Pharmacognosy

**Pharmacognosy** is the study of medicines derived from natural sources. The [American Society of P harmacognosy](http://en.wikipedia.org/wiki/American_Society_of_Pharmacognosy) defines pharmacognosy as "the study of the physical, chemical, biochemical and biological properties of drugs, drug substances or potential drugs or drug substances of natural origin as well as the search for new drugs from natural sources."

**Introduction**

The word "pharmacognosy" is derived from the [Greek](http://en.wikipedia.org/wiki/Greek_language) words *φάρμακον* pharmakon ([drug](http://en.wikipedia.org/wiki/Drug)), and γνῶσις [*gnosis*](http://en.wikipedia.org/wiki/Gnosis) or "[knowledge](http://en.wikipedia.org/wiki/Knowledge)". The term pharmacognosy was used for the first time by the Austrian physician Schmidt in 1811. Originally—during the 19th century and the beginning of the 20th century—"pharmacognosy" was used to define the branch of [medicine](http://en.wikipedia.org/wiki/Medicine) or commodity sciences (*Warenkunde* in German) which deals with [drugs](http://en.wikipedia.org/wiki/Drug) in their crude, or unprepared form. [Crude drugs](http://en.wikipedia.org/wiki/Crude_drugs) are the dried, unprepared material of plant, animal or mineral origin, used for medicine. The study of these materials under the name *pharmakognosie* was first developed in German-speaking areas of Europe, while other language areas often used the older term *materia medica* taken from the works of [Galen](http://en.wikipedia.org/wiki/Galen) and [Dioscorides](http://en.wikipedia.org/wiki/Dioscorides). In German the term *drogenkunde* ("science of crude drugs") is also used synonymously.

Although most pharmacognostic studies focus on plants and medicines derived from plants, other types of organisms are also regarded as pharmacognostically interesting, in particular, various types of microbes (bacteria, fungi, etc.), and, recently, various marine organisms.

Pharmacognosy is interdisciplinary, drawing on a broad spectrum of biological and socio-scientific subjects, including [botany](http://en.wikipedia.org/wiki/Botany), [ethnobotany](http://en.wikipedia.org/wiki/Ethnobotany), [medical anthropology](http://en.wikipedia.org/wiki/Medical_anthropology), [marine biology](http://en.wikipedia.org/wiki/Marine_biology), [microbiology](http://en.wikipedia.org/wiki/Microbiology), [herbal medicine](http://en.wikipedia.org/wiki/Herbal_medicine), [chemistry](http://en.wikipedia.org/wiki/Chemistry), [biotechnology](http://en.wikipedia.org/wiki/Biotechnology), [phytochemistry](http://en.wikipedia.org/wiki/Phytochemistry), [pharmacology](http://en.wikipedia.org/wiki/Pharmacology), [pharmaceutics](http://en.wikipedia.org/wiki/Pharmaceutics), clinical [pharmacy](http://en.wikipedia.org/wiki/Pharmacy) and [pharmacy practice](http://en.wikipedia.org/wiki/Pharmacy_practice). The contemporary study of pharmacognosy can be divided into the fields of

medical [ethnobotany](http://en.wikipedia.org/wiki/Ethnobotany): the study of the traditional use of plants for medicinal purposes;

1. [ethnopharmacology](http://en.wikipedia.org/wiki/Ethnopharmacology): the study of the pharmacological qualities of traditional medicinal substances;
2. the study of [phytotherapy](http://en.wikipedia.org/wiki/Phytotherapy) (the medicinal use of plant extracts); and
3. [phytochemistry](http://en.wikipedia.org/wiki/Phytochemistry), the study of chemicals derived from plants (including the identification of new drug candidates derived from plant sources).
4. [zoopharmacognosy](http://en.wikipedia.org/wiki/Zoopharmacognosy), the process by which animals self-medicate, by selecting and using plants, soils, and insects to treat and prevent disease.
5. [pharmcognosy-Biotechnology](http://en.wikipedia.org/w/index.php?title=Pharmcognosy-Biotechnology&action=edit&redlink=1), the synthesis of natural bioactive molecules using biotechnology.
6. [herbal interactions](http://en.wikipedia.org/w/index.php?title=Herbal_interactions&action=edit&redlink=1), the interactions of herbs with other drugs and body.
7. [harine pharmacognosy](http://en.wikipedia.org/wiki/Marine_pharmacognosy), the study of chemicals derived from marine organisms.

**Origin**

The word pharmacognosy had its debut in the early 19th century to designate the discipline related to medicinal plants. It is derived from the Greek word *pharmakon* meaning “a drug” and *gignosco* meaning “to acquire a knowledge.”

Pharmacognosy appears again in 1815 in a small work by Crr. Anotheus Seydler entitled *Analecta Pharmacognostica.*

Pharmacognosy is closely related to botany and plant chemistry and indeed, both originated from the earlier scientific studies of medicinal plants.

As late as the beginning of the 20th century, the subject had developed mainly on the botanical side, being particularly concerned with the description and identification of drugs both in their whole state and in powder form. Such branches of pharmacognosy are still of fundamental importance, particularly for pharmacopoeial identification and quality control purposes, but rapid development in other areas has enormously expanded the subject.

At the 9th congress of Italian society of pharmacognosy it was stated that current return of phyto-therapy was clearly reflected by the increased market of such products. In 1998 the latest figures available for Europe, the total OTC market for herbal medicinal products reached a figure of $6 billion, with consumption for Germany of $2.5 billion, France $1.6 billion and Italy $600 billion. In the US, where the use of herbal products has never been as prevalent as in continental Europe, the market for all herb sales reached a peak in 1998 of $700 billion. This welcomed the scientific investigation of a rigorous nature.

The plant kingdom still holds many species of plants containing substances of medicinal value which have yet to be discovered. Large numbers of plants are constantly being screened for their possible pharmacological value.

**Pharmacognosy as a science and academic discipline.**

There is information that about 14 000 chemical compounds are completely or partially synthesized by plants. The therapeutic value of medicinal plants is determined by its biologically active substances.

