AN ARCHAEOLOGICAL APPROACH TO THE STUDY OF THE HISTORY OF THE LIVING WORLD : ARABIC KNOWLEDGE AND LATIN KNOWLEDGE PRIOR TO « BIOLOGY »

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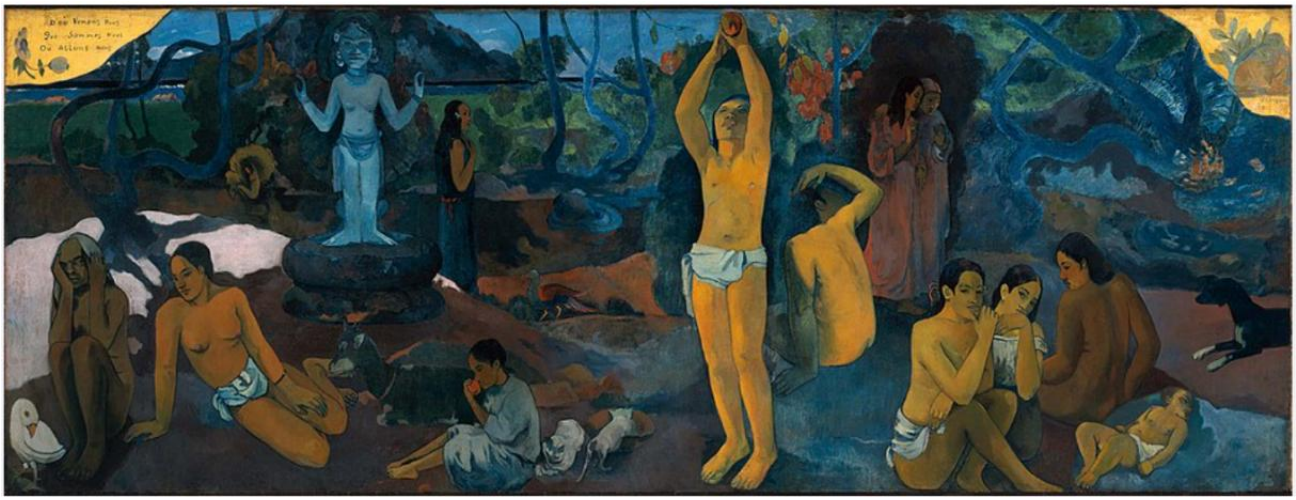

Figure1. Where do we come from? What are we? Where are we going? Paul Gauguin (1897-1898)

INTRODUCTION

The quest to understand what life is and the history of living beings has always intrigued human thought. A historical perspective on biological knowledge can enrich it and lead to a better understanding of current biology, as it seeks to "*explain how the concepts and models used today were formed, [...] to avoid mistaking the mere return of forgotten theories or models as novelty*" (Morange, 2017, p. 8). This aligns with the philosophical thought of Bachelard (1965), according to whom the history of science is "a recurrent history," and it serves to situate

contemporary debates within their context to better appreciate their significance and discern their meaning. Furthermore, scientific advances are a collective endeavor, and their history cannot be reduced to attributing a major role to only a few actors.

The objective of this contribution is to undertake an archaeological inquiry into the discursive and non-discursive foundations that made possible (or precluded) certain pre-«biological» formulations concerning aspects of the living world and its dynamics. The focus is on the Middle Ages, often described as the pinnacle and «golden age» of Arabo-Islamic civilization while portrayed as barren and stagnant in the Latin world, followed by the Classical Age and the Enlightenment. We interrogate, in this context, the notion of the existence of biological knowledge prior to the constitution of «biology» as a scientific field in the early 19th century, as well as the idea of a «precursor» to the theory of biological evolution. Furthermore, we examine the concept of historical recurrence in the discursive and non-discursive practices that conditioned the possibility of conceptualizing the dynamics of the living world. This is achieved through an analysis of excerpts from the works of medieval Arab scholars and the conceptions of Latin thinkers concerned with the living world up to the Enlightenment, while highlighting the archaeological specificities that distinguish the two realms: the Arabo-Islamic and the Latin-Christian worlds.

To this end, we draw upon the work of Michel Foucault, who described his books as «*little toolboxes. If people want to open them, to use […] in order to short-circuit, to discredit, to break down systems of power, […] well, all the better!* » (Foucault, 1975a, p. 1588). We borrow three of his concepts to conduct this epistemological analysis through an archaeological approach. These three concepts are the episteme, the apparatus, and problematization.

1. AN ARCHAEOLOGICAL APPROACH TO KNOWLEDGE: EPISTEME, APPARATUS, AND PROBLEMATIZATION

First, what is archaeology? And why archaeology? Foucault (1978) clarifies that the term «archaeology» refers to «*the kind of research that aims to extract discursive events as if they were recorded in an archive*» (p. 468). In constructing the history of a domain of knowledge, Foucault (1969) chooses not to present an ordered exposition of knowledge through the assertion of a progressing rationality, but rather the concept of discontinuity in history, which is no longer an obstacle to circumvent but «*an operative concept to be used» (p. 18). The recourse to the word «archaeology» followed from the idea that «Archaeology would be that enterprise which attempts to reveal, at the foundation of bodies of knowledge, what makes them possible*» (Gros, 1996, p. 38), whereby a determined mode of being is imposed on the objects of knowledge; precise modes of positioning are imposed on the subjects of knowledge; and ordered modes of distribution are imposed on the concepts.

Foucault (1966) initiates the study of this archaeology by proposing the concept of the *episteme*, whose Greek root signifies knowledge or *understanding*. He defines it as follows: «*it is the totality of relations that can be discovered, for a given period, between the sciences when one analyzes them at the level of discursive regularities*» (Foucault, 1969, p. 258). The study of the *episteme* concerning the living[1] has shown that the primary ground of knowledge is historical, in the sense that it coincides with historical epochs. Foucault (1966) identifies three such epochs in the Western world: the Renaissance, the Classical Age (apparatus the 17th and 18th centuries), and the Modern Age (from the 19th century onward), each associated with a distinct order of knowledge,

[1] Foucault (1966) explore trois domaines de savoir, le langage, le vivant et les richesses, par une identification de l'épistémè qui les sous-tend.

corresponding respectively to the three historical periods: *the Order of Resemblance, the Order of Representation, and the Order of History.*

In the 1970s, recognizing the limitations of an archaeological analysis framed solely in terms of the *episteme* (Foucault, 1970), Foucault introduced the concept of the *"apparatus"* . In contrast to the *episteme*, which is specifically discursive, the notion of the *apparatus* refers to:

« A thoroughly heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral, and philanthropic propositions; in short, both the said and the unsaid » (Foucault, 1977, p. 299).

The unity in the production of different knowledges during a specific period, and the variation of their products from one era to another, guided the shift from the *episteme* to the *apparatus*. This transition stems from the fact that *«beyond any sensibility, culture, or organization of knowledge, there is always power»* (Freccero, 1994, p. 32):

"Disseminated throughout the social fabric, power produces knowledge through the pursuit of truth. The temporal, perishable character of the episteme is erased by the presence of power, timeless, unassailable, and universal. Knowledge and power are inseparable" (Ibid.).

Furthermore, by challenging the conception that power is solely negative, repressive, and prohibitive, Foucault attributes to power *«the universal aspect of a productive knowledge, managed by all and in which all participate»* (Freccero, 1994, p. 32). This imbues power with what Deleuze (1986), in his article «*Writer, No: A New Cartographer*» (pp. 31-51) published in Critique in 1975 and later revised in his 1986 work Foucault, termed a functionalist conception. This perspective views power not as an attribute, but as a relation. Consequently, power cannot be treated as a

separate entity, but rather as *« power relations that presuppose complex historical conditions of emergence and involve multiple effects »* (Revel, 2009, p. 76). Moreover, employing the concept of the apparatus allowed Foucault to conceptualize power in terms of multiplicity and inseparability from freedom.

