FOR CLINICAL AND EXPERIMENTAL PATHOLOGY®

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 has developed approximately 620 tests that ARUP now performs in-house. Of these 620 tests, more than 400 were developed by institute scientists, while 200 others were improved and validated so that ARUP could perform them in-house rather than continue to refer them out. Moreover, ARUP research scientists have shared their knowledge, experience, and new developments with the scientific community by publishing more than 1,300 original peer-reviewed research publications in leading journals.

The institute's mission is to be at the forefront of innovative research and development in clinical and experimental laboratory medicine and to continually contribute to the profession. The institute sponsors projects within four broad categories: creating new laboratory tests; improving current clinical laboratory tests; evaluating and critiquing tests, including alpha- and beta-site protocols; and conducting basic and clinical research projects. Research performed on human subjects is conducted under informed consent following the protocols approved by the University of Utah Institutional Review Board (IRB).

> The ARUP Institute for Clinical and Experimental Pathology strives for a smooth translation of basic research into applied science and clinical assays.

RECENT RESEARCH PUBLICATIONS

Juenke JM, McGraw JP, McMillin GA, Johnson-Davis KL. Performance characteristics and patient comparison of the ARK Diagnostics levetiracetam immunoassay with an ultra-high performance liquid chromatography with tandem mass spectrometry detection method. *Clin Chim Acta*. 2012. 413(3-4):529–31.

Strathmann FG, Sadilkova K, Laha TJ, Lesourd SE, Bornhorst JA, Hoofnagle AN, Jack R. 3-epi-25 hydroxyvitamin D concentrations are not correlated with age in a cohort of infants and adults. *Clin Chim Acta*. 2012. 413(1-2):203–6.

Veeraraghavan R, Salama ME, Poelzing S. Interstitial volume modulates the conduction velocity- gap junction relationship. *Am J Physiol Heart Circ Physiol*. 2012. 302(1):H278–86.

Pickering JW, Hill HR. Measurement of antibodies to pneumococcal polysaccharides with Luminex xMAP microsphere-based liquid arrays. *Methods Mol Biol*. 2012. 808:361-75.

Schmidt RL, Factor RE, Affolter KE, Cook JB, Hall BJ, Narra KK, Witt BL, Wilson AR, Layfield LJ. Methods specification for diagnostic test accuracy studies in fine-needle aspiration cytology: a survey of reporting practice. *Am J Clin Pathol*. 2012. 137(1):132–41.

> The institute's mission is to be at the forefront of innovative RESEARCH and DEVELOPMENT in clinical laboratory medicine.

MISSION

ARUP MEDICAL DIRECTORS & CONSULTANTS

Archana Mishra Agarwal, MD
Medical Director, Hemoglobin Laboratory

Assistant Professor of Pathology

Robert C. Blaylock, MD
Medical Director, Blood Services and Phlebotomy and Support Services; Immunohematology Reference; University Hospitals and Clinics Clinical Lab; University Transfusion Services

Associate Professor of Pathology

Edward R. Ashwood, MD
President and CEO

Professor of Pathology

Mary Bronner, MD
Director, Anatomic Pathology and Oncology Division

Professor of Pathology

David W. Bahler, MD, PhD
Medical Director, Hematologic Flow Cytometry Laboratory

Associate Professor of Pathology

Barbara E. Chadwick, MD
Medical Director, Cytology Laboratory

Assistant Professor of Anatomic Pathology

Pinar Bayrak-Toydemir, MD, PhD
Medical Director, Molecular Genetics Laboratory; Genomics Laboratory

Associate Professor of Pathology

Xinjian Chen, MD, PhD
Assistant Medical Director, Anatomic Pathology

Assistant Professor of Anatomic Pathology and Cell Biology and Immunology

Philip S. Bernard, MD
Medical Director, Molecular Pathology Laboratory

Assistant Professor of Pathology

Frederic Clayton, MD
Director, Anatomic Pathology Autopsy Service

Associate Professor of Pathology and Autopsy Director

Hunter Best, PhD
Assistant Medical Director, Molecular Genetics

Assistant Professor of Pathology

Michael Cohen, MD
Medical Director, Anatomic Pathology and Oncology Division

Professor and Vice Chair for Faculty and House Staff Development

Marc Roger Couturier, PhD
Medical Director, Microbial Immunology; Assistant Medical Director, Parasitology and Fecal Testing; Infectious Disease Rapid Testing