According to the World Health Organization, 20,000 species of medicinal plants are used for medicinal purposes in 73 countries worldwide, but only 18,884 species of plants are included in official publications of 38 countries. Half of these species are permitted to use in medical practice in one country and only 143 species are included in the Pharmacopoeia and the Governmental Register of more than 10 countries.

 Pharmacognosy as an ancient science comprehensively studies medicinal plants, medicinal raw material of vegetable and animal origin, rarely mineral origin and as well as products of their primary processing. The word “pharmacognosy” comes from Greek "pharmacon" - medicine, poison, and "gnosis" - knowledge and the term pharmacognosy was fixed definitively after the publication "Analecta Pharmacognostica" by K.E. Seydler in 1815. Pharmacognosy had formed and developed on the basis of botany and natural compounds.

A knowledge of pharmacognosy is essential for introduction and production of natural medicinal products, including phyto- and zoopreparations. There is a close relationship between pharmacognosy and phytotherapy, zootherapy, biotechnology, homeopathy.

A major goal of pharmacognosy is to search the natural products, including biologically active substances of vegetable, animal and mineral origin and introduction new drugs. The following tasks were identified to achieve this goal:

1. Scientific research of new investigated objects, improvement and use the rational forms.
2. Study of empirical medicine, a multilateral related screening of higher, lower plants and animal substances
3. Phytochemical and zoochemical study of plant species and animal material.
4. Development and improvement of standards, various monographs on phytopreparations, purified complexes of natural compounds, individual substances and medicinal raw materials.
5. Determination the storage of raw material of plant and animal origin used in scientific medicine or the proposed new raw materials
6. Study of biological characteristics for the cultivation of various plant species and the breeding of animals in order to create and expand the resource base.

The course of pharmacognosy includes the theoretical and practical parts. The theoretical part consists of a general and a special sections. The essence, tasks, significance, the historical development of pharmacognosy, the chemical composition of the medicinal plant and its variability by the effect of various factors, the concept of active, concomitant and ballast substances, the main directions of research on medicinal plants, the rational use of storage of medicinal plants and protection, the procurement of medicinal plant materials, the basics of procurement process, pharmacognostic methods for analysis, rules of drawing up analytic and normative documents for medicinal plant materials are considered in general part. The detailed information is provided on the common features of individual groups of biologically active substances, on medicinal plants and partly materials of animal and mineral origin in a special part.

**Historical development of pharmacognosy**

The first or beginning of pre-history on use of medicinal plants or herbs or animals, and the place where and how used were not well known, and those information were unwritten for a long time. As a result, the pre-history on herbs was almost lost. However, some information was recorded by oral transmission from generation to generation.

The written history has originated which was based on region, religion and culture etc. The written history was divided into the following:

The western medicine

The orient

The Greek History

The African System

The Unani (Islam)

The Ayurveda (Indian)

It is known that the Middle East is an ancient cultural center that’s why the first knowledge of historical development of medicine was discovered there. The western medicine is originated in Mesopotamia and Egypt. Mesopotamia is considered as the first origin of human civilization. This information became an integral part of the universal culture through the study and disclosure of the cuneiform inscriptions of Babylon and the Assyrians who received the knowledge and cultural heritage of the Sumerians living in Mesopotamia 6000 years before our era. Specifically, the oldest written evidence of usage of medicinal plants for preparation of drugs was found on a Sumerian clay slab from Nagpur, approximately 5000 years old. It comprised 12 recipes for drug preparation refer- ring to over 250 plants [27]. Awareness of medicinal plants usage is a result of the many years of struggles against illnesses, which has prompted man to seek medicines in leaves, roots, barks, and other parts of plants The Sumerians developed cuneiform tablet of herbal medicines. Those tablets are preserved in British museum. In Egypt, information had been written on paper – Papyrus ebers (1600BC). It consisted of 800 prescriptions, mentioning 700 drugs.  The first pharmacopoeia named London Pharmacopoeia was published in 1618 and then British Pharmacopoeia was published in 1864.

***The Ayurveda (Indian, 2500-600 BC):*** Ayurveda is the term for traditional medicine of ancient India. The word “Ayur” means ‘Life’ and “veda” means ‘The study of’; that is “Study of Life”. The Ayurvedic writings were divided into three systems:

* Charaka Samhita
* Sushruta Samhita
* Astanga samhita.

The oldest writing was Charaka Samhita (6-700 years BC).   
The book describes uses of many metallic drugs e.g., iron, mercury, sulphur, copper etc with herbs.

***The orient (2700 BC):*** This is originated from Chinese, Japanese and Tibetians etc. The orient herbalism was very old (142 – 220 BC) and called “Kampo”. The first records of knowledge documentation were, however, produced by Shen Nung (a Chinese emperor) 2500 BC ago, describing different recipes of drug preparation from more than 300 medicinal plants for the management of numerous human diseases. Records had it that the use of plants (herbs) as medicine started gaining momentum around 500 BC, though prior to this period, their use was not limited to healing but believed to possess spiritual (ritual) power as well until the advent of scientific era. The written documents were made by the King ‘Shen Nung’ (2700 BC) and Shang dynasty (1766 – 1122 BC) etc. Shen Nung investigated medicinal value of several herbs and wrote a book – “Pen T-Sao” or native herbal. Chinese medicine is unique both in its philosophical theories and assortment of drugs of the richest flora of China. The most extensive medical text with 1892 entries was written by Li Shizhen (XVI century) and remains as the premier reference work for herbal medicine in China.

***The African System*** Basotho  ***(Tropical Africa, North and South America):*** They kept information in their groups or tribes. The information is   
transmitted from one generation to another.These regions are richest sources of medicinal plants and need to be explored for new drugs.  
Pharmacognosy is basically all about medicinal plants and their uses, pharmacognosy relies upon the crude use of these plants after detail evaluation

***The Greek and Roman History:***  The greek medicine is the most ancient. This medicine borrowed and used the preparations of egyptians, persians and other peoples of Middle East. The famous Greek physician Hippocrates (460-370 years B.C.) described 236 species of medicinal plants for therapeutic purposes, and used them without processing. He was the first natural doctor who utilized simple remedies such as vinegar, honey, herbs etc. in healing. He is also known to have collected and identified a number of medicinal plants. Hippocrates believed that plants in an unprocessed state have a more effective effect. He wrote Corpus Hipocraticum 460 B.C.

