School of Studies in Pharmaceutical Sciences, Jiwaji University

B. Pharmacy

Pharmaceutics

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Course Objectives:

This course is designed to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Student Learning Outcomes:

1) Describe history of profession of pharmacy
2) Explain basic dosage forms and solve pharmaceutical calculations
3) Interpret professional way of handling prescriptions
4) Design various conventional dosage forms

Module-I (10 hrs)

- **Historical Background and Development of Profession of Pharmacy**
- **Dosage Forms**
- **Prescription**
- **Posology**

History of Pharmacy Profession

Pharmacy:

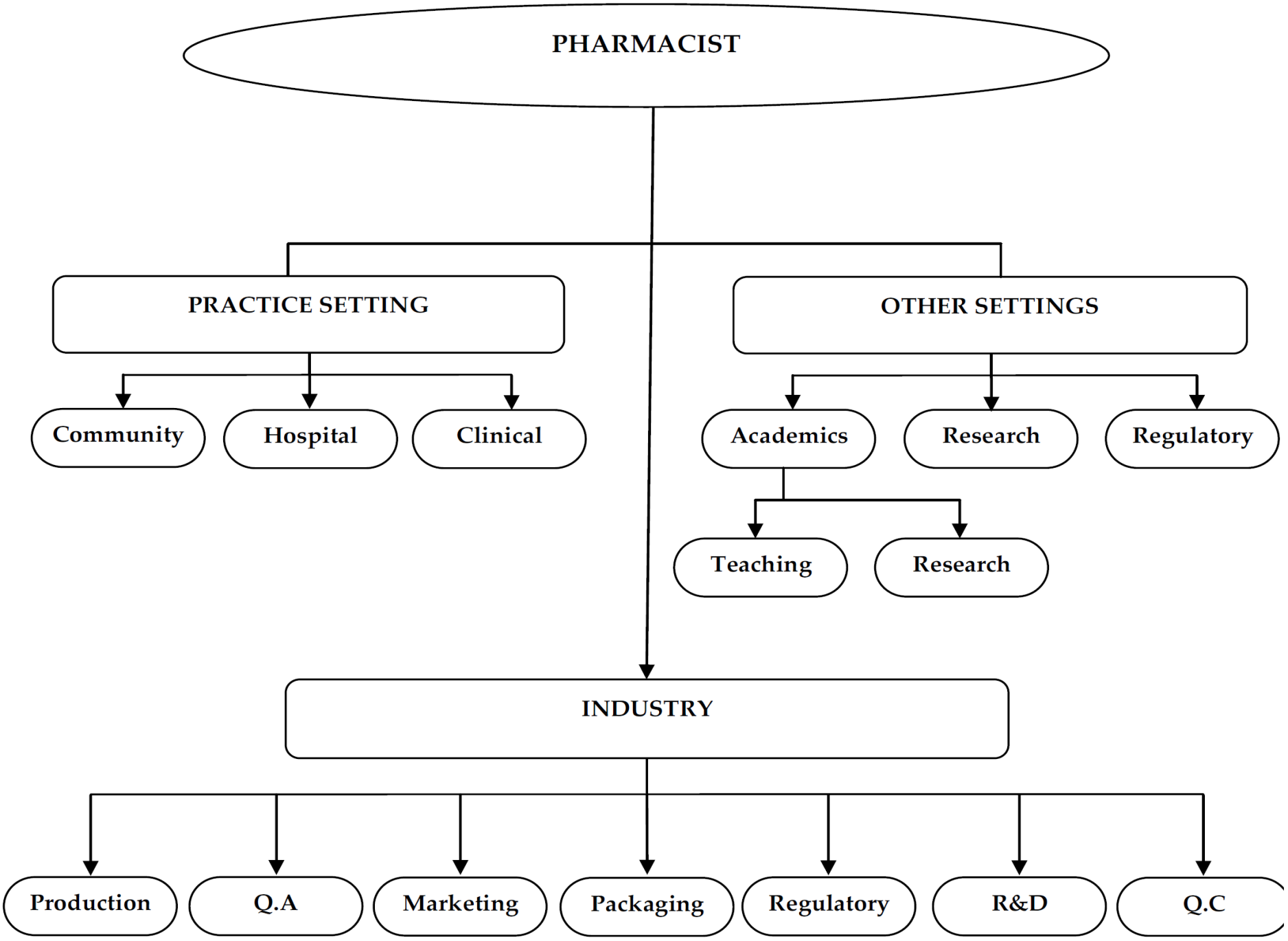
- Pharmacy is a Greek word derived from Pharma, used since the 15th-17th centuries.
- However, it originates from Greek word Pharmakon meaning “Drug”
- Pharmacy is the science and technique of preparing and dispensing drugs.
- It is a health profession that links health sciences with chemical sciences and aims to ensure the safe and effective use of pharmaceutical drugs.

