

Progress of History and Technology

CH 2: Philosophy and Science of Ancient Age

Historical Background



Era of Primitive Technology

Nature, Faith, and Philosophy

- Fear against to natural phenomenon changed to awesome and to faith
- Curiosity about the root of life and substance changed to mystery to scientific study
- Philosophy and Religion became sometimes accelerator, sometimes obstacle to advances of science and technology
 - Different development model formed in western and eastern world

Birth of Civilization

- 4 River Valley Civilizations: Mesopotamian civilization (Euphrates River Valley), Egyptian civilization (Nile River Valley), Indus Civilization (Indus River Valley), Yellow River Civilization
 - Common condition: wide fertile land, mild climate
- Hebrew civilization
- Greek civilization

War and Living Tools Creation

- Tools, instrument, and machinery appeared
- Group(agrarian) society formed and naturally a status system constructed
- War was a simple and clear solution of any conflict between groups (Law of Jungle)
- Creation of traditional culture

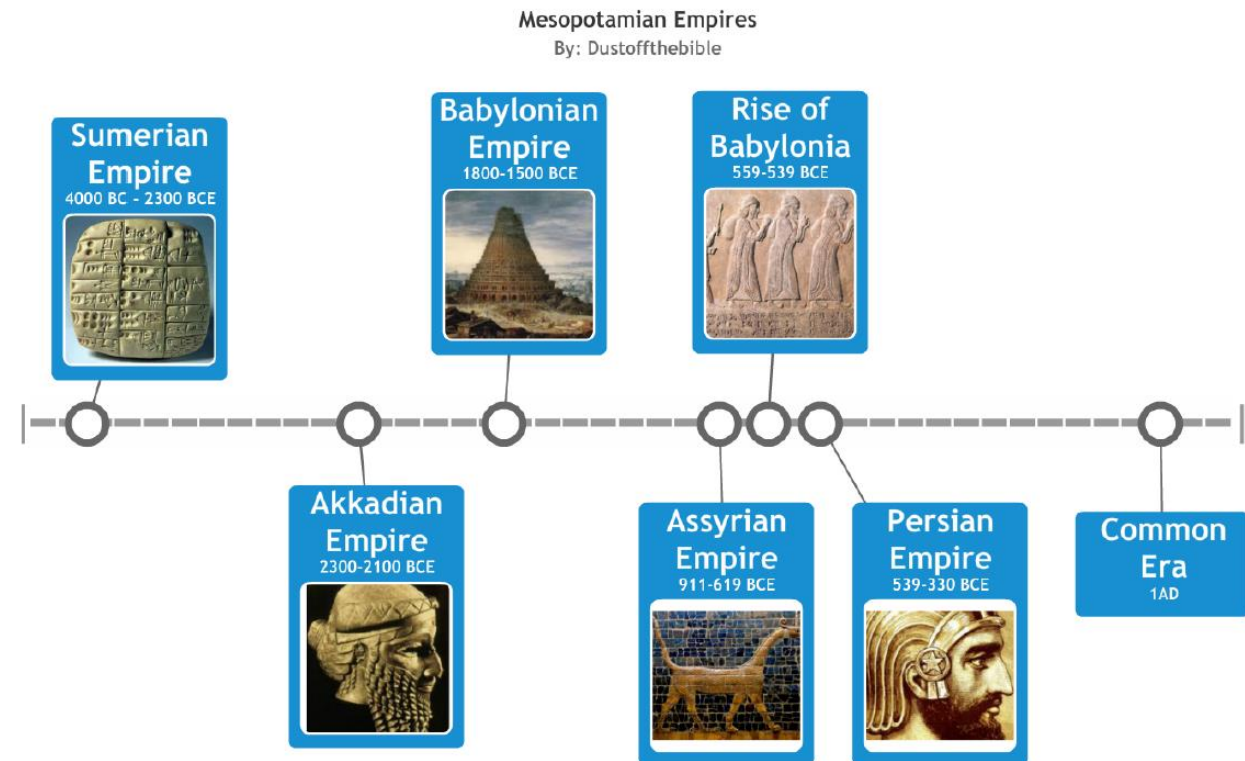
고대국가의 출현 및 패권다툼



Strive for Supremacy among Ancient Nations

Mesopotamian Region

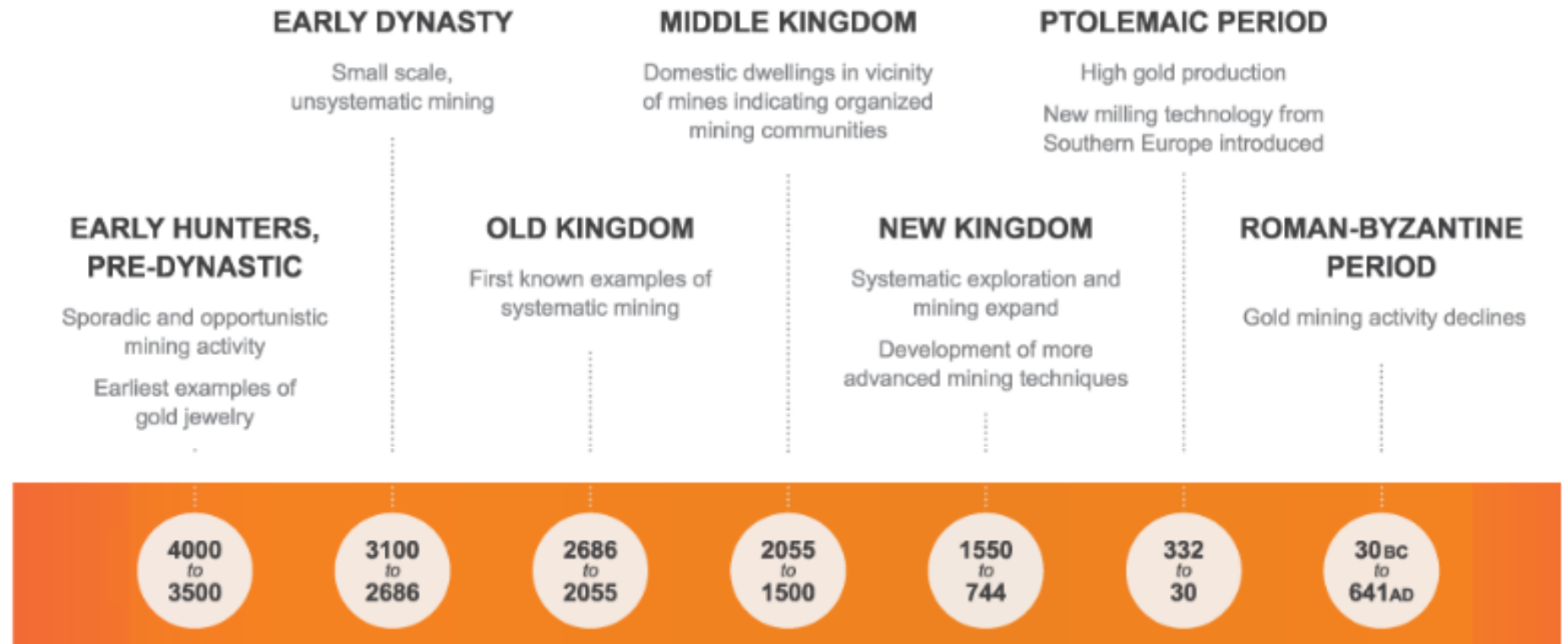
- Sumerian civilization, the 1st civilization erected about BC3500, was destroyed by Akkadians
- Amur tribe defeated Akkadians to construct UR, which was destroyed by Babylonians (The code of Hammurabi, BC2000)
 - West of Mesopotamian, Hittite greatly prospered and confronted against Egypt near Syria as border
- Changed in the order of Assyrian & New Babylonia
 - Persia
 - Macedonia occupation
 - Parthia



