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INTRODUCTION

The word pharmacy has been derived from the Greek word *"pharmakon"* meaning drug. Pharmacy is the art and science of compounding and dispensing drugs or preparing suitable dosage forms for the administration of drugs in men or animals. It includes all the stages related to a drug, from its discovery, collection, identification, isolation, purification, synthesis, standardization, formulation, use,

quality control, packaging, storage, and marketing of medicinal substances. Thus, today's pharmacy professional is a "drug expert" in the real sense. The profession of pharmacy has transformed into a hub for the "global healthcare" and evolved as a multidisciplinary, multifaceted curriculum.

Fig. 1.1: Ancient pharmacy (middle age)

In any health system, it is essential that patients have access to reliable information and competent professional care. After physicians and nurses, pharmacists constitute the third largest group of health professionals. Pharmacists work in a wide range of settings, e.g. community, hospital, and health-system settings.

Over the past 40 years, the pharmacist's role has changed from that of compounder and dispenser to one of "drug therapy manager". This involves responsibilities to ensure that wherever medicines are provided and used, quality products are selected, procured, stored, distributed, dispensed and administered so that they contribute to the health of patients, and not to their harm. The scope of pharmacy practice now includes patient-centered care with all the cognitive functions of counseling, providing drug information and monitoring drug therapy, as well as technical aspects of pharmaceutical services, including medicines supply management.

THE HISTORY OF PHARMACEUTICAL COMPOUNDING: AN OVERVIEW

It is impossible to determine when humans first began to mix substances and create preparations that produced therapeutic effects, but it is known that the compounding of medicinal preparations from animal, vegetable and mineral sources has been practiced by a range of ancient civilizations.

Before the Dawn of History

Ancient men learned from instinct, from the observation of birds and beasts. Cold water, leaf, dirt or mud were their first soothing application. By trial, they learned more and more which served them best. Eventually, they applied their knowledge for the benefits of others.

Pharmacy in Ancient Babylonia

It provides knowledge about the earliest known practice of pharmacy known as the art of apothecary. Practitioners of healing of this era (about 2600 BC) were priests, pharmacists and physicians, all in one.

Pharmacy in Ancient China

Shengnon Bencao Jing outlined basic theory of Chinese pharmacy and investigated the medicinal value of several hundred herbs like podophyllum, ginseng, cinnamon bark, etc.

- Manuscripts on silk and bamboo describe uses of drugs of animal and plant origin.
- The text *Huangdi Neijing* listed the basic principles of pharmaceutical drug use in the third century BC.

Days of the Papyrus Ebers

Papyrus Ebers is the best known and the most important pharmaceutical records. It is a collection of 800 prescriptions mentioning 700 drugs.

Papyrus Ebers has also described contemporary materia medica, formulae, remedies and the weights and measures used in pharmaceutical compounding. Many of the vegetable-based drugs, animal products and minerals described in Papyrus Ebers are recognisable today, and indeed some remain in current use such as opium, myrrh and liquorice.

Greeks and Romans

Just as the Egyptians honored Imhotep as the god–physician, the Greeks worshipped Asklepios as their god of healing.

- Theophrastus, the greatest early Greek philosopher and natural scientist, is called "Father of botany". His observations and writings dealing with medicinal properties of herbs are usually accurate, even in the light of present knowledge.

Later on, the use of medicines was carried out by the *rhizotomoi* (experts in medicinal plants), and the *pharmakopoloi* (preparers and sellers of drugs).

Terra Sigillatan: Early Trademark Drug

Man learned the prestigious advantage of trademarks as a means of identification of source and of gaining customers confidence. One of the first therapeutic agents to bear such a mark was Terra sigillatan, a clay tablet originating on the Mediterranean islands of lemons before 500 BC.

Pharmacy in Ancient India (Vedic Evolution)

- Ayurvedic medicine was first described around 800 BC. Documents list the use of drugs together with charms for expelling demons and make reference to the god of medicine, Dhanvantari.
- The **Charaka Samhita** includes reference to drugs of animal, plant and mineral origin used until the first century AD.

Hippocrates

- Considered to be the father of medicine.
- He is associated with a number of documents collectively known as the *Hippocratic Corpus* dating to 420–370 BC, which lists 200–400 drugs of vegetable origin and describes the method of preparation of gargles, ointment and pessaries.
- His works placed emphasis on treating the patient with minimal reference to magical and religious powers.