Pharmacists (Chemists or druggists):

- Pharmacists are healthcare professionals who practice in pharmacy, the field of health sciences focusing on safe and effective medication use.
- They are licensed to prepare and dispense medications, involved in patient care, counsel patients, and monitor outcomes pursuant to a prescription from a licensed health professional.

Career Goal

- “To achieve positive outcomes from the use of medication that improves patients quality of life”, According to the American Pharmaceutical Association (APA)…


PHARMACIST
PRACTICE SETTING
OTHER SETTINGS
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Hospital
Clinical
Academics
Research
Regulatory
Teaching
Research
INDUSTRY
Production
Q.A
Marketing
Packaging
Regulatory
R&D
Q.C

History of Pharmaceutical Practice through Ages

Prehistoric Pharmacy

- Pharmacy has been a part of everyday life since ancient times. Excavations, such as Shanidar (30000 B.C.E) supports this fact.
- The ancient tribal healers, also called as Shamans often guarded this knowledge of healing properties of certain natural substances. But, the recognition of the medicinal plants, was so widespread that it obstructed any necessity for a special class of drug gatherers.
- Earlier people used to describe diseases in supernatural terms. They believed the beneficial medicines worked in supernatural ways..

- The magical medicines for curing were part of the duty of Shamans. Usually they were in charge of all supernatural things in a tribe, and hence, they diagnosed and treated most serious and chronic diseases.
- These remedial medicines, connected with supernatural world for thousands of years continues to fascinate us all even today. Thus we can consider that drugs have a dual heritage, a simple curing tool and special substance with supernatural powers.
- Though ancient people have discovered a small number of drugs that heal human diseases, still this discovery can be considered as one of the humanity's greatest advances.

Antiquity:

- The advancement of societies also started influencing the fundamentals of disease and healing.
- The changes can be verified from the remains of the civilizations of Mesopotamia and Egypt.
- From ancient records of Egyptian civilization, it can be concluded that pharmaceutical sciences rose greater heights in these times, with more dosage forms compounded from more detailed formula.
- The Egyptian medical texts shows a close connection between supernatural and natural healing. Recipes usually began with a prayer or mantra and ended with plant drugs.

Middle Age

- Traditionally, Middle Ages refers to the period from the first fall of Rome (400 AD) to the fall of Constantinople (1453).
- Rational drug treatment was replaced by Church's teaching that sin and disease were related intimately.
- Monasteries became centres for healing, both spiritual and physical. At this age monks planted gardens to grow medicinal herbs, and inclined to credit their cures to the God, rather to their medical resources.