Strive for Supremacy among Ancient Nations

Egypt Region

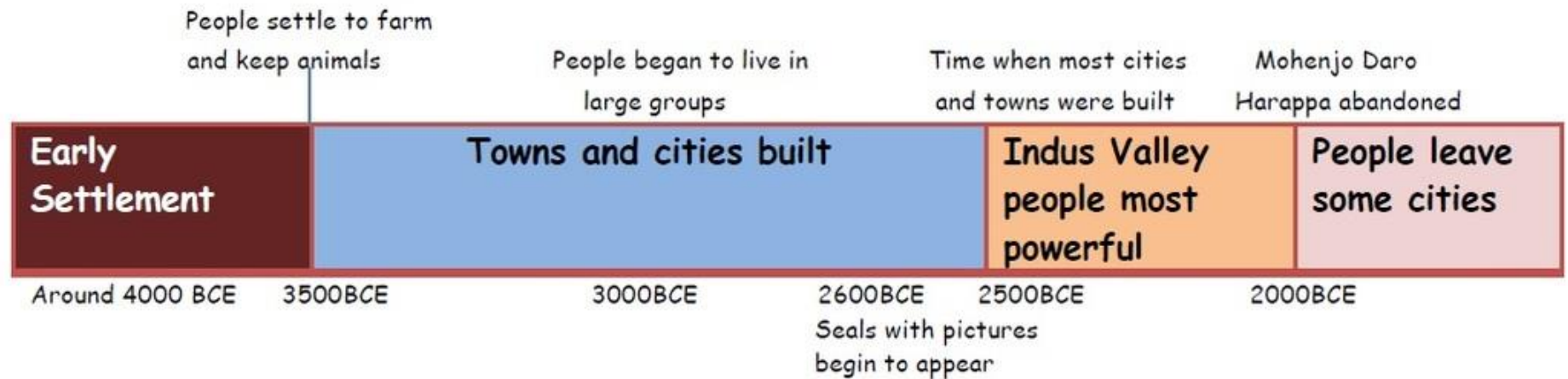
- Ancient Egypt established around BC3000 continued 30 dynasties and finally ended by Alexander in BC305
- Until ROME occupied, Ptolemaeos dynasty ruled for 300 years
- ROME occupied during BC30~AD395, then Christianity of Byzantine succeeded for AD395~642.
- Since AD643, Islamic Period has been continuing



Strive for Supremacy among Ancient Nations

| Indus Region

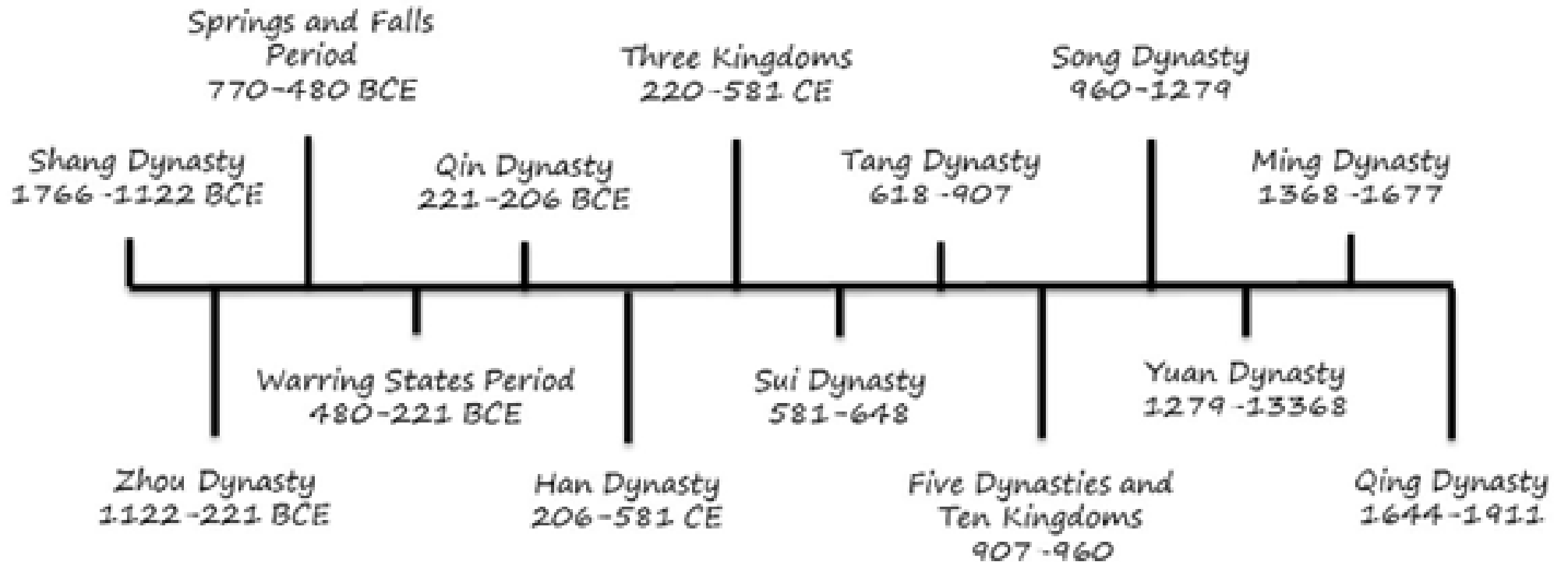
- Until BC1500 when Aryans moved in, Dravidians ruled forming Indus Civilization. They came with the caste system of Brahmanism and led the Vedic Age.
- About BC500, Buddhism appeared to overcome the harmful effects of Brahmanism.
- From BC530, Persia and Alexander invaded and ruled till BC322 when Maurya dynasty based on Buddhism took over.



Strive for Supremacy among Ancient Nations

Yellow Sea Region

- Xia Dynasty (BC21C~17C) and Shang Dynasty (BC17C~11C)
- Zhou Dynasty (BC1050~BC256) ended and separated by many countries.
- Warring States Period (BC770~BC221) BC500, Confucius worked
- King Qin unified the continent in BC221 to open Qin Dynasty which lasted only 40years



Strive for Supremacy among Ancient Nations

Aegean- Adriatic- Mediterranean (Sea) Region

- The Aegean Sea Civilization: formed around Crete island
 - Mycenaean civilization continued until BC12C
 - Dorians, Sea Peoples came southward and conquered to the world Dark Ages
 - From BC800, city states such as Athens, Thebes, Sparta appeared and fought against Persia in BC499
 - In the order of Athens-Sparta-Thebes, the region was governed until Macedonia and Rome occupied
- Adriatic-Mediterranean Region Civilization (ROME lead)
 - About BC700, Rome started as a city state where political system changed from kingdom to republic. It merged southern Italian peninsula including Genova in BC272
 - After that, Rome had ruled whole Mediterranean sea countries including Carthage

