



PATHOLOGY

A Career in Medicine



The Intersociety Council for
Pathology Information (ICPI)
www.pathologytraining.org

2015

Pathology: A Career in Medicine

The study of the nature of disease, its causes, processes, development, and consequences.

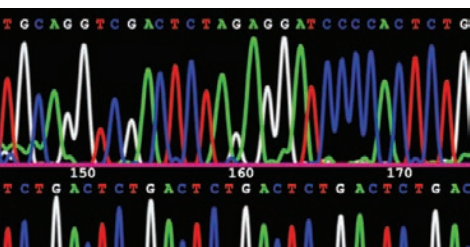
Pathology is the medical specialty that provides a scientific foundation for medical practice

The pathologist is a physician who specializes in the diagnosis and management of human disease by laboratory methods. Pathologists function in three broad areas: as diagnosticians, as teachers, and as investigators. Fundamental to the discipline of pathology is the need to integrate clinical information with physiological, biochemical and molecular laboratory studies, together with observations of tissue alterations. Pathologists in hospital and clinical laboratories practice as consultant physicians, developing and applying knowledge of tissue and laboratory analyses to assist in the diagnosis and treatment of individual patients. As teachers, they impart this knowledge of disease to their medical colleagues, to medical students, and to trainees at all levels. As scientists, they use the tools of laboratory science in clinical studies, disease models, and other experimental systems, to advance the understanding and treatment of disease.

Pathology has a special appeal to those who enjoy solving disease-related problems, using technologies based upon fundamental sciences ranging from biophysics to molecular genetics, as well as tools from the more traditional disciplines of anatomy, biochemistry, pharmacology, physiology and microbiology.



A biosample robot prepares specimens for testing



Genome DNA Data



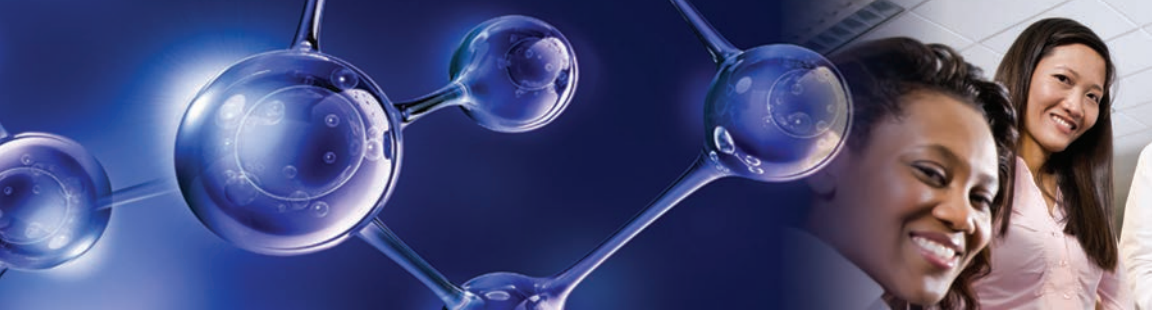
Genomic mapping of the patient's tissue sample indicates PARK9, a marker for Parkinson's Disease.

The Pathologist in Patient Care

The pathologist uses diagnostic and screening tests to identify and interpret the changes that characterize different diseases in the cells, tissues, and fluids of the body. Anatomic pathology involves the analysis of the gross and microscopic structural changes caused by disease in tissues and cells removed during biopsy procedures, in surgery, or at autopsy. Cytopathology, the examination of individual cells to aid in disease detection, is an important component of modern patient care. Clinical pathology encompasses chemistry, microbiology, immunology, hematology, coagulation, and blood banking, among other types of laboratory testing. Molecular pathology utilizes strategies for DNA and RNA hybridization and amplification as well as proteomics to aid in many aspects of both clinical and anatomic diagnoses. Collectively, all the pathology specialties contribute to understanding disease and treatment of the patient.