The various insights enabled by the concept of the apparatus and the perpetual quest for a reinvented historicity led Foucault to supplement his archaeological analysis by invoking the notion of «problematization» which he increasingly employed in the final two years of his life (Revel, 2009). According to Foucault (1993), «the study of [modes of] problematization […] is thus the way to analyze, in their historically singular form, questions of general import» (p. 73). More plainly, to proceed with a study of modes of problematization is to seek to identify what, within the totality of discursive and non-discursive practices, has allowed something to be constituted as true or false and thus to become an object of thought (Revel, 2009). Consequently, what pertains to the order of problematization involves *« the development of a domain of facts, practices, and thoughts»* (Foucault, 1984b, p. 1412), which could pose problems for politics. The recurrence of controversies regarding the treatment of the history of the living world, between the adoption of a fixist, creationist approach [2]and an evolutionist approach[3], attests to the role that must be accorded to the modes of problematization specific to an era and their articulation with freedom and power (Kebaïli, 2016).

In previous works, the importance of considering this role in pedagogical practices has been demonstrated by analyzing the knowledge taught and disseminated (e.g., at the Tunis Science City) concerning the theory of biological evolution in Tunisia, in light of this articulation (Kebaïli & Azzouna, 2015, 2016a, 2016b). In what follows, we propose to revisit pre-biological medieval knowledges

[2] This statement upholds the view that living species are immutable, do not evolve over time, and were created in their present and fixed form.
[3] This postulates that species evolve and transform over time through natural processes.

that engaged with the living world, while following the inverse path of Foucauldian intellectual progression. We thus seek to discuss the role played by modes of problematization and specific apparatus in place in approaching the living world, and to examine what they produced in terms of conceptual knowledge. Concurrently, we aim to demonstrate the historical recurrence of epistemic frameworks and their archaeological disparities within discursive practices related to the study of the history and dynamics of the living world. But first, let us return to the following question: To what extent can we speak of biological knowledges prior to the recognition of biology as a science in the early 19th century?

2. BIOLOGY BEFORE «BIOLOGY»?

The field of knowledge studying the living world only constituted itself as a scientific discipline under the name «biology» in 1802[4], with «a dual objective: on the one hand, to discover the universal laws that make life possible as a general fact; on the other, to chart the table of its diversity and its history» (Gayon, 2004, p. 2). This science thus took as its object of study knowledge pertaining both to «science» capable of attaining laws, and to history seeking to explain and order phenomena in a temporal series. Therefore, using the term «biology» to speak of scientific knowledge dealing with the living before the early 19th century could be considered an anachronism. The same applies to the «life sciences» since, according to Foucault (1966); «life» did not exist as such before the end of the 18th century either.

However, labeling the discussion of biological knowledge prior to the biology of 1802 as anachronistic can be debated on several levels. First, we recall four aspects related to «science» and «knowledge»: 1) Science or sciences are substantives of knowledge or bodies of knowledge; 2) According to Macherey

[4] This project for a new science called «biology» was formulated by the German physician Treviranus and the French naturalist Lamarck (Gayon, 2004).

(2007), «the notion of knowledge appears as prospective, whereas that of science is retrospective» (p. 221); this leads to 3) a consideration of the order of investigation relative to the order of exposition for knowledge and science respectively; and 4) the achievements of the latter are «inseparable from the movement of their production, which associates trial and error through an effort toward truth» (Ibid., p. 222).

Another level of discussion concerns the term «biology» itself, as «*It is now known that this term is much older than previously thought until recent times*» (Gayon, 2004, p. 2), whether in Arabic[5] or Latin[6] writings. By looking beyond the term's emergence to the practices it denotes, Morange (2017) argues that there is no anachronism since the term is used *«to describe events which, without being considered 'biological' in their own time, contributed in one way or another, sometimes by opposing later accepted conceptions, to current biological knowledge»* (p. 14). Understood from this perspective, it would be difficult to determine the precise moment when what would become biology was born. However, epistemologists and historians of science and the biological sciences

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[5] In Arabic writings, we find *'Ilm al-Ḥayawān* [Zoology]. It has existed since the 10th century in various classifications of the sciences: "it is found in the *Epistle on the Enumeration of the Sciences* by the great philosopher al-Fārābī. It is, he says, 'the study of what is common to the <different> species of animals and what is specific to each of them, and it is the second part of the study of <bodies> composed of different parts.' At the same time, the famous Ikhwān al-Ṣafā' [The Brethren of Purity] (10th century) devoted the entire eighth epistle of their *Encyclopedia* to 'the manner in which animals are generated and their <different> categories'" (Djebbar, 2001, p. 290). This is in addition to works entirely dedicated to the study of the animal world, notably *Kitāb al-Ḥayawān* [The Book of Animals] by the renowned al-Jāḥiẓ (d. 868). We also find the designation *al-Ṭabīʿīyāt* [the Natural Sciences] in the classification of sciences by Ibn Khaldūn (1332-1406) in *Al-Muqaddima - Kitāb al-ʿIbar* (Prolegomena to the Book of Examples). He dedicates the eighth section of the third chapter of the sixth part of the First Book to these, after having classified them within *al-ʿulūm al-ḥikmiyya al-falsafiyya* [the sciences of wisdom and philosophy] in second place, after *'Ilm al-Manṭiq* [the science of logic] (Ibn Khaldūn, 1377).

[6] "The first known occurrence, in a Latin form, dates from 1766: Hanov (1695-1773), a student of the philosopher Wolff, used it to designate the study of the general properties of living beings" (Gayon, 2004, p. 2).

(Canguilhem, 1977; Koyré, 1973; Mayr, 1982/1989; Morange, 2017) consider Aristotle (384-322 BCE) to be the father of biology.

Indeed, the constitution of biology as a domain of scientific study and research focused on the living world would not have occurred without an entire process through which bodies of knowledge were formulated, accepted for a time, subsequently refuted, and reformulated. However, it is very common in the history of science to begin with Greek civilization and then leap to the Renaissance in the 15th century, while limiting the scope to the Latin world. This occurs despite the fact that medieval Arabo-Islamic civilization constituted an important phase in the history of human societies for approximately eight centuries (Djebbar, 2001). The knowledge of medieval Arab scholars is either obscured or mentioned only summarily, even though it formed a crucial link in the renewal of Latin knowledge during the Renaissance and served as a prelude to classical European science (Ibid.). According to Koyré (2010 [1973]), the role played by the Arabs extends beyond that of intermediaries between the Greek and Latin worlds to that of *masters* and *educators*.

These medieval Arab scholars contributed to this process in two key ways within the broader history of biology. The first was direct, through the commented translation of Aristotle's writings. This translation enabled Western scholars to become reacquainted with this Greek philosopher, largely due to the work of Ibn Rushd (1126-1198) (Latinized as Averroes), known and recognized as the Commentator of Aristotle. The second contribution was indirect, through their extensive reliance on experimentation. Mayr (1982) contends that "*one can even say that they laid the foundations upon which experimental science was later to be built*" (p. 97). They contributed to this process through the naturalistic approach they adopted and through the practice of zoology (Djebbar, 2001).