Strive for Supremacy among Ancient Nations

Aegean-
Adriatic-
Mediterranean
(Sea) Region



Strive for Supremacy among Ancient Nations

Aegean- Adriatic- Mediterranean (Sea) Region



Strive for Supremacy among Ancient Nations

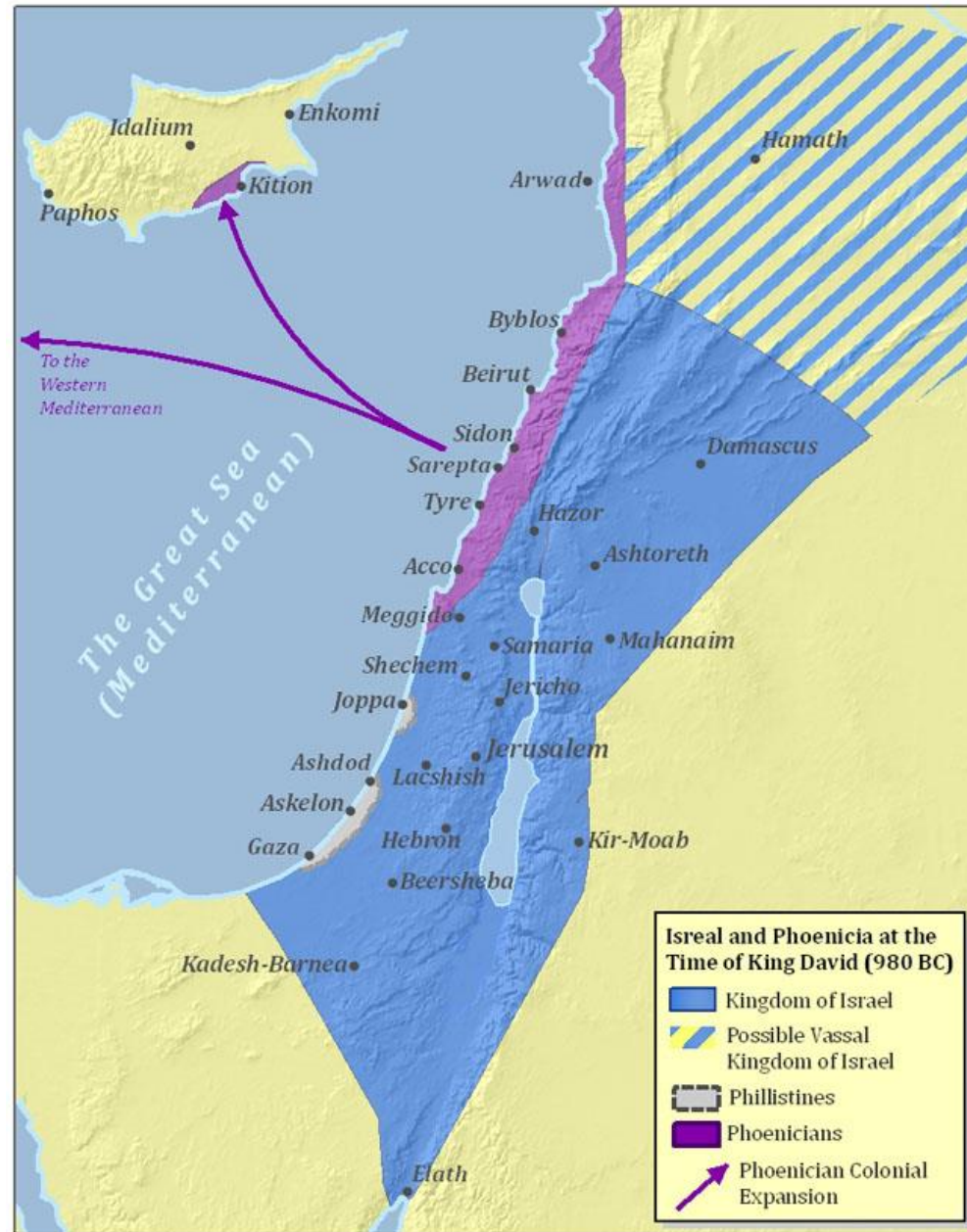
Palestinian Areas

- Phoenicia
 - Controlled the Mediterranean surrounding countries such as Lebanon, Syria, Palestine, Carthago by trading
 - Seized seaborne trade using galley ships
 - Served for God Baal (BC1200~BC900) and Created Alphabet
- Israel
 - Israel tribe invaded to Palestinian about BC1400 and unified the area during BC1050~ BC930
 - Divided by South and North, destroyed in series, North in BC722 by Assyria and South in BC586 by Babylonia
 - Afterward ruled by Persia, Greece, Rome and finally erased by Rome in AD70



Strive for Supremacy among Ancient Nations

Palestinian Areas





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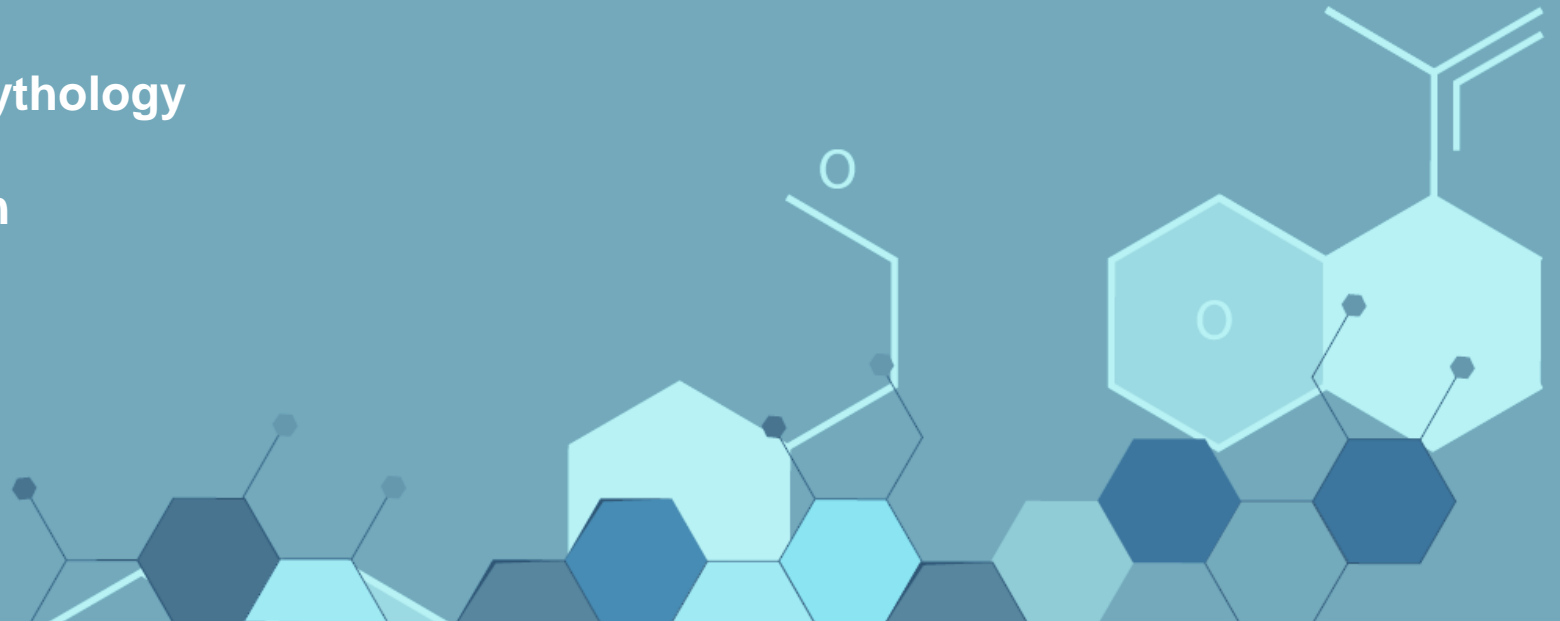
- Shamanism, Religion, and Practical Science
- Scientific Thinking of Ancient Western Philosophy
- Scientific Thinking of Ancient Eastern Philosophy
- Discussion Topics





Shamanism, Religion, and Practical Science

- Shamanism and Mythology
- High Level Religion
- Practical Science



Shamanism and Mythology

I Shamanism

- Used as means of relaxing fear on nature's power and of being protected from curse
- Faith that big objects, stars in space, or old matters have spirits, affecting this world and after death
- Utilized this faith as tools of managing social order by using God's will
- Natural phenomena and objects close to daily life became the subject of faith
 - Sun, Moon, Star, Wind, Water, Tree, Rock, etc.
- Specially because of the faith that the victory of war and the success of farming are determined by the motion pattern of celestial bodies, the roles of sorcerer were very influential



Shamanism and Mythology

I Mythology

- Attempt to explain the operation rules of life and death, earth and space without any scientific knowledge
 - How was the universe created?
 - Who rules the sun and moon, wind and water, long or short life, wealth and poverty?
 - How is the life given and sustained?
- Birth myth of a nation
 - Emphasizing elitism that my country has been established by god or god's son
 - All the birth myths have communalities in the sense that they include sky, mountain, sea, or big animal

Shamanism and Mythology

The myth of Dangun (Korean)