For all pathologists -- clinical, anatomic, molecular, investigator or researcher -- better patient care is the ultimate goal. Pathologists participate in day-to-day care of patients by providing and interpreting laboratory information to help solve diagnostic problems and to monitor the effects of therapy. Because of the expanding volume of new and highly complex tests, clinicians rely on the pathologist for guidance and direction in use of the clinical laboratory and interpretation of test results. The rapidly evolving

field of molecular diagnostics is driving precision medicine initiatives and involves techniques that permit identification of carriers of genetic disease, diagnosis of viral and bacterial infections, monitoring of cancer therapy, DNA fingerprinting for forensic (medico-legal) analysis, and detection of biomarkers that assist in prognosis. When unusual or unexpected abnormal results are identified, and particularly when critical or life-threatening alterations are found, the pathologist communicates directly with the patient's physician.



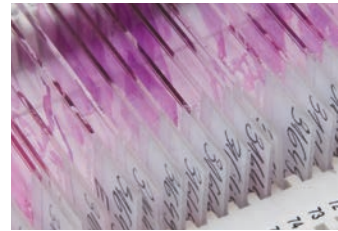
In addition to daily communication with other health care professionals about test results, many pathologists have direct patient contact on a frequent, and even daily, basis. It is common for the pathologist to perform a fine-needle aspiration of suspicious masses or a bone marrow aspiration or biopsy to diagnose hematologic disease. In Transfusion Medicine, the pathologist plays a pivotal role in the selection of appropriate blood product therapy and the management of transfusion reactions. One of the most direct patient management and practice roles that some pathologists perform is apheresis therapy, a process that removes pathologic substances from the blood stream. Apheresis is performed for a variety of disorders and can be immediately life-saving or used for long-term care. As a result, pathologists not only provide acute care, but also form long-term relationships with patients and their families.

Anatomic Pathology

Whenever tissue is removed from the body, it must be examined to determine the precise cause of the illness that prompted its removal. Microscopic analysis of tissue changes is the focus of anatomic pathology. Within the general practice of anatomic pathology are subspecialty areas including surgical pathology, neuropathology, cytopathology, autopsy pathology and forensic medicine. Pathologists in community hospitals often practice in most of these subspecialty areas. Pathologists in academic medical centers may subspecialize in only one area, and sometimes in a specific organ system.

Surgical Pathology

The surgical pathologist plays a central role in the diagnosis of biopsies or of surgically removed tissues, particularly when tumor is suspected, and works closely with surgeons and other physicians in such cases. Nonsurgical endoscopic methods often are used to examine the airways and the gastrointestinal tract. Using a flexible scope the physician can examine the lining of the airways or of the stomach or intestines. Biopsies performed during such procedures produce very small samples of tissue. Nevertheless a great deal of information often can be obtained from them by the pathologist, including specific medical disease or tumor diagnoses.



After the pathologist fixes the patient's tissue samples the specimens will be thinly sliced, mounted on slides, and examined under a microscope.

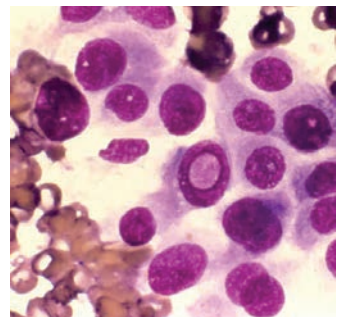
Surgical removal of tumors often results in complex specimens that require detailed examination by the pathologist. The surgical pathologist is trained to identify evidence of disease at the macroscopic as well as microscopic level. Knowledge of typical gross abnormalities and an understanding of the information that is important for patient management (such as the status of resection margins) guides the pathologist in selecting



The attending pathologist and resident examine the patient and, under the pathologist's guidance, a resident obtains the specimen.



A pathologist and resident immediately analyze the cells microscopically while the patient is still in the examining room.



The fine needle aspirate (FNA) reveals a papillary carcinoma of the thyroid which often affects young women



tissue samples for examination under the microscope.