Figure 2. A page from al-Jahiz's *Book of Animals* (*Kitâb al-Hayawân*) depicting an ostrich brooding over its eggs, from a 14th-century manuscript

While firmly situating our discussion within the intellectual framework that advocates a philosophical position integrating the conditions of emergence of knowledge into historical discourse (Bachelard, 1949; Canguilhem, 1977; Foucault, 1961, 1966, 1969, 1975; Koyré, 1973), one that defends a "non-positivism" (Lecourt, 1972) and an anti-evolutionism (Lecourt, 1982) rejecting the quest for precursors which an anachronistic reading might induce, we share Morange's (2017) perspective on this notion of precursors. Admittedly, criticisms are leveled against this notion because it tends to evaluate past knowledge in light of today's. This leads to judging the relevance of assertions by medieval Arab scholars or Renaissance Latin thinkers, for example, against the statements of modern biology, which could mislead interpretations[7] and distort the epistemological analysis of

[7] To illustrate, consider the reference to the Chain of Being by Ibn Khaldūn in the 14th-century Arab world as prefiguring evolutionism (Azzouna, 1999); and the first plate depicting the human skeleton alongside that of a bird, published in 1555 by the French physician and naturalist Pierre Belon (1517-1564), regarded as an early intuition of comparative anatomy (Le Guyader & Génermont, 1998).

certain events. The resurgence of an endless debate on various biological questions seeking precursors for the theory of biological evolution[8] has been particularly active. However, one cannot deny the contribution of this notion in certain cases, because *"the precursor may have created a space of thought which, without containing the models and theories falsely attributed to him, later allowed these models to be accommodated"* (Morange, 2017, p. 32).

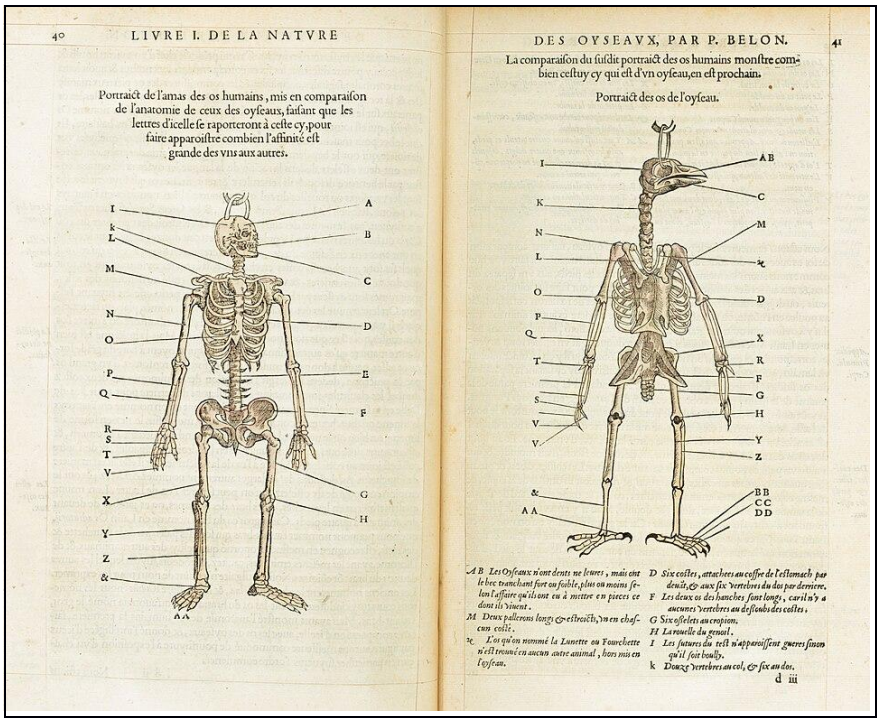

Figure 3. Depiction of a bird's and a human's skeleton (1555) by Pierre Belon (1517–1564), considered an early example of comparative anatomy

This concept encourages us to retrace the archaeological trajectory of the study of living beings to understand how it came to be conceived, or failed to be conceived, through a dynamic rather than a static approach. This allows us to highlight the conditions under which certain knowledges pertaining to the living world emerged, whose formal, informal, and non-formal treatments continue to

[8] Morange (2017) revisits the writings of Anaximander (610-546 BCE), Plato (427-348 BCE), and Lucretius (98-55 BCE) from antiquity, as well as those of Ibn Khaldūn (1332-1406 CE).

provoke controversy into the 21st century, such as those related to the theory of biological evolution (Susanne, 2004; Gould, 2006; Parliamentary Assembly, Council of Europe, 2007; Bouquiaux, 2009; Charfi, 2013, 2021; Cobut, 2009; Da Silva, 2006; De Biseau & Perbal, 2010). These controversies have endowed this theory with the character of a "hot" knowledge (Astolfi, 2008) and a "subjugated" knowledge (Kebaïli & Azzouna, 2015, 2016a), belonging to questions that are scientifically, socially, and culturally "alive" (Simonneaux, 2010). To retrace this path, we begin by examining the modes of problematization and the apparatus related to the study of living beings that enabled or impeded the development of a domain of thought, facts, and practices allowing for a dynamic approach to life.

3. MODES OF PROBLEMATIZATION AND APPROACHES: THE ELABORATION OF A DOMAIN OF THOUGHT, FACTS, AND PRACTICES

From the perspective of elaborating a domain of thought concerning approaches and modes of problematization, philosophy has played a decisive role. This role in the discovery of the living is emphasized by epistemologists, given that, in its origins, science was structured by philosophy. According to Bachelard (1940), *« The mind may change its metaphysics, but it cannot do without metaphysics» (p.13). Nevertheless, Bachelard warns against adopting a reflection based on metaphysics to illuminate scientific problems, because «if one claims to mix theorems and philosophemes, one finds oneself faced with the necessity of applying a necessarily finalistic and closed philosophy to an open scientific thought»* (p. 1).

By studying the relationship between science and metaphysics, the branch of philosophy that investigates the fundamental nature of reality, more closely, Perru (2010) clarifies that the metaphysical register concerning the living deals with it through two types of metaphysics: a metaphysics of nature, which he considers capable of maintaining a mediating role between science and religion given the

potential danger of imperialism from either side; and a metaphysics of being, founded on wonder, but whose path would be difficult to pursue today.

The origin of the practice of metaphysics of being can be traced back to ancient philosophy, essentially Aristotelian philosophy. Its practice involves two constants: "the search for causes and the analogical dimension of what is" (Perru, 2010, p. 300), along with two key factors: the very attitudes that this type of metaphysics presupposes, and that of ideology, which does not experience wonder. To give an example: if we approach creationism through the lens of a metaphysics of being, the creationist, preoccupied with proclaiming a dogma believed to be invariable, no longer experiences wonder in the face of Nature's diversity and complexity. Similarly, in the case of positivist and scientistic ideology, being convinced of the exclusive validity of models supposedly capable of accounting for the origin of diversity in the living world leaves no room for wonder.

Although the philosophical tradition of the ancient Greek philosophers had two merits, the first was to enable the transcendence of supernatural conceptions, and the second was to raise questions never before posed due to their deductive nature, it had the drawback of perpetuating the belief that an explanation of problems related to the living world could be achieved through mere intellectual effort, and that scientific explanations could be derived from simple philosophical speculations. However, with the advent of Christianity, even these speculations could no longer be considered, as they went beyond the limits prescribed by the Church. The path charted in the pursuit of knowledge gave rise to a rationalism championed by the Scholastics through a natural theology [9]that sought truth through erudition and

[9] Initiated in the 4th century by Saint Augustine, natural theology reached its peak with Saint Thomas Aquinas (1225-1274) and Albertus Magnus (1200-1280). It consists of "a philosophy that seeks to discover the Creator's design by studying nature. According to natural theology, the adaptations of organisms prove that the Creator designed each species for a specific purpose" (Campbell & Reece, 2004, p. 466). In this sense, Mayr (1989) clarifies that "In the writings of the Church Fathers, nature

logical deduction based on the texts of the Bible, rather than through observation or experimentation. This approach, according to Mayr (1982), was the origin of a phase of stagnation in the pursuit of knowledge in the Latin world throughout the medieval period.

