Greek Science, Technology, and Agriculture

3200–2000 BCE Bronze Age, Evidence of civilization in mainland Greece and neighboring islands
2000–1600 BCE First Greek-speaking Indo-Europeans Urban civilization in Crete Royal tombs at Mycenae, northeast Peloponnese
1400–1300 BCE Mycenaean kingdoms developed an agriculture including irrigation and the draining of Lake Coapis

1200–800 BCE Greek Middle Ages Mycenaean culture gave way to Greek City States. Period known to us from the stories of the Iliad and the Odyssey, epic poems attributed to Homer that tell the story of the Trojan Wars (lost city of Troy in present day Turkey). Part of Greek oral tradition.
750–450 BCE  Period of Hellenism.
Great period of Greek colonization probably instigated by the shortage of arable land on the Greek mainland.
Colonization extend as far west as Spain (Iberia) and as far east as Northern Boundary of the Black Sea.
As a result most of the famous Greek temples occur outside of Greece: Agricento in Sicily, Paestum (Italy) Ephesus and Pergamont (Turkey).
The Greek Miracle: innovation in the field of thought and technology.

Greek Colonization 750–450 BCE

5th Century BCE  Golden Age of Greece
Familiar to us through architecture (Parthenon) and magnificent art, chiefly statuary, mosaics, poetry, and the musings and thought’s of the great Greek philosophers and playwrights.
Art typified by a divine realism including depictions of Gods and animals, horses, plants and agricultural practices.
Also a period of battles, plagues, famines, intolerance, civil war, and confrontation.
The Poseidon of Artemision

Poseidon brandishing the trident with his raised right hand, possibly an original work of Kalamis, raised from the sea. Dated ca. 460 BCE.


Discus thrower

Venus de Milo

Greek Plow

Harvesting Olives
Hellenism: Flourishing of the Arts and Sciences

Greeks emphasized ideas rather than technology \textit{per se}.
Spread throughout the Mediterranean Basin via the Conquests of Alexander the Great.
Powerful influence on Rome.
Modern Western Culture is now a fusion of Greek culture, Babylonian and Egyptian science and technology, and Semitic religion.

Development of the Museum

Original Temple of the Muses;
(daughters of Zeus & Menemosyne or memory)
Eventually Palace of culture
The concept of organized centers of learning
The University derives from this period

Muses

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<th>Cleio</th>
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<td>Thalei</td>
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Greek Philosophers

- **Socrates**: 470?–399 BCE
- **Plato**: 427?–347 BCE
- **Aristotle**: 384–322 BCE
**Academy**

School of the philosopher Plato (427–327 BCE) located in a grove of trees

Groves of Academe: synonym for present day colleges and universities

Academics: College Professors
The Academy: The University
Academic Studies: University Curricular

Aristotle (384–322 BCE) student of Plato called his school the Lyceum, still the French word for school

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**Plato Teaching Geometry**

Roman mosaic, 1st century BCE


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**Plato and Aristotle**

Raphael 1509–1511
Beginnings of Science

Origins of science date to the 6th century BCE via Greece, Palestine, Babylonia, India, and China. A number of philosophers stand out. Note that the word for science, derived from the Latin word scientia, to know, came much later.

Democritus of Abdera (ca 470?–362? BCE)
Founder of the Atomic Theory
Also had theories on the nature of plants
Thought plant diversity was due to difference in the atoms of which they were composed

Democritus of Abdera (ca 470?–362? BCE)

Hippocrates (460?–359? BCE)
Disciple of Democritus, Father of Medicine.
First to expound the theory that disease had natural causes, not supernatural.
Considered that disease was caused by a balance of 4 fluids called humors (from which we get the term humor...good and bad): blood, phlegm, yellow bile, and black bile, based on color of ill people.
Concept persists in the following terms to describe distinctive temperaments:
  - Sanguine—warm and ardent
  - Phlegmatic—sluggish, apathetic
  - Bilious—ill humor (choleric)
Understood the relation of diet to health.
Herbs used in ancient Greece as medicine.
Hippocratic school mentions 240 medicinal herbs.

Rhizotomoi: Greek rootdiggers
Pharmacopoeia: drug merchants, pharmacy is derived from the Greek word for remedy or drug.