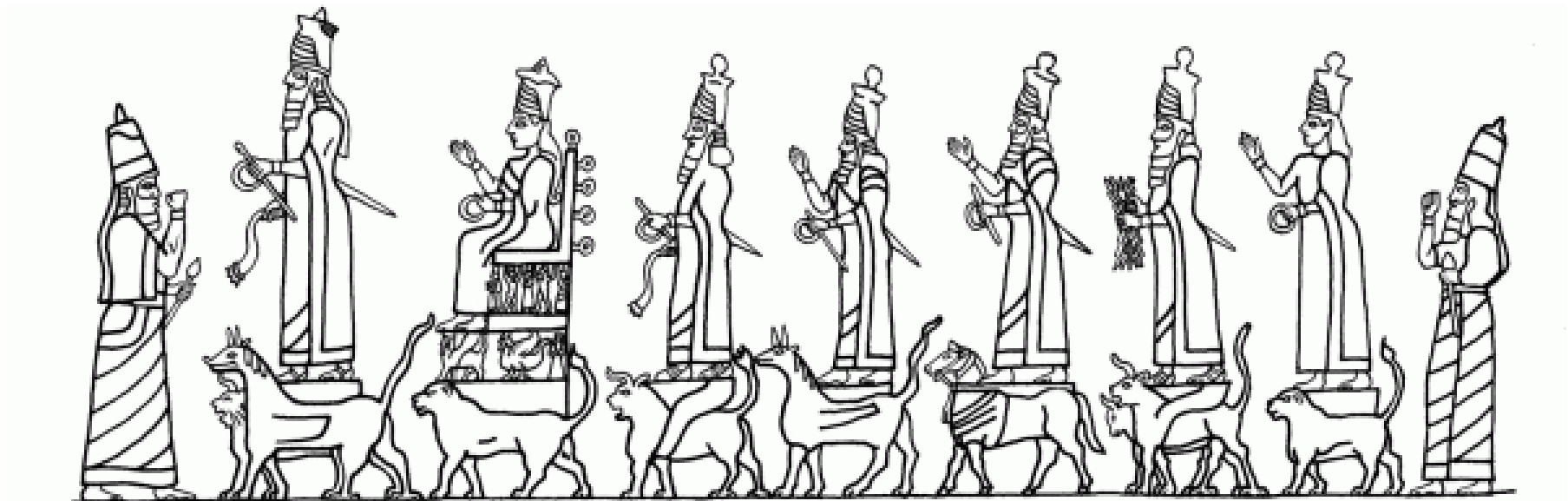


- Dangun: Progenitor of ancient Korea
 - Grandson of Hwanin, "Lord of Heaven" who sent his son Hwanung to live in Baekdu Mountain 3,000 followers who the ministers of clouds, rain, and wind, laws, medicine, and agriculture.
 - A tiger and a bear prayed to Hwanung that they may become human. Upon hearing their prayers, Hwanung gave them 20 cloves of garlic and a bundle of mugwort, ordering them to eat only this sacred food and remain out of the sunlight for 100 days. The tiger gave up after about twenty days and left the cave. However, the bear remained and was transformed into a woman.
 - The bear-woman (Ungnyeo) was grateful and made offerings to Hwanung. However, she lacked a husband, and soon became sad and prayed beneath a "Sindansu" tree to be blessed with a child. Hwanung, moved by her prayers, took her for his wife and soon she gave birth to a son, who was named Dangun Wanggeom.
 - Dangun ascended to the throne, built the walled city of Asadal, situated near Pyongyang (present capital of North Korea), and called the kingdom Joseon—referred to today as "Old/Ancient Joseon" (Korean: "Gojoseon") so as not to be confused with the Joseon kingdom which occurred much later. He then moved his capital to Asadal on Mount Baegak (or Mount Gunghol).
 - Fifteen hundred years later, in the year Kimyo, King Wu of the Zhou Dynasty enfeoffed Jizi to Joseon, and Dangun moved his capital to Jangdangyeong. Finally, he returned to Asadal and became a mountain god at the age of 1,908.

Shamanism and Mythology

Sumerian Mythology

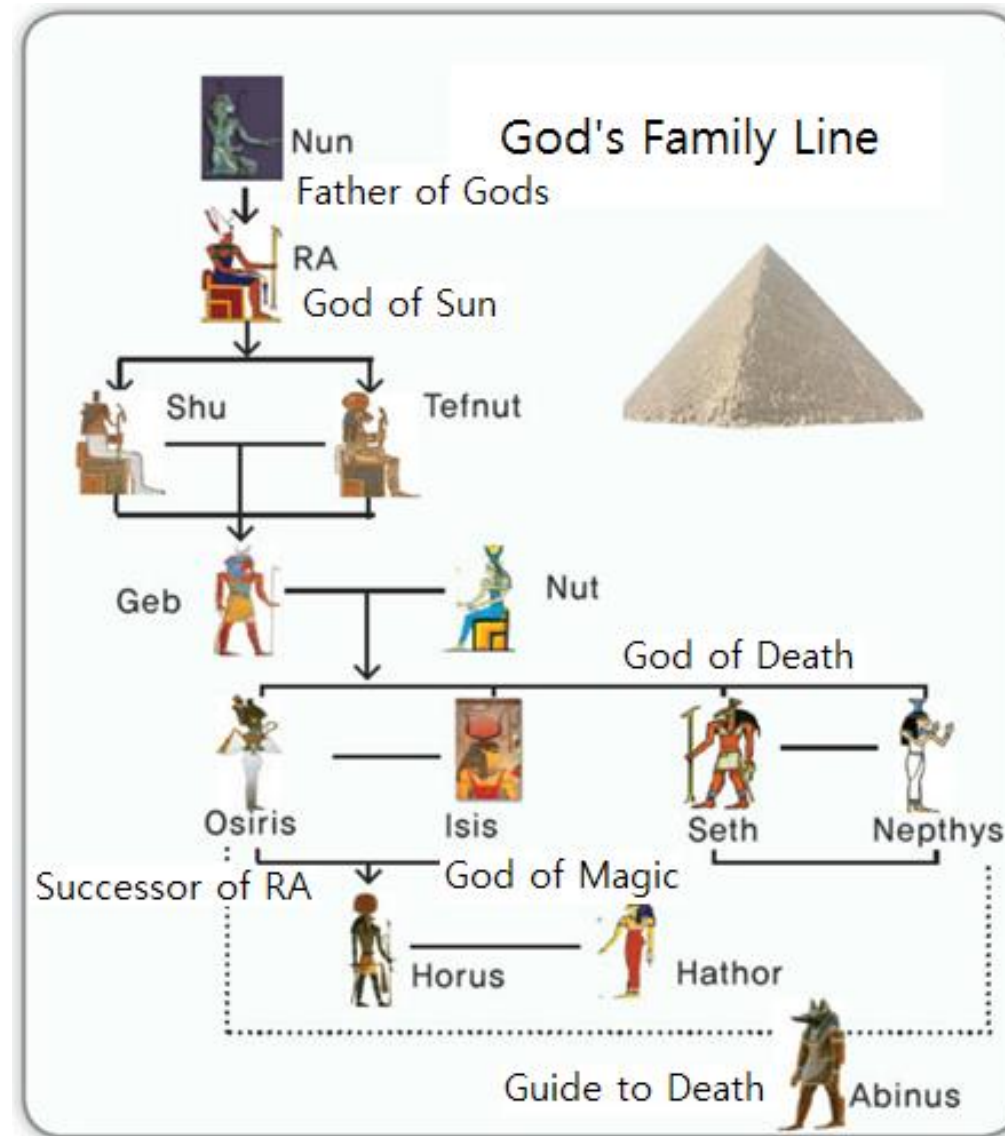
- Made in-between BC5000~BC3000
 - Each city has guardian, 50 among them consisted of a meeting 'Anunnaki'
 - Seven leaders have individual ranks and be served by their ranks
 - God of the heavens (An), God of wind and storm (Enlil), Goddess of fertility and the earth (Ninhursag), God of water and human culture (Enki), God of the moon(Nanna), God of the sun and justice(Utu), Goddess of love(Inanna)



Shamanism and Mythology

Egypt Mythology

- Formed in-between BC4000~BC2500
 - King is a representative of God
 - While studying the relationship between overflow period of Nile River and orbital movement, find some gods who control this natural phenomenon
 - Made a story where each god has a role related to daily life, after death, etc.



Appearance of High Level Religions

From Myth To Religion

- Sumerian and Egyptian mythologies influenced to the creations of myths in Greece and other Middle East area, so they have very similar story structure
- The ways to serve Gods in mythologies advanced to theological structure to become religion
- 5 requirements to be called as a Religion
 - Subject of faith (God), Scriptures, Followers (server), Mediator, Religious events
- The role of mediator used to have absolute power using divine right
 - Politics and Religion could be tightly connected to utilize each other