- In Western Europe, teachings of Mohammed was followed. Greek writings in medicines were translated into Arabic. As Arabs conquered this region, they brought new medicines with them. They rejected the idea that foul tasting medicines worked best.
- Arabic culture returned the classical knowledge of medicine to Europe. The debate on medicine among European academics were based on speculation but not on observation

- It was in 19th century the civilized world around **Baghdad** that the profession of pharmacy started acquiring shape. It slowly spread to Europe as **Alchemy** and finally developed into chemistry.
- The first known **chemical process** was carried out by the artisans of **Mesopotamia, Egypt** and **China**. However in the 19th century it completely **sprouted** out from medicine and started developing as a separate profession.
- This happened only when the role of pharmacist as a **compounder** of medicines was identified and differentiated from physician whose role was accepted as the **therapist**.

- The practice in those times was restricted to **compounding, dispensing** medication and manufacturing medicaments in **bulk lots**, not for general sale. The medicaments commonly produced included **simple elixirs, spirits, and powders** in contrast to the complex pharmaceutical remedies of the modern era.
- The 19th century witnessed various mile stones being set in the field of pharmacy.
- In 1821 first **School of Pharmacy** was established at **Philadelphia** in United States of America .
- The first USP was published in **1820.** American Pharmaceutical Association was founded in 1852. The national formulary (U.S) was published in1888.

- The inception of pharmacy profession in India was marked by the first class of the chemist and druggist conducted at **Madras medical college** in 1870s to train students to gain skills in **pharmacy practice**.

- Pharmacy **education pattern** was based on the instructions provided by the pharmaceutical society of great **Britain**.

- A **formal training of the compounders** was started in 1881 in Bengal.

- The pharmacy profession entered India almost simultaneously with U.S but the growth in India remained very slow. For almost half a century not much progress was noticed until B. Pharm course was started in 1932 at **Banaras Hindu University**, Varanasi and in 1994 at Punjab University, Lahore.
- The B. Pharm course at BHU was **industry** oriented while that at Punjab University was oriented towards **pharmacy practice**.
- Although the profession was oriented towards pharmacy practice at the introduction stage yet as it grow, it became more industry oriented.

- This lead to the development of modern **Indian pharmaceutical industry**, which is now the **4th** in terms of volume and **14th** in terms of value.
- The future prediction for the Indian pharmaceutical industry is that it is expected to become the super power by the year 2020.
- As the pharmaceutical industry is becoming highly **automatic** the trend is again towards the pharmacy practice like in rest of the world.
- The future of pharmacy is again in **pharmacy practice**. Thus history is repeating itself and pharmacy profession in India is going back to from where it started, the pharmacy practice.

Indian Systems of Medicines

- Indian Systems of Medicines includes the systems originated in India and the systems originated outside but adapted in India.
- These are Ayurveda, Unani, Siddha, Yoga, Naturopathy and Homeopathy.

Complementary & Alternative Medicine

1) Traditional Alternative Medicine

- Acupuncture
- Ayurveda
- Homeopathy
- Naturopathy
- Chinese/Oriental

2) Mind-Body Interventions

- Cognitive Behavioral Therapy
- Meditation
- Biofeedback
- Hypnosis
- Prayer
- Art, Music, Dance

3) Biologically Based Therapies

- Dietary Supplements
- Herbal Medicine

4) Manipulative and Body Based Methods

- Chiropractics
- Massage

5) Energy Therapies

- Electromagnetic Therapy

Ayurveda

- The science of life, has arrived from the Vedas. Around 1000 BC, the knowledge of Ayurveda was comprehensively documented by **Charak and Sushruta**.
- The Ayurvedic system of medicine is based on Tridosha theory of Vata, Pitta and Kapha. These three are the primary forces of the body, which develop from Panchbhoota **Prithvi (earth), Jal (water), Teja (fire)**, **Vayu (air) and Akash (sky).**
- Everything in the universe including food and the bodies we possess, is derived from these Panchbhootas.