Assistant Professor of Pathology

D. Glen Esplin, DVM, PhD
Veterinary Pathologist, Animal Reference Pathology

Adjunct Associate Professor of Pathology

Irene De Biase, MD, PhD
Assistant Medical Director, Biochemical Genetics and Newborn Screening

Assistant Professor of Pathology

Rachel E. Factor, MD, MHS
Medical Director, Cytology Laboratory

Assistant Professor of Pathology

Julio Delgado, MD, MS
Medical Director, Protein Immunology; Immunogenetics; Group Medical Director, Immunology Division

Assistant Professor of Pathology

Mark Fisher, PhD, D(ABMM)
Medical Director, Bacteriology, Antimicrobials, Parasitology, and Infectious Disease Rapid Testing Laboratories

Assistant Professor of Pathology

David D. Eckels, PhD
Medical Director, Histocompatibility and Immunogenetics Laboratory; Molecular HLA Sequencing Laboratory

Professor of Pathology

Elizabeth L. Frank, PhD
Medical Director, Analytic Biochemistry Laboratory

Associate Professor of Pathology

Gary L. Ellis, DDS
Director, Head and Neck Pathology

Professor of Pathology

Katherine Geiersbach, MD, FCAP, FACMG
Medical Director, Cytogenetics, Genomic Microarray, and Molecular Oncology Laboratories

Assistant Professor of Pathology

Lyska L. Emerson, MD
Staff Pathologist, Anatomic Pathology

Assistant Professor of Pathology

Evelyn V. Gopez, MD
Medical Director, Cytology Laboratory

Director of the Pathology Residency Training Program, Medical Director of the School of Cytotechnology, and Professor of Pathology

ARUP MEDICAL DIRECTORS & CONSULTANTS

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Medical Director, Special Chemistry Laboratory

Associate Professor of Pathology

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Medical Director, Medical Informatics

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Medical Director, Mycology, Mycobacteriology, and Virology Laboratories

Assistant Professor of Medicine and Pathology

Elke Jarboe, MD
Staff Pathologist, Cytopathology

Assistant Professor of Pathology

Charles D. Hawker, PhD, MBA, FACB
Scientific Director, Automation and Special Projects

Adjunct Professor of Pathology

Peter E. Jensen, MD
Chairman, Department of Pathology

Karen Heichman, PhD
Vice President, Oncology Technology Development and Licensing

Assistant Professor

Kamisha Johnson-Davis, PhD, DABCC
Medical Director, Clinical Toxicology Laboratory

Assistant Professor of Pathology

Harry R. Hill, MD
Executive Director, ARUP Institute For Clinical and Experimental Pathology®; Medical Director, Immunology and Infectious Disease

Professor of Pathology, Pediatrics, and Medicine and the Head of the Division of Clinical Pathology

Todd Kelley, MD
Medical Director, Molecular Hematopathology Laboratory; Assistant Medical Director, Hematopathology Laboratory

Assistant Professor of Pathology

David R. Hillyard, MD
Medical Director, Molecular Infectious Diseases

Professor of Pathology, with an Adjunct Appointment in Biology

Carl R. Kjeldsberg, MD
Consultant, Hematopathology

Professor of Pathology and Medicine

Noriko Kusukawa, PhD
Vice President; Director, New Technology Assessment and Licensing

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Ting Liu, MD
Medical Director, Surgical Pathology

Assistant Professor of Surgical Pathology

Allen N. Lamb, PhD, FACMG
Medical Director, Cytogenetics and Genomic Microarray Laboratory

Associate Professor of Clinical Pathology

Elaine Lyon, PhD
Medical Director, Genetics Division; Co-Medical Director, Pharmacogenomics; Co-Director, Clinical Molecular Genetics Fellowship Program

Associate Professor of Pathology

Lester J. Layfield, MD
Medical Director, Histology Laboratory, Gross Dissection, Surgical Pathology, and FNA Service; Co-Medical Director, Solid Tumor Diagnostics