Dioscorides: A Scientist Look at Drugs

- Prepared the document *De Materia Medica* around AD 60–78. This document provides details about medicinal herbs including side effects associated with their administration.
- His text was considered as reference source for medicine formulation, as late as the sixteenth century.

Fig. 1.2: The typical pharmacy in 17th century

Galen: Experimenter in Drug Compounding

- A physician around AD 160. He compiled medical knowledge specified by Hippocrates and Dioscorides.
- He described the use of formulations made up of numerous plants which were referred to as 'galenicals'.
- He was the originator of the formula for a cold cream.

The Arabs

- In the Arab world, a large number of texts including documents related to medicine and works by Galen were translated into Arabic and that is how these documents have been transferred along history. Documents that were prepared included formularies, herbals and books on materia medica and toxicology.
- The use of medications consisting of formulations from galenic medicine was continued.
- This required skilled preparation which laid the beginning of apothecaries in the ninth century in Baghdad. The practice of the apothecaries was inspected by the state.
- Avicenna, a Persian philosopher, compiled the book *Canon of Medicine,* in which he merged the Greek and Arab works. The book describes the use of around 760 drugs.

Evolution of Modern Pharmacy

Separation of Pharmacy and Medicine

In European countries, community pharmacy began to appear in the 17th century. In Sicily and southern Italy, pharmacy was separated from medicine.

The First Official Pharmacopoeia

The **Nuova receptario** originally written in Italian was published and became the legal standard in 1498. The idea of pharmacopoeia with official status to be followed by all apothecary shops in Florence.

The Society of Apothecary in London

In 1617, Francis Bacon formed the society of the art and mystery of apothecary in London. This was first organization of the pharmacist in the world.

Craige: America's First Apothecary General

Craige is the first man to hold the rank of commissioned pharmaceutical officer in American army. His duties included procurement, storage, manufacture and distribution of the army's drug requirement. He also developed early whole selling and manufacturing drug business.

The Father of American Pharmacy

William Proctor, graduate from the Philadelphia College of Pharmacy in 1837 was a leader in founding the American Pharmaceutical Association, served that organization as first secretary and later as president.

Pharmacy Enters in Modern Era

Today modern pharmacist deals with complex pharmaceutical remedies far different from the elixirs, spirits, and powders described in the **Pharmacopoeia of London** (1618) and the **Pharmacopoeia of Paris** (1639). In the US today, major medicines, those regarded as having the greatest therapeutic value, are selected for inclusion in the Pharmacopoeia of the United States, first published in 1820. Similarly, the **National Formulary** was published by the American Pharmaceutical Association (founded 1852) since 1888. Any significant variation from pharmacopoeia and formulary standards may be prosecuted by the Food and Drug Administration under the Pure Food and Drug Acts.

Modern pharmaceutical practice includes the dispensing, identification, selection, and analysis of drugs. Pharmacy began to develop as a profession separate from medicine in the

Fig. 1.3: The typical pharmacy of the 1950 – 1960

18th century, and in 1821 the first US school of pharmacy was established in Philadelphia.

The Industrial Revolution

The rapid change from hand methods to machine methods of production that characterized the industrial revolution in pharmacy, especially under the impact of the scientific developments of the nineteenth century. Phytochemistry and synthetic chemistry created new derivatives of old drugs and new chemical entities of medicinal value that strained the capacity of the individual pharmacy. Large scale drug manufacturing had its strong hold on society with the advent of machines and patents.

The Declining Art of the Apothecary

Industrialization had an impact on every aspect of the activity of the pharmacist.

First, it led to the creation of new drugs, drugs that the individual pharmacist's own resources could not produce.

Second, many drugs that the individual pharmacist was able to produce could be manufactured more economically, and in superior quality, by industry.

Third, industry assumed responsibility, traditionally vested in the pharmacist for the quality of the medication.

The Community Pharmacy

The nineteenth century did not see the end of the art of compounding, but the art did give way, to new technology. It has been estimated that a "broad knowledge of compounding" was still essential for 80% of the prescriptions dispensed in the 1920s. Although pharmacists increasingly relied on chemicals purchased from the manufacturer to make up the prescriptions. Further more, they were often called upon to provide first aid and medicines for such common ailments as burns, colic, flesh wounds, poisoning, constipation, and diarrhoea.

