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Scope of pharmacy

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Pharmacy has historic roots as the art and science of preparing and dispensing medications. While this traditional role is still a viable role for pharmacists, the preparation of medicines has transitioned in large part to the pharmaceutical industry. Dispensing of medicines has increasingly become more centralized and automated, with many of the tasks formerly performed by pharmacists being done using technology or delegated to pharmacy technicians. The provision of drug-related information to other healthcare professionals and the public and disease-state management programs to assure the proper use of medicines has become a more important role for pharmacists. It is now recognized that medication-use is a complex and problem-prone process, in which errors that result in injury to patients can occur at each step. This process includes prescribing, transcribing, interpretation of the order, preparation and dispensing, and administration and monitoring. It has been estimated that more than 2 million hospitalized patients per year experience an adverse drug reaction, two thirds of which were the cause of hospital admission and more than 100 000 of which are fatal.¹ For pharmacists to contribute to improving the value of medicines, they must have a role in every aspect of medication use, from preparation to monitoring the outcome of drug

therapy. Pharmacy practice therefore involves the review and interpretation of prescription orders; the compounding, labeling, and dispensing of drugs and devices; drug product selection and medication-use evaluation (MUE); patient monitoring and intervention; and the provision of information related to use of medications and non-pharmacological modalities. The American Pharmacists Association (APhA) describes the mission of pharmacy as serving society as “the profession responsible for the appropriate use of medications, devices, and services to achieve optimal therapeutic outcomes.” The Report of the Commission of Pharmacy, Pharmacists for the Future (often referred to as the Millis Report), states that “pharmacy should be conceived basically as a knowledge system that renders a health service by concerning itself with understanding drugs and their effects.”

Pharmaceutical care holds that the important role of the pharmacist is “the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient’s quality of life.” Pharmacists are experts on medications. They are also the most accessible member of today’s healthcare team, and often they are the first source of assistance and advice on many common ailments and healthcare matters.

Education

The Doctor of Pharmacy (PharmD) is the entry level degree in pharmacy. This is a graduate professional degree at the doctoral level with a clinical focus, much like medicine (MD), dentistry (DDS), optometry (OD), and veterinary medicine (DVM). The PharmD curriculum requires at least six academic years to complete and in some cases, where a BS degree is required for entry into a PharmD program, eight academic years. For the six-year program, coursework often commences in the third academic year that is considered the first professional year (PY 1). For all programs, the final professional year (PY 4) consists entirely of experiential education. There are 122 colleges and schools of pharmacy in the United States (see Table 1.1; <http://www.aacp.org>²). Colleges of Pharmacy are accredited by the Accreditation Council for Pharmacy Education (ACPE). Accreditation is the public recognition accorded a professional program that is judged to meet established qualifications and educational standards through initial and subsequent periodic evaluations (see: <https://www.acpe-accredit.org>³).

Pre-professional courses

Mathematics and the physical and biological sciences teach the principles, the application of which find their way into many of the upper-level professional pharmacy courses. Courses in chemistry, including general and organic chemistry, are of particular importance in preparing for the pharmacy curriculum. Courses in mathematics, including calculus, are also important. Courses in the social sciences, humanities, arts, history, and literature provide the broad general education required of a professional in today's society.

Professional Courses

Basic to most pharmacy curricula are courses in pharmacology, medicinal chemistry, pharmaceuticals, biopharmaceutics, therapeutics, and the clinical-pharmacy externships. Courses in social and administrative pharmacy, as well as pharmacy law, also are found in this sequence.

Opportunities for students to specialize in certain professional areas have become more available and

increasingly popular. Most prominent are hospital/institutional pharmacy, nuclear pharmacy, management, and various research specialties.

Licensure requirements

The practice of pharmacy is regulated by each individual state through the Board of Pharmacy within that state. The law in all states, including the District of Columbia, Puerto Rico, and US Territories, requires applicants for licensure to be of good moral character, have graduated from an ACPE accredited first professional degree program, have passed an examination given by the Board of Pharmacy, and be 21 years of age.

All states require that candidates for licensure have a record of practical experience or internship training acquired under the supervision and instruction of a licensed practitioner. Some jurisdictions grant licensure by licensure transfer. Requirements vary from state to state. Information about licensure transfer is available from the National Association of Pharmacy (<http://www.nabp.net/programs/licensure/licensure-transfer/index.php>⁴).