Often during surgery for suspected cancer, a pathologist is asked to prepare a frozen section. A piece of tissue is removed during the operation, frozen, thinly sliced, and prepared for rapid microscopic examination by the pathologist while the patient is still on the operating table. The preliminary diagnosis based on the frozen section guides the surgeon as to the next steps to take during surgery.

A complete pathologic work-up of tissue specimens increasingly requires correlation of histologic findings with molecular alterations. For instance, certain molecular studies may be essential to confirm the diagnosis of a histologically undifferentiated tumor, or to identify whether the patient is a candidate for therapy directed to specific molecular targets.



Viewing fine needle aspirate (FNA) extracted cells under the microscope.

Cytopathology

The cytopathologist is specially trained to examine and interpret the microscopic appearance of cells shed into fluids such as urine or pleural effusions, scraped from the uterine cervix, or aspirated from tumors with a fine needle. Some cytopathologists perform the needle aspiration procedure, especially when the tumor is palpable or identifiable by ultrasound. In other situations, the cytopathologist interprets cells obtained by image-guided aspiration of deep-seated tumors (e.g., in the lung or other organs) performed by another physician such as an interventional radiologist. Special studies, including immunohistochemical stains and molecular analyses, can be performed on cytologic specimens in many cases in order to better refine the diagnosis.



Forensic pathologist examines a kidney during an autopsy.

Autopsy

"This is the place where the dead shall teach the living." The autopsy provides unique insights into the natural history of disease and the influence of therapy on disease processes. Although autopsy information is important for general medical purposes, occasionally the patient's family is benefited directly. For example, when an unsuspected genetic disorder is found or evidence of a contagious infection or an environmental toxin is uncovered, the diagnosis and intervention can

help living members of that family. The autopsy provides feedback to the physicians involved in patient care about the accuracy of their evaluations and the effectiveness of their treatments. Together, the clinicians and pathologists assess the findings in each case so that future patients can benefit from this information. The importance of autopsy data as a measure of quality-control should not be undervalued. Some recent studies have shown up to 30 percent discrepancy rates between clinical diagnoses and actual findings at autopsy.

The autopsy's value is often dramatically demonstrated to the public when a pathologist is called to determine the exact cause and manner of death in medical legal cases, and to present the findings as an officer of the court. Special training and certification in Forensic Pathology is needed for a pathologist to serve as Medical Examiner for a city or state agency, and to conduct laboratory or postmortem studies of suspected criminal activities on suspicious deaths or those of concern to the public health and safety.



Clinical Pathology

The clinical pathology specialty laboratories include hematology, microbiology, immunology, clinical chemistry (and toxicology), the blood bank (transfusion medicine), and laboratory data management. In these areas, the pathologist acts as a consultant to the clinician, defining appropriate tests and interpreting their results. Many of these tests solidify a clinical diagnosis. After diagnosis, many tests are performed repeatedly to assess progress of the disease and response to treatment.

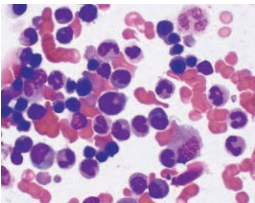
In clinical hematology, for example, pathologists review all abnormal blood smears. They may also obtain bone marrow samples from patients. In examining the smears and microscopic sections from these sources, the pathologist may encounter problems as diverse as the identification of malarial parasites or other blood-borne organisms, investigation of causes of anemia, detection of disorders of coagulation, and definitive diagnosis of malignant diseases such as leukemia.

In most hospital settings the pathologist is in charge of the blood bank and functions as an immunohematologist, who is in charge of procurement and processing of blood and blood products. The responsibilities include monitoring the use of blood within the hospital, tracing the causes of transfusion reactions, testing for determinants of tissue compatibility that permit bone marrow and other transplants, and serving as a consultant to plan appropriate therapy for a wide variety of conditions.



The hospital immunohematologist prepares a patient's blood sample for testing.