In the medieval Arabo-Islamic world, the adoption of both metaphysics, of being and of nature, occurred concurrently through the practice of a pronounced philosophical rationalism that began notably with the Mu'tazilites in the 8th century. The Tunisian philosopher, anthropologist, and Islamic scholar Youssef SEDDIK (2007) praises this era:

> « Already, logic and controversy descended into the agoras of the turbulent cities of Kufa, Basra, Hamadan, or even Medina with the first rationalist Mu'tazilites, those who learned everything from that formidable art of thinking and making others think through dialectics or sophistry; an art still under suspicion until, two generations later, the reign of the enlightened Abbasid caliph al-Ma'mun. Under his oversight, Greek thought was erected as an institution of thought in the public squares of Baghdad and even as a state dogma. Aristotle was made a Ra'īs (leader) and Pythagoras a prophet! Arab thought very quickly became the site of an episteme that aspired to be global in the dimensions of its time, which would no longer derive its authority solely from the celestial message but from a borderless rationality itself declared to be of divine origin. Our Ibn Sirin, far from joining the ghosts of an oral culture dethroned by the new magistracy of profane writing, regained a place of honor alongside leading figures in a veritable *International of Knowledge* » (p. 138).

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was sometimes compared to a book, the natural analogue to the revealed Book of the Christian religion, the Bible. Equating the two books suggested that studying the book of nature, God's creation, would allow for the development of a natural theology, complementing the revealed theology of the Bible" (p. 98).

This rationalist religious movement, initiated by the Mu'tazilites and promoted under the reign of the early Abbasid caliphs[10], is considered one of the markers of the beginning of the Islamic renaissance, as the development of this type of domain of thought was corroborated by a domain of facts and practices.

Indeed, the distinctiveness of this medieval Arab historical phase was manifested in the scientific approach adopted by the scholarly community of the time, which was endorsed and followed by the decision-making authorities of the period.

> *"Islam emerged in the seventh century […]. The advent of Muhammad and the establishment by his successors of a confederation of religious states were accompanied by a flourishing of the arts and sciences. Cultural centers developed rapidly. Institutions funded by the state and by the powerful figures of the time provided Muslim, Christian, and Jewish scholars with places to work and access to scholarly literature. Collaboration took place in a spirit of mutual understanding, and it was not uncommon for the prince or patron to take part in the discussions" (de Wit, 1997, p. 65).*

The relationship between the pursuit of knowledge and the quest for power that characterized the medieval Arab-Islamic period contrasts with that of the Latin Christian Middle Ages and demonstrates the role of institutional frameworks in shaping thought, facts, and practices at a given time within a civilization or across different civilizations. Moreover, by combining the pursuit of knowledge with the conquest of the world, Islam played a decisive role in renewing interest in nature within the Latin world[11].

[10] The Abbasid Caliphate lasted from 750 to 1258.

[11] This interest was reflected in the works of Albertus Magnus (1206–1280), who sought to disseminate Aristotelian doctrines, as well as those of his disciple Saint Thomas Aquinas (1226–1274) through Thomism. Thomism is a theological and philosophical system expounded in the *Summa*

" With remarkable ardor, scarcely had political conquest been completed than the Arab-Islamic world embarked upon the conquest of civilization, science, and Greek philosophy. All scientific and philosophical works were either translated or— as in the case of Plato—expounded and paraphrased. The Arab world regarded itself, and explicitly declared itself, the heir and continuator of the Hellenistic world—and rightly so. For the brilliant and rich civilization of the Arab Middle Ages—which is not truly a Middle Ages but rather a Renaissance—is, in all truth, the continuator and heir of Hellenistic civilization. It is for this reason that it was able to play, in relation to Latin barbarism, the eminent role of educator that it indeed fulfilled " (Koyré, 1973, p. 27).

However, as we have developed above, according to the functionalist conception of power, the apparatus may give rise to different orientations of power insofar as it is no longer an attribute but a relation. In the case of the study of living beings in the medieval Arab world, the currents of thought and practices, and their contributions to the domains of knowledge, power, and freedom that enabled its golden age, were soon short-circuited by other currents, notably those promoted by the Sunni theologian al-Ghazālī (1058–1111). His work *Tahāfut al-falāsifa* (*The Incoherence of the Philosophers*) (c. 1093) marked the beginning of the exclusion of philosophical inquiry, in which "it is the dogma of the absolute freedom of the divine will that is affirmed in

Theologica, in which Thomas Aquinas distinguishes between "prime matter, created originally by God, and what may be called the 'creation' of living beings […]. The First Being, the Creator whom we call God, would then have called into existence the various living beings already potentially present—first plants, then animals" (Perru, 2010, p. 16). His concern, according to Perru (2010), was to defend—drawing on Aristotelian philosophy as transmitted by Ibn Rushd (Averroes)—a certain autonomy of reason and philosophy vis-à-vis faith and theology. This interest was also evident in Frederick II, who, as early as 1577, had observatories constructed (Jacot, 1970).

opposition to a nature that would be governed by laws" (Charfi, 2013, p. 161), along with calls to privilege the sciences of *fiqh*[12] (jurisprudence) and certain so-called "profane" sciences, deemed "useful," at the expense of the so-called rational sciences (Charfi, 2021). This had, among other consequences, the emergence of a historical Islam that has…*" Overdetermined attachment to ritual at the expense of a spiritual elevation that is strongly present in a revealed text, the Qur'an, an elevation obscured by a pronounced 'talmudization' that grants ceremonial gesture an undue preponderance over the intimate and silent act of faith " (Seddik, 2007, p. 24).*

Thus, the perennial conflict between the proponents of dogma and those of change (Gould, 2006), the eternal struggle of humankind for the acquisition and imposition of power, with all the ensuing consequences that run counter to the prosperity of a civilization, leads humanity back onto the very path it initially sought to resist. It fought for openness, yet in seeking to preserve its power, it falls into the trap of closure. In this regard, the voice and legacy of Ibn Rushd constitute a contribution marked by enduring posterity. This twelfth-century Andalusian philosopher and scholar, renowned as a commentator on Aristotle, sought to transform the intellectual landscape of the vast domain of Arab and Islamic thought through two gestures he intended to be decisive. These gestures were, according to Seddik (2005), *"the legitimation of the philosophical enterprise, which becomes […] the very condition of 'sound' and true faith, and the relegation of the 'theological' to its illusions and instabilities by explicitly challenging the stature and the work of al-Ghazālī"* (p. 21).

[12] Literally, it means "deep understanding." It refers to Islamic sacred law derived from the *sharīʿa* (Islamic law) by Muslim jurists and based on the Qurʾan and the *Sunna* (the Prophetic tradition).

Indeed, rejecting the thesis advanced in *Tahāfut al-falāsifa* (*The Incoherence of the Philosophers*) and expressing indignation at the rise of religious sects, Ibn Rushd responded to al-Ghazālī's work with another treatise, written in 1179, entitled *Tahāfut al-tahāfut* (*The Incoherence of the Incoherence*). Moreover, he formulated a major principle grounded in the submission of religion to the criterion of scientific and rational conformity, rather than the reverse, with regard to "the connection between Revelation and philosophy" (Libera, 1996, p. 10). By making the approach to Revelation, understood as comprising both the apparent and the hidden, a fundamental practice, he wrote in his *Faṣl al-maqāl* (*The Decisive Treatise*) more than nine centuries ago:

" We categorically affirm that wherever there is a contradiction between the result of demonstrative reasoning and the apparent meaning of a statement in the Revealed Text, that statement is open to interpretation in accordance with rules of interpretation [consistent with the tropological uses] of the Arabic language"[13] *(Ibn Rushd, 1180, p. 121).*

On the Latin side, from the thirteenth century onward and thanks in part to Arab libraries, Christian Western Europe began to flourish into a genuine Renaissance, whose leading figures were influenced by the writings of Aristotle (translated and commented upon by Arab scholars), Avicenna (on the movement of seas, the formation of oceans, the formation of mountains, the natural origin of fossils, etc.), Averroes (on the relationship between science, knowledge, and religion), and others. However, despite this initial elaboration of a mode of thought oriented toward reasoning and reflection, particularly through the adoption of natural theology and Thomism, which defended a

[13] "We affirm categorically that whatever is established by demonstrative proof, yet conflicts with the apparent meaning of the revealed Law, is such that this apparent meaning admits of interpretation in accordance with the rules of Arabic interpretation." (p. 120)

certain autonomy of reason and philosophy vis-à-vis faith and theology—the deterministic and teleological theological approach, along with the Church's claim to a monopoly over thought concerning both the natural and the supernatural, still left Western humanity with little freedom to express independent views on the living world, its origin, and its history. Everything remained under the sway of the Church, which exercised a supreme influence, shaping at will both the discursive and non-discursive apparatus.

