



# Pharmacies for pain and trauma in ancient Greece

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## Abstract

**Purpose** To summarize pharmacies for pain and trauma in ancient Greece, to present several pharmaceutical/therapeutical methods reported in myths and ancient texts, and to theorize on the medical explanation upon which these pharmacies were used.

**Method** A thorough literature search was undertaken in PubMed and Google Scholar as well as in physical books in libraries to summarize the pharmacies and pain practices used for trauma in ancient Greece.

**Results** Archeological findings and historical texts have revealed that humans have always suffered from diseases and trauma that were initially managed and healed by priests and magicians. In early Greek antiquity, the term pharmacy was related to herbal inquiries, with the occupants called charmers and pharmacists. Additionally, apart from therapeutic methods, ancient Greeks acknowledged the importance of pain therapy and had invented certain remedies for both acute and chronic pain management. With observations and obtaining experience, they used plants, herbs, metals and soil as a therapeutic method, regardless of the cultural level of the population. They achieved sedation and central and peripheral analgesia with opium and cold, as well as relaxation of smooth muscle fibers and limiting secretions with atropina.

**Conclusion** History showed a lot of experience obtained from empirical testing of pain treatment in ancient people. Experience and reasoning constructed an explanatory account of diseases, therapies and health and have provided for the epistemology of medicine.

**Keywords** Pharmacies · Pain · Herbs · Plants · Drugs · Opium · Mint · Sulfur · Metals · Soil · Ancient Greece

## Introduction

Humans have always suffered from diseases and trauma that were initially managed and healed by priests and magicians who enjoyed the respect and adulation of their community [1–16]. In early Greek antiquity, precise terms for medicine that had roots in the community tradition were used; the term pharmacy was related to herbal inquiries and the occupants were charmers and pharmacists [2]. In Greek mythology, Pain

was the son of Erida and the grandson of Night, and was the punishment of humans for accepting the theft of fire by Prometheus [2, 3]. According to another myth, ancient Greeks considered that god Apollo was sending punishment (pain) transformed into a dragon to the Argeans to punish them for having killed his son Linus [2, 3]. Apart from therapeutic methods, ancient Greeks acknowledged the importance of pain therapy and had invented certain remedies for both acute and chronic pain management [4, 13–20]. With observations and obtaining experience, they used plants, herbs, metals and soil as a therapeutic method, regardless of the cultural level of the population. They achieved sedation, central and peripheral analgesia with opium (inhibition of pain perception) and cold (inhibition of pain pathways), as well as relaxation of smooth muscle fibres and limiting secretions with anticholinergics (atropine); these are some parts of the current concepts of analgesia and anaesthesia [3, 4].

This historic review aims to summarize the depiction of pharmacies and various pain regimens for trauma in mythology and Greek antiquity, to present the atmosphere of the era concerning the preparation and administration of drugs, as well as to theorize on the medical explanation upon which these pharmacies were used.

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## Hippocratic pharmacies

Hippocrates (460–377 BC) described four humours (body juices, temperaments) that were in equilibrium in healthy humans and corresponded to the four structural elements of nature: bile (yellow bile, fire), black bile (black bile, earth), blood (blood, air) and phlegm (mucus, water) (Fig. 1). Based on this, he categorized humans' temperaments as melancholic, sanguine, phlegmatic and choleric, and he recommended treating diseases with laxatives, emesis and exsanguination with suction cups or phlebotomy to remove diseased humours and return to proper function [3, 4, 20, 21].

Hippocratic Medicine provided analgesia with various types of medication, especially diets and baths (loutrotherapy or balneotherapy), and vapours from pharmaceutical plants and herbs. Pharmaceutical forms of analgesics were powders, masks for coatings, plasters and patches for topical application, tablets, pills, pads for internal use, pens and gels (forms of suppositories). The Hippocratic corpus referred to 277 pharmaceutical plants categorized according to their therapeutic properties and their use in various diseases. He used bitter powder from the bark of the tree willow as well as a decoction of willow or poplar leaves for the treatment of pain and fever. This is the first report of suppression (via salicylates) of mediators of inflammation (cytokines and prostaglandins) being responsible for peripheral pain [3, 4, 20, 21]. It is apparent that Hippocratic practice dispensed Medicine from the influence of philosophical theories and mythical worship of the gods, and provided a major evolution of Medicine and Pharmacy.