The Twentieth Century Pharmacist

The most notable change in pharmacy in modern times has been the virtual disappearance of the preparation and compounding of medicines. Whereas in the 1920s, 80% of the prescriptions filled in American pharmacies required knowledge of compounding, by the 1940s the number

of prescriptions requiring compounding had declined to 26%. As far back as 1971, only 1%, or less, of all prescriptions combined two or more active ingredients.

All this meant that the pharmacist's education and activities had to undergo change. At the same time, the scientific education of pharmacists was steadily becoming more demanding, their role in the provision of health care was becoming more and more limited. The reaction to these conditions was apparent in the drop in the production of pharmacy graduates who were planning to go into the field of community pharmacy. In 1947, about 90% of graduates planned to go into some aspect of community pharmacy; in 1973, that figure had dropped to 76.6%; in 1988, it stood at 57.1%.

A FLASHBACK: GERMINATION OF PHARMACY EDUCATION IN INDIA

The Indian traditional systems of medicine have been Ayurveda, Siddha and Unani. Ayurveda and Siddha originated in India itself. Unani, the Greco-Arabic medical system, came from west Asia. The European colonizers brought the western system of medicine to the country. During the colonial period, the new system, commonly referred to as Allopathy, got firmly established.

The pharmacy education in India was going to pass through a mutation when the founder of Banaras Hindu University, Mahamana Pt. Madan Mohan Malviya met Prof. ML Schroff and Mahamana offered him to join BHU. By the non-tiring efforts of Prof. Schroff in July 1937 "pharmaceutical chemistry" and "pharmacognosy" were introduced as the subjects for B.Sc. degree. Since then there has been no looking back. Pharmacy came to be recognized as a well-established course with fruitful outcomes. The pharmacy education in India has a long history characterized by slow growth between 1842 and 1932.

Important events

- 1842 - First recognized pharmacy course in India (Certificate course)
- 1860 - Madras Medical College (Certificate course in pharmacy)
- 1860–1920 - Certificate courses in pharmacy at Medical Colleges of Vishakhapatnam, Kolkata, Cuttack, Dhaka, Allahabad, Banaras, Lucknow, Meerut, Mumbai and Nagpur.
- 1930 - The drugs enquiry committee under the Chairmanship of Lt. Col. Dr. Ramnath Chopra — a great leap for the profession of Pharmacy in India.

Prof. ML Schroff on the call of Pandit Madan Mohan Malviya Ji the Vice-Chancellor of Banaras Hindu University started a regular B.Pharm course of 3 years in July, 1937. Since then Pharmacy education is making rapid strides in India. Later several other Universities started B.Pharm programme. Some of the important milestones are:

- 1945 - University of Bombay
- 1947 - Department of Pharmacy, Punjab University.
- 1947 - LMCP, Ahmedabad.
- 1950 - BITS, Pilani.
- 1951 - Andhra University, Vishakhapatnam.
- 1956 - Saugar University, Saugar.
- 1956 - Department of Pharmaceutical Sciences, Nagpur University, Nagpur.

CURRENT SCENARIO

Pharmaceutical education plays a very prominent role in attaining sustainable and equitable development of a country. The curriculum of the degree in some developed countries (B. Pharm.) usually requires 5 academic years of study. In most of the European countries, successful completion of a university degree leads to a one-year internship. In India, pharmacy education is a two-tier system. After

12th with science subjects of state board, one can opt for any of the two courses, namely Diploma (D.Pharm.) and Degree (B.Pharm). However, the Diploma students can also be included in Degree course directly in second year B.Pharm. However, in the coming years, the Government and Pharmacy Council of India is planning to abolish the D.Pharm course and make B.Pharm the minimum qualification for any individual to become a pharmacy professional.

The regulatory bodies for pharmacy colleges are namely, All India Council of Technical Education (AICTE), Pharmacy Council of India (PCI) and the respective university to which the college is affiliated to. Today pharmacy education like the pharmaceutical industry is also in the process of globalization. In order to have uniformity in course contents, requisite standards of education, technical faculty, facilities and infrastructure at international levels, colleges are going for accreditation and certifications from internationally approved regulating agencies. As per PCI 2005 diary calendar, the total numbers of recognized degree institutions are 220 with intake of 12,506 students and as per AICTE, the total numbers of degree colleges are 445 with the intake of 24,672 students as well 30 institutions for the postgraduation in various fields.

