CH01:Prehistory and Antiquity

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General Introduction

In the annals of human history, the chapters of prehistory and antiquity stand as the foundational canvases upon which the tapestry of our civilization was woven. Prehistory, veiled in the mists of time before the emergence of written records, challenges our understanding with artifacts unearthed from ancient soil. It spans from the dawn of humanity, marking our nomadic existence through the Paleolithic age, where survival meant mastering the art of hunting and gathering. The subsequent Neolithic period ushered in agriculture and sedentarization, setting the stage for the rise of organized societies.

Antiquity, the age of burgeoning civilizations, unfolds with the birth of written language around 3000 years BCE. This era saw the advent of structured societies along the banks of great rivers like the Nile, Euphrates, and Tigris, fostering the birth of early civilizations in Mesopotamia and Egypt. Iron, with its transformative power, replaced bronze, reshaping societies and economies. The ancient Mesopotamians, notably the Chaldeans, left behind a legacy of mathematics, astronomy, and medical knowledge inscribed on clay tablets. Meanwhile, in the Nile Valley, the Egyptians, deeply intertwined with their environment, crafted a civilization rich in astronomy, mathematics, and medicine, recording their wisdom on papyri.

In Greece, the cradle of democracy, profound thinkers like Socrates, Plato, and Aristotle pondered the mysteries of existence, laying the foundation for Western philosophy. The Hellenistic period, marked by the vast influence of Alexandria and its Museum, witnessed an intellectual flourishing. Knowledge became not just a possession but a pursuit, leading to remarkable discoveries and the compilation of vast libraries.

This chapter embarks on a journey through these epochs, exploring the remarkable achievements, the cultural intermingling, and the intellectual pursuits that shaped the prelude to our modern world. Delving into the remnants of ancient civilizations, we uncover the essence of our shared human heritage, marveling at the ingenuity and wisdom of those who came before us. Join us as we unravel the enigmas of prehistory and antiquity, uncovering the threads that bind us to our ancestors and illuminate the path of human progress with an interest in the evolutionary side of biological sciences.

I. PREHISTORY

It is conventional to start the story at the time of the invention of writing. Our knowledge of prehistory is therefore based exclusively on the analysis of art efacts discovered during archaeological excavations.

Prehistory is generally defined as the period between the appearance **of** humanity and the appearance of the first written documents. The classic definition of prehistory poses a certain number of problems, particularly with regard to the criteria used for **its beginning** and **its end,** but also for **dating .** of **its limits.** It is divided into different periods characterized by particular techniques: **The Neolithic** (the age of polished stone), **and the Paleolithic** (the age of cut stone):

I.1 The Paleolithic

This is the oldest period, characterized by the technique of carved stone and a nomadic way of life ignoring live stock or agriculture. Humans then lived by hunting and gathering. This epoch begins three emillion years ago. Among the techniques developed during the Paleolithic period, let us point out the domestication of fire, the manufacture of clothing and containers from animal skins, the manufacture of hunting tools and canoes. The domestication of the dog probably dates from the Paleolithic era.

I.2 The Neolithic

The era is originally defined by the use of polished stone, but is above all characterized by the appearance of lives tock (domestication of goats and cattle) and agriculture, and therefore by sedentarization (at least seasonal) of the populations. The oldest traces of a Neolithic population are found in the Middle East and date to between 9,000 and 6,000 BCE. At that time were also developed theart of pottery, weaving, stone construction. The invention of the wheel dates back to this period.

I .3 Medicine in Prehistory

Medicine in prehistoric times was characterized by primitive yet intuitive practices aimed at healing and alleviating ailments. Early humans relied on natural remedies derived from plants, herbs, and minerals, displaying a deep understanding of their environment. Shamanistic rituals and spiritual beliefs often played a significant role in prehistoric medicine, emphasizing the connection between the physical and spiritual realms. Despite the absence of advanced medical knowledge, prehistoric communities developed rudimentary surgical techniques, such as trepanation, to treat head injuries.