- **Vata:** Movement, physical and mental function, sensation in a single cell/whole body.
- **Pitta:** Digestion, metabolism, energy.
- **Kapha:** Strengthening the stomach and the joints, providing firmness to the limbs and refreshing the sense organs.
- Imbalance in the doshas in human body is the main cause of disease or poor health. Treatment of Ayurveda is based on to retain **equilibrium** and balance among these Dosha.
- The diagnosis of any disease is done by questioning the patients and **08 examinations**, e.g. pulse, urine, faeces, tongue, eyes, visual examination and inference.

Panchakarma

Shirodhara: Warm herbal oil/Butter milk

Abhyanga: Oil massage

Nasyam: Oil

Unani system

- USM was establish by Greek philosopher Hippocrates.
- **Principles:** Proper functioning of human body depends on **7 factors**

1) Arkan/Anasir (Elements)
2) Mizaz (Temperament)
3) Akhlat (Humors)
4) Aaza (Organs)
5) Arwah (Vital Forces)
6) Quwa (Faculties)
7) Afaal (Functions)

- **Elements** are the primary components of human body and there are **4** basic elements: Fire, water, air and earth.
- **Four temperamental qualities** assigned to theses four elements: hot, cold, moist and dry.
- **Humors** are the primary body fluids corresponding to **four** elements and their qualities.

  The four humors are: Dam (**blood**), Balgham (**phlegm**), Safra (**yellow bile**) and Sauda (**black bile**).

Siddha

- “Food is being medicine and medicine is being food”
- The basic concepts of the Siddha medicine are similar to Ayurveda.

- The only difference appears to be that the siddha medicine recognizes predominance of Vaadham, Pittham and Kapam in childhood, adulthood and old age, respectively, whereas in Ayurveda, it is totally reversed: Kapam is dominant in childhood, Vaadham in old age and Pittham in adulthood.

Homeopathy

- The German physician **Dr. Samuel Hahnemann** introduced the basic principles of Homeopathy.
- Homeopathy = homois (similar) + pathos (suffering)
- **Principle:** Substances that cause symptoms in healthy people can be used in extreme dilution to treat illnesses that cause the same symptoms (**likes cure like**)
- Basically homeopathy allows the body to heal itself by triggering body's natural immune response
- Eg., Caffeine can treat insomnia

Yoga

- Sage **Patanjali** proposed yoga.
- Yoga is a way of life and contains **8** components: restraint, observance of austerity, physical postures, breathing exercises, restraining of sense organs, contemplation, meditation and samadhi.
- Practice of yoga improves behaviour, keeps through better circulation of oxygenated blood in the body, restrain the sense organs and mind, and induce tranquillity.
- It prevents **psychological** disorders and overcome stress.
- It also improves the intelligence and memory

Naturopathy

- Treatment of disease without drug and **application of simple laws of nature** are the basic concepts of this system. The fundamental principle of this system is similar to that of **Ayurveda**.
- There are two groups; one believes in practising **ancient Indian methods** and the other believes in practising western methods similar to **physiotherapy**.
- The practitioner regulates the eating and living habits, methods of purification, hydrotherapy, fasting, cold packs, mud packs, baths, massages etc., to treat the patients.

Evolution of Pharmacist Role

Pharmacy profession has evolved through four stages.

- Traditional Era
- Scientific Era
- Clinical Era
- Industrialization Era
- Pharmaceutical care Era

Traditional Era

- Early 20th century
- Formulation and dispensing of drugs from natural sources: ***Pharmacognosy***
- The **study of the medicinal properties** of natural products of animal, plant, and mineral origins: ***Galenical Pharmacy***
- Conducted animal experiments
- Produced a systematic **classification of drugs** for treatment of disease
- Process of **creating extracts** of active medicinally active part from plants/Techniques for preparing medications

Scientific Era

- Began after **World War II**
- Scientific approach to medicine began with the ancient Greeks
- **Hippocrates** proposed that disease came from **natural**, not supernatural causes
- Established theory of **humors**
- Emergence of the **pharmaceutical industry**
- Drugs made in factories, not apothecary shop
- **Pharmacy education** emphasized sciences
- **Pharmacology:** The scientific study of drugs and their mechanism of action including side effects
- **Pharmaceutics:** Release characteristics of drug dose forms