The vast majority of the states have established continuing education requirements for re-licensure. This requirement has been adopted as a way to reassure the public that licensed pharmacists are keeping up-to-date to maintain their professional competence. The types of programs that are recognized and the prescribed range of acceptable content matter are fairly uniform. The ACPE also has responsibility for accrediting providers of professional continuing education programming.

A list of the governmental agencies that license pharmacists in the various states is available from the National Association of Boards of Pharmacy, 700 Busse Highway, Park Ridge, IL 60068–2402 (see <http://www.nabp.org>⁵).

Careers

Job opportunities for pharmacists are expected to continue to be strong because of the increased use of medications by a growing and aging population⁶. There are other factors that may increase the demand for

Table 1.1 Pharmacy professional degree programs

The following colleges and schools offering professional degree programs in pharmacy hold membership in the AACP.

Alabama	Auburn University, Harrison School of Pharmacy, Auburn University, AL 36849 Samford University, McWhorter School of Pharmacy, Birmingham, AL 35229
Arizona	Midwestern University, College of Pharmacy-Glendale, Glendale, AZ 85308 University of Arizona, College of Pharmacy, Tucson, AZ 85721
Arkansas	Harding University, College of Pharmacy, Searcy, AR 72149 University of Arkansas for Medical Sciences, College of Pharmacy, Little Rock, AR 72205
California	California Northstate College of Pharmacy, Rancho Cordova, CA 95670 Loma Linda University, School of Pharmacy, Loma Linda, CA 92350 University of California, San Diego, Skaggs School of Pharmacy and Pharmaceutical Sciences, La Jolla, CA 92093 University of California, San Francisco, School of Pharmacy, San Francisco, CA 94143 University of the Pacific, Thomas J. Long School of Pharmacy and Health Sciences, Stockton, CA 95211 University of Southern California, School of Pharmacy, Los Angeles, CA 90089 Touro University, College of Pharmacy California, Vallejo, CA 94592 Western University of the Health Sciences, College of Pharmacy, Pomona, CA 91766
Colorado	Regla University, School of Pharmacy, Denver, CO 80221 University of Colorado, Skaggs School of Pharmacy, Denver, CO 80262
Connecticut	St. Joseph College School of Pharmacy, Hartford, CT 06103 University of Connecticut, School of Pharmacy, Storrs, CT 06269
District of Columbia	Howard University, College of Pharmacy, Washington, DC 20059
Florida	Florida Agricultural and Mechanical University, College of Pharmacy and Pharmaceutical Sciences, Tallahassee, FL 32307 Nova Southeastern University, College of Pharmacy, Fort Lauderdale, FL 33328 Palm Beach Atlantic University, Lloyd L. Gregory School of Pharmacy, West Palm Beach, FL 33416 University of Florida, College of Pharmacy, Gainesville, FL 32610 University of South Florida, College of Pharmacy, Tampa, FL 33612
Georgia	Mercer University, College of Pharmacy and Health Sciences, Atlanta, GA 30341 Philadelphia College of Osteopathic Medicine School of Pharmacy, Suwanee, GA 30024 South University, School of Pharmacy, Savannah, GA 31406 University of Georgia, College of Pharmacy, Athens, GA 30602
Hawaii	University of Hawaii at Hilo, College of Pharmacy, Hilo, HI 96720
Idaho	Idaho State University, College of Pharmacy, Pocatello, ID 83209
Illinois	Chicago State University, College of Pharmacy, Chicago, IL 60628 Midwestern University, Chicago College of Pharmacy, Downers Grove, IL 60515 Roosevelt University, College of Pharmacy, Schaumburg, IL 60173 Rosalind Franklin University of Medicine and Science, North Chicago, IL 60064 Southern Illinois University Edwardsville, School of Pharmacy, Edwardsville, IL 62026 University of Illinois at Chicago, College of Pharmacy, Chicago, IL 60612

