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A Review on the Role of Pharmacognosy in Pharmacy Field

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ABSTRACT

Pharmacognosy is the origin of pharmacy. This review describes pharmacognosy and discusses its justification in pharmacy education and medication development under its impact. The article defines pharmacognosy's status quo and analyses its parts (biology, chemistry, production, and technology). It proves that whether a novel medication is synthesised or extracted from nature is irrelevant. The overview follows pharmacognosy's methodology (usage of faster and more effective phyto-analytical methods, reverse pharmacology, and reverse pharmacognosy, in silico methods). Pharmacognosy has three important difficulties in the 21st century: evaluating ethnopharmacological sources, nutraceuticals, and marine species. University education should reflect these changes. In some locations, the educational system isn't ready for the times. Adopt a multifaceted perspective toward biogenic material and use its links to educate modern pharmacy.

Keywords- Pharmacy, Pharmaconosy, Educational importance, R & D.

I. INTRODUCTION

Although pharmacognosy is deemed obsolete, there are ways to eliminate it. Based on my limited grasp of contemporary pharmacy advancements, I feel pharmaceutical chemistry (which includes drug analysis) and pharmacology are the two most important sciences. These fields have a considerable impact on drug development, but academic institutions must evaluate historical development and facts based on it. Effectiveness is more important than whether a molecule was synthesised or extracted from biogenetic material. In Europe, pharmaceutical chemistry, biology, and social pharmacy are subcategories. Each group views this "division" as a new approach to pharmacy education. While pharmacy and pharmacology instruction in major universities is flexible, it preserves basic pharmaceutical disciplines, especially in Europe and Asia.

Pharmacognosy studies plants as drug sources. The American Society of Pharmacognosy defines pharmacognosy as "the study of the physical, chemical, biochemical, and biological aspects of medications, drug substances, or potential drugs or drug substances of natural origin" [1] Schmidt and Seydler originally used the term "pharmacognosy" in 1811 and 1815, respectively. During the 19th and early 20th centuries, "pharmacognosy" referred to the discipline of medicine that deals with unprepared medications. Crude medications are dried, unprepared plant, animal, or mineral medicine. The term pharmakognosie was first used in German-speaking Europe, whereas other areas used materia medica from Galen and Dioscorides.[In German, drogenkunde means "drug science. As late as the beginning of the 20th century, [2] the subject was essentially botanical, focusing on the description and identification of whole and powdered medications. Such branches of pharmacognosy are important for botanical products (dietary supplements in the U.S., natural health products in Canada), quality control, pharmacopoeial procedures, and health regulatory frameworks.[3] Meanwhile, other study areas have enlarged the topic. The 21st century introduced a rebirth of pharmacognosy, broadening its botanical approach to molecular and metabolomic levels. [4]

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Pharmacognosy is the study of natural product molecules (usually secondary metabolites) that have pharmacological, ecological, gustatory, or other functional qualities. [5] The Pharmacognosy Institute at UIC focuses on plant-based and plant-related natural health products for human health. [6] Others include botany, ethnobotany, marine biology, microbiology, herbal medicine, chemistry, biotechnology, phytochemistry, pharmacology, pharmaceutics, clinical pharmacy, and pharmacy practise. ethnopharmacology studies the pharmacological properties of traditional therapeutic medicines. phytotherapy: therapeutic plant extracts phytochemistry: the study of plant-derived compounds (including novel medication prospects); zoopharmacognosy: animals self-medicate by using plants, soils, and insects to treat and prevent disease; Marine pharmacognosy studies marine-derived compounds.