Example of first surgical act:

Trepanation is the oldest form of surgery of which there is physical evidence. Examination of fossil skulls shows that operations of this type were carried out as early as the Neolithic; In ancient Greece; trepanation is described by **Hippocrates.**	 **Skull of a maiden trepanned with flint, Neolithic (3500 BC); the patient**

I.4 Historical aspect

The chronology of prehistory began to be established in the 19th century, following the work ofthe great systematists of the previous century, **Carl von Linne,** and especially **Buffon,** who had largely pushed back the date of the origin of life on Earth.

In 1820, Christian Jürgensen Thomsen orders the collections of his museum according to the main materials used and creates a so-called “three ages” classification:

- **Stone Age**
- **Bronze Age**
- **Iron Age**

II. ANTIQUITY (appearance of civilization)

Introduction:

The word “civilization” derives from the Latin **civis** which means “citizen”. It therefore implies a society, a group of populations in which each person has a specific role: the tasks are specialized and the relationships between individuals are governed by rules organized around a link of authority. In particular, there are laws and a judicial system (as arbitrary as it may be) which aims to settle disputes between individuals while avoiding personal score settling as much as possible.

It is agreed that the first civilizations were born from the large-scale organization of agriculture, on the banks of the great rivers of the Middle East (Nile, Euphrates, Tigris, Indus) and China.

The historical period as such begins with the invention of writing, around 3000 years before our era, in Mesopotamia and Egypt. Mesopotamia and Egypt were Bronze Age civilizations. These civilizations were shaken in the middle of the second millennium BC by the arrival of the Iron Age, whose historical significance was immense. Iron is more difficult to work than bronze, due to its higher melting temperature, requiring more sophisticated furnaces. Note that iron ore is much more abundant than copper ore, during the Bronze Age, the rarity of the metal made it a luxury item, the prerogative of nobles and warriors. The peasants had only stone tools making it difficult to farm outside narrow areas near rivers, where the land is easy to work, such as Egypt and Mesopotamia.

II.1 MESOPOTAMIAN AND BABYLONIAN PRE-SCIENCE

II.1.1 Mesopotamia in history

Mesopotamia is the "country between two rivers": the Tigris and the Euphrates, a civilization developed there as ancient as on the banks of the Nile. The use of bricks rather than stones in the construction of large buildings meant that the Mesopotamian civilization did not leave such lasting traces as the Egyptian. From the middle of the 19th century, archaeologists discovered the ruins of several buried cities, such as Our, Babylon (Babel), Nineveh, which gradually revealed the extent of Mesopotamian civilization. The oldest civilization of Mesopotamia developed near the mouths of rivers, around -3000, in the region called Sumer.

It's Sumerian which becomes a written language for the first time, around 3300 BC. J.-C. This writing was used at the beginning for the trade. The invention of writing is a very important thing for the preservation and transmission of ideas. The writing medium in Mesopotamia was clay present in many forms, in tablets; Most of the technical knowledge of Mesopotamia seems date back to the time of the Sumerians, the third millennium BC. The city of Babylon (or Babel) becomes the most important center.

In the middle of the second millennium, peoples knowing the use of iron (the Hittites) invade Mesopotamia and thereafter, in the first millennium, the power moves north, in the area known under the name of Assyria. The Assyrians (El Achoriynes in Arabic), kept the language and writing of the Babylonians. Most of the written documents that we have on Mesopotamia come from excavations carried out in Assyria. Irrefutable archaeological evidence of the Deluge, a sort of prolonged flood that affected all of lower Mesopotamia around -3200, was uncovered in the 1920s. first millennium, a people settled in Syria, the Arameans, ended up imposing their language throughout the East.

In this language, the peoples inhabiting lower Mesopotamia called themselves Kaldou, which becomes Chaldeans in French. For this reason, lower Mesopotamia is often referred to as Chaldea and its inhabitants Chaldeans.

Chaldean knowledge has come down to us mainly in the form of terracotta tablets covered with so-called cuneiform (wedge-shaped) characters, because they were printed with a carved reed.

This script was used for more than 3000 years, starting from -3500. We have hundreds of thousands of such tablets, found during multiple archaeological digs

II.1.2 Mathematics

It is on Babylonian clay tablets that we find the trace of the first mathematics:

The four basic operations were done using tables and practical problem solving using words detailing all the steps.