Table 1.1 *(continued)*

Indiana	Butler University, College of Pharmacy and Health Sciences, Indianapolis, IN 46208 Purdue University School of Pharmacy and Pharmacal Sciences, West Lafayette, IN 47907
Iowa	Drake University, College of Pharmacy and Health Sciences, Des Moines, IA 50311 University of Iowa, College of Pharmacy, Iowa City, IA 52242
Kansas	University of Kansas, School of Pharmacy, Lawrence, KS 66045
Kentucky	Sullivan University, College of Pharmacy, Louisville, KY 40205 University of Kentucky, College of Pharmacy, Lexington, KY 40536
Louisiana	University of Louisiana at Monroe, School of Pharmacy, Monroe, LA 71209 Xavier University of Louisiana, College of Pharmacy, New Orleans, LA 70125
Maine	Husson University, School of Pharmacy, Bangor, ME 04401 University of New England, College of Pharmacy, Portland, ME 04103
Maryland	Notre Dame of Maryland University, School of Pharmacy, Baltimore, MD 21210 University of Maryland, School of Pharmacy, Baltimore, MD 21201 University of Maryland Eastern Shore, School of Pharmacy, Princess Anne, MD 21853
Massachusetts	Massachusetts College of Pharmacy and Health Sciences - School of Pharmacy - Boston, Boston, MA 02115 Massachusetts College of Pharmacy and Health Sciences - School of Pharmacy - Worcester, Worcester, MA 01610 Northeastern University, School of Pharmacy, Boston, MA 02115 Western New England University, College of Pharmacy, Springfield, MA 01119
Michigan	Ferris State University, College of Pharmacy, Big Rapids, MI 49307 University of Michigan, College of Pharmacy, Ann Arbor, MI 48109 Wayne State University, Eugene Applebaum College of Pharmacy and Health Sciences, Detroit, MI 48202
Minnesota	University of Minnesota, College of Pharmacy, Minneapolis, MN 55455
Mississippi	University of Mississippi, School of Pharmacy, University, MS 38655
Missouri	St Louis College of Pharmacy, St Louis, MO 63110 University of Missouri-Kansas City, School of Pharmacy, Kansas City, MO 64110
Montana	University of Montana, School of Pharmacy and Allied Health Sciences, Missoula, MT 59812
Nebraska	Creighton University, School of Pharmacy and Health Professions, Omaha, NE 68178 University of Nebraska Medical Center, College of Pharmacy, Omaha, NE 68198
Nevada	Roseman University of Health Sciences, College of Pharmacy, Henderson, NV 89014
New Jersey	Rutgers, The State University of New Jersey, Ernest Mario College of Pharmacy, Piscataway, NJ 08854
New Mexico	University of New Mexico, College of Pharmacy, Albuquerque, NM 87131

(continued overleaf)

Table 1.1 (continued)