## Plants and herbs

Excavations in Greece revealed an impressive abundance of plants and seeds. The climate and soil of the Aegean islands

and seas sides were favourable for the growth of rare fossil flora (paleoflora) such as olive plants (Santorini island), schinos (*Pistacia lentiscus*; Chios island) and palm trees (*Chamaetoes humilis* and *Phoenix theophrastii Greuter*; Kos, Rhodes and Crete islands). Observational and empirical knowledge contributed to the fact that some plants had a therapeutic effect for humans and animals; they also determined the quantity for a therapeutic rather than a toxic effect. Excavated material also showed the use of plants as flavour enhancers, medicines and cosmetics 60,000 years ago [22].

The pharmacological properties of the plants were known since the Homeric era, as shown by the use of plants and herbs in mythical heroes. Homer delivered information from which emerged the knowledge of pharmacology and trauma healing. His texts included many drugs such as euphoric (joyful), thymophora (deadly), salvation (against sadness), anti-inflammatory and analgesics [23–27]. The first report of a drug appeared in the Homeric texts; the meaning was both medicine and poison at the same time, and ranged from euphoria, imam and spell to dangerous poison with multiple equivalents [1]. In *D rhapsody of Ilias*, Homer wrote that a doctor would look at the patient quickly and would lay herbs on the wounds to relieve the pain. These epic texts were not so much interested in the composition of drugs as to their effects [28].

A typical example of a charmer who used a pharmaceutical herb was Circe, a goddess of magic or a witch, the daughter of the Titan sun god Helios and Perse, one of the 3000 Oceanid nymphs. According to the myth, Circe seemed to be producing a herb with psychotropic properties that caused illusions [25, 28]. The herb was put in a mixture called kikeon (*κυκεώνας*, meaning admixture and confusion) which contained cheese (amino acids tyramine, casein, animal fat and calcium caseinate), honey and wine. Wine can perfectly be regarded as a means of dissolving alkaloids. Odysseus' companions ate the mixture and drank the herb, and were

**Fig. 1** The four humours (temperaments) of Hippocratic medicine: choleric, sanguine, melancholic and phlegmatic (seventeenth century AD, Charles Le Brun, part of the Grande Commande, the Palace of Versailles)



transformed into pigs (Fig. 2). However, transformation to pigs was not intended literally but refers to anticholinergic intoxication and hallucinogenic action of the herb. Eurylochus escaped and informed Odysseus. God Hermes gave Odysseus the antidote (a magical herb called by Homer moly) to remove the spells of Circe [28]. The hallucinogenic herb was probably grass such as barley, wheat, or rye. Diseased grasses show the mycelium of the fungus *Claviceps purpurea* that contains ergot alkaloids (ergometrone, ergonovine and ergovasin); ergot alkaloids have been used for the treatment of various pain syndromes as well as migraines later on, and lysergic acid (diethylamide) that is a known hallucinogenic (LSD) [25–28]. The antidote herb moly was probably *Galanthus nivalis* that contains the galanthamine alkaloid, a cholinergic agonist and acetylcholinesterase inhibitor. According to other researchers, the moly was *Fritillaria meleagris* or a species of tulips [29–31]. Albert Hoffman of Sandoz in 1948 produced a synthetic product with weak hallucinogenic activity. It is speculated that a form of LSD can be synthesized from *Claviceps purpurea*-infected cereals and grasses because of the ergot alkaloids produced by the fungus [25, 28]. The galanthamine synthetic derivative of the plant is currently used to reduce muscle relaxation and gastrointestinal and bladder gastric atony and to treat Alzheimer's disease (Reminyl®, Janssen-Cilag Pharmaceuticals, Johnson & Johnson, New Brunswick, USA); it may cause hallucinations and amnesia [25, 28].

