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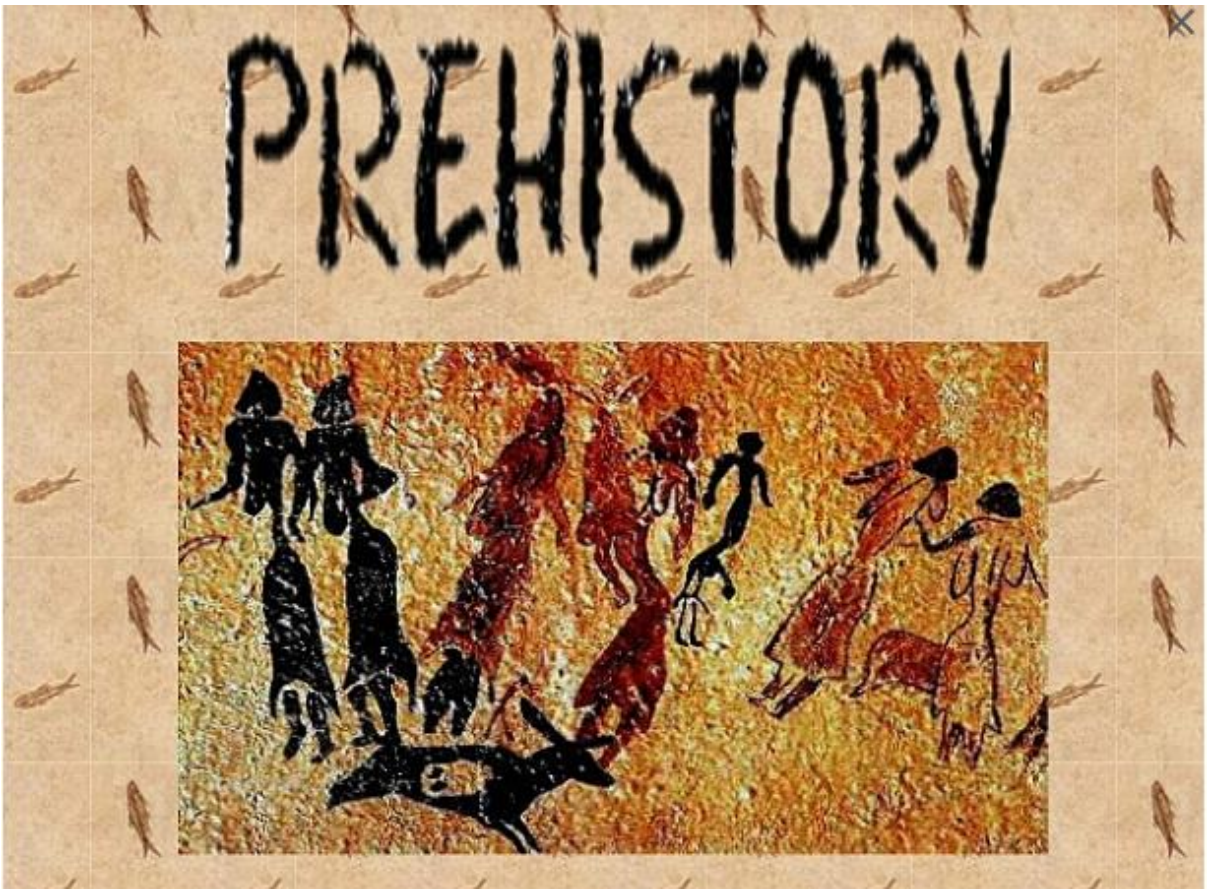
جامعت عبد الرحمان ميرة بجاية

Transversal unit

Universal History of Biological Sciences module

Chapter I



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Introduction to the Universal History of Biological Sciences

Before undertaking the history of biological sciences it seems important to understand the meaning of ***Science*** and ***Biology.***

To this end, science is defined as the clear and certain knowledge of something, based either on obvious principles and demonstrations, on experimental reasoning, or on the analysis of societies and human facts.

There are three types of science:

- The exact sciences, including mathematics and mathematical sciences such as theoretical physics
- Physical, chemical, and experimental sciences (natural and material sciences, biology, medicine);
- The human sciences, deal with mankind, its history, behaviour, language, social, psychological, and political aspects.