Head of the Division of Anatomic Pathology and Professor of Pathology

Rong Mao, MD
Medical Director, Molecular Genetics

Assistant Professor of Pathology and Co-Director of the Clinical Medical Genetics Fellowship Program

Christopher M. Lehman, MD
Co-Medical Director, University Hospitals and Clinics Clinical Laboratory

Associate Professor of Pathology

Lawrence McGill, DVM, PhD, Diplomate, ACVP
Laboratory Director, Animal Reference Pathology; Technical Vice President

Nicola Longo, MD, PhD
Co-Medical Director, Biochemical Genetics Laboratory

Associate Professor of Pathology

Gwendolyn A. McMillin, PhD
Medical Director, Toxicology and Trace Elements Laboratories; Co-Medical Director, Pharmacogenetics

Associate Professor of Pathology

Amy Lowichik, MD, PhD
Staff Pathologist, Pediatric Pathology

Associate Professor of Pediatric Pathology

A. Wayne Meikle, MD
Medical Director, Endocrinology and Automated Endrocrinology Laboratories

Professor of Medicine, Endocrinology, and Pathology

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William L. Roberts, MD, PhD
Medical Director, Automated Core Laboratory

Professor of Pathology

Marzia Pasquali, PhD
Co-Medical Director, Biochemical Genetics; Chair, Children's Health Improvement Through Laboratory Diagnostics (CHILDx) Medical Director, Newborn Screening

Professor and Clinical Scientist in the Area of Newborn Screening

Alan L. Rockwood, PhD
Scientific Director, Mass Spectrometry Laboratory

Clinical Associate Professor of Pathology

Sherrie L. Perkins, MD, PhD
Chief Medical Officer and Director of Laboratories

Professor of Pathology

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Medical Director, Hemostasis and Thrombosis Laboratory

Professor of Medicine and Pathology

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Medical Director, Special Genetics

Division of Hematology, Department of Internal Medicine

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Assistant Medical Director, Hematopathology

Associate Professor of Pathology and Director of the Hematopathology Fellowship Program

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Adjunct Professor of Pediatrics, Professor of Clinical Pathology, and Chief of the Division of Pediatric Pathology

Wade Samowitz, MD
Staff Pathologist, Anatomic Pathology

Professor of Pathology

Monica Patricia Revelo, MD, PhD
Medical Director, Renal Pathology

Associate Professor of Pathology

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Assistant Professor of Pathology

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Assistant Professor of Cytology and Surgical Pathology

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Professor of Pathology

Jia Xu, MD
Medical Director, Cytogenetics and Genomic Microarray Laboratory

Assistant Professor in the Department of Pediatrics

CONSISTENCY, SUCCESS, **EXPERIENCE**

MEDICAL DIRECTORS & CONSULTING FACULTY

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.

28 YEARS THE HISTORY OF ARUP AND GOING STRONG

In 2009, ARUP Laboratories celebrated its 25th anniversary, a tremendous achievement. The story of ARUP's birth is as unusual as it is intriguing. ARUP's unique hybrid of academics and business has survived and flourished against all odds, growing far beyond original expectations.

The seeds of ARUP were sown in 1973 when Ernst Eichwald, MD, chair of the University of Utah's Department of Pathology, hired Lloyd Martin as a new business manager. From day one, Martin promoted an unprecedented idea to ensure the financial stability of the Department of Pathology: pathologists owning and operating their own clinical reference laboratory.

Lloyd Martin

From day one, Martin promoted an unprecedented idea to ensure the financial stability of the Department of Pathology: PATHOLOGISTS OWNING AND OPERATING THEIR OWN CLINICAL REFERENCE LABORATORY.

Within a year of Martin's hiring, John Matsen, MD, joined the University of Utah as a professor and director of the university's clinical laboratories. It wasn't long until he too became swept up in Martin's vision of the future. Although Eichwald was not shy about voicing his dislike for Martin's proposal, the idea enjoyed quiet debate among a few members of the department throughout the late1970s. Carl R. Kjeldsberg, MD, ARUP's former CEO and current chairman of the board, was among those who participated in the original discussions.