Clinical Era

- 1975: Millis report, **Pharmacists** for the Future
- New educational emphasis on clinical pharmacy
- ***Pharmacokinetics:*** the activity of a drug within the body over a period of time; includes absorption, distribution, metabolism, and elimination
- ***Pathophysiology:*** the study of disease and illnesses affecting the normal function of the body

Industrialization Era

- The development of **manufacturing** pharmacy began. Rapid mass production of medicines followed.

- **Standardization**, biologically prepared products, complex chemical synthesis, and increased use of **parenteral** medications were all part of this period.

Pharmaceutical Care Era

- ***Pharmaceutical care:*** A philosophy that expanded the pharmacist's role to include appropriate medication use to achieve positive outcomes with prescribed drug therapy includes
  - ✓ **Monitoring** response to therapy
  - ✓ **Educating patients** and dispensing prescriptions
  - ✓ The beginning of this era concentrated on research to develop **new medicines**.
- New drugs were developed. Had a lot of adverse reactions to drugs so drug review and monitoring resulted.
- Pharmacists began to take a more hands on role in **dispensing** medications and **patient education**

Pharmacy Education

Courses	Duration (Yrs)
Diploma in Pharmacy (D. Pharma)	02
Bachelor in Pharmacy (B. Pharma)	04
Masters in Pharmacy (M. Pharma)	02
Doctor in Pharmacy (Pharm D)	06
Doctor of Philosophy (PhD)	3-7

First 10 Pharmacy Colleges/Universities Offering Degree Program in India

Origin	Colleges/University	Category	Degree offered
1937	Dept of P'ceutical Engg, BHU, Varanasi	Central Univ	UG, PG, PhD
1944	Univ Inst of P'ceutical Sci, Punjab Univ, Chandigarh	State Univ	UG, PG, PhD
1947	LM College of Pharmacy, Ahmedabad	Private College	UG, PG, PhD
1950	Dept of Pharmacy, Madras Medical College, Chennai	Medical College	UG, PG
	BITS, Pilani	Private Univ	UG, PG, PhD
1951	College of P'ceutical Sci, Andhra Univ, Visakhapatnam	State Univ	UG, PG, PhD
1952	Dept of P'ceutical Sci, Dr HS Gour Univ, Sagar	Central Univ	UG, PG, PhD
1956	Dept of P'ceutical Sci, Nagpur Univ, Nagpur	State Univ	UG, PG, PhD
1958	P'ceutical Dept, Univ Inst of Chemical Technology, Mumbai Univ, Mumbai	State Univ	UG (Sci), PG (Sci), PhD (Tech)
1963	Dept of P'ceutical Sci, Jadhavpur Univ, Kolkata	State Univ	UG, PG, PhD

- Pharmacy education in India traditionally has been **industry** and **product** oriented.
- In 1860, (December), the pharmacy class was started at **Madras Medical College** but it was only for providing instructions to the students who newly qualify for
  - ✓Medical degree or diploma
  - ✓Apothecary (Professional formulates material medica)
  - ✓Hospital assistance grade etc.
- not for producing professionals
- In 1886, the duration of the study was **02 years** and for entry, qualification of having passed the middle school examination was required.