The PCI controls and regulates the standards for a better pharmacy education in India. The main aims of PCI are:

- To prescribe minimum standard of education required for qualifying as a pharmacist, i.e. framing of education regulations prescribing the conditions to be fulfilled by the institutions seeking approval of the PCI for imparting education in pharmacy.
- To ensure uniform implementation of the educational standards throughout the country.
- To approve the courses of study and examination for pharmacists, i.e. approval of the academic training institutions providing pharmacy courses.

The curriculum of pharmacy education has been designed to produce the following professional categories of pharmacists:

- Community and hospital pharmacists who will work as an important link between doctor and patient and will counsel the patient on various facets of drugs like usage, side effects, indication, contraindications, compatibilities, incompatibilities, storage, dosage, etc.
- Specialist in research and development, i.e. research of new drug molecules, biotechnical research, etc.
- Occupational specialist (industrial pharmacist engaged in pharmaceutical technology), i.e. manufacture of various dosage forms, analysis and quality control, clinical trials, post-marketing surveillance, patent application and drug registration, sales and marketing.
- Academicians, i.e. teachers of pharmacy education.
- Manager and administrators of pharmaceutical services working for various regulatory authorities and pharmaceutical systems.
- Chemists and druggists engaged in selling of medicines.

The Pharmacy Council of India has now decided to start Pharm.D course from this academic year and has approved 22 colleges in the country to run Pharm.D and Pharm.D Baclaureate course (3 years after B.Pharm). The Pharm.D course will be the harbinger for the beginning of a new era in the pharmacy practice in India. Since this programme is similar to the programmes being offered in USA and UK, Indian students perusing this programme will have ample opportunities to work as pharmacists in these countries with a handsome salary. Secondly, this course gives a new dimension to pharmaceutical healthcare by giving more emphasis to patient-centered approach.

FUTURE: AN OVERVIEW

In the future, drug treatment will be increas ingly and confidently tailored to the individual's need through the help of specific diagnostics. Many new drugs will be given parenterally and targeted for specific diseases. The pharmacists will need to adapt to this changing pattern in order to be seen by the patient as part of health care team. However, in spite of many lacunae in pharmacy education system, the fact cannot be overlooked that tremendous development in the field of new drug discovery and research activities, has taken place. The government expenditure alone was of the order of 150 million in 2005–06 and in subsequent years the figure has raised even higher.

The most important objectives are:

- To provide the right kind of pharmaceutical leadership by helping the individuals develop their potential.
- To provide the country with competent men and women trained in pharmacy profession.
- To bring the pharmacy colleges closer to the community through extension of pharmaceutical knowledge and its applications for problem-solving.
- Address the pharmaceutical problems for national development, particularly issues concerning self-reliance, economic growth, employment and national integration.
- Relate to the life needs and aspirations of the people.
- To improve pharmaceutical productivity by emphasizing improvement in pharmaceutical education and research.
- Inculcate social, moral and rational values in the people.

CAREER OPPORTUNITIES OF PHARMACY PROFESSIONALS

A career in pharmacy, unfolds a vista full of opportunities leading to a golden future for a young career aspirant.

Pharmaceutical industries usually employ pharmacy graduates and postgraduates for most of the operations. The various activities include manufacturing, quality control (including quality assurance), and distribution (marketing). The available career opportunities for pharmacy graduates in pharmaceutical industries and government/ private sector include the following:

Production and Manufacturing

As manufacturing chemist, under whose active direction and personal supervision manufacturing of medicines takes place. The pharmaceutical production companies need such persons to obtain license for manufacturing. Graduates of pharmacy with 18 months of experience in manufacturing are treated as competent technical staff under Drugs and Cosmetics Act, which regulates the drug industries.

A pharmacy professional can work as a production person (chemist, officer, executive, manager, vice-president), involved in the production of bulk drug and intermediates or formulations and dosage forms.

Industries in the cosmetics, soaps, toiletries segment also hire pharmacy professionals. Other segments where opportunities exist are the field of dental products, biotechnological products, surgical dressings, medical devices and equipment, ayurvedic/homoeopathic/ Unani medicines also involve the presence of pharmacy professionals in its production.