"***Biology***" comes from the Greek: bios 'life' and logos 'discourse', and is defined as the science of living organisms: animals and plants. It covers part of the natural sciences and the natural history of living beings. The word 'Biology' was first coined at the end of the 18th century and the beginning of the 19th century by: Theodor Georg August Roose in 1797; Karl Friedrich Burdach in 1800; Gottfried Reinhold Treviranus and Jean-Baptiste de Lamarck in 1802.

The **Universal History of Biological Sciences** explores the remarkable journey of biology, tracing its development from the earliest human interactions with nature to the advanced sciences of today. This module covers the evolution of biological thought through key historical periods: **prehistory, antiquity, middle ages, renaissance, and modern times**.

Through this module, you will gain insight into how the field of biology has continuously evolved, influenced by philosophical, cultural, and technological advancements. You'll explore key figures, theories, and discoveries that have shaped modern biological sciences and examine how biology has grown into a vast and interconnected discipline that continues to unravel the complexities of life.

1. History of biology in the prehistoric era

1.1. Definition of prehistory

Prehistory is commonly defined as the period between the appearance of mankind (2.5 million BC) and the appearance of the first written documents. The knowledge of this prehistoric period, marked by the absence of writing, is based exclusively on artifacts found in archaeological digs and representations in the form of paintings, engravings and rock carvings that convey the elements that marked man at that time. The sciences that have contributed to provide evidence of this period are archaeology, and anthropology, thanks to excavations (fossils, paintings.....) the use of carbon-14 for dating, and molecular biology (DNA).

Although the term biology was not coined until 1802 by Lamarck and Treviranus, the study of life and living beings had already been around for several centuries. Prehistoric man was already familiar with biology before it became a real science. Thus, the study of biological sciences, as we know it now, stems from centuries of observation, experimentation, and inquiry. In prehistory, the knowledge of living organisms wasn't organized in scientific terms, but it was vital. Early humans had to understand which plants were edible, which animals were dangerous, how to track prey, and how to manipulate their environment to improve their chances of survival. Through hunting, gathering, and eventually agriculture, they gained a wealth of practical knowledge about biology.

1.2. Stages of prehistory

The stages of prehistory (figure 1) represent key phases in the development of human society, primarily characterized by the evolution of tools, technology, and cultural practices.

The first stage, the **Paleolithic** (Old Stone Age or the age of carved stone), from Greek palaios: ancient and / lithos (stone) was mainly constituted by three periods as below:

Low Paleolithic era (3 million – 350 000 BC)

Middle Paleolithic era (350 000 – 45 000 BC)

Upper Paleolithic era (45 000 – 12000 BC)