When Eichwald retired in 1979, he was replaced by Reginald Mason, MD. At Kjeldsberg's urging, Mason hired Joseph Knight, MD, chief of pathology

John Matsen

JOHN MATSEN TOOK ARUP FROM A VAGUE PLAN TO REALITY IN ONLY 18 MONTHS. He was well connected nationally and a visionary with natural entrepreneurial talent.

and lab medicine at Primary Children's Medical Center, to direct and expand the university's clinical labs. As ARUP added more business, Knight established a reliable courier service to transport specimens safely to ARUP. He also began offering clients value-added services—such as anatomic pathology consultations, continuing education seminars, and the opportunity for local labs to send their technicians to the university lab for training on more specialized tests—a concept that continues to be one of ARUP's greatest selling points.

When Mason died suddenly in 1982, John Matsen was named the new chair of the Department of Pathology. Matsen proved to be an ideal choice; he was well connected nationally and a visionary with natural entrepreneurial talent. He took ARUP from a vague plan to reality in only 18 months.

Later that year, an event occurred that would be a key factor in the creation of ARUP. St. Mark's Hospital in Salt Lake City began soliciting outside bids to take over its pathology work, although the actual lab and personnel would remain under the auspices of St. Mark's. Kjeldsberg and Knight entered into negotiations with St. Mark's and eventually secured the contract.

On October 27, 1983, Matsen incorporated Associated Regional and University Pathologists, Inc. (ARUP Laboratories). The University of Utah, as the owner of the School of Medicine and all the departments within, would become the arms-length legal owner. Although ARUP was ready to launch, legal transfer of lab ownership from the hospital to ARUP required formal approval from the hospital's board of directors and took until March of 1984 to receive.

ARUP Laboratories officially launched on June 15, 1984, without a model for guidance. Prior to the launch, hospital staff members were given their pink slips and were immediately hired by a brand new company: ARUP. With John Matsen as its first president, ARUP leased a building in Research Park at 390 Wakara Way and painstakingly moved over the course of three days, one lab division at a time; the entire migration took several months. During that time, not a single item was damaged or lost; not a single test was interrupted. In spite of a quiet launch, ARUP began expanding both its personnel and its business, which included LDS Hospital and Primary Children's Medical Center.

1973

1973—The seeds of ARUP are sown when Ernst Eichwald, MD, chair of the University of Utah's Department of Pathology, hires Lloyd Martin as a new business manager.

1982

1982—John Matsen, MD, is named the new chair of the Department of Pathology.

1982—St. Mark's Hospital in Salt Lake City begins soliciting outside bids to take over its pathology work. Carl Kjeldsberg, MD, and Joseph Knight, MD, enter into negotiations with St. Mark's and eventually secure the contract.

1983

1983—On October 27, Matsen incorporates Associated Regional and University Pathologists, Inc. (ARUP Laboratories).

1984

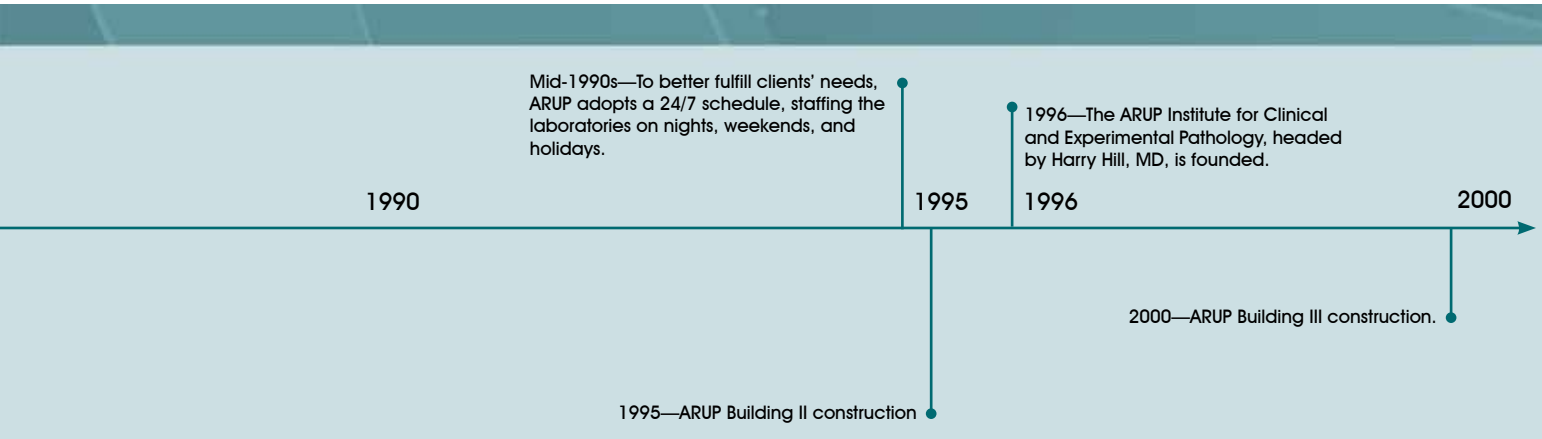
1984—ARUP Laboratories launches on June 15 without a model for guidance.

