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Some Speculations on Biological Evolution from Kant's and Goethe's Responses to Egyptian Philosophy

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Abstract Both Immanuel Kant (1724-1804) and Johann Wolfgang von Goethe (1749-1832) have been recognized for their scientific ideas that anticipated the later theory of biological evolution (Mayr 1959; Wells 1967). While Kant had referenced the evolutionary rebirth of the phoenix in 1755 and then quoted the inscription of the Egyptian goddess Isis' Temple as early as 1763, he later questioned in 1796: "though unable to lift the veil of Isis, can [philosophers] yet make it so thin that one may divine the goddess beneath it"? (1796/2002: 439). Along similar lines of thought, Goethe had written of nature's veil in his artistic and experimental portrayals of biological phenomena in 1808 as follows: "A weaving flowing, Life all-glowing, Thus at Time's humming loom 'tis my hand prepares, The garment of Life which the Deity wears!" (Goethe 1808/2018: 17). For both, their diverse and subtle references to Egyptian philosophical imagery helped frame their proposals of evolutionary concepts, and these together are demonstrable of characteristics, simultaneously, of a hesitancy to speculate beyond the bounds of their reason, as well as a willingness to allow their thoughts to emerge in new and unexplored contexts.

Keywords Kant, Goethe, Egyptian philosophy, Evolution, Metaphysics, Epistemology

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Introducing Egyptian Symbols into European Contexts

The famous—and now eroded and lost—Isis inscription of the Temple at Saïs, Western Nile, had been known in European records since at least the 1st-century CE. The widely traveled Greek historian Plutarch (46 -119 CE) recorded in a commentary on the hidden truths of Egyptian religion that "the shrine of Minerva at Saïs, whom they consider the same with Isis, bears this inscription—'I am all that hath been, and is, and shall be; and my veil no mortal has hitherto raised'" (Plutarch c.100CE/1898: 8). In the middle ages, Plutarch's record was appropriated into religious allegories. Later however, by the 14th century, Giovanni Boccaccio (1313-1375) published the paradigmatic text *De clarismulieribus* (1374) and included among other female deifications, the goddess Isis from ancient Egypt, without any reference to European traditions (Campino 2023). Renaissance humanists of the 16th century continued to exemplify this tradition: Raffaello Sanzio da Urbino (1483-1520) in his polymaston 'Artemis of Ephesus' statue in Rome, Italy (1508), Niccolò Tribolo (1500-1550) with his marble statue of this design at the Château de Fontainebleau, France (1529), and the novelist Edmund Spenser (1552-1599) in his *The Faerie Queene* (1590s) which personified nature as a veiled woman. In the 17th century, Athanasius Kircher (1602-1680) in *Oedipus Aegyptiacus* (1652) provided an interpretation of Isis's veil as an emblem of the secrets of nature, while the frontispiece to Gerhard Blasius's (1627-1682) *Anatome Animalum* (1681) included an engraving by Jan Luyken (1649-1712) of an Isis-Artemis figure representing nature with her veil being removed (Britt 2004: 108). Both Immanuel Kant (1724-1804) and Johann Wolfgang von Goethe (1749-1832) are known to have read Plutarch and Kircher,[1] although perhaps there were other sources about the veil of Isis—among many available—which presented themselves before them in their diverse readings, and thus these ideas made their way into their publications.

Under the maternal protection of the goddess Isis within the system of Egyptian mythology was considered to have been the Bennu bird, which also became associated with or known by the name of the phoenix. The Greek historian Herodotus (c.484-c.425 BCE) had recorded in Ch.73 of his *Histories* that the people of Heliopolis, Egypt —a now no longer extant city—had described to him this mythical bird and to have seen it only at lengthy intervals. Thereby, the record of Bennu had been transmitted from North Africa to Europe since at least the middle of the 5th-century BCE, and with a specific term employed by Herodotus in this text which appears to have taken its etymology from Phoenicia, suggesting its cross-cultural origin. There has in this regard been some scholarly suggestion by Spiegelberg (1901) and Sethe (1931) for a common etymology of Bennu through the pronunciation *boin and *phoinix. However, in an influential treatise of this subject, Roel Van den Broek (1972) has claimed that "there is no resemblance whatever between the two birds; fusion of their iconography first occurred in Roman Egypt" (1972: 25), and at an early point in the history of Egypt, the Bennu was represented by a yellow wagtail and then, subsequently, became represented by a heron—both periods distinguishable and clearly based on known species of birds. Yet according to the more general mythologies, the phoenix, like the Bennu bird, was etiologically derived from multiple representations available in discoverable artifacts and is likely not to have been based on a known species of bird. Indeed, it is standard to properly consider it as a chimerical representation of multiple birds from diverse origins:

"The phoenix cannot, by any stretch of the imagination, be traced to any particular species of bird. A creature composed of a cock's head, a snake's neck, a swallow's chin, a tortoise's back and a fish's tail is *a hybrid* [...] There is no point in comparing such a bird to a pheasant or a peacock, whatever it may have borrowed from them; it is purely a product of the imagination, designed to furnish an *analogue to what the sun stood for* in the primitive mind" (Suhr 1976: 29, emphasis added).

Researchers will certainly continue to seek evidence and debate the exact cultural origin of these captivating mythical birds depicted in hieroglyphs and sculptures, and Kant and Goethe, as this article will demonstrate, are indeed among the important Western philosophers who had commented within this forgotten tradition. As generally understood, though, it can be accurately stated that both the Bennu and the phoenix at least share in common: (1) their composite features from multiple living and non-living species, and (2) their ability to rise again from the ashes of fire that had brought extinction to the life-forms of a given epoch. When employed in typology, the symbol may merely represent a fantasy or a moment of resurrection, although perhaps for other writers it also might mean something historical or even something biophysically possible. Thus when Kant and Goethe turned to this figure in their writings, it is essential, for a true understanding of their philosophy, that their specific use or uses of it be evaluated and analyzed.

[1] For example, Kant's educational exposure to Plutarch can be found at Kuehn (2001: 48) and a later reference to Plutarch can be found in Kant (1802/2012: 497); his references to Kircher can be found at (1802/2012: 494, 618). Similarly, a reference to Plutarch can be found in Goethe (1882: 163); his references to Kircher can be found at (Goethe 1840: 31, 371).

Herodotus, who had first described the Bennu/phoenix as known to the people of Hieropolis, Egypt, in Ch.73 of the *Histories*, had also made note of other mythical North African creatures. Specifically, he described in Ch.46 the Criosphinx, having the body of a lion and the head of a goat, as well as in Ch.92 and Ch.191 a Hieracosphinx, having the body of a lion and the head and wings of an eagle. It has been thought that he coined these original terms in the Greek based on the root word 'sphingo', meaning 'to strangle', accordingly employed because lions strangle their prey. To the Egyptians, though, the sphinx was known by the name of Shesepankh, meaning 'living image'. Herodotus' descriptions that he recorded in the *Histories* were likely based upon his having seen small or mid-sized statues in various temples in Egypt and Syria. However, and inexplicable to contemporary scholars, Herodotus actually made no reference to the great sphinx of Giza, although he did make direct reference to the great pyramids of Giza. Some contemporary scholars have speculated that Herodotus had written his *Histories* before Sophocles' play *Oedipus Tyrannos*(429 BCE) was premiered, which, containing other references to fantastical monsters, would have provided a parallel narrative for including the great sphinx—and thus Herodotus opted to leave out a mention of the sphinx (Evans 2016: 15). But the riddle is perplexing.

Archaeologists believe that the great sphinx was built during Egypt's Old Kingdom (c.2575–2150 BCE) by the fourth-dynasty pharaoh Khafre. Just like the Bennu/phoenix theory of a common etymological origin, some scholars have also speculated about the name sphinx as a subtle statement of shared language patterns across the ancient near East, Greece and North Africa during the Phoenician empire (c.1550-300 BCE):

"The debated origins of the Greek name for the sphinx may have a solution, or at least a new valid hypothesis here [...] It is not impossible that the Greek name was a translation of the name from the Phoenician/Syrian realm. Even if 'sphingo' were not the original Greek root of the name, the Archaic Greek-speaker quite possibly understood it as such and drew a connection between the Semitic and Greek names. This is not an unlikely scenario as the hybrid entered, or re-entered, Greek iconography and mythology in the orientalizing period after centuries of aniconic art. The existence of other leonine monsters and threats in the afterlife as attested in the Phoenician world strengthens the possibility" (López-Ruiz 2024: 199-200).