II. HISTORY OF PHARMACOGNOSY

Pharmacognosy might be considered the history of pharmacy and medicine because it originated in the health-related activities of ancient humans. Early man must have used plants to treat injuries, pain, and disease. By combining these strategies, ancient people probably learned about medicinal and food plants.[7] Once he found botanical properties, he couldn't forget them. Many historical figures practised herbal medicine in ancient Greece. Hippocrates (460-370 BC), Aristotle (384-322 BC), Theophrastus (370-287 BC), Dioscorides (First Century AD), Pliny the Elder (23-70 AD), and Galen contributed greatly to human knowledge of therapeutic plants (131-200 AD). Hippocrates is considered the father of medicine for his work in anatomy and physiology. He collected, identified, and used therapeutic plants. 300-400 medicinal herbs make up his Materia Medica. Aristotle recorded 500 therapeutic plants' characteristics. Dioscorides published 'De Materia Medica' in 78 AD. This encyclopaedia documented 600 medicinal plants' collecting, storage, and usage. Next generations added to the inherited knowledge. So, natural drug knowledge grew throughout time.[8] Each generation specialised in collecting and processing medicinal herbs to treat ailments. This group became the 'Medicine men' of early civilizations and monopolised drug plant knowledge. They buried pharmacological knowledge in cryptic incantations used as charms. Before people could read and write, pharmacological knowledge was passed down orally or through symbols.

As civilization advanced, written language replaced signs and symbols for documenting medicine and disease knowledge.[9] Galen was a Greek pharmacist-physician who detailed hundreds of plants and animal-based therapeutic remedies. Twenty books contain his recipes, preparation methods, and insights on therapeutic plants. The phrase 'Galenical pharmacy' is a tribute to his methodology and formulas. Galen's theories form the basis for allopathic and homoeopathic medicine today. Ancient Arabian physicians and monarchs knew medicinal herbs well. They helped build Greek-based modern medicine.[10]

Historically, the apothecary (pharmacy-physician) handled both pharmacist and physician labour. In addition to diagnosing the patient's ailment and prescribing a remedy, he would collect, identify, and process the medicine for compounding and distribution.[11] As illness knowledge, therapeutic uses of medicinal plants, and medication production technology grew, it became impossible for a single person to manage these two areas of health management. Thus, health management professionals specialised in two areas. First were doctors, then apothecaries or pharmacists. Pharmacognosy was the beginning of pharmacy and medicine.[12]

The Pen Tsao, credited to the legendary Emperor Shen Nung and written between 3000 and 2730 BC, appears to be the oldest pharmacopoeia on earth. This book contains traditional Chinese medicinal recipes and therapeutic purposes.[13] Babylonians (around 3000 BC) knew a lot about therapeutic plants. Some of the same plants are still utilised today. Ebers Papyrus (1550 BC) shows that ancient Egyptians knew the medical benefits of hundreds of plants and animals. Henbane, Mandrake, Opium, Pomegranate, Castor Oil, Aloe, Onion, various essential oils, bile, fat, and others were used in Egypt 4500 years ago. Around 1200 BC, 127 plants were listed as Ayurvedic remedies.[14-15]

III. CURRENT SCENARIO OF PHARMACOGNOSY

Currently, pharmacognosy is still popular. In the last decade, biogenic resources have been increasingly used. Medications are gaining trust. [15]These items are increasing in international pharmacy, and pharmacy students are becoming more interested in this sector. At some countries, phytopharmaceuticals (including phototherapy) are still taught in pharmacy schools, and scientific interest in them is expanding. Pharmacognosy research has shifted from identifying medications to studying their biological action. Pharmacognosy also incorporates ethnobotany, ethnomedicine, and ethnopharmacology.

Pharmacognosy plays a key role in the discovery and development of novel medications and therapies. It also inspired the theme "pharmacy." Pharmacognosy is a neglected topic in modern pharmacy curriculam, especially in the West.[16] Traditional plant-based treatments should not be forgotten for modern medicine's fads. Traditional medicine knowledge has never been more important for modern pharmacists. Artemisia annua (qinghaosu) has long been used in China for intermittent fever or malaria. In the 1980s, extracts from this plant were researched in the West, leading to the creation of artemisinins, effective