The study of nature had no legitimate place, and the only points of reference were the words of Jesus and what remained of the Greek texts on nature (Mills, 2005). The work of thinkers was therefore based on what they found in ancient scriptures, whose content was deemed to be in agreement with the assertions of the sacred text. Consequently, the sole custodians of "truth" were theologians, who confined themselves to the biological data found in the Bible. The Church's monopoly over the pursuit of knowledge, exercised through dogmatism and an extreme domination of the intellectual field by theologians, went so far, in France for example, between 1210 and 1215, as to prohibit the reading of certain works by Aristotle, out of fear that such readings might rekindle an interest in nature (de Wit, 1997; de Libera, 1996).

The other harm inflicted on the study of living beings by the practice of natural theology lies in the essentially apologetic character of its proponents' investigations, oriented toward demonstrating order and harmony in the world as an argument for the existence of God, an intelligent Being who directs all things toward an end. The transcendence of the prohibitions imposed by the Church on the study of life could unfold only through a shift in the philosophical frame of reference, a transformation that took place during the Enlightenment.

Indeed, shifts in approaches, from animism to vitalism and then to mechanism as domains of thought; transformations in methodology in the way living beings were apprehended, from erudition and reflection to observation and experimentation, as domains of practice; and the desire to move beyond the teachings of the Church as a domain of facts all made it possible to initiate new questions. Although this desire for transcendence was initially tempered by caution vis-à-vis the Church, it became, according to Mayr (1989), a truly revolutionary movement during the Enlightenment.

This century brought together a group of philosophers, the Encyclopedists[14], who did not conceal their break with established dogmas. They raised three fundamental questions in biology: the definition of life and its origin; the nature of the mind; and the manner in which the "Chain of Being" was established. According to Mazliak (2006), these questions ultimately aimed to interrogate the origin of the world itself, whether it stemmed from a single creator or from a progressive transformation of the earliest beings. In seeking answers, and alongside their deism, a philosophical position that acknowledges the existence of a divinity while rejecting revealed religion and dogma, the philosophers of the Enlightenment returned to the ideas of Lucretius[15], thereby giving greater scope to overcoming fixist and creationist conceptions.

Essentialism, inherited from the Greeks, and providentialism, the belief in providence as the wise governance of God over creation, were modes of thought that characterized the eighteenth century and were defended by

[14] They evoke the Muʿtazilites, Arab "encyclopedists" of the ninth and tenth centuries.

[15] In the first century BCE, Lucretius reinvigorated the chance/necessity dilemma by opposing Aristotle's determinism and positing that the origin of the living world is a consequence of chance. He rejected any notion of providence and advocated instead the ideas of metamorphosis and spontaneous generation. According to him, it was "the Earth that first gave rise to plants of all kinds, then animals, and finally the human species" (Buican, 1995, p. 20).

Gottfried Leibniz (1646–1715) through his doctrine of optimism. These positions were refuted by Voltaire (1759) in *Candide*. Through *Optimism*, Voltaire criticized French despotism and challenged Leibniz's philosophical system, which espoused a blind optimism, caricatured in the character of Professor Pangloss. As for Diderot, through his critical spirit, he asked in 1746 in the *Pensées philosophiques* why he should "accept as an explanation for what I do not understand something that I understand even less" (cited in Dupouey, 2007, p. 65), in reference to creationism. He proposed the idea of spontaneous generation and the possibility of fortuitous combinations of molecules or living germs giving rise to higher organisms, in order to explain diversity in the living world.

In *Le Rêve d'Alembert*, written in 1769 and published in 1830, Diderot set out his ideas through the feverish delirium of Alembert. He urged readers not to trust the apparent stability that living beings present to our eyes: "in the memory of a rose, one has never seen a gardener die," as Fontenelle (1657–1757) remarked, a notion Diderot (1830) termed the "sophism of the ephemeral."

He also articulated his conception of adaptation in the living world through one of Alembert's remarks, endorsed by the physician Bordeu, as follows: "Organs produce needs, and conversely, needs produce organs" (p. 91). This sentence is regarded by Mayr (1989) as the most striking statement in *Le Rêve*, and as one of the cornerstones of Jean-Baptiste de Lamarck's transformist theory (1744–1829), published in 1809 in his *Philosophie zoologique*. However, what Diderot lacked in order to be a true transformist was, according to Mazliak (2006), the idea of filiation (phylogenesis) between extinct species and extant species. This idea could only be conceived after the

emergence of what Foucault (1966) termed "double historicity," and what Jacob (1970) described as horizontal continuity [16]and vertical continuity[17].

The reciprocal conditioning of modes of problematization and of the apparatus organizing the pursuit of knowledge concerning the study of the living world, in their relation to power, made a renaissance possible in the medieval Arab-Islamic world, while preventing its emergence in the Latin Christian world. Two factors may account for this reciprocal determination. The first relates to what distinguishes Christianity from Islam, which, according to Seddik (2009), "lies in the rejection of the dogma of the Incarnation, of the divine filiation of Jesus, and of his Passion on the Cross, a rejection that effaces the founding dogma of the Trinity, condemned as a late conciliar construction" (p. 20). The second factor consists in the willingness of Muslim rulers of the time to act in favor of a religion founded on openness and on the encouragement of knowledge, thus conforming to the precepts of the Qurʾan and the Hadith. This orientation was reflected in the encouragement of scholars in all fields and from all monotheistic religions, without discrimination, through both discursive and non-discursive apparatus, with the aim of contributing to the construction of a knowledge-based society.

This approach to the elaboration of thought, facts, and practices, combining rationalism and materialism as modes of problematization, and privileging productive rather than repressive power in its relation to knowledge as apparatus in the medieval Arab-Islamic world, made possible the formulation of bodies of knowledge that have been interpreted by some proponents of the idea of precursors to the theory of biological evolution as

[16] The Continuity across the totality of beings.
[17] The continuity of life across successive generations.

constituting an outline of an evolutionist conception of the history of life. Revisiting selected passages from the works of medieval Arab scholars makes it possible to identify the *episteme* relating to the study of the living world that emerged from the modes of problematization and the apparatus in place at that time.

4. THE STUDY OF THE LIVING WORLD AND ITS "DYNAMICS" IN THE WRITINGS OF MEDIEVAL ARAB SCHOLARS

A reading of *Kitāb al-Ḥayawān* (*The Book of Animals*) by the renowned al-Jāḥiẓ (d. 868), as well as other works by medieval Arab scholars, such as the *Rasāʾil* (*Epistles*) of the Ikhwān al-Ṣafāʾ [18](between the ninth and tenth centuries), *Al-Fawz al-Aṣghar* (*The Minor Triumph*) by Ibn Miskawayh (933–1030), *ʿAjāʾib al-Makhlūqāt wa Gharāʾib al-Mawjūdāt* (*The Marvels of Creatures and the Wonders of Existing Things*) by al-Qazwīnī (1203–1283), and *Al-Muqaddima* (*Prolegomena*, 1375–1379) by Ibn Khaldūn (1332–1406), among others, makes it possible to identify the development of a number of ideas and concepts relating to the living world, its origin, and the early emergence of a dynamic conception of life in the thought of certain scholars (Kebaïli, 2019).