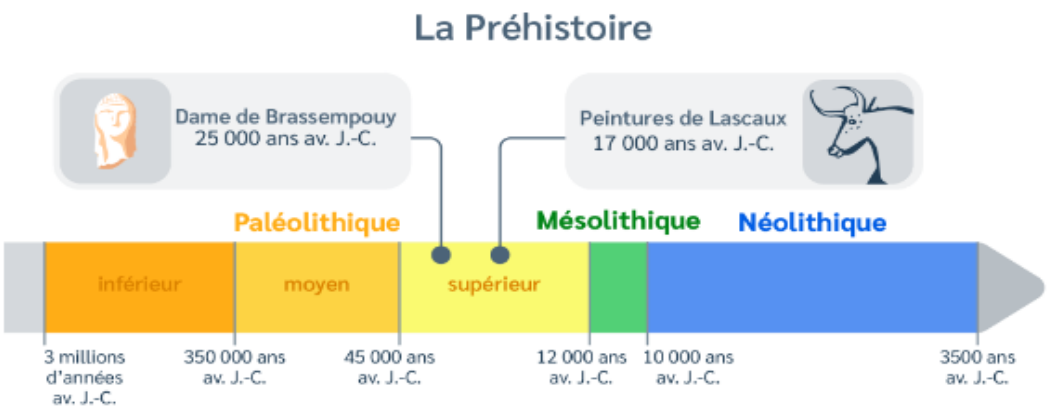


Figure 1: Timeline of prehistoric era

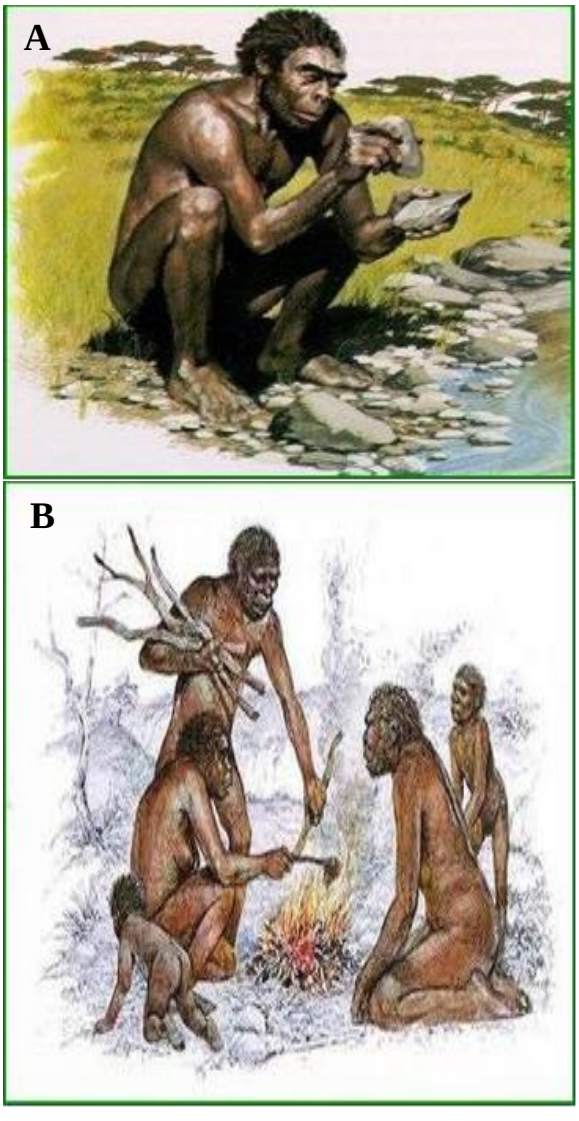
Caracterisctics

The paleolithic era was marked by humans living as hunter-gatherers which led to a nomadic way of life. They lived in small groups of about 20-30 peoples. They developed simple tools from stone, bones or wood (figure 2). They learned to control fire, developing early art forms like cave paintings and manufacturing clothing and containers from animal skins (figure 3). The dog is the only species domesticated for hunting purposes, and only at the very end of this period.

Figure 2: Paleolithic tools

Figure 3: Cave painting and simple tools made from stone, wood and animal's skin.

This era also saw the emergence of early first hominids, such as *Homo habilis* and *Homo erectus*, eventually leading to *Homo sapiens* (figure 4).



Homo habilis (*dexterous man*) (A) is considered as the first representative of the human species. He appeared over 3 million years ago. He was small in stature, but could already stand upright. He lived in rudimentary shelters or even in trees to protect itself from predators, feeding mainly on roots, wild berries, insects or shellfish. *Homo habilis* was the first to use tools, notably carved stones for butchering animal corpses. That's why the period he lived in is called the **Paleolithic** (*carved stone Age*). They live in small groups that move around in search of food. They are therefore **nomadic.**

A million years ago, ***Homo erectus*** (*standing man*) (B) appeared. He was a great traveler. His traces can be found in Africa, Europe, and Asia. He cut flint more precisely (**biface**) and used increasingly sophisticated tools. His

habitat also evolved. He began to live near lakes and rivers, in huts made of branches or animal bones and covered with skins. The discovery of spears and propellers enabled them to hunt larger animals such as mammoths, bison, and reindeer. 500,000 years ago, he discovered fire and gradually mastered it. Fire enabled early man to ward off predators, harden spearwood, and cook meat to make it more digestible, keep warm, and stay awake longer. It was also used as artificial lightning.