When Homer was describing a person in the Odyssey, he usually used one or more adjectives to identify that person instead of his name; the adjectives he used for Circe were polypharmacus, respected, aubergine and elusive [1, 2, 25]; she was a specialist of attraction and illusion with quest for pleasure [28]. This report of herb-poison and drug-antidote by Homer put an end to religious therapies by priests; the Homeric physicians had knowledge of drug preparation and procurement from plants and soil [23–27] and put the basis of the pharmacological and toxicological knowledge [28].



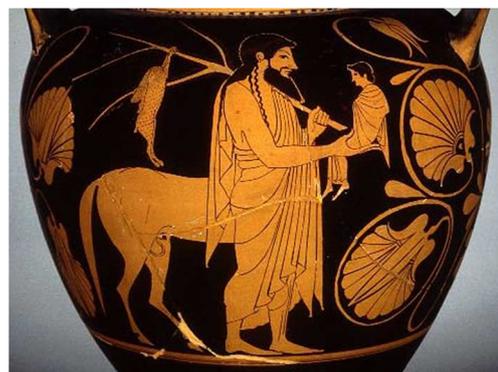
**Fig. 2** Wine cup (kylix) depicting Circe offering the kikeon to Odysseus and his transformed men (Greek Archaic Period, sixth century BC, Museum of Fine Arts, Boston)

In Greek mythology, the Trojan War (thirteenth or twelfth century BC) was waged against the city of Troy by the Achaeans after Paris of Troy took Helen from her husband king Menelaus of Sparta. Helen was called by Achilles horrible and oregonon [28]. The wilted common plants of the Greek countryside stimulate the uterus and cause contractions when taken in large doses. The genus of *Origanum* that includes various species of pharmaceutical plants such as dictamus, majorana and vulgare have healing properties and have been linked to the cessation of pregnancy; this is why Achilles was calling Helen with this adjective [28].

Powders (pulveres adspergenti) are pharmaceutical formulations of modern Pharmacoepias [2]. Peionon was called to heal Mars (god of war) and Hades (god of death and underworld) by application on their wounds powder of analgesic herbs. In Iliad, the heroes never get sick; they live or die, and if they get injured, a miracle god makes sure they do not die [28]. The wounded Evripylus asked Patroclus to pull the arrow from his thigh and put analgesic herbs on it, as Achilles taught him, who has been taught medicine from the Centaurus Chiron in mountain Pelion (Fig. 3) [28].

According to Pausanias (second century AC), in Chaeronea, there was a type of pharmaceutical industry of the era, where they produced analgesic ointments from flowers of lily, rose, narcissus and iris [32]. Greek and Roman physicians mixed these pharmaceutical plants with other common grasses that had no effect, thus introducing the concept of the excipient, a component without pharmacological action that facilitates the intake of the active drug. They knew that the alkaloids did not dissolve in water but only in organic solvents; therefore, they mixed them with wine [33–35].

According to Euripides (480–406 BC), Heracles suffered from epilepsy, the Heracleian or sacred disease that is a complex crisis of focal epilepsy. The first attempt to diagnose and treat the Heracleian disease with scientific



**Fig. 3** Centaurus Chiron holding Achilles (Attica amphora, 520 BC, Louvre museum, Paris, France)

criteria without religious prejudices refers to Hippocrates' work "On Sacred Disease" (fifth century BC) where the cause of the disease and epileptic seizures are clearly described. Hippocrates considered the disease an organic brain damage, with a hereditary predisposition, and rejected any relation with supernatural phenomena and divine origin, as previously believed. He also recommended a ketone diet that is still applied to resistant childhood epilepsy, and administered mixtures of herbs, some of which have GABA-depressant action on the central nervous system such as *Valeriana officinalis* (valerian) and *Passiflora incarnata* (passion flower) with currently acknowledged sedative and analgesic effects [1–9].