*Aristotle (384-322 BC:* He gave the philosophy of medicine. He listed more than 500 plants of medicinal importance.

Theophrastus (*371-287 BC*.) pupil of Aristotle, wrote treatise consisting of 15 books on botany, where the large section was devoted to medicinal plants.

The invasion of Alexander the Great (335-325 B.C.) helped to increase the number of drugs known at that time. The Greek Empire was followed by that of the Romans, and Dioscorides who was a Greek by birth, travelled to Egypt and other countries bordering the Mediterranean Sea and became acquainted with a great variety of plants and drugs. He was the first to describe drugs, and his work “Greek Herbal of Dioscorides” included not less than 5000 medicinal plants in addition to animal and mineral drugs. He is considered the first known Pharmacognosist. Dioscurides wrote the book “Materica medica” with illustrations of plants which are used in treatment of different diseases. This book remained the medical authority in Europe since the 16th century. The founder of european pharmacognosy is Dioscurides.

Pliny the Elder (23-79 AD) who lived about the same time as Dioscrides, was also an eminent author of natural history. He published the encyclopedia “Historia Naturalis” and used 2000 works to compile it.

The prominent philosopher and physician Galen (***131-200 AD):*** wrote a good number of medicinal and pharmaceutical works, developed the methods of preparing and compounding medicines by mechanical means. He was the originator of the formulae for a cold cream. He laid the foundation of the production of extraction preparations known as galenic formulations. In the writings Galen mentioned 304 plants, 80 animals and 60 minerals.

On the subsequent declince of the Roman Empire, a retrogression of scientific activity took place until the Arabian Empire rose.

***Unani (islamic)*** “The Canon of Medicine” - a multi-volume book compiled by the prominent physician Abu Ali Sina (Avicenna), lived in Bukhara Х century- had acquired a great fame among the arabian medical books. The works of Avicenna in Europe had the same authority as Galen, Hippocrates and Dioscorides. There are several medical systems, distinguished by their unique experience, philosophical theory, methods of treatment and practical features.

Kamil as-sınaat at tibbiyyat» (X century) Ali Ibn Madcusi Arjani is among the most famous works in the field of medicine. This work reflects almost on all aspects of medical science of the era, and information about the simple and complicated medication. The list of handbooks of Eastern and Azerbaijani physicians includes the bookd «appearance and chorezmshah» of Zayn al- Din Abu Ibragim Husein Al- Jurjanin. This work consists of 9 books, in which the basic laws of medieval theoretical and practical medicine are described.

In 1311, the famous Azerbaijani scientist and physician Yusif Ibn Ismail Hoyi wrote a book entitled "Ma-layasau təbib caxlaxu", which is known as "Jam al-Baghdadi (Baghdad collection). This work was as the encyclopedia of medieval pharmacognosy. Several thousand medications of plants, animal and mineral origin have been described in this book. The author of "Ihtiatar-i Badia", which refers to the Middle Ages, was Ali ibn Hussein Ansari (1329-1404). He was known asHaci Zayn al-Abidin Attar. This book provides with information about several thousand various kinds of medication. Karabadin" was written by Muzaffar bin Muhammad Huseyn Shafai.  "Karabadin" is considered as an original and independent work. The pharmacopoeia of the previous editions were used in the writing of this book.

Haji Sulaiman ibn Saman Kajaf Irevani, native of Irevani (Yerevan) is the famous azerbaijani physician XVII century. Greek medicine had an impact on the development of medicine of slavic peoples, which led to the formation of the Slavic-Greek direction in medicine until the 16th century.

In XV century the assortment of medicinal plants in Europe was significantly supplemented by the raw material brought form America – cinchona bark, rubber, tobacco, coca, cocoa. In the XVII-XVIII centuries in Europe, atlases of medicinal plants, tutorial on pharmacognosy were published, pharmacognosy departments were established and pharmaceutical journals began to be published.

In this period in Europe, the Swiss scientist - pharmacognosist Alexander Tschirch published three volume tutorials, known throughout the world. International relations and trade had enabled to know the medications of various countries, and as a result in XVII-XX centuries in Europe the iranian, arabic, indian, chinese, american, african and oth. medicinal materials are begun to use. In the early 20th century the pharmaceutical science and industry began to develop strenuously throughout Europe, the preparation of wild plants was significantly increased, and also the attention was paid to the introduction of medicinal plants.

The pharmaceutical industry of Europe was based on the import raw materials, that’s why it became necessary to study the local flora and search a new plant material. The problem of new direction in pharmaceutical education was raised in this situation. Pharmacognosy had to determine its position in pharmaceutical education and solve the objectives.

**The concept of natural products** dates back to the early 19th century, when the foundations of [organic chemistry](https://en.wikipedia.org/wiki/Organic_chemistry" \o "Organic chemistry) were laid. Organic chemistry was regarded at that time as the chemistry of substances that plants and animals are composed of. It was a relatively complex form of chemistry and stood in stark contrast to [inorganic chemistry](https://en.wikipedia.org/wiki/Inorganic_chemistry" \o "Inorganic chemistry), the principles of which had been established in 1789 by the Frenchman [Antoine Lavoisier](https://en.wikipedia.org/wiki/Antoine_Lavoisier" \o "Antoine Lavoisier) in his work *[Traité Élémentaire de Chimie](https://en.wikipedia.org/wiki/Trait%C3%A9_%C3%89l%C3%A9mentaire_de_Chimie" \o "Traité Élémentaire de Chimie)*.[[85]](https://en.wikipedia.org/wiki/Natural_product" \l "cite_note-ACS_Lavoisier_Landmark-85)