Hippocrates

Aristotle (384–323 BCE) of Macedonia

Writings are climax of the Golden Age of Greece
Student of Plato (427–327 BCE)
Teacher of Alexander the Great

Plato was interested in the search for ideas
Aristotle was involved in a search for facts and explanations

Important writings in physics (unfortunately many incorrect) persisted for almost 2000 years
E.g., the concept that speed of objects dropped is proportional to mass (finally disproved by Galileo)

Aristotle (384–323 BCE) of Macedonia

The descriptive writings in biology were excellent
*On Psyche, Histories of Animals, Generation of Animals, Parts of Animals.*

Writings on plants lost but Aristotle cited 5 of his own works.

Aristotle developed the concept of life force (vitalism), the idea that life is due to a force beyond the ordinary workings of chemistry and physics. Modern biology has been chipping away on this concept.

Concept persists and may only be discarded if life is actually created. Is science getting close?

The religious concept that humans are essentially different from other animals is an extension of vitalism. Modern Science views life as explainable by laws of chemistry and physics (anathema to religious believers who insist on a divine spark or soul).
Theophrastus of Eresus (371–287 BCE)

Father of Botany
Legatee of Aristotle’s Lyceum, bequeathed the library
Writer of 227 treatises (on religion, politics, ethics, education, rhetoric, mathematics, astronomy, logic, meteorology, natural history)
Had over 2000 disciples (students) averaging 60 per year.
Two botanical works survived: History of Plants and Causes of Plants (may be lecture notes). These are the earliest books of this kind in world literature but surely not the first. Deal with 500–550 species.
Other works that survive include On Stones and Character Sketches (still good reading).

Theophrastus of Eresus (371–287 BCE)

History of Plants (Historia de plantes, latin name)
Largely descriptive
Distinguishes parts of plants.
Nine books:
1. Parts of plants and their nature classification
2. Propagation (especially trees)
3. Wild trees
4. Geographic botany, trees related to districts
5. Timber of various trees
6. Undershubs
7. Herbaceous plants
8. Cereals, pulses, summer crops
9. Juices of plants
Causes of Plants, (De causis plantarum)
More philosophic but still full of facts.
Six books:
1. Generation and propagation of plants
2. Things which help the increase of plants
3. Plantation of shrubs and preparation of the soil, viticulture
4. Goodness of seeds and their degeneration
5. Diseases
6. Savors and odors

Theophrastus of Eresus (371–287 BCE)

Although much practical information, Theophrastus interested in plants for their own sake.
Given differences between plants or organs, how do we account for them?
What are the intentions of nature?
Classification endured for 2000 years.
Studied form and function, germination, distinguished monocots and dicots, leaf descriptions, codified names of 500 plants, considered ecological groupings, propagation.

Spontaneous Generation
Cases of spontaneous generation occur after spells of rain.
Rainy spells bring about cases of decomposition and alterations, the water penetrating far and wide, but feed what is formed and make it grow larger, while the sun warms and dries.

This being how most authorities account for the generation of animals as well.
Note that Theophrastus appears skeptical
False Spontaneous Generations

And if the air (and rivers too) provides seeds which it carries down with the rain, the rain spells will be all the more prolific.

These forms of generation would not appear to be spontaneous, but a kind of propagation by sowing seeds or setting pieces in the ground.

False Spontaneous Generation: From Unnoticed Seed

One might fancy that the generation of the fruitless trees is rather a spontaneous one, since these trees are neither set in the ground nor produced from seed, and it is a necessary consequence that they are produced spontaneously if they are not produced in either of these ways... The truth being that we fail to observe all the cases of growth from seed.

Propagation: Grafting

Definition and descriptions
Time of grafting (Autumn and Spring)
Techniques and mechanics
Effect of rain
Scion vs. stock
Alexander the Great

Alexander, King of Macedon, son of Philip of Macedon and student of Aristotle, extended Greek influence from the Greek isles to India and to Egypt.

At death in 323 BCE, his kingdom was divided among his generals. The Ptolemies were Greco-Egyptian rulers of Egypt from 323–30 BCE, Cleopatra, the last.

Center of learning, shifted to Alexandria, Egyptian city on the delta of Egypt, one of the many named after him. Results in a fusion of Egyptian, Mideastern and Greek culture later to be important in the development of Christianity.

The Greek school in Alexandria with its famous library was destroyed in 415, perhaps by fanatical Christians, a tremendous loss for all humankind.
Images from the Greek World

Floral mosaic, Antioch

Images of horticulture and war, Ephesus

Funerary horticultural wreath, Aphrodisias

Flowers, Bergama, Asklepeion

Ionic column of acanthus leaves, Bergana, Asklepeion