Homo neandertalensis (C) appears morphologically different from present-day man: they had a more massive stature, bony head with supraorbital ridges, powerful jaw, and teeth. Neanderthals are robust, averaging 1.70 m in height and stocky. They have a large cranial capacity, up to 1750 cm3, which is greater than that of modern man. This enabled them to withstand the cold of the Ice Age. Their flint-cutting technique was more precise, with flakes taken from cobbles being retouched for specific uses (scrapers, points). First known in Europe, the geographical distribution of Neanderthals was extended as far as China. They were the first to master articulated language and cave paintings.

C

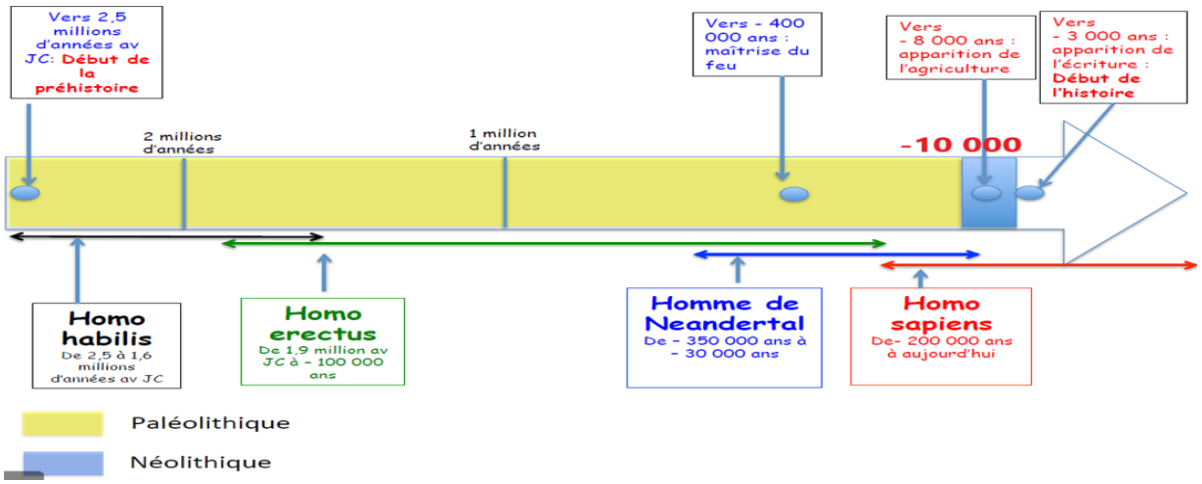


Figure 4: Men in prehistoric era

Next, the **Mesolithic** (Middle Stone Age), from 10,000 to 6,000 BCE, was a transitional period where humans refined their tools and developed more complex social structures. While still relying on hunting and gathering, they began to settle in semi-permanent locations and used more specialized tools like microliths. Fishing became an important food source, signaling more sophisticated resource management.

The **Neolithic** (from the Greek 'neos = new, 'líthos'=stone) literally refers to the 'new stone age', from 6,000 to 2,000 BCE. The Neolithic has also often been described as the 'polished stone age' (as distinct from the Palaeolithic, the 'carved stone age'), since in many regions it was distinguished by the systematic polishing of certain stone tools. This stone is smoother, stronger and sharper.

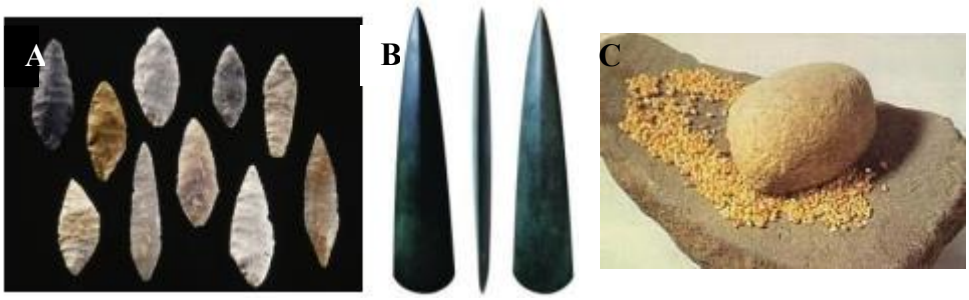
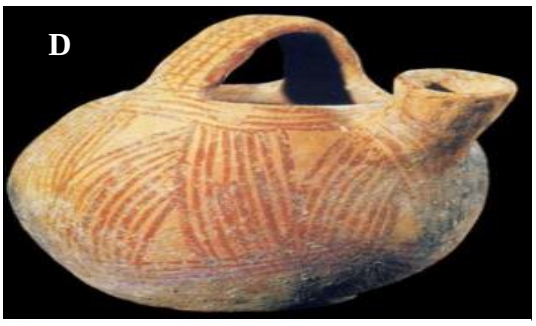