### Isolation. Lavoisier showed at the end of the 18th century that organic substances consisted of a limited number of elements: primarily carbon and hydrogen and supplemented by oxygen and nitrogen. He quickly focused on the isolation of these substances, often because they had an interesting pharmacological activity. Plants were the main source of such compounds, especially [alkaloids](https://en.wikipedia.org/wiki/Alkaloids" \o "Alkaloids) and [glycosides](https://en.wikipedia.org/wiki/Glycoside" \o "Glycoside). It was long been known that opium, a sticky mixture of alkaloids (including [codeine](https://en.wikipedia.org/wiki/Codeine" \o "Codeine), [morphine](https://en.wikipedia.org/wiki/Morphine" \o "Morphine), [noscapine](https://en.wikipedia.org/wiki/Noscapine" \o "Noscapine), [thebaine](https://en.wikipedia.org/wiki/Thebaine" \o "Thebaine), and [papaverine](https://en.wikipedia.org/wiki/Papaverine" \o "Papaverine)) from the opium poppy ([Papaver somniferum](https://en.wikipedia.org/wiki/Papaver_somniferum" \o "Papaver somniferum)), possessed a narcotic and at the same time mind-altering properties. By 1805, morphine had already been isolated by the German chemist [Friedrich Sertürner](https://en.wikipedia.org/wiki/Friedrich_Sert%C3%BCrner" \o "Friedrich Sertürner) and in the 1870s it was discovered that boiling morphine with [acetic anhydride](https://en.wikipedia.org/wiki/Acetic_anhydride" \o "Acetic anhydride)produced a substance with a strong pain suppressive effect: [heroin](https://en.wikipedia.org/wiki/Heroin" \o "Heroin). In 1815, [Eugène Chevreul](https://en.wikipedia.org/wiki/Eug%C3%A8ne_Chevreul" \o "Eugène Chevreul) isolated [cholesterol](https://en.wikipedia.org/wiki/Cholesterol" \o "Cholesterol), a crystalline substance, from animal tissue that belongs to the class of steroids, and in 1820 [strychnine](https://en.wikipedia.org/wiki/Strychnine" \o "Strychnine), an alkaloid was isolated.

### Synthesis. A second important step was the synthesis of organic compounds. Whereas the synthesis of inorganic substances had been known for a long time, the synthesis of organic substances was a difficult hurdle. In 1827 the Swedish chemist [Jöns Jacob Berzelius](https://en.wikipedia.org/wiki/J%C3%B6ns_Jacob_Berzelius" \o "Jöns Jacob Berzelius)held that an indispensable force of nature for the synthesis of organic compounds, called vital force or life force, was needed. This philosophical idea, [vitalism](https://en.wikipedia.org/wiki/Vitalism" \o "Vitalism), well into the 19th century had many supporters, even after the introduction of the [atomic theory](https://en.wikipedia.org/wiki/Atomic_theory" \o "Atomic theory). The idea of vitalism especially fitted in with beliefs in medicine; the most traditional healing practices believed that disease was the result of some imbalance in the vital energies that distinguishes life from nonlife. A first attempt to break the vitalism idea in science was made in 1828, when the German chemist [Friedrich Wöhler](https://en.wikipedia.org/wiki/Friedrich_W%C3%B6hler" \o "Friedrich Wöhler) succeeded in synthesizing [urea](https://en.wikipedia.org/wiki/Urea" \o "Urea), a natural product found in [urine](https://en.wikipedia.org/wiki/Urine" \o "Urine), by heating [ammonium cyanate](https://en.wikipedia.org/wiki/Ammonium_cyanate" \o "Ammonium cyanate), an inorganic substance:

NH4OCN →  60∘C   H2NCONH2This reaction showed that there was no need for a life force in order to prepare organic substances. This idea, however, was initially met with a high degree of skepticism, and only 20 years later, with the synthesis of acetic acid from carbon by [Adolph Wilhelm Hermann Kolbe](https://en.wikipedia.org/wiki/Adolph_Wilhelm_Hermann_Kolbe), was the idea accepted. Organic chemistry has since developed into an independent area of research dedicated to the study of carbon-containing compounds, since that element in common was detected in a variety of nature-derived substances. An important factor in the characterization of organic materials was on the basis of their physical properties (such as melting point, boiling point, solubility, crystallinity, or color).

The concept of natural product, which initially based on organic compounds that could be isolated from plants, was extended to include animal material in the middle of the 19th century by the German [Justus von Liebig](https://en.wikipedia.org/wiki/Justus_von_Liebig). [Hermann Emil Fischer](https://en.wikipedia.org/wiki/Hermann_Emil_Fischer) in 1884, turned his attention to the study of carbohydrates and purines, work for which he was awarded the Nobel Prize in 1902. He also succeeded to make synthetically in the laboratory in a variety of carbohydrates, including [glucose](https://en.wikipedia.org/wiki/Glucose) and [mannose](https://en.wikipedia.org/wiki/Mannose). After the discovery of [penicillin](https://en.wikipedia.org/wiki/Penicillin) by [Alexander Fleming](https://en.wikipedia.org/wiki/Alexander_Fleming) in 1928, fungi and other micro-organisms were added to the arsenal of sources of natural products.[[86](https://en.wikipedia.org/wiki/Natural_product#cite_note-Dias_2012-86)

By the 1930s, several large classes of natural products were known. Important milestones included:

* [Terpenes](https://en.wikipedia.org/wiki/Terpene), first systematically studied by [Otto Wallach](https://en.wikipedia.org/wiki/Otto_Wallach) (Nobel Prize 1910) and later by [Leopold Ružička](https://en.wikipedia.org/wiki/Leopold_Ru%C5%BEi%C4%8Dka) (Nobel Prize 1939)
* Dyes based on [porphins](https://en.wikipedia.org/wiki/Porphin) (including [chlorophyll](https://en.wikipedia.org/wiki/Chlorophyll) and [heme](https://en.wikipedia.org/wiki/Heme)), studied by [Richard Willstätter](https://en.wikipedia.org/wiki/Richard_Willst%C3%A4tter)(Nobel Prize 1915) and Hans Fischer (Nobel Prize 1930)
* [Steroids](https://en.wikipedia.org/wiki/Steroid), studied by [Heinrich Otto Wieland](https://en.wikipedia.org/wiki/Heinrich_Otto_Wieland) (Nobel Prize 1927) and [Adolf Windaus](https://en.wikipedia.org/wiki/Adolf_Windaus)(Nobel Prize 1928)
* [Carotenoids](https://en.wikipedia.org/wiki/Carotenoid), studied by [Paul Karrer](https://en.wikipedia.org/wiki/Paul_Karrer) (Nobel Prize 1937)
* [Vitamins](https://en.wikipedia.org/wiki/Vitamin), studied among others by [Paul Karrer](https://en.wikipedia.org/wiki/Paul_Karrer), Adolf Windaus, [Robert R. Williams](https://en.wikipedia.org/wiki/Robert_R._Williams), [Norman Haworth](https://en.wikipedia.org/wiki/Norman_Haworth) (Nobel Prize 1937), [Richard Kuhn](https://en.wikipedia.org/wiki/Richard_Kuhn) (Nobel Prize 1938) and [Albert Szent-Györgyi](https://en.wikipedia.org/wiki/Albert_Szent-Gy%C3%B6rgyi)
* [Hormones](https://en.wikipedia.org/wiki/Hormone) studied by [Adolf Butenandt](https://en.wikipedia.org/wiki/Adolf_Butenandt) (Nobel Prize 1939) and Edward Calvin Kendall (Nobel Prize 1950)
* Alkaloids and [anthocyanins](https://en.wikipedia.org/wiki/Anthocyanin), studied by, among others, [Robert Robinson](https://en.wikipedia.org/wiki/Robert_Robinson_(organic_chemist)) (Nobel Prize 1947)

The foundation of the Academy of Sciences (1724) had a great influence on the development of phamacognosy in Russia. Several book, journals and essays were written about the medicinal plants.

The foundation of the USSR had a significant influence on the development of pharmacognosy in Eastern Europe in 20th century. Pharmaceutical institutes and faculties were established to train highly qualified specialists capable to solve the pharmaceutical problems. The research institutes were organised, which studied the chemical composition of raw material, the inventory of material, and the development of normative-technical documents, substances, the biological activity of substances were tested and the phytopreparations were introduced. Specialized farms were established to grow the medicinal plants in different botanical-geographical regions.

A great work in the field of pharmacognosy was carried out by the scientists of former Soviet Union: A.Ph. Gammerman, K.Ph. Blinov, M.A. Kusnetcova, G.P. Yakovlev, D.A. Muravyrva, M.M. Molochnikov, L.I. Eoistavi and oth.

In Azerbaijan pharmacognosy is associated with the name of Irafil Damirov Adish oglu. He is the founder of the Department of Pharmacognosy and Botany of Azerbaijan Medical University. Professor I. Damirov trained a large number of experienced and scientific experts in the field of pharmacy. He published the first textbook of pharmacognosy in the Azerbaijani language, monographs on medicinal plants of Azerbaijan. In most of his publications the information about the folk medicine of Republic is reflected and complied.

Prof. Y.B. Karimov, candidate of pharmaceutical sciences A. B. Manafov, N.A. Islamova, G.Z. Shukurov, R.B, Bagirov and G.S. Khalilov are the pupils of professor I.A. Damirov. Professor T.S. Suleimanov and J.I. Isaev, post-doctoral fellows supervised by Professor Yu. B. Kerimov in the specialty of Pharmacognosy have a great service in this field in recent years.

Mutual scientific-educational activity of technologists (prof. R.G. Aliyev, prof. A.I. Ismayilov), pharmaceutical chemists (prof. X.M. Aliyev, prof. A.I. Ismayilov), toxicologists (prof. A.Z. Babayev, prof. G.B. Iskenderov), biologists (prof. L.I. Prilipko, prof. N.M. Ismayilov) and pharmacologists (prof. D.Y. Guseynov, prof. G.B. Allahverdiyev, assistant professor P.A. Yuzbashinskaya) has a positive influence on the development of pharmacognosy in Azerbaijan.

The rich and diverse vegetation of Azerbaijan creates great opportunities for the development of pharmacognostic analysis for the solution of the following tasks: the search for biologically active substances, the determination of the areas of medicinal plants and storage of material and the production of phytopreparations.

Folk medicine based on the combination of widely used methods of treatment in certain regions. Folk medicine is based on the experience of one or many generations of people, that’s why there are different types of “folk medicine’. The accumulated experience is easily lost in disintegration of human societies or the death of the main carrier of this experience – healers. Recording information on folk medicine is a reason of the foundation of traditional medicine.

Traditional medicine is based on folk-medicine. These medical systems established in larger regions of the globe are based on the experience of significant amount of human generations. Traditional medicine are reflected in medical treatises, the most important of them are treasies of Mesopotamia, Babylon, Egypt, China and India. This traditional medicine had great influence on the formation of tibetan, greek and roman medicine. Traditional medicine covers most plants which are not included in Governmental registry and they are used for therapeutic purposes. The exception is only plants containing the cardiac glycosides and potent alkaloids.

The folk medicine formed the basis of traditional medicine, which developed in large regions of globe and based on the experience of the generation.

Medicine of each large civilization was reflected in written sources. Understanding and reading of these ancient sources and terms – is a serious scientifical problem, required the joint effort of physicians, pharmacists, botanics, ethnographists, linguists.

Empirical medicine was developing on the basis of people knowledge of one or several generations during many centuries. Folk medicine is an accumulation of information about the medications of human use and methods for treating diseases. The accumulated experience is easily lost in the disintegration of human societies or the death of the main carrier of this experience - healers.

Traditional medicine- ancient greek, roman, chinese, arabian, indian and oth. - have an influence on the development of modern scientific medicine, based on the philosophical ideas (scheme 1).

Modern scientific medicine began to take shape in Europe and North America at the end of 18th century. Scientific medicine is closely related with experiment, during which the scientific-based theories are introduced.

According to the methods and medicaitons used in the treatment of patient the therapy is divided into phytotherapy, chemotherapy, physiotherapy, zootherapy and oth.

Phytotherapy is based on the use of medicinal plant material, herbal medicine (galen) for the purpose of prevention and treatment of disease.