In clinical chemistry, the pathologist supervises the technical staff in performance of tests to determine the concentration of organic and inorganic substances and medications in body fluids. For example, the level of glucose (sugar) in blood or urine is needed to diagnose diabetes and to monitor the daily insulin dosage. Supervision of the use of instruments and maintenance of a



*Wright stain of a post-transplant bone marrow.**

strict system of quality control are essential to assure accurate laboratory determinations. Toxicology is often part of the clinical chemistry service, involving the pathologist in

therapeutic drug monitoring and detection of illicit drugs and poisons. In cases of infection, the microbiology laboratory identifies the offending organism and tests to discover which antimicrobials are capable of killing or arresting the growth of that particular agent (bacteria, viruses, parasites).



Diagnostic tests on the patient's blood specimen will be run on automated machines.

Testing for immune reactions and allergies is a growing area of laboratory activity. Allergic and toxic reactions to foreign materials have long been recognized, but many recently identified diseases reflect immune responses to normal body proteins that are either altered or present in abnormal locations. Immune functions are also critical in toleration of transplanted tissues or organs.

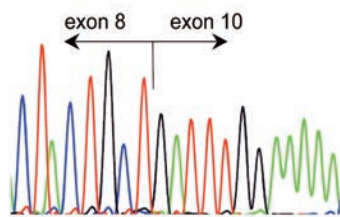
Other areas of responsibility of the clinical pathologist are the development of comprehensive information systems and the maintenance of quality control and quality assurance procedures. Both are needed to ensure economical use of the clinical laboratory, to enable the development of new testing and appropriate utilization of existing services, while maintaining a high quality of medical care.



Pathologists constantly seek ways to achieve greater accuracy, precision, specificity and sensitivity of laboratory tests. Information systems are needed to handle the enormous volume of test information correctly attributed to each individual patient, and provide the correct ranges of normal values for each test in that laboratory, while maintaining patient confidentiality. Quality control checks on the accuracy of test results, whereas quality assurance aims to provide prompt, efficient collection and rapid availability of test results to the treating physician.

Molecular Pathology

The tools of molecular biology contribute to the rapid growth of new tests with both greater accuracy and precision in many of the above areas of laboratory medicine. Infectious agents are identified by virtue of their unique DNA and RNA sequences. Molecular identification of chromosomal rearrangements is used for diagnosis, guiding treatment, monitoring the effectiveness of therapy and detection of residual disease. Genetic alterations underlying heart diseases, iron metabolism defects, and congenital abnormalities, to name a few, are far more common than was previously recognized. Prenatal screening is now available to detect many genetic diseases, such as hemoglobin disorders, cystic fibrosis, and storage diseases. Genetic susceptibility to certain types of cancer is another emerging testing area. The advent of new treatments for certain breast cancers depends on identification of a gene that is amplified and over-expressed in those cancers. The new field of pharmacogenomics focuses on the genetic basis of the metabolism of many important medications, affecting decisions on drug selection and dosage.



Sequencing of RT-PCR products of aberrantly spliced BRCA2 c.682-2A>C mRNA.
(J Mol Diagn 2014, 16:324-334)

Pathology Informatics

It is said that 70% of all of the information used to make decisions on clinical care comes from laboratory data. Lab test results generate large amounts of information and pathologists turn that information into knowledge that is used in the service of their patients. The special area of pathology that is focused on the collection of laboratory information and its synthesis into actionable clinical knowledge is called "pathology informatics." This field is relatively new.

Pathology "informaticists" work with laboratory information systems, electronic medical records, high density molecular data, cellular image analytics, prognostic and predictive modeling functions, and clinical decision support systems. Pathology informatics is embedded in every part of the clinical laboratory and is a tremendous bridge for bringing translational research to clinical care. There are not yet many physicians formally trained in pathology informatics, but the discipline is exploding as the computer becomes the central analytic tool in every corner of the clinical labs. Subspecialty certification in Clinical Informatics is a joint function of the American Board of Pathology and the American Board of Preventive Medicine.



3D computer generated and enhanced image of chromosomes through an electron microscope.