[18] The *Epistles of the Brethren of Purity* comprise fifty-two epistles devoted to various subjects—mathematical sciences (14 epistles), natural sciences (17 epistles), psychological and rational sciences (10 epistles), and theological sciences (11 epistles). They also include a treatise (*Al-Risāla al-Jāmiʿa*), which synthesizes the work as a whole. http://www.universalis.fr/encyclopedie/geologie-histoire-des-sciences-de-la-terre/2-le-moyen-age/ (consulted on July 25, 2025)

Figure 4. Scholars in an Abbasid library.
Maqâmât al-Harîrî Schefer, illustrated by Yahya Mohamed al-Wasiti (1237).

The earliest formulations of new conceptions of the world can be traced back to al-Jāḥiẓ (775–868). An Arab polymath, scholar, and rationalist theologian, he was driven by curiosity and wonder in the face of the immense diversity of the living world, which led him to seek an explanation for the order observed in nature, thereby making him a naturalist as well. In his monumental work *Kitāb al-Ḥayawān* (*The Book of Animals*), seven volumes of approximately 400 pages each, written between 815 and 867, al-Jāḥiẓ proposes a classification of the world by dividing bodies into two classes: the inanimate and the "growing" (that which is capable of growth). He then proceeds to classify living beings on the basis of inquiry, observation, and the critical examination of assertions found in the writings of certain Greek philosophers, particularly Aristotle, whom al-Jāḥiẓ referred to as the "father of logic." Al-Jāḥiẓ did not limit himself to proposing a summary classification of

living beings; rather, he undertook an analysis of the various aspects characterizing the animal world. This analysis enabled him to compile an animal anthology and to articulate a naturalist mode of thought describing a global dynamic involving the mineral, vegetal, and animal realms. He thus proposed classifications of the animal world through the investigation of similarities and differences among species, alongside the study of their behaviors and an analysis of the role and influence of the environment upon them.

"Those species that lay a large number of eggs include fish, then locusts, then the eagle, then the lizard, because fish neither regurgitate food nor place it in the mouths [of their young] … they neither brood nor suckle. Since this is the case, God has multiplied their progeny and increased the number of their offspring; thus, their condition stands in contrast to that of pigeons." (p. 23)

"When the bat came to require sustenance and nourishment … it sought this at the time of sunset … because that is when mosquitoes and mosquito-like insects are active … mosquitoes emerge to feed, and bats emerge in search of food; thus the seeker of sustenance meets the seeker of sustenance." (p. 170)

With regard to the human being, al-Jāḥiẓ integrates humans into the animal world, considering the human as a compendium of everything: "Indeed, the human being … is called the 'microcosm,' the offspring of the 'macrocosm,' because in him they found all the forms that exist in the greater world" (p. 128).

"In its gaze (that of the monkey) and in the closing of its eyes, in its laughter, in its imitative behavior, in its hand and its fingers, in the way it raises and lowers them, in how it grasps with them, prepares a morsel and

brings it to its mouth, and in how it cracks nuts and extracts their kernels… it is also the case that, among all animals, when it falls into water it drowns like a human being; and despite the presence of the means of understanding within it, it still drowns unless it acquires the knowledge of swimming… Yet the monkey does not, by this degree of proximity, cross beyond certain limits proper to monkeys into the limits of the human being." (p. 130)

Through this passage, al-Jāḥiẓ records his observations and comments on the anatomical, morphological, and behavioral similarities between the monkey and the human being, while also highlighting a particular "proximity" of the monkey to humans, manifested in its ability to produce grimaces, expressions, and vocalizations resembling laughter.

He also advanced explanatory proposals regarding the relationships between animals and their environment, citing several examples that suggest the occurrence of "adaptive transformations" following a change of habitat, transformations affecting not only the plant world but also the animal world, including human beings. His depiction of both unity and diversity, through the identification of distinctive traits and the exploration of possible signs of "kinship" among species, together with his attention to adaptation, the acquisition of new characteristics, progression, and their transmission to descendants (inferred from observed modifications and variations in traits), allows one to argue that al-Jāḥiẓ's approach is non-fixist and that, for him, the living world is dynamic.

After al-Jāḥiẓ, the Ikhwān al-Ṣafāʾ, a group of philosophers also described as encyclopedists, defended the idea of the "chain of beings" and proposed a chronology of the living world.

" Minerals are the first in existence, followed by plants, then animals, and then human beings. For each of these classes there is a specific characteristic that has priority. The specificity of the four elements lies in the four qualities, heat, cold, moisture, and dryness, and in their transformation into one another. The distinctive feature of plants is nutrition and growth; that of animals is sensation and movement; that of human beings is speech, thought, and the elaboration of proofs; and that of angels is that they never die. Human beings share the characteristics of all these classes, because they possess the four qualities capable of transformation and change, like the four elements; they undergo corruption and generation like minerals; they nourish themselves and grow like plants; they sense and move like animals; and they may attain non-mortality like the angels."

Source: Ikhwān aṣ-Ṣafāʾ, *Rasāʾil* (*Epistles*), vol. II, p. 118" (cited in Djabbar, 2001, p. 298).

The idea of the chain of beings and of the proximity between humans and apes is also developed by Ibn Miskawayh (cited in Azzouna, 1999):

"When beings become unified and the first of them is connected to the last, what is called the 'circle of existence', it is this unification that makes multiplicity into unity." (p. 78)

"Until the last of each kind became connected to the first of another kind, so that it became like a single string that arranges many beads in a sound composition, until from them all there came to be a single necklace." (*Al-Fawz al-Aṣghar*, p. 112)

"The first effect that appeared in our world … after the mixing of the primary elements, as a result of the movement of the soul, was in plants. Thus, plants became distinguished from inanimate matter by movement and

nourishment. Plants possess innumerable degrees, though we divide them into three levels … […] The final level of plants constitutes the first horizon of animals; it is the first of their stages. This is because the first way in which plants rise from their final station is by detaching themselves from the earth." (*Al-Fawz al-Aṣghar*, p. 113)

"The first level of animality is weak, due to the weakness of sensation within it … then it ascends beyond this level … until it comes to possess two senses … then four senses … then five senses. These, too, are differentiated in rank until they reach the level just prior to that of the human being, which is the level of the apes." (*Al-Fawz al-Aṣghar*, p. 117)

"Animals that are guided toward pairing, seeking offspring, and preserving and nurturing their young—as we observe among those that give birth or lay eggs and provide nourishment—are superior. Next comes the animal that is receptive to discipline, then the animal that imitates the human being and resembles him, such as the apes." (*Tahdhīb al-Akhlāq wa Taṭhīr al-Aʿrāq*, p. 77)

"It is as if the human being were a compendium of all beings and the synthesis of the whole." (*Al-Fawz al-Aṣghar*, p. 118)

Djebbar (2001) reproduces an excerpt from al-Qazwīnī's *ʿAjāʾib al-makhlūqāt wa gharāʾib al-mawjūdāt* (*The Marvels of Creatures and the Wonders of Existing Things*), presenting it as a description of the four phases of the living world's evolution according to al-Qazwīnī:

" The first stage of these creatures is the earth, and the last is a purified angelic soul. As for minerals, their first stage is connected to earth and water, and their ultimate stage to plants; for plants, their first stage is connected to

minerals, and their ultimate stage to animals; for animals, their first stage is connected to plants, and their ultimate stage to the human being; for human souls, their first stage is connected to animals, and their ultimate stage to angelic souls".