If the Phoenicians had influenced Herodotus in the name given to the sphinx, then this would have chronologically succeeded the time period of the great sphinx's construction which was one thousand years earlier— however, such overlapping histories are not entirely extrinsic to our understanding of North Africa. Herodotus himself appeared to have noticed discrepancies in various statements from the Egyptian priests, for example in Ch.43 ("having come to speech with the priests of the god, I asked them how long time it was since their temple had been set up: and these also I found to be at variance […]"). Such statements by Herodotus have been critically characterized by Barthold Niebuhr, positing that he "understood nothing of the Egyptian language, was unable to read the hieroglyphics, and was obliged to receive, in regard to everything, that which the priests thought fit to tell him" (Niebuhr1852: 44). As is often said of it, the Shesepankh/sphinx remains a riddle, even to the point that its time of its construction, cultural origin of its concept, and etymology of title are in many ways unknown. These historical aspects being considered, when the dramatic-playwright and speculative-scientist Goethe invoked the sphinx typology in his *Doctor Faust* (1808/1832), the statements given might best be read as the speculative representations of a deeply questioning philosopher intending to clarify this profound and veiled mystery from the ancient world.

Kant's Envisioned Construction of a New Scientific Paradigm

Kant's educational path took him from the standard matriculation steps in place at the University of Königsberg, and his early—and often forgotten texts—reflect a certain impressive willingness to take scholarly risks. His father died in 1746 requiring him to return home to attend to his family, interrupt his studies, and work independently. His first publication *True Estimation of Living Forces* (1749), which he sent mathematician Leonhard Euler (1707-1783) with no response, was at first considered a scientific failure by his contemporaries. His next major work *Universal Natural History* (1755), though original for its suggestion of the nebular hypothesis, was printed by a bankrupt publisher and went unnoticed. Then his metaphysical texts *New Elucidation* (1755) and *Physical Monadology* (1755) departed from the Wolff-Leibniz tradition and were unable to gain him a position at Königsberg as an associate professor succeeding his deceased teacher Martin Knutzen (1713-1751). Later in life, as a notable or perhaps nationally-renowned philosopher of the *Critiques*, some of these earlier works went through reprintings, thus enabling re-evaluations of them even during his professorial lifetime; for example, *Universal Natural History* (1755) was published in an abridgment in 1791 followed by a complete third edition in 1798 and fourth edition in 1808 (Warda 1919). Besides the nebular hypothesis of this once forgotten text, Kant had also outlined a simple description of biological evolution

framed with allegorical reference to the interculturally derived and mysterious phoenix bird, rising from the ashes of planetary systems consumed by the fire of stars:

"A quantity of flammable matter as these burning suns represent, together with the retinue of their planets dissolved by the ineffable heat, will disperse the material of their masses in the old space of their sphere of formation and there the materials for the new formations are provided through the same mechanical laws, through which again the empty space can be populated with worlds and systems. If we follow *this phoenix of nature*, which burns itself only to rise rejuvenated from its ashes to new life through all infinity of time and space; when one sees how, even in the region where it decays and ages, it continues unexhausted with new appearances and on the other border of creation it proceeds in the space of unformed raw matter with constant steps for the expansion of the plan of divine revelation to fill eternity as well as all the spaces with its wonders: then the mind that contemplates all this sinks into a profound astonishment" (Kant 1755/2012: 272, emphasis added).

For Kant, the reference was perhaps simply a useful allegory. It is not directly known from what source he drew this term; although, since other references to Herodotus' *Histories* appear in his writings (Kant, e.g. 1754/2012: 173), Kant might have read it from Ch.73 of this text. When he prefaced the work, Kant had noted similarities between his theory of cosmic evolution and "Lucretius or his predecessors Epicurus, Leucippus, and Democritus" (1755/2012: 198). The naturalistic pagan imagery of the phoenix was perhaps additionally included to suggest that already in our accepted and shared cultural (or intercultural) consciousness, some type of material causation was understood to be a necessary or perhaps sufficient explanation of the origin of life. As Peter McLaughlin in the recent compilation *Kant's Theory of Biology* has noted, this text outlined the evolutionary "processes [as] completely natural, and [Kant] had no qualms about propagating something like spontaneous generation of the first inhabitants of countless planets as soon as the physical conditions were right" (McLaughlin 2014: 157). Probably fearing condemnation as a pagan or atheist, Kant was certain to be "safe with regard to the duties of religion" and even dedicated the book to Prussian King Frederick II (1712-1786) with adulatory titles such as 'noble,' 'mighty,' and 'gracious lord' (1755/2012: 192, 194). However, as is well known, the publisher of *Universal Natural History* (1755) went bankrupt and the supply was impounded by the court (Kuehn 2001: 99). His theory as proposed, despite its plea to what seemed to be the interculturally accepted phoenix allegory, was unsuccessful.