- The strength of Chaldean mathematics lies in their positional numeral system, base 60 (sexagesimal).
- The division of the circle into 360 degrees, of thedegree into 60 minutes and of the minute into 60 seconds (and similarly for the units of time) goes back to the Chaldeans, whotransmitted it to the Greeks.
- The Chaldeans ignore the zero, which makes their notation ambiguous. They apply their number system to fractions.
- The Chaldeans can also be considered as the founders of algebra, However, this algebra will not be extended and we will have to wait for the work of Muslim mathematicians to develop this aspect of mathematics.
- **For trade,** it was necessary to name animals and plants. But they did not limit themselves to a simple enumeration, theyclassified them and this went beyond the mere market domain.
- This is how hundreds of animals and plants are classified into " kingdoms ".

II.1.3 Astronomy

Magic and astrology played an important social role in Mesopotamia. Therefore, the astronomical observations of the Chaldeans were numerous:

- The Chaldeans used a lunar calendar. Like the period of the Moon (29 d., 12h., 44 min., or 29.531 days).
- They concluded that the solar year is 365.20 days. This is remarkably close to reality (365.26 days).
- They could predict lunar eclipses and solar
- eclipse possibilities (i.e. they could tell when a solar eclipse was likely to occur.
- They are the authors of the Zodiac and of its division into twelve constellations.
- They observed the positions of the planets, without however developing a theory to explain them;
- geographical maps are also produced, such as that of the city of Nippur (which was even used by archaeologists exploring the remains of the city). A map of the world was even found, placing Babylon in the center and the distances represented by the duration of the journey and not by the actual distances.

II.1.4 Medicine

- The Mesopotamians knew several diseases and had remedies for each of them.
- Medical texts and manuals had even been written, but it would seem that the doctor's experience was the mostimportant.
- Remedies, based on plant drugs such as roots but also minerals such as salt, rubbed shoulders with magic.

II.2 EGYPTIAN SCIENCE

II.2.1 Egypt in history

Egypt was host, along with Mesopotamia, to the first great civilization of antiquity. From the distant civilization of the Neolithic. Its existence and maintenance span more than 3,000 years.

Egyptian civilization is linked to a unique geographical location which is its entire foundation: the Nile Valley. This country is entirely dependent on its artery, the Nile, and its annual floods which fertilize the soil. It is the Nile which, by its flood, brings water and silt, that is to say, life. The kings who reigned over Egypt (pharaohs) were classified by ancient historians into thirty dynasties.

II.2.2 Character of Egyptian knowledge

Ancient Egypt was a centralized monarchical state. The scribes, a sort of accounting functionaries, were responsible for the inventory and the distribution of the harvests and it was in their hands that the transmissible knowledge of the Egyptians rested, in particular in mathematics.

Paradoxically, the most fertile era in technical inventions is *the Old Kingdom* **(the era of the great pyramids).** For example, the great pyramids of Cheops and Chephren have their faces oriented towards the four cardinal points in relation to the course of the Sun (equinox).

Egyptian **engineering** achieved impressive efficiency: the Egyptians took only thirty years to build each ofthe great pyramids. The number of workers needed, the volume of stones to bring, the transport from the quarries, the infrastructure necessary for the realization (ramps), the quantity of food to bring to the workers, everything is calculated. The precision of the stone-cutting technique, too, is truly impressive and it is still not understood how the20,000 workers of the **pyramid of Chephren** have succeeded in making such huge blocks perfectly joined by mounting them where they are. The temples, obelisks and tombs are equally impressive. The scribes calculated quickly and well, the workers worked quickly and well.

II.2.3 Mathematics

- The Egyptians have a *juxta-positional* numeral system (analogous to Roman numerals); They have signs for the unit, the ten, the hundred, etc.
- The significance of the number 10 likely stems from our ten fingers, which have been used to count since prehistorictimes.
- The Egyptians only know integers, unit fractions (of the form $1/n$, where n is an integer).
- All other fractions must be reduced to combinations of these.
- **Herodotus** attributes the invention of geometry to the Egyptians. In fact, their geometric

- knowledge is purelypractical and empirical.
- They know how to calculate the area of a rectangle, a trapezium, a triangle.