The Pathologist as a Consultant

The pathologist has long been considered the "doctor's doctor," consulted for interpretation of laboratory results, selection of diagnostic tests, monitoring the accuracy of surgical judgments, and introduction of new diagnostic modalities. They serve on many committees important in hospital and medical management,



Continuing medical education, and quality assessment. More recently, because of the range and complexity of diagnostic services, a role for the pathologist in explaining tests and their results directly to the patient has evolved. In addition, a very different role has emerged for pathologists in this era of Managed Care and Precision Medicine. Pathologists have considerable experience with laboratory and hospital management. They are accustomed to thinking diagnostically across a broad spectrum of human disease. Their familiarity with issues of quality control and quality assurance also provides expertise in assessment of appropriate utilization of testing for the individual patient. These attributes are important in the evaluation and auditing of health care services for insurers and government agencies.

The Pathologist as a Teacher

Pathologists teach at the bedside, in the laboratory, over the microscope, and in the lecture hall, workshops, and seminars. They instruct medical students, residents in pathology and other clinical training programs, graduate students in basic science departments, and students in related medical disciplines. They are also important in the continuing medical education of practicing physicians in both academic and community settings. The community-based pathologist has a unique perspective on patients from the viewpoint of each individual's cumulative laboratory data. This perspective is necessary for consultation on individual patients as well as for guidance on the applicability, interpretation, and usefulness of both standard and specialized, often newly available tests. In the academic setting, the pathologist may be the developer of new testing approaches, responding to perceived patient diagnostic or therapeutic problems. In all these environments, pathologists contribute substantially to teaching on the clinical services.

Pathology is a required component of the medical school curriculum, and is often the first introduction to human disease processes. Additional electives, tutorials, and guided research programs are available to the talented medical student in many schools. Exceptional students may be recognized by the Pathology Honor Society, sponsored by the Intersociety Council for Pathology Information in collaboration with the Association of Pathology Chairs.

To teach well, one must continue to learn. Pathologists are committed to their own educational growth and regularly attend and contribute to programs at local, regional, national, and international meetings, where new basic science findings, diagnostic applications, and technology are presented.

One of the great appeals of a career in pathology is that it offers the opportunity to teach at many levels. No other medical specialty offers as many different opportunities in education.

The Pathologist in Research

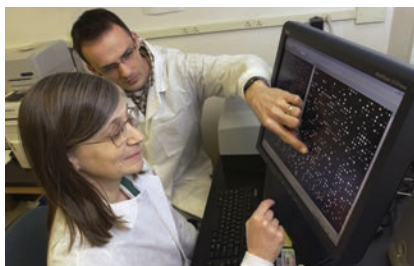
The pathologist-investigator seeks new understanding of the basic nature of disease as a first step toward devising better ways to identify, control and prevent it. In many cases, the normal must be understood in order to define the abnormal. Pathologists have a unique advantage in biomedical research because of their close



Teaching in pathology is often conducted one-on-one with an experienced pathologist serving as mentor to a younger colleague. Here, a neuropathologist provides instruction on the gross anatomy of the brain and how to process the sample to diagnose the cause of death.

ties to clinical medicine, their familiarity with laboratory technology, and their recognition of and insight into the significance of diseased tissue changes. Pathologists engaged in research use the sophisticated technologies of modern molecular biology, biochemistry, immunology, cell biology, and tissue pathology. These tools and methods include cell culture, biochemical analysis, electron microscopy, immunological and molecular genetic techniques, computer modeling, and use of animal models. Understanding at the molecular level is particularly critical in defining normal biological mechanisms, so that the defects that lead to disease can be recognized.

Pathologists are uniquely prepared to investigate the causes and mechanisms of disease because of their experience in recognition of disease manifestations. Some examples of the range of problems under study have included tracing a newly recognized disease to its origin, improving diagnostic approaches to well-known diseases, or identifying the genetic basis for response (or failure of response) to treatment.



Chief Pathologist Dr. Elizabeth Unger, CDC, reviews a microarray image of gene expression data with postdoctoral fellow Martin Steinau, PhD.