During the late 17th- to early 18th-centuries, the scholarly study of Egyptian culture had found itself in a rather antagonistic exchange, this during the decades just prior to Kant's writings. The polymaths Gottfried Wilhelm Leibniz (1646-1716) and Christian Wolff (1679-1754) had both studied hieroglyphic languages such as Egyptian and Chinese from new sources that were being made available. Leibniz suggested that the need for a 'characteristica universalis', or universal scientific language, could be answered by employing these general symbols; and Wolff, not merely systematizing and popularizing Leibniz's ideas, suggested further that these supposéd rationalistic tendencies of hieroglyphic languages, particularly Chinese, could be used to formalize 'characteristica universalis' not only in the sciences, but also in the field of ethics (Lach 1953). Addressed to the students of Halle University in July 1721, this infamous 'Confucius speech' led to Wolff's expulsion from the university (on the grounds of his promoting determinism in opposition to the enforcement of law with respect to free-willed subjects), and required his retreat to Hesse-Marburg to avoid execution by hanging on King Frederick William I's (1688-1740) orders. Years of work later, Wolff was able to publish his *Psychologia Empirca* (1732) wherein he had further developed his theory of hieroglyphics and perhaps had modified the deterministic tendencies of the rationalistic reading he had previously assigned them:

"[Wolff] applied the term 'hieroglyphic signification' to 'the use of a certain thing to denote another thing.' According to Wolff, a figment of the imagination is a true image or has hieroglyphic meaning if it is composed in such a way that the resemblance of its constitutive parts to the intrinsic determinations of the thing allows one to infer the latter (reality) from the former (phantasm) [...] Contrary to what Leibniz assumed, productions of the imagination do not become more perfect with increase in simplicity. Rather, the perfection of the image lies in its complexity. The perfect image contains the greatest possible number of significant elements" (Buchenau 2013: 79).

Wolff's infamy had attracted a large number of readers beginning in in the 1720s, and following his rehabilitation (Frederick William I read his work in 1738 and Frederick II invited him to join the Prussian Academy in 1740), he was able to continue teaching his ideas. One of his students from these later years was Alexander Gottlieb Baumgarten (1714-1762), whose *Metaphysica* (1757) was later used as the textbook for Kant's classes on this subject from around 1757 until his last teaching year in 1796.