New York	Albany College of Pharmacy and Health Sciences, Albany, NY 12208 D'Youville College, School of Pharmacy, Buffalo, NY 14201 Long Island University, Arnold and Marie Schwartz College of Pharmacy and Health Sciences, Brooklyn, NY 11201 St. John Fisher College, Wegmans School of Pharmacy, Rochester, NY 14618 St John's University, College of Pharmacy and Allied Health Professions, Jamaica, NY 11439 Touro College of Pharmacy - New York, New York, NY 10027 University of Buffalo, The State University of New York, School of Pharmacy and Pharmaceutical Sciences, Buffalo, NY 14260
North Carolina	Campbell University, School of Pharmacy, Buies Creek, NC 27506 University of North Carolina at Chapel Hill, School of Pharmacy, Chapel Hill, NC 27599 Wingate University, School of Pharmacy, Wingate, NC 28174
North Dakota	North Dakota State University, College of Pharmacy, Fargo, ND 58105
Ohio	Northeast Ohio Medical University, College of Pharmacy, Rootstown, OH 44272 Ohio Northern University, R.H. Raabe College of Pharmacy, Ada, OH 45810 The Ohio State University, College of Pharmacy, Columbus, OH 43210 University of Cincinnati, College of Pharmacy, Cincinnati, OH 45267 The University of Findlay, College of Pharmacy, Findlay, OH 45840 University of Toledo, College of Pharmacy, Toledo, OH 43606
Oklahoma	Southwestern Oklahoma State University, School of Pharmacy, Weatherford, OK 73096 University of Oklahoma, College of Pharmacy, Oklahoma City, OK 73190
Oregon	Oregon State University, College of Pharmacy, Corvallis, OR 97331 Pacific University Oregon, Hillsboro, OR 97123
Pennsylvania	Duquesne University, Mylan School of Pharmacy, Pittsburgh, PA 15282 Lake Erie College of Osteopathic Medicine, School of Pharmacy, Erie, PA 16509 Temple University, School of Pharmacy, Philadelphia, PA 19140 Thomas Jefferson University, Jefferson School of Pharmacy, Philadelphia, PA 19107 University of Pittsburgh, School of Pharmacy, Pittsburgh, PA 15261 University of the Sciences, Philadelphia College of Pharmacy, Philadelphia, PA 19104 Wilkes University, Nesbitt School of Pharmacy, Wilkes-Barre, PA 18766
Puerto Rico	University of Puerto Rico, School of Pharmacy, San Juan, PR 00936
Rhode Island	University of Rhode Island, College of Pharmacy, Kingston, RI 02881
South Carolina	Presbyterian College, School of Pharmacy, Clinton, SC. 29325 South Carolina, College of Pharmacy – MUSC Campus, Charleston, SC 29425 South Carolina, College of Pharmacy – USC Campus, Columbia, SC 29208
South Dakota	South Dakota State University, College of Pharmacy, Brookings, SD 57007
Tennessee	Belmont University, School of Pharmacy, Nashville, TN 37212 East Tennessee State University, Bill Gatton College of Pharmacy, Johnson City, TN 37614 Lipscomb University, College of Pharmacy, Nashville, TN 37204 Union University, School of Pharmacy, Jackson, TN 38305 University of Tennessee, College of Pharmacy, Memphis, TN 38163

Table 1.1 (continued)	
Texas	Texas AandM Health Sciences Center, Kinsville, TX 78363 Texas Southern University, College of Pharmacy and Health Sciences, Houston, TX 77004 Texas Tech University Health Sciences Center, School of Pharmacy, Amarillo, TX 79106 University of Houston, College of Pharmacy, Houston, TX 77204 University of the Incarnate Word, Feik School of Pharmacy, San Antonio, TX 78209 The University of Texas at Austin, College of Pharmacy, Austin, TX 78712
Utah	University of Utah, College of Pharmacy, Salt Lake City, UT 84112
Virginia	Appalachian College of Pharmacy, Oakwood, VA 24631 Hampton University, School of Pharmacy, Hampton, VA 23668 Shenandoah University, Bernard J Dunn School of Pharmacy, Winchester, VA 22601 Virginia Commonwealth University, School of Pharmacy, Richmond, VA 23298 University of Washington, School of Pharmacy, Seattle, WA 98195 Washington State University, College of Pharmacy, Pullman, WA 99164
West Virginia	University of Charleston, School of Pharmacy, Charleston, WV 25304 West Virginia University, School of Pharmacy, Morgantown, WV 26506
Wisconsin	Concordia University Wisconsin, School of Pharmacy, Mequon, WI 53097 University of Wisconsin-Madison, School of Pharmacy, Madison, WI 53705
Wyoming	University of Wyoming, School of Pharmacy, Laramie, WY 82071

pharmacists. Scientific advances, including genomics, will result in the discovery of more drugs for the prevention, diagnosis, and treatment of disease. A better understanding of how drugs work will result in personalized medicine. There will be new developments in how medications are administered. The increased availability of information about medicines by well-informed consumers, who are sophisticated about healthcare, will create a need to help them understand how to make use of this information.

Community pharmacy

Community pharmacy is a hybrid practice requiring well-developed professional skills and, in many cases, management abilities. Success in community pharmacy practice depends on business management skills because a pharmacy is a business, and on clinical and therapeutic knowledge because a pharmacist is also a healthcare provider. People skills are also important because of the direct patient contact in a community

pharmacy. In addition to dispensing pharmaceuticals, pharmacists in community pharmacies answer questions about prescription and over-the-counter (OTC) drugs and give advice about home healthcare supplies and durable medical equipment. Of an estimated 200 000 pharmacists now in practice, the majority are in community pharmacy practice. Pharmacy technicians and pharmacy interns are also important members of the community pharmacy workforce. While there are still independent community pharmacies in smaller communities and those that provide specialty services such as compounding, an increasing number of community pharmacies are chain drug stores or located in larger retail settings, including grocery stores.