Research and Development

This forms the heart of any industry, as it is the key to growth and sustenance. Mainly M. Pharms and PhDs are in great demand in the various areas of Pharmaceutical R&D. Other areas where professionals are required are:

- **New drug discovery research (NDDR):** Discovering a new drug has assumed prime importance in the post-GATT era.
- **Process and development (P&D):** One of the important areas in bulk drugs indus-

try is developing viable processes for the manufacture of drugs and intermediates for their commercial production.

- **Formulation and development (F&D):** The success of any pharma company lies in the quality of its products, i.e. its formulations and dosage forms.
- **Clinical trials, bioequivalence studies, toxicological studies:** These are some of the areas of clinical research which are in high demand as they are involved in the systematic evaluation of potential drug substances prior to getting them approved by the authorities.

Analysis and Testing

The medicines that have been sampled either from manufacturing units or from retail drug stores are tested in government drug testing laboratories. The graduate pharmacists can join these government laboratories as government analyst. But the graduate pharmacists do need to undergo training on testing of drugs under a government analyst or in approved laboratories.

Quality Control/Quality Assurance

Quality assurance is a total process for assuring the quality of pharmaceutical products as per standard specified in national or other approved pharmacopoeias. Quality control is a component of quality assurance programme which deals with checking of representative samples of production to find out their compliance with standards. The graduates with aptitude in analysis of pharmaceuticals and handling of sophisticated instruments find the job interesting. There are promotional scopes too from quality control chemists to quality assurance manager.

Marketing

Pharmaceutical marketing is different from marketing of other consumer goods. Here, real consumer, the patient, has little or no choice. The marketing takes place through doctors and chemists. Thus the job is more challenging and requires special skill and training as they deal with highly qualified doctors in one hand and the professional businessman (often called drug trader in common terminology). This is a never saturating professional area and jobs are always available. The sales personell are called as medical representatives or business executives. They can grow from medical representatives to general manager.

Hospital Pharmacy

The pharmacists in hospitals do wide range of functions ranging from procurement of medicines to dispensing to the patients. In short, they are responsible for medicine management in the hospitals. Though legally diploma in pharmacy qualification is sufficient for medicine dispensing, the degree pharmacists are preferred in procurement system in government sector and service sector in corporate hospitals. The promotional scope in this sector is limited.

Clinical Pharmacy

B.Pharm/M.Pharm degree holders can take up career in clinical research. The human testing phase is called the clinical trial. A pharmacist can work as clinical research associate or clinical pharmacist and can rise to the position of project manager. The clinical research associate plays an important role of monitoring and overseeing the conducts of clinical trials, which are conducted on healthy human volunteers. They have to see that the trials meet the international guidelines and the national regulatory requirements.

Community Pharmacy

Community pharmacies usually consist of a retail store-front with a dispensary where medications are stored and dispensed. The dispensary is subject to pharmacy legislation; with requirements for storage conditions, compulsory texts, equipment, etc. specified in legislation. Self-owned pharmacy in a good

location not only gives good revenues but also provides ample opportunities to provide professional pharmaceutical services to the consumers. A license from the state drugs control authority is necessary to start a retail pharmacy business.

Through the services of community pharmacy, a pharmacist becomes a vital link between the patients and the products, i.e. drugs. The pharmacist also serves a vital link between the patients and other health care professionals, especially the medical experts. In community pharmacy a pharmacist has to play fallowing roles:

- Counseling the patients regarding the use of the drugs and dosage forms.
- Providing up-to-date infomation on drugs/ dosage forms to the patients, as well as medical staff.
- Maintaining patient records and history.
- Involved in the usage of self-diagnostic kits by the patients for disorders like diabetes, hypertension, etc.
- Providing supply of home care dosage forms. Like dosage form including home parenteral therapy and dosage form for veterinany therapy.

Medical Transcription

The B.Pharm graduate can work with medical practitioners to maintain the patient treatment history, the drug to which he/she is allergic, etc.