- They know that thevolume of a pyramid is 13 *Bh (B:* base, *h:* height).
- Note that the proof of this last formula requires reasoning based on the integral calculus, but we do not know howthe Egyptians achieved it. They adopt the value $\pi \approx 3.1605$.
- In general, the Egyptians are stronger in geometry than in arithmetic.

II.2.4 Astronomy

- The Egyptians distinguish the planets from the stars.
- They have rudimentary instruments for measuring astronomical positions.
- The zodiac, which we have inherited, is none other than the calendar of the Egyptian seasons, established from theMesopotamian zodiac.
- They have the best calendar of Antiquity: a year divided into 12 months of 30 days, plus 5 days.
- This calendar underestimates the length of the year by about 6 hours and leads to "floating solstices" (wanderingyear), that is to say a progressive shift in the seasons (a receding season every 360 years, approximately).
- It isthe kings who will demand the development of a new calendar, with a leap year every four years to correct the situation.
- The Egyptians measured time using sundials during the day and *clepsydras* (water clocks) at night.

II.2.5 Medicine

- knowledge of Egyptian medicine is based mainly on the discovery of numerous papyri where diagnoses andtreatments are recorded.
- The legendary founder of Egyptian medicine is the physician-architect in the service of Pharaoh **Djoser,** who lived around (-2800/ - 2700).
- Egyptian medicine is hybrid: on the one hand it contains a strong dose of magic; incantations uttered by the doctor are supposed to bring healing bythemselves
- The use of empirically discovered drugs also seems important.
- The Egyptian doctor is a craftsman, whose knowledge must be transmitted in a hereditary way: one is a doctor fromfather to son, as one is a scribe, or armourer, or shoemaker from father to son. It seems that Egyptian surgery was superior to medicine.

- Egyptian doctors have an in-depth knowledge of the inside of the human body. They identified and described a large number of diseases.
- They are competent in cardiological, gynecological, eye, intestinal and urinary tract medicine.
- They perform operations successfully knew how to sew upwounds; they made dental fillings with

gold; they repaired fractures by replacing the bones and holding them together with wooden splints.

- They are the most famous of their time and are widely called upon, including from abroad. As with mathematics, they taught their knowledge orally and through a number of papyri. It is no coincidence that Greek physicians, like their mathematician or astronomer colleagues, came to train in the *House of Life* in the famous **library of Alexandria.**

II.3 GREEK SCIENCE

II.3.1. Extent of Greek civilization in history

Those who are called Greeks, but who call themselves Hellenes, are of Indo-Aryan origin and populated present-day Greece around the year (–2000).

During the archaic period (–750/–500) the mercantile economy developed and the bourgeoisie and at the same time the blossoming of science and philosophy.

At that time, several cities founded colonies around the Aegean Sea, in southern Italy (Great Greece), in Sicily. The city of Miletus alone founded 80 colonies, including Naucratis, on the Nile delta. Among the colonies of Phocaea is Massalia (Marseille), founded around -600. Greek civilization spread over almost the entire Mediterranean and the Black Sea.

The following period (–500/–338) is the so-called classical period. The democratic system is spreading. Ionia is conquered by the Persians and mainland Greece fights against them (Medic wars). Civil wars rage between various cities, in particular between Athens and Sparta, this period marks the pinnacle of classical Greek culture in literature and the arts. It is also the time of Socrates, Plato and Aristotle.

After -338, Greece came under Macedonian domination but its civilization spread throughout the East through the conquests of Alexander the Great. Greek kingdoms shared the East (Egypt of the Ptolemies, Syria of the Seleucids) and Greek cities flourished: Alexandria in Egypt, Antioch, Pergame, etc. The Greek language becomes the language of communication in the Mediterranean. This is the Hellenistic period, that of the apogee of ancient science.

II.3.2 Character of Greek science

Greek philosophy is characterized above all by a concern for intelligibility: we wanted to understand phenomena by inserting them into a system. It is also characterized by the use of logical reasoning), but in general very speculative.