In those early years, there was no grounds crew. A brutal blizzard in 1984 forced employees to tunnel through snow to get to work. In the summers, some of the managers would mow the lawn and trim the trees. ARUP's "fleet" of specimen transport vehicles was so small that staff would often use their own cars. Labs were cold in the winter and full of wasps in the summer. Space was tight, and employees, forced to share close quarters, developed a sense of humor and of family; several office romances developed, 59 of them resulting in marriage.

ARUP had many hurdles to overcome in those early years, including merging academia with business, learning to keep pace with its competitors, and dealing with an inadequate computer system. One of ARUP's biggest challenges was to convince potential clients outside the intermountain region that it could handle sophisticated tests. Nevertheless, ARUP's selling points far outweighed its weaknesses. As a medical school lab with sophisticated technology capable of providing high-quality, cost-competitive, full-service esoteric testing, ARUP diligently avoided competing directly with its clients for physicians' office testing and openly shared its knowledge, technology, and expertise. ARUP's strengths won the business of several big name medical schools, including the University of Minnesota and the University of Washington. Their endorsement paved the way to more business and proved that ARUP

Space was tight, and employees, forced to share close quarters, developed a sense of humor and of family; SEVERAL OFFICE ROMANCES DEVELOPED, 59 OF THEM RESULTING IN MARRIAGE.

ARUP's first building at 390 Wakara Way in Research Park; ARUP OUTGREW ITS FIRST HOME WITHIN THREE YEARS.



was a legitimate player in the reference laboratory business.

As the company grew and perfected its transportation system, ARUP eventually became one of Delta Air Lines' biggest shippers of airfreight. Because Delta's hub is located in Salt Lake City, most specimens can be transported and tested the next day. ARUP also developed a shipping container that is nearly impossible to damage.

In the mid-1990s, to better fulfill clients' needs, ARUP adopted a 24/7 schedule, staffing the laboratories on nights, weekends, and holidays. By this time, nearly two-thirds of the nation's leading academic health centers were sending samples to ARUP, including Stanford, Pennsylvania, and Harvard. The University of Utah could now boast the strongest clinical pathologist group in the nation.

The ARUP Institute for Clinical and Experimental Pathology, headed by Harry Hill, MD, was founded in 1996. Its mission, to be at the forefront of innovative research and development in clinical and experimental laboratory medicine, creates a synergy between academia and ARUP's laboratory business. The company also created ARUP's Institute for Learning (IFL), which offers both clients and employees valuable continuing education and outreach programs.

A number of scientific breakthroughs and patents, the discoveries of ARUP pathologists and personnel, have taken place over the years. Most notable were Carl Wittwer's rapid PCR instruments, the Rapid Cycler® and the LightCycler®. Due to Wittwer's persistence, ARUP entered the field of molecular diagnostics in the mid-1990s. ARUP's commitment to patients and not to the dollar was illustrated when, in 2002, it launched an initiative to promote the screening of newborns through tandem mass spectrometry for over 30 metabolic disorders.

ARUP Institute for Clinical and Experimental Pathology personnel, University of Utah Department of Pathology faculty, and distinguished judges after the 11TH ANNUAL ARUP INSTITUTE FOR CLINICAL AND EXPERIMENTAL PATHOLOGY RESEARCH COLLOQUIUM.

2002—ARUP launches an initiative to promote the screening of newborns through tandem mass spectrometry for over 30 metabolic disorders.

2003—ARUP 1.5 expansion.