In *Argonautica*, a Greek epic poem written by Apollonius Rhodius (third century BC), Jason was promised the golden fleece by King Aetes of Colchis (current Black Sea, coast of Georgia) if he could first yoke the Khalkotauroi (Colchis bulls). They were two immense bulls with bronze hooves, and bronze mouths through which they breathe fire; they were a gift of god Hephaestus to King Aetes. Medea, King Aetes' daughter and a pharmacist, fell in love with Jason; to protect him from the breaths of the Khalkotauroi, she gave him an unguent with which to anoint himself and his weapons, to protect from the bulls' fiery breaths. Thus, Jason survived the burning flames of the bronze bulls. The ointment of Medea was the first report of the drug *Colchicum autumnale*, commonly known as autumn crocus from which colchicine is extracted [36–39].

## Mint

Hippocrates considered mint as a cooling agent for peripheral pain. Mint has spasmolytic, anti-inflammatory and cooling properties [40]. The active ingredients in mint's leaves and sprouts contain 1 to 2% essences (menthol), tannins or tannoids and flavonoids. Menthol is a powerful antibacterial agent [41]. Mint and peppermint have been used in the treatment of irritable bowel syndrome and as gastro-protectors by increasing mucus and prostaglandin E2 (PGE2) production [8, 20]. Mint compounds bind to the TRPM8 receptors of nerve cells in the human skin. The TRPM8 protein is expressed in sensory neurons and is activated by cold, and inhibits the pain pathways and centre of pain in the central nervous system [42]. Clinical studies have shown that alcoholic solution of mint essence and eucalyptus oil stimulates A-D fibers and inhibit expression of pain. The essences of these plants stimulate the cold receptors on the skin, partially inhibiting expression of pain. It has been reported that 1 g of paracetamol or aspirin has the same efficacy in the treatment of migraine pain with 10% alcoholic solution of mint essence [42].

## Essences and myrrh

Essences are concentrated hydrophobic liquids that contain volatile aromatics and emit the aroma-characteristic of the plant of origin; ethereal or volatile oils are complex, aromatic odor and oily composite plant mixtures of various compounds that evaporate at ambient normal temperature [30, 31, 43, 44]. Myrrha or myrrh is an extract derived from many species of the genus *Commiphora Jacq.* It is one of the oldest essences, expensive and rare; its use by people shows financial welfare [28, 30]. People involved in essences and myrrh seemed to have a deep knowledge of the healing properties of the respective plants from which these were extracted. For instance, rose oil is an ethereal oil obtained by steam distillation from the flowers of *Rosa gallica*, *Rosa Geranium*, *Rxdamascena*, *Rxcentifolia* and others [28–31].

Cretans knew the properties, preparation techniques and use in medicine of essences. Distillation was done in the Minoan period between 1900 BC and 1700 BC [30]. In the Trojan war, the dead king Hector and Patroclus were covered with rose oil for embalming [28, 30]. Homer described goddess Aphrodite (Venus) to apply pharmaceutical essences (aromatherapy); "from a small clay pot used to store the rose, Aphrodite takes a portion with her fingertips, heats it on her palms until it becomes thin to be absorbed better and she puts it gently on the injured, scratched skin of Hector" to relieve pain and heal the wounds [28]. Achilles ordered for the dead Patroclus to be cleaned, his hair washed, and total body and wounds covered with essences and myrrh (Fig. 4) [28, 30]. Nowadays, essential oils are very useful in dental pain and may contribute to improving the quality of dental treatments [30]. Additionally, in modern manufacturing, rose geranium oil is used as an inexpensive substitute for rose oil. It is also used as fragrance in soaps, cosmetics and perfumes but also as a painkiller [31].