Health-systems pharmacy

Health-systems pharmacy is the practice of pharmacy in private and government-owned hospitals, health maintenance organizations (HMOs), clinics, walk-in

health centers, and nursing homes. This has become a significant setting for pharmacy practice over the past 50 years. In these settings pharmacists, with the assistance of pharmacy technicians, pharmacy interns, and automated technologies, prepare and dispense medications, compound nonsterile and sterile preparations, advise other professionals and patients on the use of drugs, monitor drug regimens, and evaluate drug use. They advise other professionals on the selection and effects of drugs and, in some cases, make patient rounds with them or provide direct patient care. Hospital pharmacy practice involves working extensively with other members of the healthcare team, including physicians, nurses, and other health professionals and workers.

Nuclear pharmacy

Nuclear pharmacy applies the principles and practices of pharmacy and nuclear chemistry to produce radioactive drugs used for diagnosis and therapy. Some of these pharmacists work in hospitals and others work for private nuclear pharmacies that provide radioactive drugs to hospitals.

Industrial pharmacy

Industrial pharmacy offers opportunities to pharmacists of all educational levels. The largest number of pharmacists is involved in marketing, sales, and administration. Some pharmaceutical manufacturers employ pharmacists as their professional service representatives, to educate physicians and pharmacists about the manufacturer's products. This can be a rewarding career for persons with the right personality and motivation, and it is often a stepping-stone to supervisory positions in sales and a path toward integration into the administrative and sales structure of a pharmaceutical firm. Pharmacists with master's degrees in business or additional degrees in law find additional opportunities in the pharmaceutical industry in the marketing, sales, and legal departments. Pharmacists can also serve the industry as professional communications managers and clinical research scientists; research and development personnel often have advanced degrees, although this is not always the case. Production and quality-control (or quality-assurance) supervisory positions often are held by pharmacists.

Government service

Government service offers opportunities to pharmacists in various capacities. They may serve as noncommissioned or commissioned officers in the Army, Navy, Air Force, and Coast Guard. They also serve as commissioned officers in the United States Public Health Service, which furnishes pharmacists for the Food and Drug Administration, Bureau of Prisons, and the Indian Health Service. Appointments are available for pharmacists in the Drug Enforcement Administration of the Department of Justice, and in the National Institutes of Health, the Center for Medicare and Medicaid Services, the Health Resources and Services Administration, and various other agencies.

Pharmaceutical education

Pharmaceutical education offers opportunities to pharmacists with advanced degrees in any of the professional specialties. Expanding enrollments and changes in the curricula at colleges to meet the employment needs of the future result in an increased need for college-level instructors. Potentially higher salaries, more freedom for research and writing, independence of action, and the cultural surroundings in pharmaceutical education make teaching attractive.

Pharmaceutical journalism

This offers rewarding experiences for a limited number of pharmacists with writing and editing skills.

Organizational management

Organizational management careers are available for those with pharmacy education who wish to serve in national and state associations and on state boards of pharmacy. The increasing number of pharmacists and the interface of pharmacy with insurance carriers and health and welfare agencies mean the responsibilities of associations and boards must expand accordingly and be complicated by the greater involvement of state and federal governments in healthcare. Thus, pharmacists who have organizational interests and talents will be in great demand and will play important roles in the future of pharmacy in the United States.

Postgraduate training

More than 20% of graduating pharmacists enter pharmacy residency programs.² An increasing number of hospitals require the completion of a pharmacy residency as a requirement for employment. Pharmacists interested in advanced clinical roles almost always need to have completed a pharmacy practice residency and often a second specialty residency. Pharmacy practice residencies (post-graduate year (PGY) 1 residencies) are 12-month programs with a general focus on all aspects of practice in a defined area, such as a health-system, community pharmacy or managed care. Specialty residencies (PGY 2 residencies) are 12 months or longer, require a PGY 1 residency as a prerequisite, and focus on a particular area of practice, such as pediatrics, psychiatry, hematology-oncology, transplant, critical care, nutrition support, or infectious diseases. The American Society of Health-System Pharmacists (ASHP) accredits pharmacy residency programs. The increase in the knowledge about medicines and the advanced roles that pharmacists play in medication-use management increasingly requires formal postgraduate training beyond an entry level degree and licensure in pharmacy.