Academics

Excellent opportunities for the professionals are available in teaching profession also. As per the AICTE norms the minimum entry-level qualification as lecturer is M.Pharm. This is a profession associated with job satisfaction and social status, as teaching is considered to be a noble profession. The higher posts in academics are senior lecturer, reader, asst. professor, professor, principal, etc. The emoluments are satisfactory. Besides teaching, academic-related opportunities involve positions in research posts and training programs.

Regulatory Affairs

The medicines are not only required to be effective but must be safe and of assured quality. In order to assure efficacy, safety and quality, the entire pharmaceutical scenario, from manufacturing to sale of medicines, is regulated by the central and state government through a process of licensing and inspecting. The pharmaceutical graduates can join the government services usually through public service commission as drugs inspectors. They have promotional scopes to grow up to the rank of drugs controller.

With globalization process reaching out to India, the geographical barriers have become obsolete. Any country will have to compete and trade globally in order to progress and survive in the years to come. Companies have realized this fact and have stepped into the global area of competitive trade. If an Indian manufacturer wants to sell his drug or formulation to a foreign country, in order to enter into trade with the foreign countries it is mandatory to get the necessary approvals and sanctions as per the formats given by local regulatory authorities. For example, approvals to be obtained from USFDA (United States Food and Drug Administration) for USA, TGA (Therapeutic Goods Administration) for Australia and New Zealand, MCA and MHRA (Medicines and healthcare products regulatory agency) for UK and European countries and ICH guidelines going to be uniform for international levels.

Since, the business involved, worthing multibillion dollars; this branch has assumed tremendous significance and is bound to grow enormously, in the post-GATT (General agreement on tariffs and trade) era. Many big players in the drugs and pharma field have already established separate Regulatory Affairs Departments in their companies. Regulatory experts are thus in great demand.

Since, the field is highly technical, pharmacy professionals again fit in these positions.

Similarly, patents and trademarks, IPR, experts are also in high demand as far as the pharma industry is concerned.

Documentation, Library Information Services and Pharma Journalism

The regulatory affairs as well as, patenting processes and issues involve a lot of documentation work to be done and submitted to the concerned regulatory authorities, in a highly specialized and technical manner. Pharmacy professionals are again fitting in the bill. Most of the major Indian pharma companies have established separate documentation departments with a highly technical and skilled staff for this purpose. Similarly, the R&D and QC departments of the pharma companies need a wealth of technical information, which needs to be updated regularly, in order to match the pace of global competition. Therefore, library information services are another field in much demand as far as the pharma industry is concerned. Furthermore, with the advent and boom of the information technology, bio-informatics and electronic data retrieval systems, this field is already scaling new heights.

Pharma journalism is another area filled with great potentialities. This requires specialist technical personnel like pharmacy graduates on the editorial staff to cover the various aspects. There is already a very lucrative business in this field.

Consultancy

This is an ideal opportunity for highly technical and experienced pharmacy professionals to earn handsomely as self-employed entrepreneurs, even after the age of retirement. Consultancy services in pharmacy are offered in various fields against very attractive financial fees:

- Regulatory affairs
- Documentation
- Approvals
- Manufacturing processes
- Analytical series
- Research
- Market surveys and sales promotion
- Information retrieval
- Data management
- Turn key projects, etc.

Internet Pharmacy

Since about the year 2000, a growing number of internet pharmacies have been established worldwide. Many of these pharmacies are similar to community pharmacies, and in fact, many of them are actually operated as community pharmacies that serve consumers online and those that walk in their door. The primary difference is the method by which the medications are requested and received. Some customers consider this to be more convenient and private method rather than traveling to a community drugstore. Internet pharmacies (also known as online pharmacies) are also recommended to some patients by their physicians, if they are homebound.

While most internet pharmacies sell prescription drugs and require a valid prescription, some internet pharmacies sell prescription drugs without requiring a prescription. Many customers order drugs from such pharmacies to avoid the "inconvenience" of visiting a doctor or to obtain medications which their doctors were unwilling to prescribe.

Canada is home to dozens of licensed internet pharmacies, many of which sell their lower-cost prescription drugs to US consumers, who pay one of the world's highest drug prices. In recent years, many consumers in the US and in other countries with high drug costs have turned to licensed internet pharmacies in India, Israel and the UK, which often have even lower prices than in Canada.