Fig. 4 Achilles treating Patroclus' wound at Trojan war (Greek stamps mythology, 1959; image from Attica vase, Berlin museum)

## Soil

Besides the plants, soil was also used in ancient medicine. The soil at Lemnos island was blessed by priestesses of Hephæstia (capital of Lemnos); the ceremony was done early in the morning, so that the soil was moist and soft. It was then transported to the city, where after preparation it was packed in tablets. This is the first standardized formulation of drug in the history of medicine. In Iliad (718–25 BC), the Achæans left Philoctetes in Lemnos to have his contaminated wounds healed with application of blessed soil of the island. After wound healing, he traveled to Troy, because according to the myth, it would not be possible to conquer Troy without him [28, 45]. Herodotus also considered soil from Lemnos to be curative for contaminated wounds, hemostatic, highly analgesic, antipyretic, antiulcer and antidote to poisons [28, 43, 45].

## Opium

Poppy is a flowering plant of the subfamily *Papaveroideae* of the family *Papaveraceae* from which opium is extracted. Opium is associated with specific opioid receptors in the central nervous system; morphine is the major analgesic contained in the opium and is the standard opioid agonist. Sleep can be caused by the common poppy (*Papaver rhoeas*) and death by the opium poppy (*Papaver somniferum*).

In ancient Greece, poppy was the holy plant of the goddess Dimitra and symbolized the presence of Dimitra in the spring corps [25, 35]. In the Eleusinian Mysteries, the religionists were bringing jars with poppies for the worship of Dimitra [45–47]. The poppy was also used as a symbol of sleep, peace and death because of its sedative properties [48–50]. The Greeks were well aware of the hypnotic and narcotic properties of the poppy. In Theogony of Hesiod, the sons of Hades, *Ypnos* (ὕπνος, sleep) and *Thanatos* (θάνατος, death) were living in Tartarus as wicked Gods and were portrayed to hold poppies in their hands [48].

Hesiod (eighth century BC) reported that in the area of Corinth there was a city called Mekones (Μήκωνος, meaning poppy-town) with extensive poppy cultivation [48, 49]. The Greek-Minoan civilization indicated the importance of suppression of the central nervous system by portraying the goddess of Mekones (1450 BC) with a crown of poppy sprouts and flowers in her head; this depicts the knowledge of the ancient Greeks for the location of the centre of pain in the brain (Fig. 5) [47, 49, 51]. Writings were found on *Papaver somniferum* for both medical and entertaining purposes; *Papaver somniferum* was used not only to relieve pain but also as an elixir of euphoria, and was called by the Sumerians “plant of joy” [25, 26]. Cultivation and use of the *Papaver somniferum* was demonstrated by the Great



**Fig. 5** The Minoan poppy goddess (Greek-Minoan civilization, twelfth century BC, Archeological museum of Heraklion, Crete, Greece)

Goddess of Crete and depicted in jewels her priestesses were wearing [25, 52]. Hippocrates reported that the poppy juice could be given as a hypnotic, narcotic, astringent and laxative drug. Besides its use as a soothing and analgesic medicine, opium was also given as a poison. Philosopher Socrates was voted guilty of refusing to recognize the gods and of corrupting the youth by a jury of 500 Athenian democrats; he was sentenced to death and was offered to choose between the conium (poison hemlock) and opium (poppy juice) [8, 21, 49]. Opium was further mentioned thereafter in 50 BC by Virgil, in 100 AD by Dioscorides in Athens, and in 130 AD by Pliny the elder and Galen [25, 35]. Roman Scribonius Largus, a physician and pharmacologist of Emperor Claudius, described in *Compressum Medicamentorum* how opium was prepared. He stated that opium is present in the milky juice of immature poppies, which contained the seeds that are then dried. Overdosage and poisoning was reported on several occasions, and sometimes the use of opium was ineffective [53].

## Metals

In antiquity, they used incandescent (burning) metal tools to treat wounds as haemostatic and as cutters to remove pathological tissue from the body and to amputate diseased limbs [10–12]. Metals have been also used for their antiseptic, wound healing and subsequently analgesic properties. The antiseptic and wound healing properties of copper were known since the time of Hippocrates; he used copper to disinfect ulcers from varicose veins and treated painful wounds and skin problems with copper and honey [4, 8, 54–57]. Slaves rarely experienced rheumatic or arthritic problems and contaminated wounds because they were chained with copper strips in their wrists

and ankles that protected them from such diseases [4, 8, 20, 54–57].