Fellowship programs in similar specialty practice areas focus on research and are usually 24 months or longer. Pharmacists interested in an academic career often have a graduate degree and/or fellowship training, in addition to an entry level degree in pharmacy.

Graduate education

Areas of graduate study include pharmaceuticals, industrial pharmacy, pharmacology, pharmaceutical/medicinal chemistry, pharmacognosy, and social and administrative pharmacy. A master's or PhD degree in the pharmaceutical sciences or a related field usually is required for research positions, and a PharmD, MS, or PhD degree is necessary for administrative or faculty positions.

Organizations

American Pharmacists Association (APhA)

The APhA is the national professional organization of pharmacists representing pharmacy practitioners,

and pharmaceutical scientists and students. Since its founding in 1852, the APhA has been a leader in the professional and scientific advancement of pharmacy. Membership in one of the three academies of the APhA – the Academy of Pharmacy Practice and Management (APPM), the Academy of Pharmaceutical Research and Science (APRS), and the Academy of Student Pharmacists (ASP) – offers members specialized benefits and the opportunity to influence their practice areas.

American Society of Health-System Pharmacists (ASHP)

The ASHP is the professional association of pharmacists who practice in organized healthcare settings. The ASHP endeavors to create an environment in which pharmacists can focus the full potential of their knowledge and expertise on patient care. The mission of the ASHP is to represent its more than 30 000 members, providing leadership that will enable pharmacists in organized healthcare settings to provide high-quality pharmaceutical services that foster the efficacy, safety, and cost-effectiveness of drug use; contribute to programs and services that emphasize the health needs of the public and the prevention of disease; and promote pharmacy as an essential component of the healthcare team. Members can participate in seven Sections and Forums, including the Pharmacy Student Forum, New Practitioner Forum, Section of Ambulatory Care Practitioners, Section of Clinical Specialists and Scientists, Section of Inpatient Practitioners, Section of Pharmacy Informatics and Technology, and Section of Pharmacy Practice Managers.

American Society of Consultant Pharmacists (ASCP)

The ASCP promotes the development and advancement of pharmaceutical care activities directed at elderly patients, particularly those in long-term care institutions. The ASCP has more than 7000 members and 4500 student members. There are 23 ASCP chapters that are defined by geographic region.

National Community Pharmacists Association (NCPA)

Membership in the NCPA, formerly known as the National Association of Retail Druggists (NARD), is

open to independent community pharmacy owners, managers, and employees, as well as pharmacy students and corporations. The NCPA is dedicated to the continuing growth and prosperity of the 23 000 independent community pharmacies in the United States.

American Association of Pharmaceutical Scientists (AAPS)

The AAPS serves an advocacy role for the pharmaceutical sciences, promotes the economic viability of the pharmaceutical sciences and its scientists, and represents scientific interests within academia, industry, government, and other research institutions. AAPS members are eligible for membership in one of several sections: Analysis and Pharmaceutical Quality; Biotechnology; Clinical Pharmacology and Translational Research; Drug Design and Discovery; Formulation Design and Development; Manufacturing Science and Engineering; Physical Pharmacy and Biopharmaceutics; Pharmacokinetics, Pharmacodynamics, and Drug Metabolism; and Regulatory Sciences. There are 12 000 members of the AAPS.

American College of Clinical Pharmacists (ACCP)

The ACCP is a professional and scientific society that provides leadership, education, advocacy, and resources, enabling clinical pharmacists to achieve excellence in practice and research.

ACCP's membership is composed of practitioners, scientists, educators, administrators, students, residents, fellows, and others committed to excellence in clinical pharmacy and patient pharmacotherapy.

American Association of Colleges of Pharmacy (AACP)

Founded in 1900, the AACP is the national organization representing pharmacy education in the United States. The mission of the Association is to both represent and be an advocate for all segments of the academic community in the profession of pharmacy. The AACP comprises all colleges and schools with pharmacy degree programs accredited by the Accreditation Council for Pharmacy Education, including approximately 57 000 professional degree students, 5700 students enrolled in graduate studies, and more than 5600 full-time faculty.

References

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