The Greeks are above all excellent dialecticians, that is to say, they strive to convince their interlocutors. One of the main tasks of the great Greek philosophers will be the sanitation of logic and dialectics.

It remains that the Greeks are clearly distinguished from their Eastern predecessors by this taste for speculative philosophy and geometry. The Greeks did practically no scientific experiments in the sense we understand it today.

We will divide Greek science into three periods, corresponding to the eras: (1) archaic, (2) classical and (3) Hellenistic.

II.3.3 The Archaic Period *(The Pre-Socratics)*

II.3.3.1 The first Ionian philosophers

- The first known Greek philosophers did not inhabit Greece proper, but the periphery of the Greek world, notably Ionia and southern Italy. The city of Miletus was the most important in Ionia and was the homeland of several philosophers ofthis period.
- The main characteristic of the Ionian philosophers is their ***materialism:*** they propose an explanation of natural phenomena without having recourse to the intervention of the gods, but only by the natural play of matter. They are theinventors of the concept of ***Nature,*** in Greek ***physis,*** as distinct from the supernatural world.
- The first known philosopher is **Thales** of Miletus, one of the "seven sages" of ancient Greece, he drew the course ofthe sun from one solstice to another, and demonstrated that compared to the sun, the moon is the one hundred and twentieth part. It was he again who fixed the duration of the month at thirty days, and who wrote the first treatise on Nature. He suspected that water was the principle of things, that the world was animated and full of demons. It is saidthat he discovered the seasons of the year, and that he divided it into three hundred and sixty-five days, he measuredthe Pyramids by calculating the ratio between their shadows and that of our body.
- **Anaximander** from a younger generation than Thales, also from Miletus, was perhaps the pupil and **Anaximenes,** last representative of the school of Miletus

The Pythagoreans

- Little is known of **PYTHAGORE,** except that he was born in Samos in (-572) and that he emigrated to Crotona, in southern Italy. He founded, in Crotona, a politico-religious sect, whose disciples were subjected to strict discipline. The sect of Pythagoras exercised temporary control over Croton, but soon the inhabitants revolted against such a rigid order and forced the exile of Pythagoras to Metapontum, where he died around -500.
- A disciple of Pythagoras, **PHILOLAOS** (-470), left Italy for Greece where he founded a Pythagorean community.Philolaos left us a model of the Universe: The Earth is spherical. All the stars revolve around a central focal point.

- The Pythagorean doctrine involved a belief in the reincarnation of souls, it places mathematics at the heart of philosophy. The Pythagoreans knew the so-called “Pythagorean theorem”, apparently without proof, gradually adopted the requirement of a proof in the study of mathematics, integrated music *into* mathematics; The fact that the sounds produced by vibrating strings are in harmonious ratio when the lengths of these strings have integer ratios (at equal tension and density) was of capital importance to them. This fact tended to demonstrate that “numbers are the models of things”.

II.3.4 The classical period

Socrates

Socrates has been called "the midwife of reason" because of his dialectical method which consists to guide his interlocutor towards a rational conclusion rather than presenting his ideas directly to him.

Plato and his school

Plato Unlike Socrates, of whom he is the most important disciple, Plato is interested in the physical world and the means of knowing it, Plato is above all an idealist in the strong sense of the term: he distinguishes the sensible world (that of *sensations)* of the *intelligible* world (that of ***ideas).*** Note that in Greek, ***eidos*** can be translated both by *idea* and by *form.* However, he attaches great importance to the study of geometry and the stars.

Eudoxus of Cnidus

Attached to the school of Plato, Eudoxe of Cnide (–406/–355), considered one of the greatest mathematicians of antiquity. Eudoxus' main contribution to mathematics is the introduction of the concept of 'magnitude'. Problems that could have been handled algebraically or arithmetically are now expressed in purely geometric language.

Aristotle

Aristotle (–384/–322) was a disciple of Plato. He founded his own school in Athens which was called *Lyceum,* because of its location on a site dedicated to Apollo Lycian. Aristotle often gave his lessons while walking in the company of his students. After Aristotle's death, his school was led by Theophrastus (– 322/–287), then by Strato (–286/–270) and by Lycon (–270/–228).