Christianity



Christianity



Shinto



Jainism



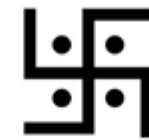
Taoism



Buddhism



Sikhism



Jainism



Wicca



Islam



Bahai



Menorah



Islam



Hinduism

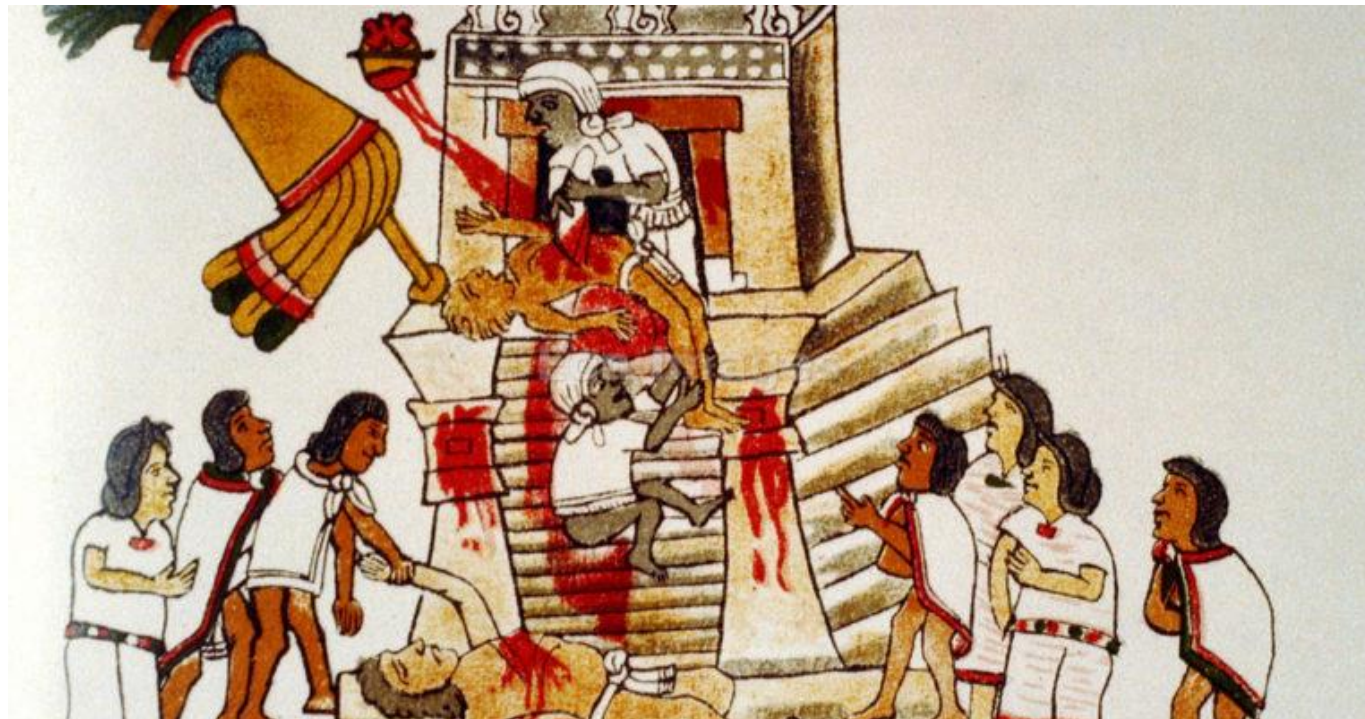


Buddhism

Appearance of High Level Religions

Barbarism Of Mythological Religion

- Mythological religion usually ignored morality and humanity
 - Sexual ritual accompanied: king and priestess, ritual attendants and priestess had sexual relationship (Baal, Asherah etc.)
 - Human body rites: Sacrifice human body to god (Assyria, Canaan area)
 - Butchering animals (Ancient Greece and Rome)
- Religion was used as a tool to absolutize the ruler's authority
- Discrimination based on social classes (Hindu)



Appearance of High Level Religions

High Level Religion

- 3 High Level Religions: Christianity, Buddhism, Islam
- Teaches right lesson, peaceful coexistence with neighbors, healthy life
- Separation of Religion and Politics
 - In the Middle Ages, religion stood over politics
- Extremist damages the values of the religion so frequently

Judaism & Christianity

- Generated about BC2000 in Palestine region
- The one and only God: differently from other religions, serve only god Yahweh
 - Belief that God had created all things in the world selected only Jews themselves
- Systematized scripture: Yahweh wrote Ten Commandments in person
 - 5 Books of Moses (Pentateuch), Torah
- Priesthood succeed in blood and political leader succeed in ability
 - Separation of priest from political leadership
 - Following the ritual procedure written in Pentateuch
- Separated to Catholic when Jesus was born, divided to Protestant
 - Catholic influenced Europe during the middle ages leading to dark era

Appearance of High Level Religions

Brahmanism & Buddhism

- Brahmanism: polytheism believing Vedic scripture, appeared in BC15C in India
 - Caste system dividing people by 4 classes and inheriting the class to descendants
 - 33 Gods having different roles punish for sin and forgive for repent
 - By communication with Gods by daily tributes, life is vitalized and maintained
 - Need too many services and asceticism (practice)
- Buddhism: Buddha in India created in BC6C
 - To comfort miserable class people, spread the verity (truth, nirvana) he realized
 - Human can reach nirvana by realizing mysterious knowledge about ultimate existence of ego and universe and by cutting out endless samsara of life and death
 - Avoid penance (hardship) or hedonism (physical pleasure) and follow middle way

Confucianism

- Confucius: Philosopher worded in BC6C, the Warring States Period
- Scripture
 - Four Books: Great Learning, Doctrine of the Mean, Analects, Mencius
 - Five Classics: Classic of Poetry, Book of Documents, Book of Rites, Book of Changing, Spring and Autumn Annals
- Belief
 - Confucius' idea of the Three Bonds and Five Relationships was religionized by systemizing the worship of heaven and the will of heaven
 - No afterlife views, but emphasized self realization and practice based on royalty, filial duty, benevolence
- Service: Complex, but the goal is to emphasizing staunch ethicality

Utilization of Natural Objects

- To work with less energy and more safely, tools were made of natural objects
 - Utilized hardness of stone, animal bones, and tree, etc.
 - Prickle of fish was used as a needle for sewing



Application Technology (Western)

- Characters (BC3200)
 - Systemic structure of characters were formed from Hieroglyphics (pictograph) (Sumer, Egypt)
 - Syllabic character (BC1500) and Alphabet (BC1100, Phoenicia) appeared
- Architect and surveying technique applications
 - Construct using burnt bricks, Separate border of lands by measurement tools
- Numbers (BC3000)
 - Decimal number in Egypt, Decimal and Hexadecimal number Babylonia
- Papyrus: Primitive paper made of stem of plants
- Bow:
 - Found in Old Stone Age (Paleolithic Era)
 - Good sample that human made a tool by experimental discovery and enhanced by scientific analysis
- Astronomy and Calendar
 - Periodicity of plant life and celestial bodies were used for farming
 - Calculation of solar eclipse
 - Define a year as 365 days, measure time

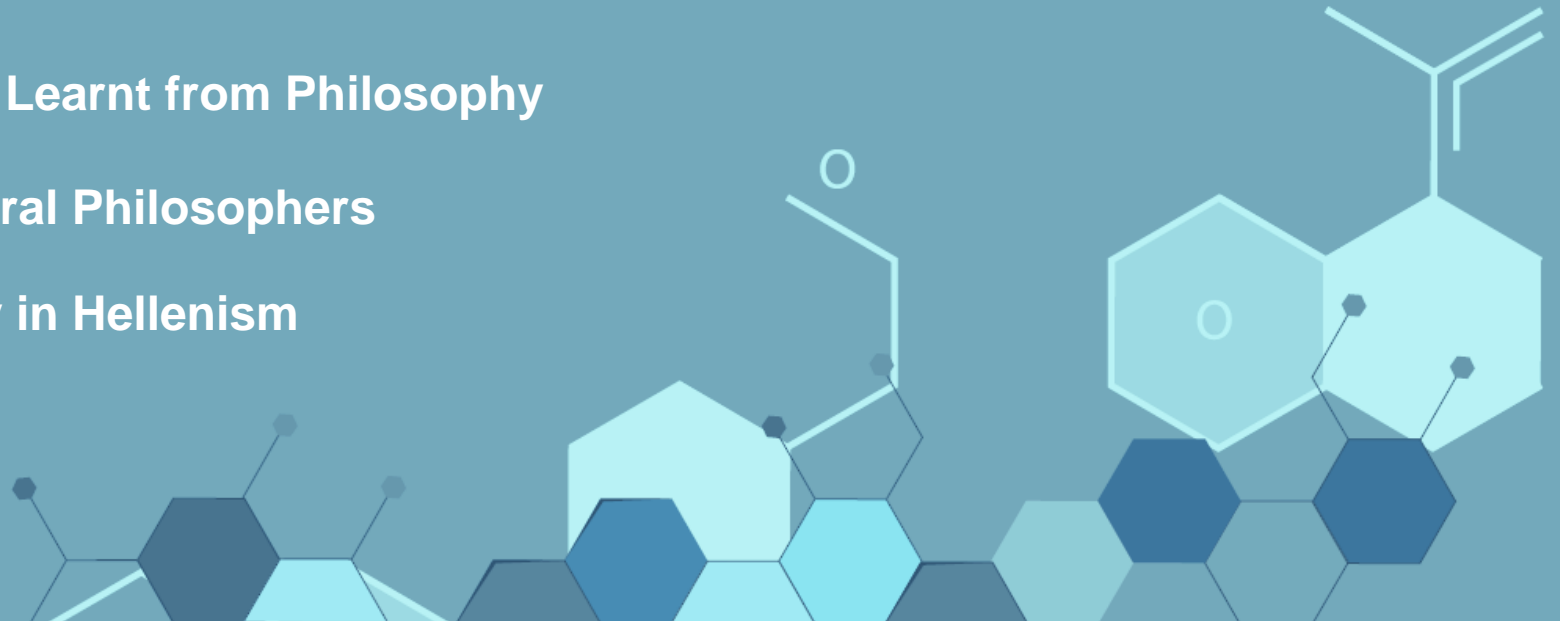
Application Technology (Eastern)

- China
 - Inscriptions on bones and tortoise carapaces (BC1600)
 - Bamboos were connected in series as a book and wrote using brush
 - Coin (BC15~1300)
 - Am(plow), Brit(plough) for farming
 - Crossbow from bow
 - Canal construction with advanced civil engineering technology
- India
 - City planning: Rectangular streets, sewerage system
 - Used burnt bricks
 - Private and public bathhouse and well
 - Weights and measures

2

Scientific Thinking of Ancient Western Philosophy

- Scientific Thinking Learnt from Philosophy
- Foundings by Natural Philosophers
- Natural Philosophy in Hellenism