Source: al-Qazwīnī, *ʿAjāʾib al-makhlūqāt wa gharāʾib al-mawjūdāt* (*The Marvels of Creatures and the Curiosities of Existing Things*). Cited by ʿA. Sakrī, in *Encyclopédie de la civilisation arabo-musulmane*, op. cit., vol. I, p. 627."
(Djebbar, 2001, p. 299)

"The first level of animality is weak, due to the weakness of sensation within it … then it ascends beyond this level … until it comes to possess two senses … then four senses … then five senses. These, too, are differentiated in rank until they reach the level just prior to that of the human being, which is the level of the apes." (*Al-Fawz al-Aṣghar*, p. 117)

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Source: al-Qazwīnī, *ʿAjāʾib al-makhlūqāt wa gharāʾib al-mawjūdāt* (*The Marvels of Creatures and the Curiosities of Existing Things*). Cited by ʿA. Sakrī, in *Encyclopédie de la civilisation arabo-musulmane*, op. cit., vol. I, p. 627." (Djebbar, 2001, p. 299)

Ibn Khaldūn, historian, jurist, statesman, and theologian, distinguished in the fourteenth century for his political, anthropological, and social thought, also took an interest in the living world and its history, defending the idea of the chain of beings.

" Know, may God guide us and you, that we observe this world, with all the creatures it contains, to be arranged in an orderly and well-structured manner, with causes linked to effects, beings connected to one another, and some existents transforming into others. … Then consider the world of generation: how it begins with minerals, then plants, then animals, in a wondrously gradual progression. The final horizon of minerals is connected to the first horizon of plants, and the final horizon of plants is connected to the first horizon of animals. … The meaning of this connection among these generated beings is that the final horizon of each is prepared, by a remarkable predisposition, to become the first horizon of what follows it. The animal world expands and its species multiply, until the process of generation culminates in the human being, endowed with reflection and deliberation. He ascends to this level from the world of apes, in which sensation and

perception are present, but in which reflection and rational thought have not yet been fully realized. This constitutes the first horizon of humanity and what follows it. … Beyond this, there must necessarily exist another realm that grants it the powers of perception and movement, is also connected to it, and whose very essence is pure intellect and absolute cognition: this is the world of the angels." (Ibn Khaldūn, p. 106)

These excerpts from *Al-Muqaddima* show that the observation and comparison of living beings, their similarities and differences, led Ibn Khaldūn to conceive of the living world as governed by a natural order, a "hierarchy," a gradation, and a "continuity" among existing entities, along with the idea of possible "transformations" of certain beings into others within a "chain of beings." Human beings are integrated into this chain, in which the most "advanced" animal (the ape) is capable of transforming into a human.

The early interest in the living world among Latin thinkers was largely confined to identifying resemblances through the construction of a network of similarities. Yet this recourse took place in a different manner, according to other visions and in the service of aims distinct from those that motivated medieval Arab scholars, being shaped, in this respect, by apparatus that constrained the freedom to think, to discourse, and to practice.

5. THE STUDY OF THE LIVING WORLD AND ITS HISTORY AMONG LATIN THINKERS PRIOR TO THE EMERGENCE OF "BIOLOGY"

Following, among other factors, the phenomenon of "appropriation" (Djebbar, 2013) of Arab sciences and new forms of knowledge by Latin thinkers—which "began to stammer at the end of the tenth century […], sketched a few encouraging steps at the end of the eleventh […], and then exploded […] at the beginning of the twelfth" (ibid., p. 169)—a new perspective on the living world began to emerge. This shift was reinforced by the striking and immense diversity of living beings revealed through major voyages of exploration. Scholars then began to devote themselves to the study of this diversity by seeking out resemblances.

Thus, until the end of the sixteenth century and the beginning of the seventeenth, resemblance "organized the play of symbols, made possible the knowledge of visible and invisible things, and guided the art of representing them" (Foucault, 1966, p. 32). To elucidate the *Order of Resemblances* that constituted the *episteme* governing the study of the living world at that time, Foucault (1966) identified four essential figures: *convenientia*[19], *aemulatio*[20], *analogy*[21], and the play of *sympathies*[22]. Within the space of Order that

[19] One may read, with regard to the human being: "his pulse beats in his veins just as the stars move along their own paths; the seven openings of his face correspond to the seven planets of the sky. […] [There is] an analogy between the human animal and the earth it inhabits: his flesh is a clod of soil, his bones are rocks, his veins are great rivers, his bladder is the sea, and his seven principal members are the seven metals hidden in the depths of the mines" (Foucault, 1966, p. 37).

[20] Foucault cites as an example the emulation between the human face and the heavens, the human intellect and the wisdom of God, the two eyes and the Moon and the Sun, the mouth and Venus, and the nose and the scepter of Jupiter and the caduceus of Mercury. "The plant is an animal that stands on its head, with its mouth, or its roots, plunged into the earth" (p. ??). He refers here to the similarities evoked by Crollius in his *Treatise on Signatures*, published in 1624, between plants and stars, whose difference, according to Crollius, is limited to matter alone.

[21] Where *convenientia* and *aemulatio* overlap, "for example, the stars in the sky where they shimmer are likewise found in the grass on the earth, in living beings upon the globe they inhabit, in minerals and diamonds within the rocks where they are buried, in the sensory organs upon the face they animate, and in the spots on the skin that secretly mark the body" (p. 36). Foucault also cites the analogy between the plant and the animal, an analogy reinforced by Cesalpino (1583) in *De plantis*

governed the construction of knowledge during the Renaissance, these four forms of resemblance manifested themselves through the "signatures" presented by the world of similitude, for without signatures there could be no resemblances. At that time, these signatures were perceived as signs of God. Jacob (1970) explains recourse to such an approach in the pursuit of knowledge of the living world as stemming from the requirement to discern visible signs capable of revealing invisible relations to human understanding.

Such an *episteme* entails a number of consequences regarding the nature of knowledge in the sixteenth century, which Foucault (1966) characterizes as both "plethoric and absolutely impoverished" (p. 45). It is plethoric because the quest for knowledge is grounded in limitless resemblances, in which each similarity refers to another, which in turn calls forth yet more. It is impoverished because sixteenth-century knowledge condemned itself to knowing only the same thing over and over again through an unlimited system of resemblances. These are the consequences of restricting the pursuit of knowledge to "a confrontation between fidelity to the Ancients, a taste for the marvelous, and an attention already awakened to this sovereign rationality" (Foucault, 1966, p. 47). This limitation led to the decline of resemblance, marked by the tragicomic epic of Cervantes's *Don Quixote* (1605–1615) (Foucault, ibid.). The knight of La Mancha sees resemblances everywhere, yet shatters against them; for they no longer constitute the prose of truth but rather "the path to delirium," since words no longer mark things. This shift resulted in the exclusion of resemblance

libri, where he shows that the plant is an upright animal whose nutritive principles rise from bottom to top: "The plant is an animal that stands on its head, with its mouth, or its roots, embedded in the earth" (p. 36).

[22] Pour illustrer cette forme de similitude, Foucault cite l'exemple de l'idée de la haine entre les plantes, et autres êtres du monde, et reprend un texte de Cardan (1656) à travers lequel ce dernier insiste sur la relation de haine entre les plantes (olive et vigne/chou ; concombre/olive…), et sur la perniciosité entre les arbres.

as the primary form of knowledge. Henceforth, "the old network of similarities was replaced by that of comparisons" (Jacob, 1970, p. 54).