2002

2003

2006

2002—ARUP volunteers its world-class lab facilities to UCLA, which performs athlete drug testing during the Salt Lake City Winter Olympics.

In 2002, ARUP came to the rescue of the International Olympic Committee by volunteering use of its world-class lab facilities to the doping control lab, UCLA, which performed athlete drug testing during the Salt Lake City Winter Olympics.

Throughout the years, ARUP continued to increase its personnel as well as its revenue, and grew so quickly that within three years it had outgrown its Wakara Way home and began construction on a new building at its present 500 Chipeta Way address. The building, designed by Russ Haymond and Charles DeWitt, was constructed in just 10 months and completed in 1989.

ARUP constructed ARUP II in 1995, adding ARUP III in 2000 and ARUP 1.5 in 2003. Today, ARUP's main campus encompasses four interconnected brick, stone, and glass buildings that comprise 315,000 square feet of work space. In the fall of 2008, needing more laboratory space, ARUP purchased a building on 560 Arapeen Drive, moving administrative employees to the new space over the course of a year in 2009, thereby freeing up prime lab space at the main facility. ARUP Blood Services also moved to its new state-of-the art 15,000-square-foot facility located in Sandy, Utah, in October 2009, while the Transportation Department moved to a new airport facility in fall 2008. A new parking lot off Komas Drive was also constructed in 2009.

Edward Ashwood

In June 2009, Carl R. Kjeldsberg retired as ARUP's CEO, retaining his position as ARUP's chairman of the board. EDWARD ASHWOOD, MD, FORMERLY ARUP'S CHIEF MEDICAL OFFICER (CMO) AND DIRECTOR OF LABORATORIES, BECAME ARUP'S PRESIDENT AND CEO.

DEFINING THE FUTURE TOGETHER®

2008

2008—ARUP purchases a building on 560 Arapeen Drive, moving administrative employees to the new space over the course of a year in 2009, thereby freeing up prime lab space at the main facility.

2009

2009—Dr. Kjeldsberg retires as ARUP's CEO, retaining his position as ARUP's chairman of the board. Edward Ashwood, MD, becomes ARUP's president and CEO.

2010

2010—The implementation of a CRM connects Marketing, Sales, Client Services, and the Pathologist-on-Call service, providing ARUP's client-facing divisions with real-time communication tools to better serve our clients.

2010—ARUP Consult releases the Consult app in the App Store.

2011

2011—New fully searchable, user-friendly Genetics and Pain Management websites are launched.

2012

2012—ARUP introduces genomics and next-generation sequencing.

2012—ARUP assumes testing oversight of the University of Utah community clinics and South Jordan laboratories.

In June 2009, Kjeldsberg retired as ARUP's CEO, retaining his position as ARUP's chairman of the board. Edward Ashwood, MD, formerly ARUP's chief medical officer (CMO) and director of laboratories, became ARUP's president and CEO. Sherrie Perkins, MD, PhD, took over as ARUP's CMO and director of laboratories.

ARUP's growth has been remarkable. In the beginning, 99 percent of ARUP's revenue source was derived from the University of Utah Hospital. As a result of the breadth and quality of its testing capabilities, ARUP greatly increased its client base and progressed from being a modest, regional laboratory to a nationally recognized and respected referral laboratory with clients in all 50 states. Beginning with fewer than 100 employees and only a handful of faculty members, ARUP now consists of nearly 3,000 employees and 70 medical directors.

Although operating in a field that has traditionally had difficulty recruiting and maintaining employees, ARUP lures and retains employees with a focus on work/life balance and an attractive benefits package.

Offering a test menu of more than 3,000 tests and test combinations and processing 30,000–35,000 specimens daily, ARUP is continually adding cutting-edge, state-of-the-art equipment and testing to its portfolio, while continuing to focus on esoteric, leading-edge technologies as it builds on a tradition of service, education, and research.

ARUP EMPLOIYEES CELEBRATE ARUP'S 25 YEAR ANNIVERSARY.
As part of the festivities, employees participated in a 5K walk/run, rock-band contest, talent show, and photo contest, and Lifetime Fitness Awards were presented.

ARUP® LABORATORIES

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ARUP is a nonprofit enterprise of the University of Utah and its Department of Pathology.