Scientific Thinking Learnt from Philosophy

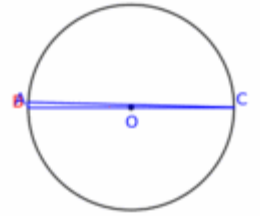
I Philosophers

- Philosophers, such as Thales, moved the God oriented society where mythology and shamanism governed to Human oriented one about BC650 in Greece,
- Dealt with existence, knowledge, value, cognitive, rationality to explain Natural Phenomenon by cause and result, resulted in natural science
- In AD18C, physics and chemistry were spined out from Philosophy

I Questions

- Foundation of nature substance (Socrates BC400)
 - Thales (water), Anaximenes (air), Pythagoras(number)
 - Empedocles (water, fire, air, earth)
 - Democritos (non-dividable atom)
 - > Start of efforts to scientific explanation of mythology
- Sophist: Concentrated on Human
 - Set Hypothesis and Persuade others to believe
 - 'Even Negation can be converted into Positive
 - > Suggested methodological thinking system, hypothesis and proof methodology

Thales: The origin of all Substances is WATER



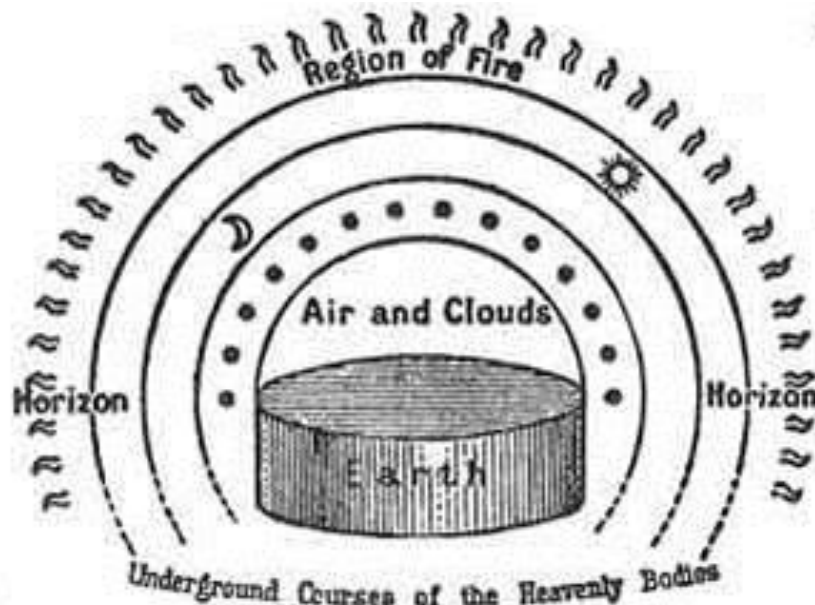
Thales is credited with the following five theorems of geometry:

1. A circle is bisected by its diameter.
2. Angles at the base of any isosceles triangle are equal.
3. If two straight lines intersect, the opposite angles formed are equal.
4. If one triangle has two angles and one side equal to another triangle, the two triangles are equal in all respects. (See Congruence)
5. Any angle inscribed in a semicircle is a right angle.

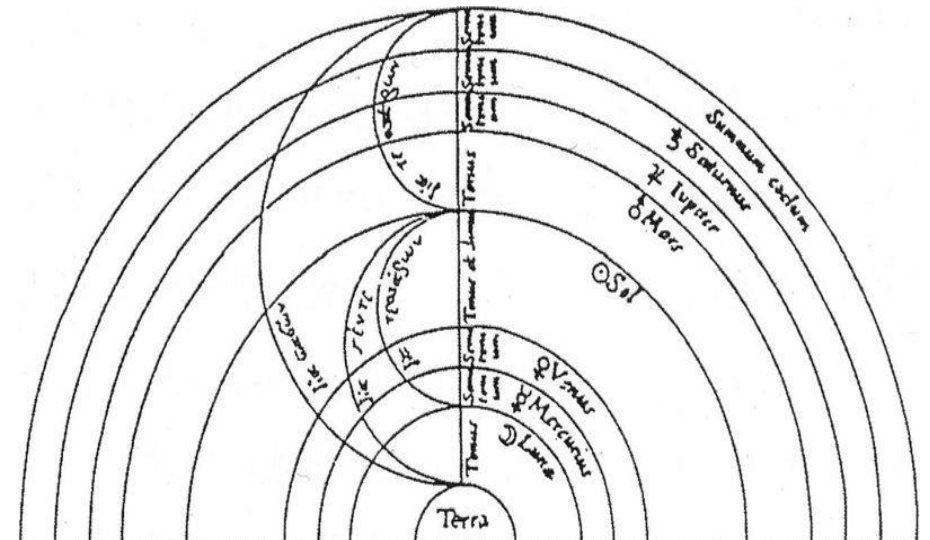
Foundings by Natural Scientists

Astronomy Observation

- Anaximandros (~BC545): Scientific analysis of the secrets of nature
 - The earth as a drifting cylindrical object whose height is 3 times of the diameter
 - Thunder occurs when wind separates, Lightning occurs when cloud separates
 - Eclipse of the sun occurs when the wheel hole moving the sun is stuck
- Pythagoras (~BC500): helio-centricism
 - The Sun (fire) is at the center of the universe, the Earth is around the Sun, The counter Earth is located opposite side
- Eudoxos (BC365): Concentric Celestial Sphere
 - Sun, Moon, Planets are circling with uniform speed around the earth



Anaximandros's universe



Pythagoras's Universe

Foundings by Natural Scientists

Components of Substance

- Anaximenes (~BC525): Air is the source of all creation
 - Condensation air is compressed to become wind, cloud, water, soil, and stone
 - Thinned air becomes fire
- Pythagoras (~BC500): Number is the source of all creation
 - By analyzing the relationship b/t length and frequency of a string, setup the science of harmony
 - Found irrational number which cannot be represented by rational number (integer and fraction)
- Empedocles (~BC430): All creation are consisted of water, fire, air, and soil
 - coupling ratio of bone and blood: 0:4:2:2 and 1:1:1:1
- Democritos (~BC370): All creation are consisted of combination of immense atoms
 - Atom existed from the beginning
 - Combination ratio determines the identity of the substance
 - Natural phenomenon also occurs while combination process
- Hippocrates (~BC370): systematization of medical science
 - Body consists of blood, mucus, yellow and black bile
 - Spring Summer, Fall and Winter correspond to Hot, Cold, Humid, Dry
 - Imbalance of these components causes disease

Natural Philosophy in Hellenism

| Socrates

- Master of Plato
- Interest of Philosophy changed from interpretation of natural phenomenon into human

| Plato

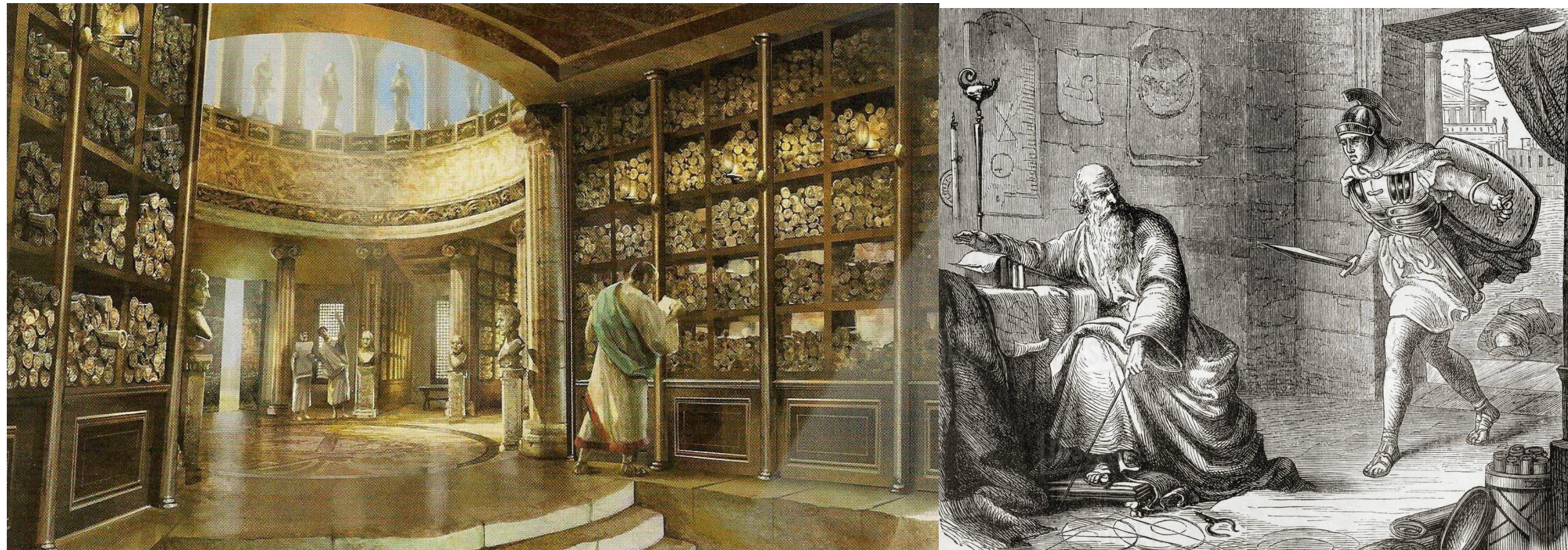
- Master of Aristotle : Established Academia
- World consists of Idea (complete) one and its duplicate (real imperfect) one
- Demiourgos, The Creator created the world with already existed substances
- The Creator operates Astronomy with mathematic and geometric rules
- 4 element: Fire(a regular tetrahedron), Air(regular octahedron), Water(an icosahedron), soil(a regular hexahedron, a cube)
- Additional 5th element: Sky (regular dodecahedron)