Organic substances of plants are more close to human organism for its nature than the synthetic preparations. That’s why there is a great bioavailability, rare adverse effects, intolerance and manifestations of drug disease. This is a very important feature of phytotherapy.

Zootherapy is the medicinal use of animals, animal raw material for prevention and treatment of diseases. Zootherapy is most commonly practiced in folk and tradiitonal medicine.

Medicine of Mesopotamia,

Banylon and Ancient Egypt

Ancient Greek

Ancient Chinese

Ancient indian

Ancient Rome

Modern traditional chinese

Modern traditional indian

Arabian

Traditinal European

Tibet

Scientific medicine

Scheme 1. The influence of system of traditional medicine on the formation of a scientific medicine.

**Tasks of current pharmacognosy, future perspectives**

1) plant chemical constituents investigations (biogenesis, ontogenic and environmental influences on accumulation of biologically active substances, the most convenient time and conditions of collection, drying and storage).

2) medicinal plant materials standardization (working out of Temporary Pharmacopoeia monographs, changing actual appropriate analytic and normative documents, improvement of evaluation methods).

3) plant resources investigation (habitation, determination of volumes for collection, restoration of rare species).

4) introduction and selection

5) plant biotechnology - the use of isolated plant cells for production of biologically active substances.

**Relation of pharmacognosy to other disciplines.**

It is important to know other disciplines for proper understanding of pharmacognosy by students, especially botany, latin language, organic chemistry, analytical chemistry, colloidal physical chemistry, pharmaceutical chemistry, biochemistry, pharmacology and oth. The botany knowledge is very important for determination and differentiation the diagnostic features of the morphological and anatomical structure of medicinal plants. In pahrmacognosy the name of medicinal plants, materials and family are written in latin language. Also, since different terms are given in Latin language, it is important to know this subject. Most compounds in medicinal plants are organic.. It is important to know the organic chemistry for more detailed information about the chemical structure. The necessary knowledge for qualitative and quantitative anaylsis of medicinal plant material and carrying out the chemical, physical-chemical methods is imparted in analytical and pharmaceutical chemistry. Colloidal physical chemistry plays a substantial role in formation of knowledge of surface activity of highly-molecular compounds and compounds of plant origin. It is necessary to know biochemistry for understanding of complex biochemical processes occured in biologically active compounds and medicinal plants. Medicinal plants contain the biologically active compounds with various pharmacological action, which are used for prevention and treatment of different diseases. Therefore, it is important to study the pharmacology subject to be informed about the pharmacological properties of these compounds.

**Ethnopharmacology**

When studying the effectiveness of herbal medicines and other nature-derived remedies, information on the traditional uses of certain extracts or even extract combinations plays a key role. The lack of studies proving the use of herbs in traditional care is especially an issue in the United States, where treatment with herbal medicine has fallen out of use since the Second World War. Herbal medicine has also been considered suspect since the Flexner Report of 1910 led to the closing of the eclectic medical schools where botanical medicine was exclusively practiced. This situation is further complicated by most herbal studies in the latter part of the 20th Century having been published in languages other than English such as German, Dutch, Chinese, Japanese, Korean and Persian. As it may be more difficult to review foreign language publications, much of the relevant information may be unavailable to English speaking scholars. Some of the important botanicals have been incorporated into the U.S. Food and Drug Administration (FDA) determinations of drug safety. In 1994, US Congress passed the Dietary Supplement Health and Education Act (DSHEA), regulating labeling and sales of herbs and other supplements. Most of the 2000 US companies making herbal or natural products choose to market their products as food supplements that do not require substantial testing.

**Homeopatic medicine** is one of the department of therapy. Medicinal plants and animals are more widely used in homeopathic medicine than in allopathic.

The word “homeopathy” is derived from the greek “homoios” meaning similar and “pathos” meaning sufferinig. Homeopathy is an therapy originated by german physician and researcher Samuel Friedrich Hahnemann. In classical homeopathic the prescription of medicine is based upon individual patient’s characteristics and symptom picture.

The complex preparations included more than 10 homeopathic substances of various origin are widely used in recent years. At present the homeopathic preparations are produced under factory conditions and in extremely small doses, ten- fold and hundred-fold dilutions are used. There are many hypotheses about the effects of homeopathic preparations. However there is not single theoretical basis of mechanism of action of extremely small doses. The use of homeopathic preparations eliminate the following factors: adverse effects, intoxicaiton, contraindications and age. Homeopathic preparations are prescribed for the treatment of oncological and infectious diseases by taking the preparations of scientific allopathic medicine. Homeopathic treatment has legal recognition of many countries especially in Germany, England, France, India, Pakistan, Russia, the USA, Canada and oth.

**Issues in phytotherapy**

The part of pharmacognosy focusing on use of crude extracts or semi-pure mixtures originating from nature, namely phytotherapy, is probably the best known and also the most debated area in pharmacognosy. Although phytotherapy is sometimes connected to alternative medicine, when critically conducted, it may be considered the scientific study on the effects and clinical use of herbal medicines.

**Constituents and drug synergyism**

One characteristic of crude drug material is that constituents may have an opposite, moderating or enhancing effect. Hence, the final effect of any crude drug material will be a product of the interactions between the constituents and the effect of each constituent on its own. To effectively study the existence and affect of such interactions, scientific studies must examine the effect that multiple constituents, given concurrently, have on the system. Herbalists assert that as phytopharmaceuticals rely upon synergy for their activities, plants with high levels of active constituents like ginsenosides or hypericin may not correlate with the strength of the herbs. In phytopharmaceutical or herbal medicine, the therapeutic effects of herbs cannot be determined unless its active ingredient or cofactors are identified or the herb is administered as a whole. One way manufacturers have attempted to indicate strength is to engage in standardization to a marker compound. Companies use different markers, or different levels of the same markers, or different methods of testing for marker compounds. Many herbalists believe that the active ingredient in a plant is the plant itself.