Pathologists figured prominently in recognition of pulmonary disease among smokers, miners, asbestos and textile workers; of liver cancer from prolonged contact with vinyl chloride and aflatoxin; of nerve disorders and sterility from exposure to certain pesticides and toxic wastes.

The pathologist plays a key role in improving diagnoses through identifying new pathogenic bacteria, discovery of new infectious agents such as Hanta virus, and better application of modern methods of diagnosis; some recent examples include the unraveling of the role of

retroviruses in AIDS, the application of DNA hybridization for rapid and precise identification of atypical forms of mycobacteria that cause infections closely related to tuberculosis, and the identification of the virus that causes SARS.

Pathologists have recognized new diseases produced by medications used to treat various illnesses. They have identified genes that are amplified in certain kinds of cancer and devised methods to test for gene amplification. Using such methods, it has been demonstrated that amplification of an oncogene in the childhood tumor, neuroblastoma, is an indicator of poor prognosis. Other amplified genes seem to confer drug resistance.

Other important pathology research led to the recognition that smoking and obesity are associated with the early onset of atherosclerosis in young Americans as well as the relationship between elevated levels of homocysteine and heart disease.

Pathologists who used their understanding of pathologic processes to make significant contributions to medicine have garnered Nobel Prizes. For example, Nobel Laureate pathologists include **Alexis Carrel, (1912)** who pioneered vascular suturing techniques, **Karl Landsteiner, (1930)** the discoverer of the A, B, O blood groups, **George Whipple, (1934)** who, with Minot and Murphy, recognized that liver contained a substance necessary to prevent pernicious anemia, **Edward C. Kendall, (1950)** who, with Reichstein and Hench, studied the hormones of the adrenal cortex, their structure and biological effects which helped develop cortisone as a therapeutic agent, **Thomas Weller, (1954)** who developed methods for the growth of polio virus in tissue culture, **Peyton Rous, (1966)** the discoverer of tumor-inducing viruses, **Baruj Benacerraf, (1980)** who identified genetically determined structures on the cell surface that regulate immunological reactions, **Peter C. Doherty and Rolf M. Zinkernagel, (1996)**, who discovered cell mediated immune defense, **J. Robin Warren, (2005)** who with Barry J. Marshall, recognized



Testing blood for the ebola virus.

that gastritis and gastric cancer are caused by infections with *Helicobacter pylori*, and Harald zur Hausen (2008) for his discovery that human papilloma viruses cause cervical cancer.

Graduate Medical Education in Pathology

Medical school graduates in the United States and Canada need three to four years of accredited residency training to prepare for a career in pathology. There are accredited training programs in many hospitals throughout the United States and Canada, and many varied opportunities for subspecialty study after residency. During training, the resident becomes familiar with all activities of a pathology department.



Dr. Meera Hameed, Attending Pathologist, Memorial Sloan Kettering Cancer Center, specializes in the fields of surgical pathology and the molecular biology of bone and soft tissue tumors, in the areas of clinical service, research, and teaching.

Most pathology residents receive training in both anatomic pathology (AP) and clinical pathology (CP), although it is possible to train in only one. Specialty certification for the medical practice of pathology is the responsibility of the American Board of Pathology (ABP) in the United States, which offers primary specialty (AP and CP) and subspecialty examinations for certification. Four full years of approved training are required for AP/CP, and three years for AP or CP alone. A physician-scientist track (involving additional training) is also available for those residents interested in concentrating on medical research. Residency training in Canada is the responsibility of the Royal College of Physicians and Surgeons.

Following residency training, candidates requesting certification must pass an objective written and practical examination. As in other medical disciplines, Board certification is not required for practice, but it is highly prized as evidence of professional competence. In both the United States and Canada, pathologists who have been board certified must continue to demonstrate competency throughout their careers and in the United States (except for those who were certified before 2006) must enter the

Maintenance of Certification program of the American Board of Pathology.