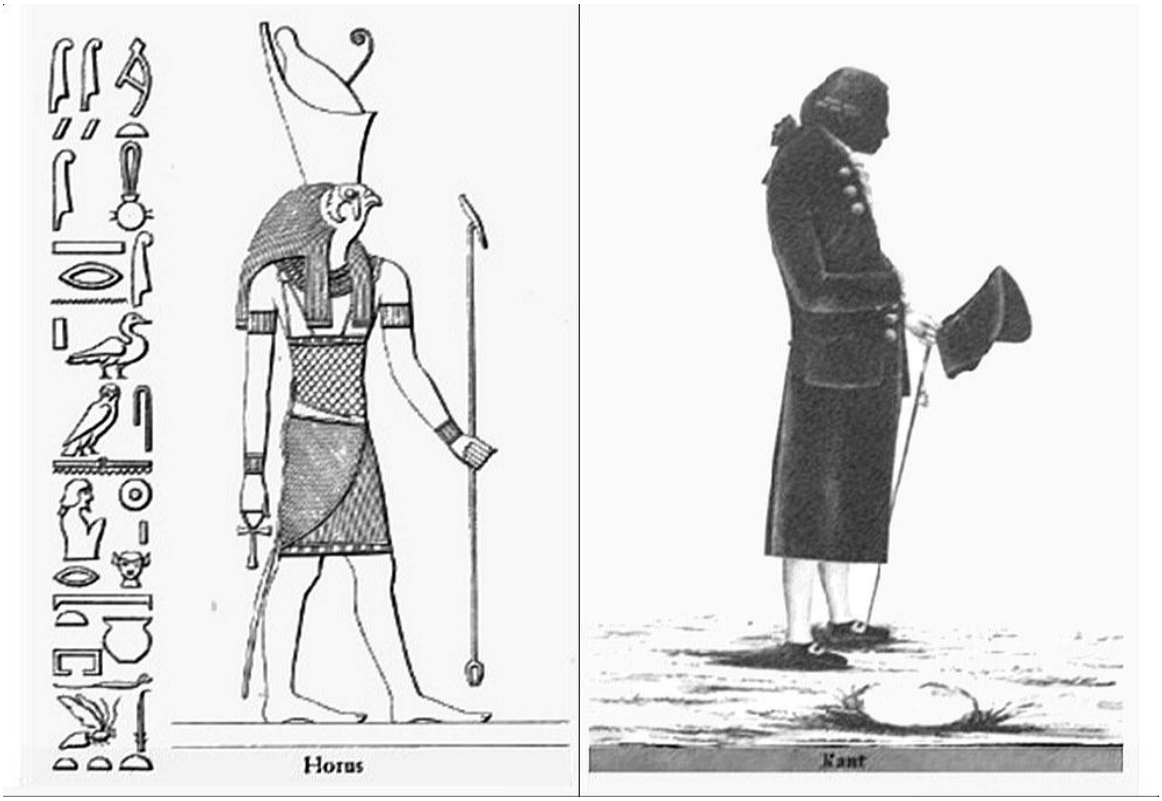


Figure 1: (L) Depiction of Horus from p.9 of *Bilder-Atlas: Ikonographische Encyklopädie* (1875), compiled by Karl Gustav von Berneck (1803-1871) for Brockhaus Press. Digitized by Google books. (R) Silhouette of Kant (1793) by a student at University of Königsberg named Johann Theodor [Gottlieb] Puttrich (?-?), re-rendered portrait by Daniel Berger (1744-1824). Available online at University of Manchester, UK.

The influence of Wolff and the hieroglyphic interpretation controversy is clearly evident, even if indirectly, in Kant's student lecture notes from these years. For example, the following can be read in the *Bloomberg Logic* from the 1770s:

"The Egyptians and Persians had probably been the first whose understanding overstepped its limits and who began to make *speculationes*. *Astrologia*, *cosmologia*, arose before the physical sciences. The foremost object of their investigation was the origin of things [...] However, this first inquiry will of course have contained more superstition than philosophy. This much is certain: Before *philosophia* had utterly and completely separated itself from [...] the authority of the clergy in a nation, no philosophy could really be produced [...] The Jews in Egypt, finally, adopted the allegorical method and even the philosophy of this country, namely, the concept of the emanations, which arose from the intermingling of the opinions of Zoroaster, Pythagoras, and others. They sought to combine all this as well as possible with their opinions […] In the 2nd century, the Jews' fear of being scattered prompted them to formulate this doctrine in writing, and thus they propagated these errors further and further. On this, see more in Formey's History of Philosophy pp. 72, 184. The philosophy of the ancients contains the defect [...] that one did not combine mathematics with observations of nature" (c.1770/1992a: 20-22).

As propounded in these lectures, Kant stated that he did not think that the cultures that had used hieroglyphics had been able to give clear articulation to their ideas—their philosophy had stagnated in the ambiguity of its symbols. For Kantian philosophers, it is commonly thought that "the most telling testimony to Kant's debt to Wolff was the *Critique of Pure Reason* itself [since] the structure of it directly mirrors that of Wolff's German Metaphysics" (Schulting et al. 2015: 157), but it is being overlooked that Kant was an heir to the hieroglyphic controversy that Wolff had written on, and that in many ways, although critical of Wolff, he was also a successor to his tradition. His distinct reading of Egyptian wisdom departing from the Leibniz-Wolff tradition is nonetheless in many ways evident. Such is the case with Kant's lectures from the 1780s, where he is certain not to attribute too much philosophical insight to these hieroglyphic cultures:

"No people on the earth began to philosophize earlier than the Greeks, since no people thought through concepts, but instead all thought through images. They first began to study rules in abstracto. Which people investigated the concepts of virtue, of the highest good? The Egyptian wisdom is nothing but child's play compared to the Greek, and modern authors have proved that the Egyptians did have surveyors, to be sure, who measured fields according to a certain accepted standard, but they did not understand anything about mathematics. The Greeks were the founders of mathematics, who demonstrated it from first grounds and elements" (Kant c.1780/1992a: 261).