**Herb and drug interactions**

The Sloan Kettering Memorial Cancer Center stated, in a review of a juice product, which had been marketed as preventing cancer that antioxidants could theoretically interfere with chemotherapy. A recent review of the effect of antioxidants on chemotherapy, however, found no evidence for any deleterious effects of antioxidants on chemotherapy. A study of herb drug interactions indicated that the vast majority of drug interactions occurred in four classes of drugs, the chief class being blood thinners, but also including protease inhibitors, cardiac glycosides and the immuno-suppressant ciclosporin.

The major herbs that have caused interactions include St. Johns Wort, which will counteract immunosuppressive drugs and interfere with digoxin and protease inhibitors. A complete list can be found at: http://www.herbological.com/images/SJW\_table.pdf. The constituents of garlic, peppermint and milk thistle have been shown to have effects on the CYP3A4 enzymes in vitro, but it is not clear whether these constituents will have the same effect in vivo (humans).

**Loss of biodiversity**

Farnsworth for example, has found that 25% of all prescriptions dispensed from community pharmacies in the United States from 1959 to 1980 contained active ingredients extracted from higher plants. In some countries in Asia and Africa 80% of the population relies on traditional medicine (including herbal medicine) for primary health care.

Constituents of substances used by traditional healers, have rarely been incorporated into modern medicine. [Quinine](http://en.wikipedia.org/wiki/Quinine), [physostigmine](http://en.wikipedia.org/wiki/Physostigmine), d-[tubocurarine](http://en.wikipedia.org/wiki/Tubocurarine), [pilocarpine](http://en.wikipedia.org/wiki/Pilocarpine) and [ephedrine](http://en.wikipedia.org/wiki/Ephedrine), have been demonstrated to have active effects.Knowledge of traditional medicinal practices is fast disappearing, particularly in the Amazon, as native healers die out and are replaced by more modern medical practitioners. Botanists and pharmacologists are racing to learn these ancient practices, which, like the forest plants they employ, are also endangered.

An explanation for some species loss is habitat lost due to [invasive species](http://en.wikipedia.org/wiki/Invasive_species) introduction. Herbalist [David Winston](http://en.wikipedia.org/wiki/David_Winston) has suggested that a high proportion of nonnative species seen as invasive ([kudzu](http://en.wikipedia.org/wiki/Kudzu), Japanese knotweed, mimosa, lonicera, St. Johnswort and purple loosestrife) may be harvested for the domestic herbal medicine market.

Species extinction is not only due to habitat loss. Overharvesting of medicinal species of plants and animals also contributes to species loss. This is particularly notable in the matter of [Traditional Chinese Medicine](http://en.wikipedia.org/wiki/Traditional_Chinese_Medicine) where [crude drugs](http://en.wikipedia.org/wiki/Crude_drugs) of plant and animal origin are used with increasing demand. People with a stake in TCM often seek chemical and biological alternatives to endangered species because they realize that plants and animals lost from the wild are also lost to medicine forever but different cultural attitudes bedevil conservation efforts. Still conservation is not a new idea: Chinese advice against [overexploitation](http://en.wikipedia.org/wiki/Overexploitation) of natural medicinal species dates from at least [Mencius](http://en.wikipedia.org/wiki/Mencius), a philosopher living in the 4th century BC.

Cooperation between western conservationists and practitioners have been beset by cultural difficulties. Westerners may emphasise urgency in matters of conservation, while Chinese may wish for the products used in TCM to remain publicly available. One repeated fallacyis that [rhinoceros](http://en.wikipedia.org/wiki/Rhinoceros) horn is used as an aphrodisiac in TCM. It is, in fact, prescribed for fevers and convulsions by TCM practitioners. There are no peer-reviewed studies showing that this treatment is effective. In 1995 representatives of the oriental medicine communities in Asia met with conservationists at a symposium in Hong Kong, organized by [TRAFFIC](http://en.wikipedia.org/wiki/TRAFFIC). The two groups established a clear willingness to cooperate through dialogue and mutual understanding. This has led to several meetings, including the 1997 First International Symposium on [Endangered Species](http://en.wikipedia.org/wiki/Endangered_Species) Used in Traditional East Asian Medicine where China was among 136 nations to sign a formal resolution recognizing that the uncontrolled use of wild species in traditional medicine threatens their survival and the continuation of these medical practices. The resolution, drawn up by the UN Convention on International Trade in Endangered Species ([CITES](http://en.wikipedia.org/wiki/CITES)), aims to initiate new partnerships in conservation.

**Sustainable sources of plant and animal drugs**

As species face loss of habitat or overharvesting, there have been new issues to deal with in sourcing crude drugs. These include changes to the herb from farming practices, substitution of species or other plants altogether, adulteration and cross-pollination issues. For instance, ginseng which is field farmed may have significant problems with fungus, making contamination with fungicides an issue. This may be remedied with woods grown programs, but they are insufficient to produce enough ginseng to meet demand. The wildcrafted echinacea, black cohosh and American ginseng often rely upon old growth root, often in excess of 50 years of age and it is not clear that younger stock will have the same pharmaceutical effect. Black cohosh may be adulterated with the related Chinese actea species, which is not the same. Ginseng may be replaced by ginseniodes from Jiaogulan which has been stated to have a different effect than the full panax root.

The problem may be exacerbated by the growth of pills and capsules as the preferred method of ingesting medication as they are cheaper and more available than traditional, individually tailored prescriptions of raw medicinals but the contents are harder to track. Seahorses are a case in point: Seahorses once had to be of a certain size and quality before they were accepted by practitioners and consumers. But declining availability of the preferred large, pale and smooth seahorses has been offset by the shift towards prepackaged medicines, which make it possible for TCM merchants to sell previously unused juvenile, spiny and dark-coloured animals. Today almost a third of the seahorses sold in China are prepackaged.

The farming of plant or animal species, used for medicinal purposes has caused difficulties. Rob Parry Jones and Amanda Vincent write:

One solution is to farm medicinal animals and plants. Chinese officials have promoted this as a way of guaranteeing supplies as well as protecting endangered species. And there have been some successes—notably with plant species, such as American ginseng—which is used as a general tonic and for chronic coughs. Red deer, too, have for centuries been farmed for their antlers, which are used to treat impotence and general fatigue. But growing your own is not a universal panacea. Some plants grow so slowly that cultivation in not economically viable. Animals such as musk deer may be difficult to farm, and so generate little profit. [Seahorses](http://en.wikipedia.org/wiki/Seahorses) are difficult to feed and plagued by disease in captivity. Other species cannot be cultivated at all. Even when it works, farming usually fails to match the scale of demand. Overall, cultivated TCM plants in China supply less than 20 per cent of the required 1.6 million tonnes per annum. Similarly, China's demand for animal products such as musk and pangolin scales far exceeds supply from captive-bred sources.