Pathologists can be certified to practice in the following subspecialties in the United States:

- Blood banking/transfusion medicine
- Chemical pathology
- Clinical Informatics (with the American Board of Preventive Medicine)
- Cytopathology
- Dermatopathology (with the American Board of Dermatology)
- Forensic pathology
- Hematopathology (Hematology)
- Medical microbiology
- Molecular genetic pathology (with the American Board of Medical Genetics)
- Neuropathology
- Pediatric pathology

Career Options

The largest numbers of pathologists are found in community hospital practices, where they play important roles in clinical decision making and continuing medical education of physicians throughout the hospital staff. As laboratory director, the pathologist also has responsibilities for quality improvement, risk management, and development of comprehensive information systems. In addition, hospital pathologists often operate laboratories that serve the office practices of their community's physicians. With the continuing growth of ambulatory care, pathologists may also practice in non-hospital settings such as private or group practice, clinics, and other health care facilities. Independent laboratories have assumed an increasing role as practice sites for pathologists. Many of these laboratories are part of major national

medical networks; others are regional or local.



Dr. Stanley Cohen, former Professor & Chair of the Department of Pathology & Laboratory Medicine at the University of Medicine and Dentistry of New Jersey (UMDNJ) is a world renowned researcher in immunology and teacher.

Although 75 percent of pathologists practice in the community hospital setting, many other options exist. Medical schools attract the second largest group of pathologists - currently over 3,000 individuals, interested in basic or applied research, which is often combined with extensive teaching opportunities, and diagnostic responsibilities in university hospitals. Because of their broad medical perspective, pathologists often fill leadership roles within medical schools, national professional societies, and research organizations.

Yet other positions for pathologists are available in the military and in government agencies such as the National Institutes of Health (NIH), Center of Disease Control and Prevention (CDC), and Food and Drug Administration (FDA). Forensic pathologists typically work in municipal, state, and federal agencies, where they investigate unexplained and unnatural deaths. In addition, pathologists often provide medical direction in research institutes and with pharmaceutical and biotechnology companies. The best available data suggest a strong continuing need for pathologists in all sectors for the future.

Sources of Information

Contact with individual pathologists in hospitals, laboratories and medical schools is the best way to learn about the profession and its personal rewards. For additional information about pathology as a career, contact local, state or national pathology organizations, including:

American Society for Clinical Pathology (ASCP)

www.ascp.org

American Society for Investigative Pathology (ASIP)

www.asip.org

Association of Pathology Chairs (APC)

www.apcprods.org

College of American Pathologists (CAP)

www.cap.org

United States and Canadian Academy of Pathology (USCAP)

www.uscap.org

ICPI is a consortium of five pathology societies (APC, ASCP, ASIP, CAP, and USCAP) created specifically to promote pathology as a career through its publications and information activities. Their website is www.pathologytraining.org.

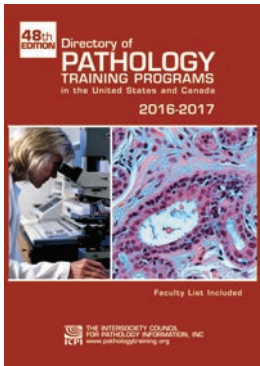
Certification

In the United States:

American Board of Pathology
4830 W. Kennedy Blvd. Suite 690
Tampa, FL 33609-2571
Telephone (813) 286-2444
www.abpath.org

In Canada:

Office of Training and Evaluation
Royal College of Physicians and Surgeons
774 Echo Drive
Ottawa Ontario K1S 5N8
Telephone (613) 730-6209
<http://rcpsc.medical.org>



Directory of Pathology Training Programs

Published by the Intersociety Council for

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Listing of Residency Training Programs, Fellowships, and Post-Sophomore Fellowships

Order the print on-demand version at

www.pathologytraining.org

The *Directory* is also available online and is fully searchable by institution, region/state, faculty, and specialization.