Figure 5: Cut stones (A), polished stones (B) and polished stone tools (C).

This period marked a major turning point with the advent of agriculture and the domestication of animals (domestication of goats, pigs, and cattle). Humans shifted from nomadic life to establishing permanent settlements, growing crops, and raising livestock. This period also saw the development of pottery decorate with different designs (D) (for cooking and preserving food), weaving, and the construction of more complex dwellings (E) usually made from timber, wattle daub, or mud leading to the formation of early farming communities and more intricate social organizations. The invention of the wheel is also related to this part of the prehistory.



The first commercial exchanges were developed in this period of time. Barter was used to exchange agricultural produce for handicrafts. Long-distance trade was made possible by boats, and wheeled vehicles.

- **The appearance of megalithic monuments**

There are different types:

A. ***Menhirs*** (figure 6), made up of a single vertical block of stone. Menhirs were generally used as landmarks. It can mark the entry to a dolmen, a direction, or a boundary.

Figure 6: Menhirs

B. ***Cromlechs*** (stone circles) monuments made up of several menhirs (elongated stones standing vertically) arranged in a circle.

C. ***Dolmens***, (rough stones arranged in the shape of a gigantic table) gigantic table monuments consisting of a horizontal slab resting on vertical blocks.

These monuments were erected in Western Europe between 3500 and 1700 BC.

Biological thinking appears in this era of time. Evidence that **trepanation** was practiced in the Neolithic had been found in Western Europe prior to the mid-19th. Cow skull, dating to at least 3,000 BC and found at the Neolithic site of Champ-Durand in France, is the earliest example of such surgery on an animal. Trepanation is considered as the oldest surgical procedure.

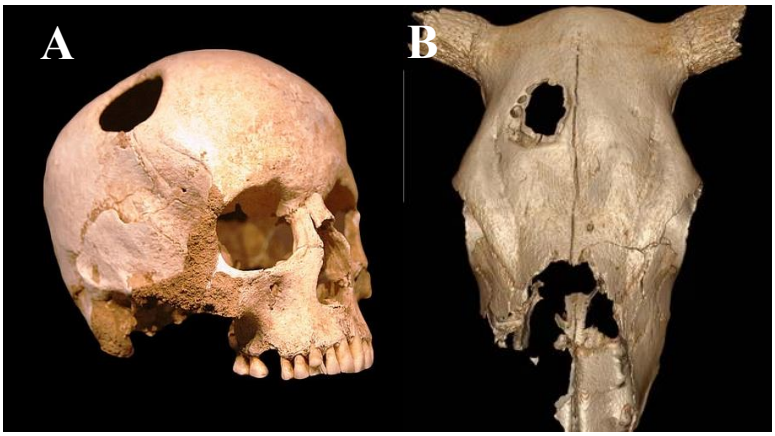


Figure 7: Trepanation on human (A) and animal skull (B).

Chalcolithic (Copper Age), beginning around 3,500 BCE, was a transitional phase where humans began using copper tools alongside traditional stone tools. Societies became more complex, with expanded trade networks and early forms of social hierarchy, setting the stage for the Bronze Age.

Finally, the **Bronze Age** (around 3,300 to 1,200 BCE) marked the end of prehistory in many regions, as humans began using bronze for tools and weapons. This era saw the rise of cities, writing systems like cuneiform, and complex state societies. The development of writing signifies the end of prehistory and the beginning of recorded history.

Each stage of prehistory reflects significant advancements in technology, culture, and societal organization, laying the foundation for the civilizations that followed.