According to Aristotle, we must distinguish sensitive knowledge (ie provided by our senses) from truly scientific knowledge, obtained by a series of definitions and demonstrations. In this sense, Aristotle is Platonic. However, unlike Plato, Aristotle admits that ideas are partially accessible through the senses. Aristotle is the founder of natural history (biology) and devotes at least a quarter of his treatises to it.

II.3.5 Classical Greek Medicine

Temple medicine: During the classical period, two types of medicine were opposed in Greece: the medicine of the temples and that of the different schools of medicine.

The first is a magical practice, flourishing in Greece at the very moment of the birth of philosophy and rational science.

It is possible that she was imported from Egypt, or at least strongly influenced by her. In addition, there were herbalists who prepared a host of traditional remedies.

Their practice is not only empirical, but tinged with magical beliefs. In particular, they believed that certain plants should be picked at particular times of the lunar cycle, by pronouncing certain formulas or incantations.

Medical Schools: Parallel to – and in opposition to temple medicine there were medical schools.

The school of Cnidus attached great importance to observations (for example, auscultation of the lungs was practiced there), but was reticent about theory.

The school of Cos, on the contrary, insisted on the importance of theory and reasoning, the medicine of Cos is the first truly scientific medicine, although its theories seem very naive to us today. The most illustrious representative of the school of Cos is Hippocrates (-460/ *-377).* We can rightly consider Hippocrates as the father of scientific medicine, because of his caution, his distrust of magical practices.

II.3.6 The Hellenistic period

The Hellenistic period was cluttered with wars ended with the Roman conquest of the Greek world, with the mixing of ideas, cultures and religions that took place there, this cosmopolitan period is that of antiquity that most resembles our modern world. It was at this time, more precisely between (-300 and -150) that ancient science reached its peak.

Alexandria and the Museum

- Alexandria was not only the capital of the kingdom of Egypt, but the effective metropolis of the Greek world and of science until the fifth century of our era, that is to say for seven centuries.
- Ptolemy I is the founder of the *Museum* of Alexandria which was a cultural and scientific institute inspired by Aristotle's High School, but on a larger scale.
- The Museum had promenades, classrooms, cells (offices), an observatory, dissecting rooms, living quarters and even a zoological garden, it was flanked by a huge library, which numbered several *hundred* thousand volumes (in the form of papyrus rolls).

II.4 THE ROMANS

The decline of the ancient sciences undeniably occurs from the beginning of the Roman Empire. The strictly Roman contributions are more technological than scientific. It is however worth mentioning their architecture, The Romans,**excellent engineers,** left roads and buildings still usable after 2000 years, but their reluctance in the face of speculative philosophy did not allow any real development.

Among the Latin authors touching on science, let us quote:

1. **Titus Lucretius Carus, (-98/ -55)** is a poet attached to the Epicurean school. In a long poem entitled *De Natura Rerum* (Of Nature), he describes Epicurean physics and draws moral lessons from it.

He warns humans against needless fear of the gods, since the fate of the world is governed by material phenomena only.

2. **Marcus Vitruvius Pollio** is an engineer-architect of the first century BC. In his work, *De Architectura* (On Architecture),he explains not only the theoretical and aesthetic principles of architecture, but also the basics of physics and mechanics known at the time.
3. **the Elder Caius Plinus Secundus, (23/79)** is above all a naturalist, author of a vast encyclopedia (the first known)entitled *Natural History* in which he wants to bring together all the knowledge of his time.

II.5 CHINA

II.5.1 China in history

China has been hosting to an **organized civilization** from the earliest antiquity. Although it has not always been unified, it has nevertheless experienced less upheaval than the Mediterranean world and has enjoyed much greaterethnic and cultural stability.