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antimalarials. Some of Pharmacognosy's components are still present in Pharmacy curricula in the UK and USA, such as drug discovery from natural products/medicinal plants, herbal therapy, phytotherapy, natural medicines, and phytopharmaceuticals. Despite all odds, Pharmacognosy's popularity and uses are growing in Brazil, China, and India, where it has the potential to contribute billions of dollars to their economies. Medicinal plants and their compounds have provided many helpful medicines. Despite the hurdles, natural compounds from medicinal plants will remain a vital part of drug research. Drug development from medicinal plants uses botanical, computational, phytochemical, biological, and molecular approaches.[17] Medicinal plant drug research provides novel and vital leads against cancer, HIV/AIDS, Alzheimer's, malaria, and pain. Several plant-based medications were recently introduced or are in late-stage clinical studies. Pharmacognosy is not a subject of the past; it has changed throughout the years to adapt to a changing environment and is now ready to tackle the challenges of drug discovery and development. Pharmacognosy is crucial in pharmacy. Pharmacognosy will remain a vital and essential contributor to the knowledge and understanding of medications and therapies, and should be included in all meaningful academic Pharmacy programmes.[18]

There is growing scholarly interest in natural medicines and nutraceuticals, increasing financing prospects, but also increasing rivalry from people outside academic pharmaceutical organisations who view it as a staple. Pharmacognosists' knowledge can help discover new medications. With additional scientific disciplines and their progress,[19]future projects may be more complex than in the 20th century. As pharmacognosy research gets more specialised, it should find a strong and cohesive representation at national and international events, ensuring the field's survival. Combinatorial synthesis, genomics, and proteomics should be at the forefront of pharmacognosy development.[20]Natural substances researchers (and academics) will need to be more adaptable than ever, but thanks to new techniques and technologies, the benefits will be larger[21] for their own scientific interest and for society. Pharmacognosy looks forward with optimism. [23] By the end of the 20th century, it was evident that pharmacists with a broad education, ingenuity in drug discovery, and improvisation abilities would lead pharmacognosy.[24] Pharmacognosy faces three untested challenges:

First, evaluating ethnic group medicinal medications based on cultural tradition and not using receptor theory (principles of traditional Chinese medicine [yin-yang], traditional Indian medicine [Ayurveda], traditional Japanese [Kampo], and Mongolian medicine [Dom]).

Second, pharmacognosy's involvement in evaluating biogenic material (extracts and pure compounds) and nutraceuticals, dietary supplements, and innovative foods is a difficulty. Special meals with no therapeutic indication play a significant role in therapy and must be evaluated. Nutraceuticals are often utilised as part of regulated therapy or as the therapeutic agent in self-medication. Complexity requires legislation (certain processes are ongoing at EU level). Pharmacy-pharmacognosy must inform expert opinion, not politics. Modern knowledge must be used to address nutraceuticals, even if they are foods.[25]

Third, marine pharmacognosy. 50 years ago,[26] and 40 years ago, these were initially used (e.g., in Sweden).[27,28] Several papers show the scope of pharmacognosy. [29,30] Pharmacist-pharmacologists must be trained in modern technologies to isolate macromolecular compounds with unique effects.[31]; small-molecule compounds are easier to handle in pharmacognosy.

Reverse pharmacognosy and reverse pharmacology play an essential part in modern pharmacognosy. They focus on identifying natural resources that include active compounds using virtual or actual screening. HTS, virtual screening, and databases of traditional plant usage are utilised. Classical pharmacognosy employs plants to uncover bioactive molecules, while reverse pharmacognosy uses natural metabolites to find new medicinal properties. Pharmacognosy and reverse pharmacognosy help speed up the development of novel medications. [32-34]

Reverse pharmacology[35] (sometimes called target-based drug discovery, TDD)[36] is based on two steps. First, it is predicted that modulating a certain protein target will have therapeutic benefits. Then, small-molecule chemical libraries are employed to find target-affine molecules. This screening helps find drug candidates. This technology for sequencing the human genome has enabled rapid cloning and synthesis of vast numbers of purified proteins and is the most used in drug research. [37] Reverse pharmacology predicts the action of in vivo found active molecules, but only in the final stages of drug discovery. It's crucial for evaluating natural chemicals.[38]