Farming alone can never resolve conservation concerns, as government authorities and those who use Chinese medicine realise. For a start, consumers often prefer ingredients taken from the wild, believing them to be more potent. This is reflected in the price, with wild oriental ginseng fetching up to 32 times as much as cultivated plants. Then there are welfare concerns. Bear farming in [China](http://en.wikipedia.org/wiki/China) is particularly controversial. Around 7600 captive bears have their bile "milked" through tubes inserted into their gall bladders. The World Society for the Protection of Animals states that bear farming is surrounded by "appalling levels of cruelty and neglect". Chinese officials state that 10 000 wild bears would need to be killed each year to produce as much bile, making bear farming the more desirable option. The World society for the Protection of Animals, however, states that "it is commonly believed in China that the bile from a wild bear is the most potent, and so farming bears for their bile cannot replace the demand for the product extracted from wild animals".

One alternative to farming involves replacing medical ingredients from threatened species with manufactured chemical compounds. In general, this sort of substitution is difficult to achieve because the active ingredient is often not known. In addition, most TCM users believe that TCM compounds may act synergistically so several ingredients may interact to give the required effect. Thus TCM users often people prefer the wild source. [Tauro ursodeoxycholic acid](http://en.wikipedia.org/w/index.php?title=Tauro_ursodeoxycholic_acid&action=edit&redlink=1), the active ingredient of [bear bile](http://en.wikipedia.org/wiki/Bear_bile), can be synthesised and is used by some Western doctors to treat gallstones, but many TCM consumers reject it as being inferior to the natural substance from wild animals.

**Major terms**

1. **Medicinal plants** are plants (wild or cultivated) used for medicinal purposes.
2. **Medicinal plant materials** (crude vegetable drugs, or herbal materials) are entire medicinal plants or their parts, used in dried (sometimes in fresh) forms in order to obtain medicinal substances, plant drug preparations (phytopharmaceuticals) or other medicines, permitted for medicinal use.
3. **Herbal medicines** include herbs, herbal materials, herbal preparations and finished herbal products.
4. **Herbs**include crude materials which could be derived from lichen, algae, fungi or higher plants, such as leaves, flowers, fruit, fruiting bodies, seeds, stems, wood, bark, roots, rhizomes or other parts, which may be entire, fragmented or powdered.
5. **Crude drugs** are vegetable or animal drugs that consist of natural substances that have undergone only the processes of collection and drying.
6. **Medicinal products** are substances or their mixtures of natural, synthetic, or biotechnological nature, used for prophylaxis, diagnosis and treatment of human diseases, or intended to change the physiological state and functions of the organism.
7. **Medicinal plant products** may be divided into the following groups:
8. 1). crude products (powder, tea, herbal collections)
9. 2). galenical and neogalenical phytopharmaceuticals (hydroalcoholic tinctures, fluid extracts)
10. 3). primary processed plant products (volatile and fixed oils, resins)
11. 4). individual principles (alkaloids, glycosides).
12. **Herbal materials** include, in addition to herbs, fresh juices, gums, fixed oils, essential oils, resins and dry powders of herbs. In some countries, these materials may be processed by various local procedures, such as steaming, roasting or stirbaking with honey, alcoholic beverages or other materials.
13. **Herbal preparations**are the basis for finished herbal products and may include comminuted or cut herbal materials, or extracts, tinctures and fatty oils of herbal materials. They are produced by extraction, fractionation, purification, concentration, or other physical or biological processes. They also include preparations made by steeping or heating herbal materials in alcoholic beverages and/or honey, or in other materials.
14. **Finished herbal products**consist of herbal preparations made from one or more herbs. If more than one herb is used, the term “mixture herbal product” can also be used. Finished herbal products and mixture herbal products may contain excipients in addition to the active ingredients. However, finished herbal products or mixture herbal products to which chemically defined active substances have been added, including synthetic compounds and/or isolated constituents from herbal materials, are not considered to be herbal.
15. **Biologically active substances** affect the biological processes in human and animal organisms. Medicinal substances are the biologically active substances that may change the physiological state and function of the organism, may have the prophylactic, diagnostic or therapeutic effects and be used in manufacturing of medicinal preparations. These **active constituents** are differentiated from **inert constituents**, which also occur in plant and animal drugs.
16. **Pharmacologically active constitutuens** are responsible for the therapeutic activity of the drug. The single chemicals are exemplified by sugars, starches, plant acids, enzymes, glycosides, steroids, alkaloids, proteins, hormones and vitamins. The mixtures include fixed oils, fats, waxes, volatile oils, resins, oleoresins, oleo-gum-resins, and balsams.
17. **Constituents with known therapeutic** **activity**are substances or groups of substances which are chemically defined and known to contribute to the therapeutic activity of a herbal material or of a preparation.
18. **Markers** are chemically defined constituents of a herbal material utilized for control purposes. They may or may not contribute to the clinical efficacy. When they contribute to the clinical efficacy, however, evidence that they are solely responsible for the clinical efficacy may or may not be available. Markers are generally employed when constituents of known therapeutic activity are not known or are not clearly identified, and may be used to identify the herbal material or preparation or calculate their quantity in the finished product.
19. The herbal material(s) or the herbal preparation(s) will be considered to be **active ingredient(s)** of a herbal medicine(s). However, if constituents with known therapeutic activities are known, the active ingredients should be standardized to contain a defined amount of this/these constituent(s).
20. **Therapeutic activity** refers to the successful prevention, diagnosis and treatment of physical and mental illnesses, improvement of symptoms of illnesses, as well as beneficial alteration or regulation of the physical and mental status of the body and development of a sense of general well-being.