In the first Trojan war, the Greeks by incorrect naval calculations disembarked in Mysia and attacked the city mistaking it for Troy. The king of Mysia Telephus, the son of Heracles and Auge, routed the Greeks and forced them back to their ships. The Mysians were victorious, and the Greeks returned home. Telephus was wounded in the thigh by Achilles' spear. Because his wound was not healing, he consulted the oracle of Apollo at Delphi who answered “ὁ τρώσας ἴσεται” (meaning the man who injured you, will heal you). Then, Telephus went to Argos, where the Greeks were assembling for the second Trojan war, to seek cure by Achilles in return to guide the Greeks to Troy. There, Achilles healed Telephus by putting on his wound a few chips from his spear; rust scraped from Achilles spear was the healing/analgesic agent (Fig. 6) [28].

## Sulfur

Ancient Greeks used sulfur as a disinfectant, for cleansing and killing insects. Eurycleia, the wet-nurse of Odysseus, was the only person to recognize him without him first revealing himself after his return home from the Trojan War. After Odysseus entered his own house as a guest of Penelope disguised as a beggar, Eurycleia bathes him and recognizes him by a scar just above his knee, which he got from a boar while hunting with his grandfather. Odysseus stops her from telling Penelope or anyone else in the house of his true identity, and asks her to bring him “sulfur to clear the evil, and fire to clean the palace” [28]. Achilles also used sulfur to clean his bowl, but probably this cleansing was more ceremonial [28]. In the tragedy of Euripides Helen, the Egyptian witch Theonie told Helen to clean his way with sulfur [58]. Homer, in different occasions describing the lightnings of god Zeus, emphasized on the odor of sulfur. When Ajax the Telamonian injured Hector, the latter



**Fig. 6** Marble depicting Achilles (right) healing the seated Telephus, son of Heracles, with rust from his spear (first century BC, Herculaneum, Naples, National Archaeological Museum of Greece)

“fell like an oak hit by lightning with a heavy smell of sulfur around” [28]. In fact, during the various electrical outbursts of lightning, ozone is formed, the odor of which is similar to that of sulfur dioxide [28].

## Other options for analgesia and anesthesia in antiquity

Local pressure proximal to the site of trauma or surgery was found to help control pain [59, 60]. By applying pressure on both the vessels and the nerves, it was found that pain could be numbed; pressure over the brachial plexus provided at least suboptimal anesthetic/analgesic conditions for hand surgery. Bilateral local pressure over the carotid arteries rendered patients unconscious, an ineffective method to temporally sedate patients as after removal of the pressure the patient regained consciousness very quickly, while prolonged pressure led to fatal consequences [59, 60]. Physical attempts at anesthesia including a blow to the head were also frequently employed [59].

Hemlock (conium, the poison ingested by Socrates that caused his death), alcohol, laudanum (a mixture of alcohol with opioids) and dwale a combination of various ingredients such as bile of a boar, lettuce, vinegar, bryony root, hemlock, opium and henbane were essential pharmacies for pain control during and after surgical interventions in antiquity. It is, however, noteworthy that the poor methodology of administration, the lack of dosing control and the inability to tailor therapeutic interventions to patients' needs was the major shortcoming of anaesthesia and pain therapy in Greek antiquity [3].

## Conclusion

History shows a lot of experience obtained from empirical testing of pain treatment in ancient people. They combined *peira* (experience, the judge of what is plainly apparent) and *logos* (reasoning, what anyone can plausibly twist for himself) to construct an explanatory account of diseases, therapies and health, and to establish scientific conclusions. Currently, *peira* alone is a limited tool; trials and errors provide the chance to suggest a possible course of action, and repeated testing confirms or disconfirms efficacy of treatments [61, 62].

## Compliance with ethical standards

**Conflicts of interest** The authors declare that they have no conflicts of interest.

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