Veterinary Pharmacy

Veterinary pharmacies, sometimes called *animal pharmacies* may fall in the category of

hospital pharmacy, retail pharmacy or mail-order pharmacy. Veterinary pharmacies stock different varieties and different strengths of medications to fulfill the pharmaceutical needs of animals. Because, the needs of animals as well as the regulations on veterinary medicine are often very different from those related to people; veterinary pharmacy is often kept separate from regular pharmacies.

Nuclear Pharmacy

Nuclear pharmacy focuses on preparing radioactive materials for diagnostic tests and for treating certain diseases. Nuclear pharmacists undergo additional training specific to handling radioactive materials, and unlike in community and hospital pharmacies, nuclear pharmacists typically do not interact directly with patients.

Military Pharmacy

Military pharmacy is an entirely different working environment due to the fact that technicians perform most duties that in a civilian sector would be illegal. State laws of technician patient counseling and medication checking by a pharmacist do not apply.

Pharmacy Informatics

Pharmacy informatics is the combination of pharmacy practice science and applied information science. Pharmacy informaticists work in many practice areas of pharmacy; however, they may also work in information technology departments or for health care information technology. As a practice area and specialist domain, pharmacy informatics is growing quickly to meet the needs of major national and international patient information projects and health system interoperability goals. Pharmacists are well trained to participate in medication management system development, deployment and optimization.

Pediatric Pharmacy Practice

The pediatric patients present a unique challenge with regard to drug therapy administration and monitoring. Unlike adults, dosing is most commonly based on body weight, and pharmacokinetic variables are standardized relative to weight and/or body surface area. Most commercially available drugs are not formulated for use in infants and children. In addition, the pediatric patient population poses a higher risk for medication errors. Pediatric patients are three times more likely to suffer from a medication error; and a relatively small magnitude of error, as compared to adults, may result in more serious consequences, especially in the youngest, most vulnerable patients. Pediatric patients frequently experience adverse drug reactions similar to adults, but adverse reactions in the pediatric population may be harder to recognize or be of greater or lesser intensity. Pediatric pharmacists have specialized knowledge of the age-related differences that impact on medication regimens, are able to recognize the need of the individual patient, and then make the necessary adjustments to ensure safe and effective medication use in infants, children and adolescents.

Geriatric Pharmacy Practice

Elderly patients are unique in the way that they possess an altered metabolic capacity for medications due to increased body fat, decreased muscle mass, decreased cardiac output and perfusion, decreased protein binding, reduced liver function, and reduced physiologic reserve—all of which lead to unique medication selection and dosing requirements compared to younger adults. They also often require additional assistance to understand how to take their medications to avoid possible adverse drug effects. There is a shortage of healthcare professionals trained in geriatric pharmacotherapy. As the number of elderly patients continues to increase, the contribution of the pharmacist to quality, long-term medication management will require dramatic expansion.

Nutrition Support Pharmacy

Addresses the care of patients who receive specialized nutrition support, including parenteral and enteral nutrition. Nutrition support pharmacists have responsibility for promoting maintenance and/or restoration of optimal nutritional status and designing and modifying treatment according to the needs of the individual patient. Nutrition support pharmacists have responsibility for direct patient care and often function as members of an interprofessional nutrition support team.

Oncology Pharmacy

Care to patients with cancer is called oncology. Specialists recommend for proper design, monitor and modify pharmacotherapeutic plans to optimize outcomes in patients with malignant diseases. This includes the supportive care needed to minimize side effects from the oncology treatments and the disease. Chemotherapy require specialized handling and preparation, and the patients require frequent monitoring to achieve the desired outcome. Oncology pharmacists play a key role in assuring the safety and optimum care of these patients. Oncology pharmacists may practice in hospitals or ambulatory oncology clinics, or a combination of both.

Psychiatric Pharmacy

Addresses the care of patients with psychiatric-related illnesses. As a member of an interprofessional treatment team, the psychiatric pharmacy specialist is often responsible for optimizing drug treatment and patient care by conducting such activities as monitoring patient response, patient assessment, recognizing drug-induced problems, and recommending appropriate treatment plans.

Managed Care Organizations

A pharmacist in a managed care practice provides a markedly different type of professional activity, and as a result, additional competencies are required. For a pharmacist working in this environment, patients are monitored as a population database and pharmacist care is directed through database review and querying. Economic and clinical outcomes are weighed against, and with each other, to make appropriate decisions for a "population" of patients.