| Aristotle

- Master of Alexander (Established Lykeion, ~BC322)
- Empirical Outlook: Hidden order of nature can be found by classifying with experiences
Ex) Organism can be classified from high to low level in order
- Universe consists of Heavenly world (composed of Aether existed from the origin and the end) and Earthly world (composed of soil, water, air, fire)
 - 4 composition rule: creation, transmutation, displacement, extinction
- Heavenly world does a circular movement, Earthly world does Straight line motion
- The world is a structured system advancing to a goal

Natural Philosophy in Hellenism

Natural Philosophers in Mouseion

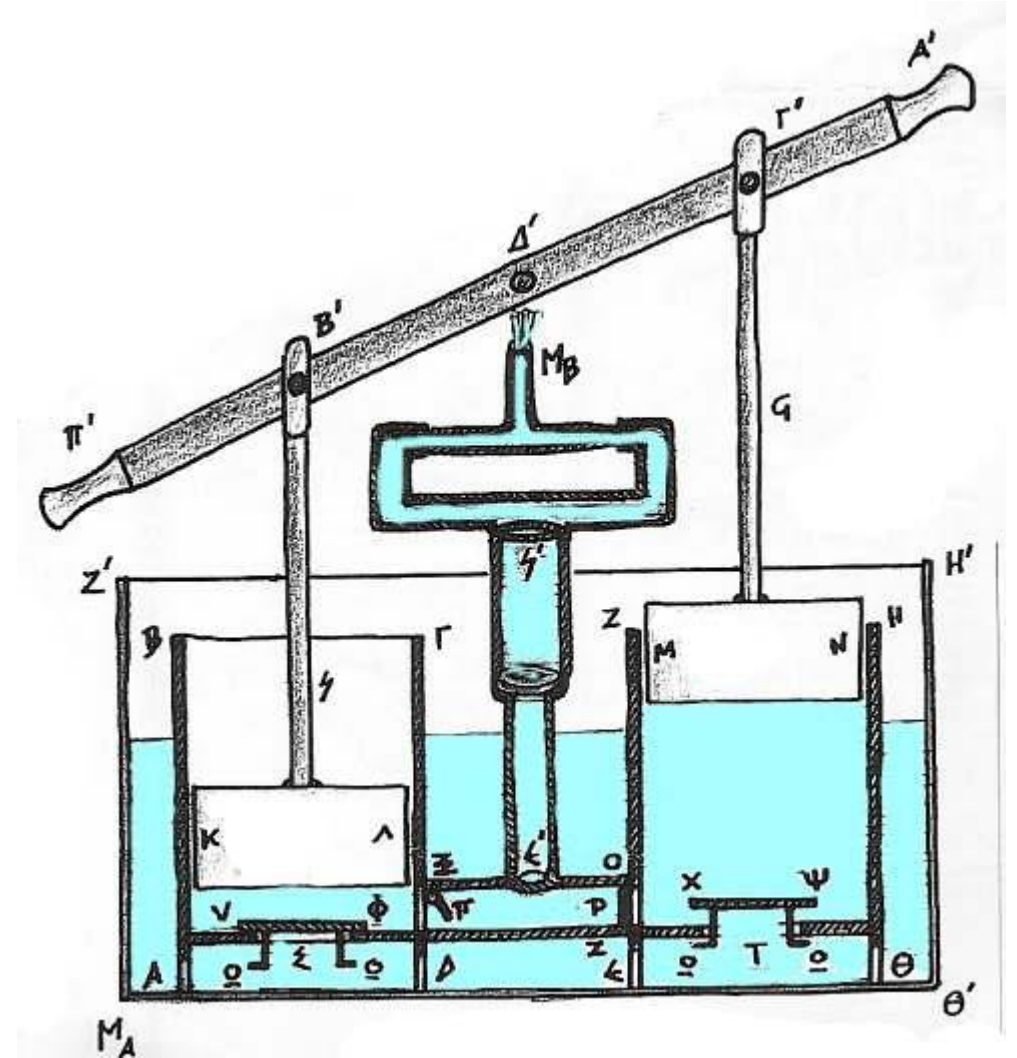
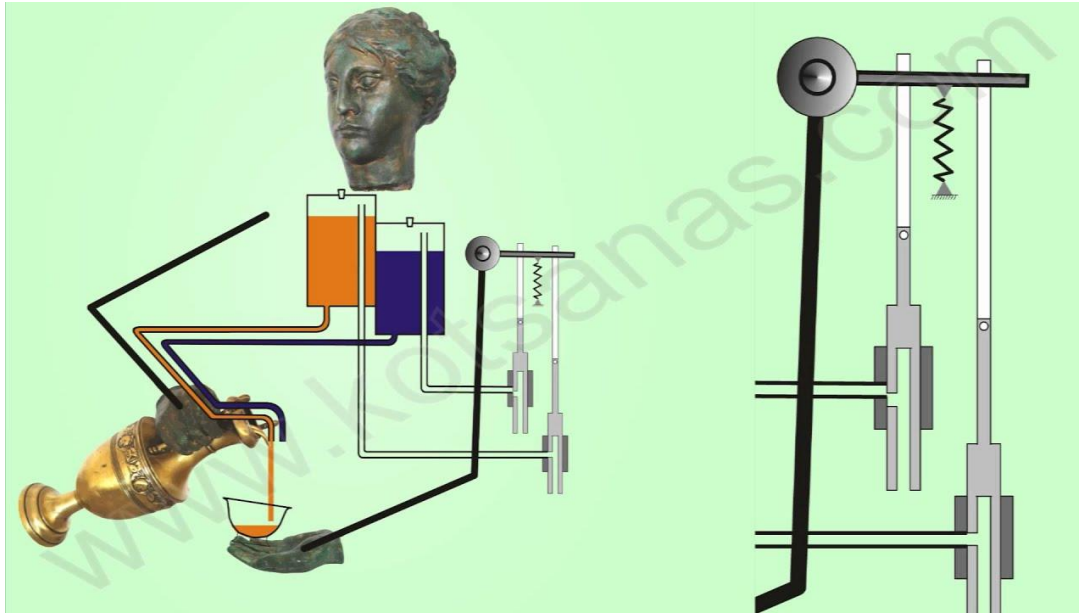


Natural Philosophy in Hellenism

Natural Philosophers in Mouseion

- Academic center established by the son of Ptolemy, the general of Alexander, in Alexandria of Egypt, in BC280
- Until AD400, operated Zoo, Botanical Gardens, Observatory, Laboratory, Dissecting room, with having more than 500,000 books
- Herophilos (~BC255): studied Brain, nervous system, internal organs, heart beat, cardiac impulse
- Erasistratos (BC250): studied physiological phenomenon and the causes of disease
- Claudios Galenos (~BC216):
 - studied body function such as Digestive organ (liver etc), Respiratory organs (lung and heart), Nerve system (brain centered)
 - understood that each organ is nourished by natural spirit, life spirit, soul spirit
- Archimedes (~BC212): scientist and architect: presented the law of Lever, volume and surface of a ball, buoyancy using mathematical equations, developed a catapult
- Ktēsibios (BC212): water organ and piston pump
- Philon (BC200): automatic servant and water clock
- Heron (~BC212): automatic door switch
- Eratosthenes(~BC194): calculated the circumference of the earth assuming a globular shape