IV. THE FUTURE OF PHARMACOGNOSY IN ACADEMIC EDUCATION

Plants are one of the oldest and most important sources of medicine, and pharmacognosy is part of pharmacists' education. Originally, this field focused on identifying medicinal plants and their ingredients, pharmacological effects, and therapeutic efficacy. However, in the last 20 years, a new focus on molecular biology has emerged. [39]This tendency was linked to research on biosynthesis and molecular mechanisms of biologically active natural chemicals, leading to the identification of new targets for developing novel active compounds for modern pharmaceutical goods. Many

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European countries are debating how pharmacognosy should position itself in academic research and education. All "classical" places must be modernised because of scientific and technical progress. Original information about plant identification, components, effects, and efficacy, a vital part of a pharmacist's education, must not be disregarded.[40]

Such knowledge lays the basis for scientific phytotherapy and the use of plant medicines recognised as medicines by European law. Pharmacognosy seems to be important for future pharmacists' basic skills, understanding of medicinal plants, and proficiency in using herbal medicines. Modern pharmacognosy should include both plant and molecular biology. ESCOP believes that biogenic chemicals should be a key academic competency.[41]The medicinal plant, along with microbes and animal products, is a target for active ingredient research. Pharmacognosy includes main and secondary compounds, complex mixes (extracts), biotechnological substances, and living cells. Future pharmacists who only study biochemical pathways and engineering to produce new active substances will be able to describe exact biochemical procedures and synthesise new drugs, but they won't be able to identify medicinal plants with their constituents, pharmacological effects, and therapeutic efficacy. Without pharmacognosy, it's impossible to understand the complicated background of new active chemicals and modern medicines.[42]ESCOP would want to see modern pharmacognosy find its place alongside pharmacology, pharmaceutical chemistry and technology, and clinical pharmacy, while maintaining unique knowledge about medicinal plants, their effects, and their therapeutic efficacy.[43]

V. THERAPEUTIC IMPORTANCE OF PLANT SECONDARY METABOLITES

Secondary metabolites are organic compounds found in all plant tissues to drive metabolic activities and provide self-defense against herbivores [44]. Plants are a well-known source of traditional and modern treatments for human ailments. Secondary metabolites are responsible for this use [9]. They are also used industrially to make dyes, medicines, polymers, waxes, glues, fibres, antibiotics, herbicides, insecticides, cosmetics, etc. [45]. Plant secondary metabolites include terpenes (cardiac glycosides, carotenoids, and sterols), phenolics (flavonoids and nonflavonoids), and nitrogen-based chemicals (alkaloids and glucosinolates.

Terpenes are the largest and most diverse class of secondary metabolites from isoprenoid polymerization [46]. It can be classified into monoterpenes, sesquiterpenes, diterpenes, triterpenes, tetraterpenes, polyterpenes, and steroids whose precursor is triterpenes. Terpenes from eucalyptus oil are antidiabetic [47], ursolic acid from Rosmarinus officinalis and -sesquiphellandrene from Piper guineense are psychoprotective [48]. Terpenoids from Pilgerodendron uviferum, Picea abies, and other plants are antibacterial and antifungal [47-48]. Moreover, glycyrrhizic acid is anti-inflammatory [49].

The phenolics are secondary metabolites formed in the shikimic acid pathway of plants by phenylpropanoid metabolization of at least one aromatic ring of hydrocarbon linked to one or more hydroxyl groups [50, 51]. Flavonoids and nonflavonoids are two types of phenolics. Flavonoids are generated from two aromatic rings joined by a three-carbon bridge (C6C3C6) and subdivided into six categories: flavonols, flavones, flavanones, flavan-3-ols, isoflavones, and anthocyanins. Nonflavonoids include hydroxybenzoates, hydroxycinnamates, lignans, and stilbenes [52]. Phytophenols have antidiabetic, antioxidant, antiviral, antibacterial, anticancer, and anti-inflammatory properties. cyanidin 3-sambubioside and 5-caffeoyl quinic acid produced from Viburnum dilatatum Thumb. displayed substantial antioxidant and radical scavenging properties while reducing postprandial hyperglycemia [53]. Garcinone E, kaempferol, resveratrol, syringaresinol, and quercetin are powerful anticancer agents [54]. phenolics are anti-inflammatory, antiviral, and antibacterial [55,56,57].