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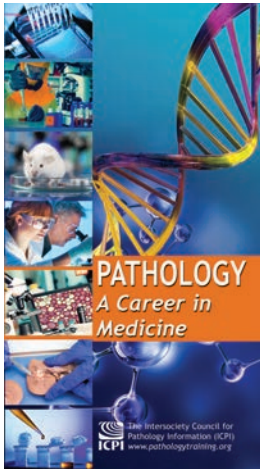
Pathology Information (ICPI)

This career booklet provides a snapshot of the various roles pathologists serve in medicine, research and academia to students interested in pursuing a career in pathology.

Topics Include:

The Pathologist in Patient Care, Anatomic Pathology, Surgical Pathology, Cytopathology, Autopsy, Clinical Pathology, Molecular Pathology, Pathology Informatics, The Pathologist as a Consultant

The Pathologist as a Teacher, The Pathologist in Research, Academic Paths and Career Options. ***Additional copies of this brochure may be obtained by emailing: icpi@asip.org.***

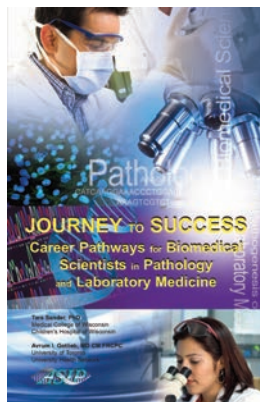


Journey to Success: Career Pathways for Biomedical Scientists in Pathology and Laboratory Medicine

Tara Sander, PhD and Avrum I. Gotlieb, MD CM FRCPC

Published by the American Society for Investigative Pathology (ASIP) with support from the Intersociety Council for Pathology Information (ICPI)

This career booklet was inspired by the American Society for Investigative Pathology (ASIP) to provide a guide for PhD candidates in the life sciences considering a career in experimental pathology. The purpose is to present opportunities in experimental pathology for PhDs that exist in many sectors including academia, molecular diagnostics labs, public and private laboratories, industry, and consulting for-profit and non-profit institutions. This booklet should be helpful to biomedical scientists to understand how to train and then develop their early career to carry out either basic, translational, and/or clinical investigations in academic Departments of Pathology and Laboratory Medicine or in numerous non-academic environments. ***Order your free copy today by emailing: asip@asip.org.***



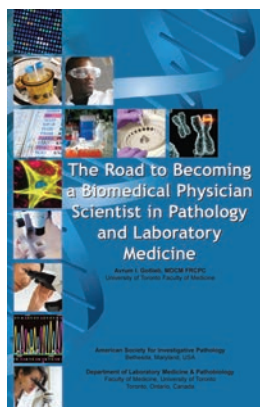
The Road to Becoming a Biomedical Physician Scientist in Pathology and Laboratory Medicine

Avrum I. Gotlieb, MDCM, FRCPC

Published by the American Society for Investigative Pathology (ASIP) with support from the Intersociety Council for Pathology Information (ICPI)

Topics Include:

What is a Physician Scientist in Pathology and Laboratory Medicine? Why Choose Academic Pathology and Laboratory Medicine? Is a Physician Scientist Career for Me? Choosing a Training Path (PhD followed by MD, MD/PhD, Physician Scientist, Training Programs, Post Residency Training) Choosing a Program, Choosing a Supervisor, Searching for Your First Job, Launching your Physician Scientist Career, Tenure, Promotions and the First Ten Years, The Institutional Challenge to Train and Maintain Physician Scientists, and Links and Resources. ***Order your free copy today by emailing: asip@asip.org.***



This brochure, **PATHOLOGY: A Career in Medicine**, has been published by the Intersociety Council for Pathology Information, (ICPI), whose mission is:

- to publish the annual *Directory of Pathology Training Programs* for medical students and graduate physicians;
- to provide information about pathology as a career in medicine; and
- to respond to general inquiries about pathology from the media, professional organizations, and the public.

Mark E. Sobel, MD, PhD
Editor

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Photography

ICPI acknowledges the following individuals and organizations for providing photographs:

Stanley Cohen, MD, *University of Medicine and Dentistry of New Jersey (UMDNJ)*

Daniel G. Remick, MD, *Boston University School of Medicine*

Martin Steinau, MD, PhD, *Centers for Disease Control and Prevention (CDC)*

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