Patient Care Call Centers

Call center pharmacists provide patient and prescriber education, patient counseling, drug information, and customer service, as well as drug utilization review, health management and formulary management. Pharmacists in call centers interact with patients telephonically to promote effective drug therapy. Call center pharmacists are primarily employed in health maintenance organizations (HMOs), and health plans. Some call center pharmacists focus on specific disease states.

Hospice

Hospices range from small rural organizations to very large hospices. Pharmacists practicing in this setting help to ensure that medications are appropriately selected and that management of symptoms is balanced with cost-effectiveness.

Drug and Poison

Drug and poison information services have had a long-standing role in the emergence of clinical roles for pharmacists that were built on "drug expert" contributions. Pharmacy drug information services have expanded in recent years to include hospital drug information service to community practice-based pharmacies. Easier access to information via the Internet, CD or DVD-based drug information databases, and electronic journals has contributed to this development.

Opportunities Abroad

Golden opportunities for qualified Pharmacy professionals in various courtiers including the USA, Canada; European countries like UK, France, Germany; African countries like S. Africa, Nigeria, Yemen; Gulf countries

like Saudi Arabia, Kuwait; South East Asian countries like Singapore, Korea, Japan, etc.; and the Australian continent including New Zealand. There are plenty of higher education and research opportunities in the developed countries along with excellent job openings. The pharmaceutical career is one of the highest rewarding careers in these countries.

Further Studies Abroad

One may even consider venturing into pursuing higher studies abroad in order to make his career even more lucrative and challenging.

USA: One may consider opting for pursuing higher studies abroad. After graduation from a recognised university, the students can appear for their GRE (graduate record examination) and TOEFL (test of English as a foreign language) for entry into foreign universities. In USA, they can give "pharmacy equivalent examinations." For example, FPGEE (foreign pharmacist licensure examination) followed by internship and then finally NAPLEX (North American pharmacist licensure examination) both these examinations can be cleared in about one year and there one can practice retail pharmacies, which are expanding very fast in USA. In USA, M.Pharm and Ph.D. is essential to enter industry or academic institution.

Australia: Indian students know most of the universities in USA but very few know about the postgraduate studies in Australia. University of the South Australia (SA) is the largest university in the South Australia. There are about 300 programs and about 10,000 international students are studying in university SA. It offers degree in medical radiation, occupational therapy, pharmacy, physiotherapy, environmental toxicology, etc. It is top ranking university for innovative research linked to industry.

Forecasting the Demand of Pharmacy Professionals

From ancient times, pharmacy was known as a branch associated with health care services. Times have changed now and so has the profession of pharmacy. Today, the discipline of pharmacy has made enormous progress and has matured as a distinctly independent branch of science. Of late there has been a great upgrading in the status of the pharmacy profession and now qualified pharmacists have unlimited opportunities to look forward. Going by the current trend, it has been estimated that there will be an ever-increasing demand for pharmacists in the coming years in both developed and developing countries. One might wonder why the number of people needed to work in the field of pharmacy is increasing. To answer this question, a number of factors must be taken into account:

- India has a vast and growing pharmaceutical industry. Increasing number of hospitals, nursing homes and pharmaceutical companies all over the country is a clear indication of the growing scope in this area.
- The rise in chronic health problems worldwide has resulted in a need for more pharmacists to work as health care professionals.
- The expanding pharmaceutical industry, fuelled by more lenient regulatory and patent laws, has led to a demand for more trained industrial pharmacists.
- The advent of new drug technologies has led to an increased demand for pharmacy researchers. The current boom in the biotechnology industry is creating new positions for research pharmacists as well.
- Outsourcing of clinical research by pharmaceutical companies to contract research organizations has led to increased demand for trained professional.
- There is a feeling among the pharmacy community, that the field of personalized medicines based on pharmacogenomics will affect the way drugs are prescribed in the future. This will result in greater

involvement of pharmacists in community settings and clinical care areas.

Apart from this, there are ample opportunities for carrying out further education including PhD programs, research fellowships, and postdoctorate openings.

No matter what venue is selected, pharmacy offers excellent working conditions, job satisfaction, and financial rewards in a job that can positively impact people's lives. Pharmacy offers reasonably good career opportunities both by way of jobs and in terms of starting one's own business.