Alkaloids are heterocyclic secondary metabolites produced from nitrogen-based amino acids. Based on its heterocyclic and building block, alkaloids are categorised as indole, tropane, piperidine, purine, imidazole, pyrrolizidine, pyrrolidine, quinolizidine, and isoquinoline [22]. Plant alkaloids have medicinal benefits. Callistemon citrinus and Vernonia adoensis contain alkaloids that kill Staphylococcus aureus and Pseudomonas aeruginosa [23]. Alkaloids from Aerva lanata roots helped diabetic rats avoid postprandial hyperglycemia [24]. Alkaloid in Phoebe declinata leaves extract is also antioxidant. It inhibits DPPH while converting ferric chloride to ferrous [25]. Reserpiline, -yohimbine, methylaplysinopsin, isoquinoline, physostigmine, and pilocarpine are excellent psychoprotective agents [12].

VI. HERBAL MEDICINE IN THERAPEUTIC VALUE

Healing with medicinal plants is ancient. The link between man and his search for natural medicines extends back to ancient times, when written papers, monuments, and original plant medicines [58]. The oldest written evidence of medicinal plant use was found on a 5000-year-old Sumerian clay slab from Nagpur. It included 12 medication production techniques including 250 plants [59]. Many years of illness have led man to seek medicines in leaves, roots, barks, and other plant parts [60]. Knowledge of the development of ideas connected to medicinal plants and the evolution of awareness has strengthened health professionals' ability

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to respond to difficulties that have occurred with the proliferation of professional services in enhancing man's life. Plants were used to treat and prevent various ailments before iatrochemistry [61]. Since time immemorial, medicinal plants have been a vital aspect of global health care.

In recent decades, it's become clear that many plants have medical promise, and medicinal plants are increasingly regarded as potential lead molecules in drug discovery. In fact, the developed world has seen an increase in CAM, especially herbal therapies [62]. Over 80% of the population in Sub-Saharan African nations like Nigeria and South Africa utilise herbal treatments for basic health care, while over 70% of their populations have tried CAM at least once [63]. Medicinal herbs are the most frequent traditional medicine worldwide. Medicinal herbs are the most accessible health resource in most countries. Patients prefer them. Traditional healers provide information, counselling, and treatment to patients and their families in a personal manner [64].

Modern allopathic medicine has its roots in traditional medicine, and it's possible that many important novel medicines will be created and commercialised in the future from plant biodiversity, as it has done until now. Traditional medicine, especially medicinal herbs, is widely used for cultural and economic reasons. The WHO encourages member states to promote and incorporate traditional medicine [65]. While many plants (only a few are listed here) have therapeutic and pharmacological effects against diseases such as diabetes (Artemisia afra, Chilianthus olearaceus, Vernonia amygdalina [66], Dicoma anomala [67], Psidium guajava [68], and Solanum incanum [67], cancer (Taxus brevifolia, Podophyllum peltatum [66], (NTD).

VII. CONCLUSION

Each discipline is as strong as its definition is true and credible, as long as it can enforce it on the basis of economic and internal political possibilities and personnel-inventive workers. The teaching profile is a matter of not only a real need, but also the consensual process of the university staff involved, who create this profile and there are always animosities in such a process. If there are one-sided opinions, stemming from ignorance or prejudice, then the development of any field is significantly hampered. We may only desire that these antagonistic conflicts are as small as possible in terms of pharmacognosy and its application in the educational system of the pharmacist.

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