- In 1894, the Pharmaceutical Journal and Transactions noted, The certificate of **Chemist & Druggist** is given in Madras medical college to the students who attends full courses of instruction in **material medica**, chemistry, practical chemistry & practical pharmacy.
- **H.W. Honey**, the "first qualified person" to get recognition as chemist and druggist in India in 1866.
- In 1874, 02 years course for **"Chemists and Druggists** Diploma" at MMC, was started.
- **E. J. Wang** tabled the motion for publication of **Indian Pharmacopoeia-** 4th march 1864.
- "First Pharmacopoeia of India" under British Monarchy was published in **1868.**

- **School of Chemical Technology** at Calcutta was opened in 1919 which gave short courses in pharmaceutical chemistry and drug manufacture and indigenous drugs (by research), soap & oil, food and technologies etc.
- In 1920, Calcutta University introduced MSc in **Applied Chemistry, with pharmaceutics** as a specialization from 1940
- In 1920, The first organized move to form a **pharmaceutical society**, the **Calcutta Chemists & Druggists Association** released third, which changed its name to Bengal Chemists & Druggists Association in 1926.

- Pharmaceutical Society of India was started in the year **1923** under the name of **“The Pharmaceutical Association**”.
- In 1925, the name was changed into **“The Pharmaceutical Society of India”.** It’s the oldest organization
- In 1932, **Pharmaceutical Chemistry** was introduced as one of the subject for **B.Sc. Degree in Banaras Hindu University**, UP.
- In 1934, an integrated two years course of studies leading to **B.Sc.** (**Pharmaceutics**) was started in **Banaras Hindu University**, UP.

- This is the first Indian University to start **3 years B. Pharm**. course in the year of 1937. The first batch graduated in 1940.
- The course studies included Pharmacy, Pharmaceutical chemistry, Pharmacognosy, German & pharmaceutical economics. But, the Human physiology & Pharmacology were not included.
- **Subhadra Kumar Patni** became the first Pharmacy Graduate in India in 1940.
- In April 1940, the BHU started **M. Pharm** research degree.

- In September 1938, The **University of Madras** started 2 years degree course leading to **B.Sc Pharmacy**.

- The Madras Medical College was recognized in May 1939 for conducting the **degree course**. The classes started on 3rd July 1939 with 10 students

- In 1946, Madras Medical College was got a separate department of **Pharmaceutics** which entrusted with the teaching of **Pharmaceutics, Pharmaceutical Chemistry and Pharmacognosy**.

- First issue of **Indian Journal of Pharmacy** was released in 1939- Official publication of IPA.

- **Gorakh Prasad Srivastava** became the first Post Graduate in Pharmacy from BHU in 1943.

- 1945: Govt. brought the **Pharmacy Bill** to standardize the Pharmacy Education in India.

- Indian Pharmaceutical Congress Association **(IPCA)** was floated in 1948 at Calcutta and the first annual conference was held in Calcutta itself in December 1948 with **Prof. M.L. Shroff** as a president Elected.

- First **Diploma in Pharmacy** education institute started at Jalpaiguri, 1949 at **West Bengal**.

- In 1949, The **Pharmaceutical Society of India** stood amalgamated with the Madras Branch of the **Indian Pharmaceutical Association**

- In 1953, education regulation of PCI laid down Diploma of Pharmacy **(D. Pharm)** as the minimum qualification to enter into the profession of pharmacy in India.
- **Sheovihari Lal** became the first PhD holder in Pharmacy field, obtaining his Doctorate degree from University of Patna (Patna Medical College) under the guidance of Dr Achari, Department of Pharmacology, 1953.
- **Dr. Khem Singh Grewal** , founder of pharmaceutical education at the Panjab University, Panjab. It becoming second institution in India and started B. Pharm course from 1944.

- In 1947, **Dr. Ratibhai Prabhudas Patel,** Principle of the Lallu Bhai Motilal College of Pharmacy, Ahmedabad which started 2.5 years B. Pharm degree of the University of Bombay with an intake of 60 students. This college was affiliated with Gujarat University in 1950.

- In 1950, Prof. M.L . Schroff & Prof. Paramjit Rai appointed as HOD, Department of Pharmacy, BITS, Pilani.

- **Prof M.L. Schroff:** "The Father of Pharmacy in India" and was elected the PCI President on 15th November, 1954.