In principle, this new *episteme* recalls the one that characterized the production of knowledge among medieval Arab scholars, yet it differs in its procedures, measurement and order, which made it possible following two epistemological ruptures. Indeed, aware of the confusion generated by resemblances, classical thought required an analytic practice framed in terms of identities and differences. Foucault (1966) specifies that this analytical practice operated through comparison in its two forms: that of measurement and that of order. Consequently, what makes knowledge possible, and the mode of being of what is to be known is transformed, thereby altering knowledge itself. This transformation occurred through two ruptures.

The emergence of mechanism [23]as a new configuration constituted a first rupture. Indeed, the mechanistic approach brought an end to old superstitious or magical beliefs and marked nature's entry into the scientific order (Foucault, 1966). However, this entry occurred while preserving nature's subordination to the Church, since exegetes continued to exercise their authority over knowledge, which was still required to demonstrate divine Providence and omnipotence, to conform to the imperative of concordance with biblical assertions, and to remain articulated around the three notions of divinity, the soul, and the cosmos.

[23] It defends the idea that assimilates living beings to a machine.

Figure 5. Michel Foucault begins 'The Order of Things' by analyzing Diego Velázquez's 'Las Meninas' (1656) to illustrate the concept of "classical representation"

As a result, the *Order of Representations* allowed the "new sciences of life" to take a variety of directions. Yet, despite this diversity, the questions being posed were largely the same, each time receiving different solutions depending on the prevailing theoretical orientations, and this situation persisted until the end of the seventeenth century. A second point of rupture had to occur during the Enlightenment for a new mode of reasoning to come into effect (Perru, 2005). This second rupture was triggered by a movement of ideas grounded in confidence in progress and in reason, as well as by a struggle against fanaticism in the name of freedom of thought. It constituted a rupture insofar as it enabled the emergence of divergent opinions and passions, along with new forms of reasoning that began to take shape through differing interpretations and solutions to questions concerning life and living beings.

The two ruptures, the first affecting how the living world was represented through the rise of rationalism in the seventeenth century, and the second affecting how a science of life could be conceived through confidence in

progress and reason during the Enlightenment, made it possible to discern, long before Darwinian evolutionism and even before Lamarckian transformism, the opening of a major debate on evolutionism. Foucault (1966) traces this debate back to the publication of *Telliamed*[24], *Palingénésie*[25], and *Le Rêve de d'Alembert*[26].

Moreover, the idea of the "Chain of Beings," which was more accurately an "Ladder of Beings," began to be used as a reference for explaining a conception of continuity in nature. This conception was "defended with skill by Leibniz (in the seventeenth century) and later by Charles Bonnet, Buffon, Diderot, and others" (Mazliak, 2002, p. 106). Among the arguments mobilized in favor of this idea of continuity was recourse to monsters and fossils, for "*against the background of continuity, the monster recounts, as if in caricature, the genesis of differences, and the fossil recalls, through the uncertainty of its resemblances, the earliest stubborn insistences of identity*" (Foucault, 1966, p. 170). Thus, monsters and fossils played the role of a "backward projector" of differences and identities within the configuration of continuity according to which…

"The Creator, at the genesis of the world, is said to have formed a continuous series (the Chain of Beings), passing without any hiatus from the most inert mineral, to the primitive monad (for Leibniz), to lower beings

[24] *Telliamed* (an anagram of its author's name), or *Conversations between an Indian Philosopher and a French Missionary on the Retreat of the Sea, the Formation of the Earth, and the Origin of Humankind* (1748), is a work by Benoît (or Bernard) de Maillet (1656–1738), which offers what Mazliak (2002, p. 155) describes as a "fantasmagorical version of evolution." Its main thesis is that the Earth was once entirely covered by water and gradually emerged from it, a process that would have taken millions of years. Originally, only aquatic plants and animals existed, and some of these, upon venturing onto dry land, transformed into their terrestrial counterparts. The Earth as we see it today is not the product of an instantaneous creation but was formed gradually through the action of natural processes (Mayr, 1982/1989, p. 302).

[25] *Palingénésie philosophique* by Charles Bonnet (1720–1793), who was a preformationist, that is, he upheld the view according to which "the new being is not formed, but already exists, complete and in miniature, within the germ; this germ then enlarges and unfolds to give rise to the living being" (Astolfi & Develay, 1996, p. 14).

[26] *Le Rêve de d'Alembert*, by Denis Diderot, was written in 1769 and published in 1830.

(infusoria, zoophytes, plants), to lower animals (insects), to higher animals (quadrupeds), to human beings, and perhaps beyond, up to angels and God himself" (Mazliak, 2002, p. 106).

This latter idea of attaining the level of angels was formulated by the Ikhwān al-Ṣafāʾ, al-Qazwīnī, and Ibn Khaldūn. However, despite the scientific advances achieved during the Enlightenment and the growing distance taken from the authority of the Church, reference to the idea of the chain of beings remained confined to a conception of continuity grounded in a fixist and non-dynamic view of the living world. A transformist conception could only be formulated with the advent of biology as a scientific discipline, unlike what can already be observed in the work of al-Jāḥiẓ in the ninth century. This discrepancy may be explained by the weight of centuries of discursive and non-discursive apparatus that authorized only a single conception of life and its history in the pre-"biological" Latin world, namely, that derived from the Genesis narrative and the idea of the fixity of living beings.

CONCLUSION

In light of this final discussion of the *episteme* governing knowledge of the living world and its dynamics, it may be observed that historical recurrence follows the patterns previously identified with respect to modes of problematization and apparatus. Indeed, it is only with a form of knowledge that is not subordinated to totalitarian powers and/or economic constraints, often accompanied by a rise in religious fundamentalisms, that a pathway toward a scientific treatment of the living world and its origins becomes possible. This process has involved an inversion of the trajectories respectively followed in the Arab-Islamic world and in the Latin Christian world.

The recurrence of archaeological configurations, at the levels of thought, facts, and practices, in both worlds underpinned a recurrence of the *episteme* that guided knowledge of the living world prior to the emergence of "biology." However, the configurations of the *episteme* characteristic of each period were at once similar and distinct. They were similar in what guided them, namely, the search for resemblances and differences, and distinct in what each configuration was able to produce as knowledge among medieval Arab scholars and among Latin scholars from the Renaissance to the end of the eighteenth century, in light of the discursive and non-discursive apparatus to which the pursuit of knowledge was subjected. The examples of knowledge produced by scholars in both worlds make it possible to identify a discrepancy between the levels at which such knowledge was formulated, in terms of the rationalities adopted and the conceptual approaches employed. This supports the idea of the importance of taking into account modes of problematization and apparatus in relation to knowledge of the living world when undertaking an epistemological and didactic approach to this body of knowledge.

This article develops an archaeological approach to "biological" forms of knowledge prior to the emergence of biology as a discipline. However, as indicated in the introduction, the choice of this approach also implies a didactic and formative objective with regard to the debates that may arise in a time when regimes of truth are multiple and when the capacities for communication and dissemination are immense. In this sense, we share the assertion formulated by Morange (2017): "The development of science is not an acquired given" (p. 45).

"We undoubtedly live today too much under the illusion that the place of the sciences is definitively secured and that no political or religious power could call their status into question. […] Totalitarian regimes […] and religious ideologies may […] challenge what was considered an established achievement of scientific thought,

such as the theory of evolution, find a receptive audience among parts of the population, and gain support from certain leaders" (ibid., p. 46).

Indeed, given the "obstacle-strewn" path through which the teaching and media dissemination of the theory of biological evolution have proceeded (Coquidé & Tirard, 2008), revisiting the historical, epistemological, and archaeological processes through which knowledge relating to the study of the history of the living world has evolved makes it possible to better understand the issues surrounding its treatment. Such an understanding of the processes by which knowledge is constructed would help to enrich debate and to propose didactic and pedagogical approaches that would render the treatment of biological evolution less constrained, and more strongly focused on its scientific nature and its contributions to the biological sciences, rather than on its perceived conflict with religious or other beliefs.

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