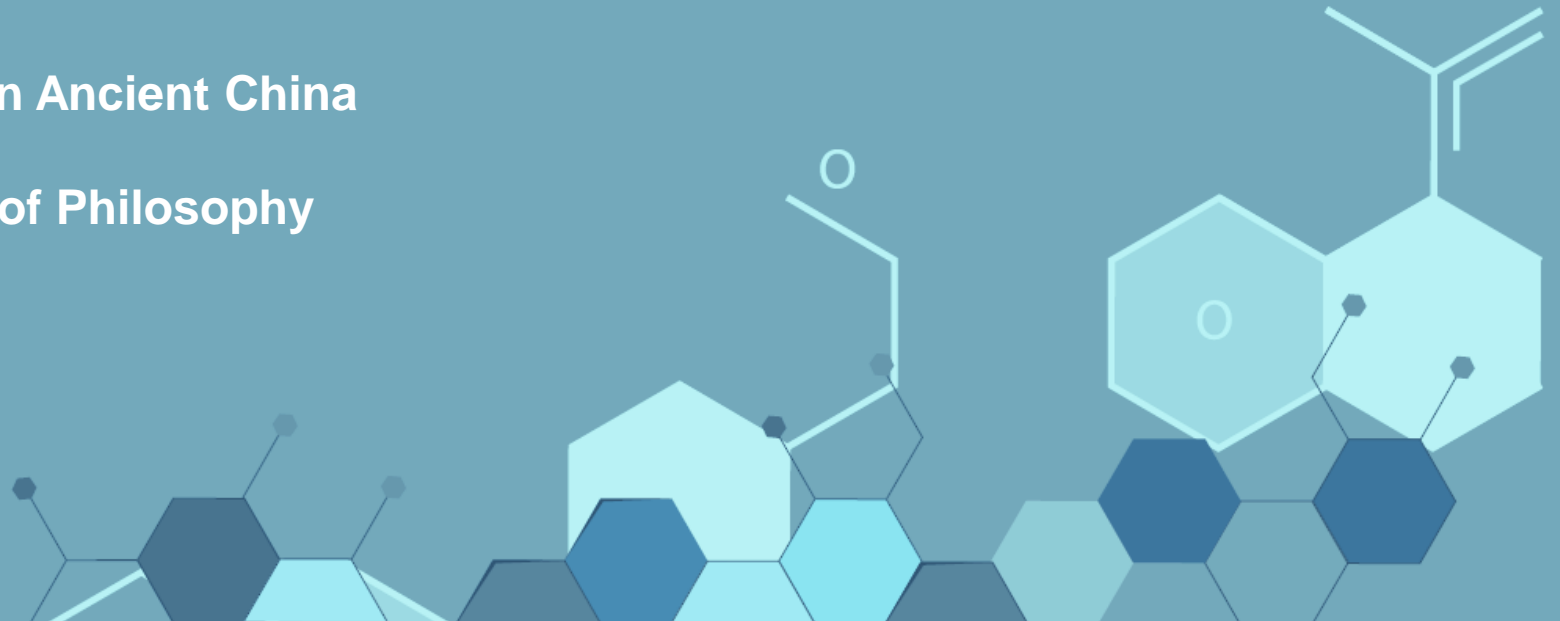
Natural Philosophy in Hellenism



3

Scientific Thinking of Ancient Eastern Philosophy

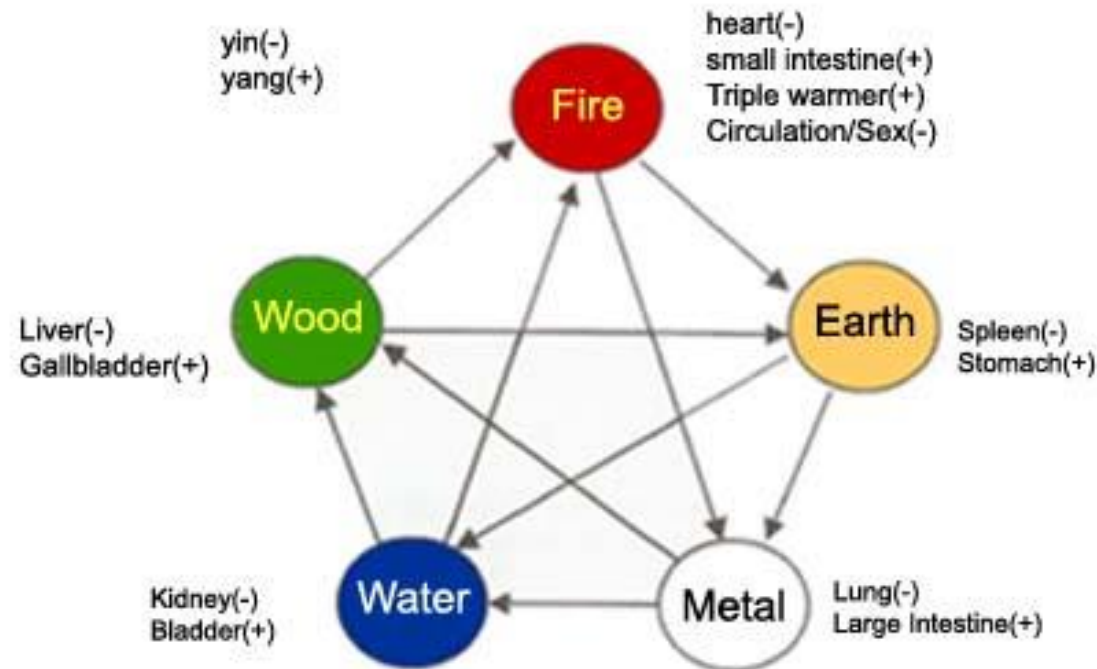
- Philosophy Trend in Ancient China
- Scientific Heritage of Philosophy



Philosophy Trend of Ancient China

Chinese Philosophy

- Substantiality was found in true nature in Western philosophy, but in relationship in Chinese philosophy
- While inheriting from Confucius to Taoism, Legalism, Mohism, Logicism, various thinking ways were spreading
- Yin-Yang and the Five Elements theory was centered
 - Element and impetus of nature is Yin (Negation) and yang (Positive), Five primary substance [metal, wood, water, fire, earth]
 - It determines 5 colors, 5 smells, 5 grains, 5 directions, 5 sounds, 5 human relations



Philosophy Trend of Ancient China

| Confucianism

- Confucius (BC522~BC479) born during the age of civil wars in country of Lu
 - To keep social order (peace and mutual respect), universal education is essential and intellectual democracy is necessary
 - Universe shows the ethical order and thus human should do as universe to maintain social order and to make a good country
 - Mencius and Hsün-tzū religionized by serving Confucius as the guardian spirit
- > Not much related to scientific thinking but tried to change reality by clarifying the human relation system

| Taoism

- Mixture of Philosophy that the rightness of human society cannot be realized without knowing natural order and Shamanism that served the natural phenomenon (Primitive science and magic included)
- Idleness, the state that human nature is fulfilled by trusting the natural flow, can be achieved only by the experience acquired through observation on nature
 - Emphasizing experimental experience (respecting artisan and technician)
 - By observing the circulation of nature, change and evolution and survival of the fittest rules were proposed
- To upgrade to a rank of ascetic whose body is not changing, keep the balance of Yin and Yang by respiration training, exercise, drug dispensing

Philosophy Trend of Ancient China

I Mohism

- Philosophy of General Love that pain in the world disappears when all people love each other
- Aims at peacefully coexisting world though primitive infinitesimal communal society
- Instead of helping attacking side, helped defending side with good skill of making fence (anarchic idea)
- Emphasizing logical thinking like Taoism and Necromancer, Optics, Geometry, Dynamics were studied

Scientific Heritage of Philosophy

Scientific Observation



(Zhang Zi, Chapter 18)

All species contains certain root elements.

When they are in the water, they become a minutest organism.

At the place water and land meet, they become clothes of frog and oyster (a kind of tidal current)

On shore, they become ?

Scientific Heritage of Philosophy

| Mathematics

- Practical mathematics
 - Concentrating on prediction of astronomical phenomena and on commerce
 - From Zhou Dynasty, math was one of 6 mandatory education subjects
- About Han Dynasty
 - Zou Astro and Math Principles (BC300): Principles on astronomy, weight and measurement (including fraction and square root, triangulation method)
 - The Nine Chapters on the Mathematical Art (written by ZhaChang in BC200): Provides the solutions on 264 problems

| Science

- Astronomy
 - The lunisolar calendar made in Eun dynasty was more correctly modified by including leap month in Zhou dynasty
- Astronomical calendar
 - Yu Hong's Calendar: By finding that the moon's motion is not with constant velocity, forecast of solar eclipse and lunar eclipse became possible

4

Discussion Topics

- When did the history begin in Indo-China?
- By comparing the philosophies of Aristotle and Confucius, evaluate the influences on technology advancement in the Eastern and Western worlds
- Find what were the critical elements of competitiveness in ancient countries? What was the power of the tribes who unified the neighboring regions?
- What technologies developed in ancient countries have influenced on making current civilization?