II.5.2Character of Chinese science

- The Chinese did not practice a speculative and deductive philosophy like the Greeks.
- Their science is both more practical and more observational.
- The Chinese term for **"science",** *kexue,* means **"classifying knowledge".**
- Ancient Chinese techniques were generally superior to those of Europeans until the 15th century.
- The greatest Chinese cultural and scientific thrust dates back to the Warring States period (–5th/–3rd centuries) and curiouslycoincides with the period of greatest progress in Greek science.
- The next period, during which a bureaucratic empire takes hold, also marks a slowdown in progress. This slowdown is attributed to Confucian social doctrine, which tends to favor a stationary regime by suppressing individual selfishness and competition, which prevents the emergence of a merchant bourgeoisie, to the benefit of a caste of civil servants.
- However, it seems that the existence of a merchant bourgeoisie is very favorable to the rapid development of science and technology.

II.5.3Chinese technical innovations

Some Chinese innovations that only found their way to the West later:

1. Printing, usually without movable type.

2. The compass.

3. The universal joint (known *as Cardan* in the West).

4. Mechanical clocks.

5. Gunpowder

6. magnetic compass

7. blood circulation

Among China's most important scientists are **Shen Kuo** (1031-1095) and **Zhang Heng** (78- 139)

II.5.4 Mathematics

- The Chinese used, as early as the -14th century, a positional numeral system based on 10. Their language includedmonosyllabic words for all the numbers from 1 to 10, in addition to 100 and 1000. These words are still the same today today.
- Calculations were therefore relatively simple in China, compared to Greece, which explains
- their greater prowess in algebra, but alsotheir weakness in geometry.
- The zero was not introduced until the 8th century.
- The abacus (or abacus) was invented between the 3rd and 6th centuries and made it possible to quickly perform complicated arithmetic calculations.
- Chinese geometry was much less developed than that of the Greeks.
- The Chinese however knew the Pythagorean theorem, an ingenious proof of which was given by **Tchao Kiun king** in the 2nd century.
- Their value of ÿ is remarkably precise: in the 3rd century, Lieou Houei obtains $\pi \approx 3$, 14159. Tsou
- Tchong Tche, a little later, obtains $3.1415926 < \pi < 3$, 1415927

II.5.5 Astronomy

- The Chinese have used a year of 365.14 days from the first centuries of their history.
- They compiled extensive star catalogs (a catalog from the Warring States period has 1464 stars) and
- meticulously observed novas and comets.
- These old observations are still useful to astrophysicists.
- The Chinese used an equatorial celestial coordinate system, as is customary in astronomy today.
- The ancient Chinese cosmology is naive. However, it is said that there is no celestial vault (the
- "extended night") and that the stars float in the void.
- From the year 527, mention is made of marine fossils and the correct explanation is given: the formation of mountains at the bottom of the ocean.

II.5.6 Physics

Chinese physics is based on two principles (yin and yang) and on five elements (or agents): earth, fire, metal, water and wood. The two principles are in constant opposition and Nature always seeks to restore the balance. Thefollowing qualities are associated with the two principles:

1. Yin: dark, cold, damp, feminine, odd.
2. Yang: clear, warm, dry, masculine, even.

As for the five elements, they also correspond to.

1. five flavors (sour, bitter, sweet, astringent, salty),
2. five places (north, east, south, west, center),
3. five colors (blue-green, red, yellow, white, black),

II.6 INDIA

India, a land steeped in history and ancient wisdom, boasts one of the world's oldest and most profound civilizations. Stretching back over 4,500 years, the Indian civilization has been a cradle of diverse cultures, languages, and traditions. From the great Indus Valley Civilization, one of the world's earliest urban centers, to the Vedic period's philosophical and scientific contributions, India's heritage is rich and multifaceted. Throughout millennia, it has been a melting pot of ideas, spirituality, and artistic expression, giving birth to major religions like Hinduism, Buddhism, Jainism, and Sikhism. India's contributions to mathematics, astronomy, literature, and medicine have left an indelible mark on human knowledge.