- **Madras Medical College** has provision for M.Sc degree in Pharmacy, included a regular course work and submission of thesis.
- The pharmacy studies at the **Andhra University**, Waltair was started in the year 1937.
- The students graduating with honours in chemical technology had a special subject of pharmaceuticals and fine chemicals. The 3 years B. Pharm was started in 1951 & Department of Pharmacy was created in 1952.
- Prof. **Srinivasa Rangaswami** was appointed the head.

- The **01 year M. Pharm** course was introduced Andhra University in 1954 with two special subjects, namely

  1) Analysis of foods, drugs and water

  2) Manufacture of pharmaceuticals and fine chemicals

- From 1969, The university offered **two years M. Pharm** in

  1) Pharmaceutical and food analysis

  2) Pharmaceutical and fermentation technology (recent the name is Pharmaceutical Biotechnology)

  3) Pharmaceutical chemistry

- In July 1948, introduction of a **diploma in soaps and cosmetics** was started. In July 1952, the BSc course was designated with

  1) Chemistry 2) Pharmaceutical Chemistry 3) Industrial Chemistry

- **Prof. A.K. Bhattacharya**, founder of pharmaceutical education in Dr. H.S. Gour Vishwavidyalaya, started short B. Pharm course in 1954 & new B. Pharm course in July 1956.
- The Department of Pharmacy, **Nagpur University** appeared on the scene in July 1956 & Dr. A.S. Paranjpe became HOD in November 1957.

- In **Jadavpur University**, Calcutta the B. Pharm course started in September 1963. In July, 1964, Prof M.L. Schroff appointed as Professor and HOD. Earlier Professor Bijan Kumar Gupta joined as a reader. The department was renamed as Pharmaceutical Technology in 1988 under the Faculty of Engineering and Technology.
- In 1966, Department of Pharmacy of the Jadavpur University started 2 years **M. Pharm** in

  1) Pharmaceutics 2) Pharmacology 3) Pharmaceutical chemistry 4) Biochemistry 5) Pharmacognosy 6) Pharmaceutical Microbiology 7) Pharmaceutical Engineering.

- In 1970, the college of pharmacy at **Manipal** started M. Pharm in Pharmacy Administration.
- In 1979, the College of pharmacy at **New Delhi** offered M. Pharm in Pharmaceutics and Pharmacology & from 1982 M. Pharm in Hospital Pharmacy.
- In 1982, Hamdard College of Pharmacy (Affiliated with Delhi University) introduced M. Pharm (Pharmacognosy & Phytochemistry).
- In 1983, **Kakatiya University** introduced M. Pharm in Drug formulation and Technology (Pharmaceutics)

- Dr. Homi R. Nanji, HOD, Pharmaceuticals and Fine Chemicals Section, University Department of Chemical Technology, **University of Bombay** was commenced the BSc (Tech) in Pharmaceuticals and Fine Chemicals in 1943.
- The 03 years **B. Pharm** course was introduced in June 1958 which was upgraded in 1984-85 (4 years B. Pharm).
- Since 1988, the degree course was renamed as the Bachelor of Pharmaceutical Sciences (B. Pharm. Sci).

Regulation of Pharmacy Education in India

1) Pharmacy Council of India (PCI) under the Pharmacy Act of 1948
2) All India Council for Technical Education (AICTE) which was established under the AICTE Act of 1987.

- PCI makes regulations regarding the minimum standard of education required for qualification as a pharmacist.
- PCI is responsible for registration of persons fulfilling the prescribed eligibility criteria (minimum D. Pharm) and issuing a license permitting them to practice in an Indian state.

- Registration activity is decentralized and the **State Pharmacy Councils** are responsible for registering pharmacists in their respective states.

- PCI regulates the D. Pharm program and the recently introduced Pharm D program.

- The B. Pharm program needs to be recognized by the PCI for the qualifications to be accepted for registration purpose only. Now The PCI has jurisdiction over M. Pharm.