II.6.1 The Vedic Indians

- In the middle of the second millennium BC, at the beginning of the Iron Age (-1500), Aryan-speaking peoples gradually invaded Iran and northern India.
- The invaders of India are said to be Vedic Aryans and their language is Sanskrit, still today the sacred language of India.
- These people elaborate sacred texts called Vedas (meaning “knowledge”), the main one being the Rig Veda (Veda of hymns).
- The Vedas contain by allusion certain conceptions of the material world, in particular on a certain normal order of the world. •
- During the first millennium BC, supplements to the Vedas, the Brâhmanas, were written.
- The Vedic world system is described in one of them. The immense influence of the Vedic religion is felt in all the “scientific” knowledge of the Indians.
- In fact, astronomical and mathematical knowledge is difficult to dissociate from religion for them.

II.6.2 Astronomy

- The Vedic Indians placed great importance on astronomy, due to their deep belief in cycling, ie the cyclical repetition of the world's race and events.
- Knowledge of the period of revolution of the stars was therefore important.
- The great length of certain cycles forced the Indians to develop a number system that could describe very large numbers.
- The Vedic calendar uses a year of 12 months of 30 days (360 days). A leap month of 25 or 26 days is added every five years. Each day is divided into 15 “hours” (or moments) of day and 15 moments of night.
- The number of these moments in a year is therefore 10,800, which is also the number of metric units in the Rig- Veda! A certain mystique of numbers seems to characterize Vedic philosophy.

- It seems that the Greeks influenced India very early in astronomy, through contacts during the conquests of Alexander and also later.
- However, the Indians made, for religious reasons, careful observations of the movement of the Moon and the Sun.
- The astronomer Aryabhata (born in 476), who perfected the system of epicycles borrowed from the Greeks and who believed in the rotation of the Earth, used the value $\pi = 3.1416$.
- In trigonometry, Aryabhata is also the inventor of the sine.
- Indian mathematics is subordinate to astronomy: there is no treatise on pure mathematics and mathematical knowledge is exposed in treatises on astronomy.
- On the other hand, no importance seems to be given to evidence, which is a major setback compared to the Greeks.
- In ancient times, the Indians used a semi-positional numeral system, with different symbols for 1-9, 10-90, 100-900, etc.
- It is generally accepted that the zero made its appearance in the 5th century, the numbers from 1 to 9 being older.
- Westerners say that the most lasting legacy that Indian science has left to humanity is undoubtedly the decimal numeral system of nine Arabic Indian digits plus zero.
- However, the oldest inscription still visible using this complete decimal system dates from the year 876, a date coinciding with the Muslim civilization.
- The decimal system with zero reached China to the east and spreads to the West in the 12th century.
- In chemistry, they carried out remarkable work in the fusion of iron

II.6.3 Medicine

- They discovered that some illnesses were caused by changes in the environment (change of seasons, poor hygiene, etc.), but they did not try to classify the illnesses.
- The fundamental treatise of Hindu medicine is **Ayurveda**. The latter explained that diseases are due to an imbalance and that thus to cure a patient it is necessary to replace the harmful elements by those which are harmonious.
- Explanations of various surgical operations are also prese

Conclusion

In conclusion, the journey through the **history of science**, from *prehistoric* times to antiquity, reveals the remarkable evolution of human understanding and curiosity. During the prehistoric era, our ancestors' keen observations of the natural world laid the foundation for scientific inquiry. They made significant strides in understanding celestial patterns, animal behaviors, and plant properties, setting the stage for the systematic study of nature.

In antiquity, the torch of knowledge was carried forward by ancient civilizations such as Mesopotamia, Egypt, China, India, and Greece. These cultures made groundbreaking contributions to various scientific disciplines, including mathematics, astronomy, medicine, and philosophy. Thinkers like Pythagoras, Euclid, and Aristotle pioneered theories and concepts that shaped the course of scientific exploration for centuries to come.

As we reflect on **prehistory and antiquity,** we recognize the ingenuity and intellectual curiosity of our forebears. Their discoveries, theories, and methods form the bedrock upon which modern science stands. The lessons learned from these early pursuits continue to inspire contemporary scientists, reminding us of the enduring human spirit that seeks to unravel the mysteries of the universe. The chapters of prehistory and antiquity serve as a testament to the enduring human quest for knowledge, a quest that continues to drive scientific inquiry and discovery in the modern age.