From such passages, it seems that Kant had forthrightly distinguished his views from those of Leibniz and Wolff, here and in other statements too, by not conceding the universal features of a scientific language to hieroglyphic cultures. However, he also left open the further question of how advanced North African science had become by acknowledging their use of mathematics in certain applications such as surveying. It was not until the 20th-century, in fact, that records became available to Western scholars demonstrating that Egyptian astronomy's calculations had been shared with the Babylonians and that their formula of a right triangle of sides 3,4, 5 had been demonstrated before Pythagoras's theorem (Heath 1921). What perplexed Kant it seems, in his lifetime as it did others then, was the lack of recorded sources demonstrating that the Egyptian culture had allowed science to flourish, and yet, as if under a veil of symbols, the advanced nature of their scientific development, evident in their towering monuments and pyramids, was still nonetheless being suggested to him.

In his pre-critical years of philosophical writing, Kant had left several reflections on the transcendent nature of such inaccessible realms of human thought. If the Egyptians had failed to reach the level of development that the Greeks would later advance toward, it was not therefore concluded by Kant that Egyptian philosophy had no internal explanation for its great silence on the 'grounds and elements' that undergirded the method of rational scientific proof. This is evident by Kant's vague allusions to the words of the Isis inscription from Saïs Temple in his text *The Only Possible Argument* (1763):

"This supreme Being embraces within itself everything which can be thought by man, when he, a creature made of dust, dares to cast a spying eye *behind the curtain which veils* from mortal eyes the mysteries of the inscrutable. God is all-sufficient. Whatever exists, whether it be possible or actual, is only something in so far as it is given through Him. If it be permitted to translate the communings of the Infinite with Himself into human language, we may imagine God addressing Himself in these terms: 'I am from eternity to eternity: apart from me there is nothing, except it be through me.' This thought, of all thoughts the most sublime, is still widely neglected, and mostly not considered at all" (Kant 1763/1992b: 191, emphasis added).

Kant's reference here to certain inscribed words being "sublime" was later repeated in the *Critique of Judgment* (1790) where Isis' name is directly invoked. While here, there remains in the phraseology some similarity of these words to those of Psalm 90:1 and Revelation 1:8, these texts are quite distinct and certainly not identical. It is actually not entirely clear where Kant exacted this particular passage from since they are nowhere else to be found word-for-word, and there is a definite possibility that Kant was leaving such statements as a sort of preliminary meditation on the hidden and secret method of Egyptian philosophy. This pattern of abstract meditation is also to be found in his text responding to the metaphysical philosophy of Emanuel Swedenborg (1688-1772) published by Kant in *Dreams of a Spirit-Seer* (1766):

"Nor has human reason been endowed with the wings which would enable it to fly so high as to cleave the clouds which veil from our eyes the mysteries of the other world. And to those who are eager for knowledge of such things and who attempt to inform themselves with such importunity about mysteries of this kind, one can give this simply but very natural advice [...] which Voltaire gave to his honest Candide after so many futile scholastic disputes: 'Let us attend to our happiness, and go into the garden and work'" (Kant 1766/1992b: 191).

Kant had here sought in this text to expose the flaws of Swedenborg's speculative metaphysics by demonstrating that inevitably extreme premises of metaphysics could give rise to a variety of absurd conclusions. It is well known, however, that *Dreams of a Spirit-Seer* (1766) was "also a self-critique" and an attempt to "preempt mockery by others," but that having once admitted these fatal points in his own work, "the entire pre-critical project Kant had worked on since he was twenty had come to a crashing halt" (Schönfeld & Thompson 2019: 1). What followed are now considered by philosophy historians to have been his "silent years" (1770-1781). Kant must have thought of himself as now under the veil of this philosophy too.

Nonetheless, there are from these years, a number of works that demonstrate how Kant continued to endeavor toward synthesizing his early ideas on cosmic evolution from *Universal Natural History* (1755) with the metaphysical

questions of *The Only Possible Argument* (1763) and *Dreams of a Spirit Seer* (1766). As 20th century scholars have written of these years, his "theory of race formation [in these texts] stands in a class by itself, occupying in some respects an intermediate position between the environmentalist hypothesis and the random-variation-and-selection approach" (Greene 1954: 36). For example, in Anthropology lectures notes published as part of an announcement of his course for the year 1775, he wrote:

"An animal species that also has a common stem, does not contain various kinds [Arten] (for the latter means precisely a difference in lineage [Abstammung]); rather, its variations [Abweichungen] are called subspecies [Abartungen] if they are heritable. If the lineage's heritable characteristics are in accord with their origin, they take after the origin; if the subspecies can no longer produce the original form of its stem [Stammbildung], then it would be called degeneration [Ausartung]. Among the subspecies, i.e., the heritable differences of animals that belong to a single stem, those that consistently maintain themselves over many generations in all transplantations (transfers to other regions) as well always producing hybrid offspring with other subspecies of the same stem are called races [Racen]. Those that consistently maintain their subspecies in all transplantations but do not necessarily produce hybrids in interbreeding with others are called sports [Spielarten], those that breed true [nacharten] often but not consistently, varieties. Conversely, the subspecies that produces hybrids with others but gradually disappears after transplantation is called a special sort [Schlag]" (Kant 1775/2007: 82).

These ideas have been unusually characterized by A.O. Lovejoy as representative of "anthropological evolution" but not "biological evolution" (Lovejoy 1910: 553) and by John C. Greene as representative of "preformation and subsequent development as an adaptive response to changed environmental conditions" (Greene 1954: 38)—although these characterizations have been challenged by some scholars. For example, Alix Cohen has described it as a "teleological account of the evolution of the species" in which "mechanical explanations are oriented by teleological principles" (Cohen 2009: 34). The balance that Kant perhaps sought to mediate was arguably between the extreme views of fantastical and whimsical evolution, with its associated metaphysical chaos, and the fixed rigidity of Greek theorems and proofs.

Kant taught courses and this subject beginning in the semester of 1772/73 and up until the year 1795/96. By focusing on giving specific terminology to this organic process of evolution, he might have seen a possibility for bringing Egyptian and Greek philosophy into a new synthesis. Indeed, when Kant wrote the *Critique of Pure Reason* (1781/1787) around this same time, the concept of a new scientific revolution was on the forefront of his mind:

"Mathematics was left groping about for a long time—chiefly among the Egyptians—and that its transformation is to be ascribed to a revolution [...] A new light broke upon the first person who demonstrated the isosceles triangle, whether he was called 'Thales' or had some other name. For he found that what he had to do was not to trace what he saw in this figure, or even trace its mere concept, and read off, as it were, from the properties of the figure; but rather that he had to produce the latter from what he himself thought into the object" (Kant 1787/1998: 108).

In a comparative essay, Ian Hacking has recently noted similarities between Kant's view of scientific revolutions and that of Thomas Kuhn's highly influential *The Structure of Scientific Revolution* (Kuhn 1969/2012: xii). It is possible that Kant had perceived that biology and anthropology were also groping about for a more exact set of scientific classification methods, and that the revolution was needed to provide terms of this very type of rigor.

Support for this reading of Kant's Anthropology lectures—and his statements on scientific paradigm shifts from the *Critique of Pure Reason* (1781/1787)—is corroborated by later ideas articulated in the *Critique of Judgment* (1790). Here Kant again returned to his meditations from as early as *Universal Natural History* (1755) on the ability of crude matter to form itself into patterns that eventually lead to complex life forms, although without making any direct reference to the phoenix:

"For the different animal genera approach one another gradually: from the genus where the principle of purposes seems to be bourne out most, namely, man, all the way to the polyp, and from it even to mosses and lichens and finally to the lowest stage of matter discernable to us, crude matter. From this matter, and its forces governed by mechanical laws (like those it follows in crystal formation), seems to stem all the technic that nature displays in organized beings [...] This kind of generation is not absurd, as in *generatio æquivoca*, which is the production of an organized being by the mechanics of crude, unorganized matter. Rather, this generation would still be a *generatio univoca* in the most general sense of the world, because anything organic would be produced only from something else that is also organic, even though different in kind from it among beings of that type, as when, e.g., certain aquatic animals developed

gradually into marsh animals and from these, after several generations, into land animals. This is not inconsistent *a priori*, in the judgment of mere reason" (Kant 1790/1987: 304-305).

It is moreover conceivable that Kant envisioned the ultimate principle veiled by Isis to be exactly what he sought—i.e. the elusive emergence of living matter from non-living matter. Sections earlier in this same text, before these cited passages of *Critique of Judgment* (1790) quoted here above, Kant had, in fact, already made a direct reference to the inscription of Isis:

"Perhaps nothing more sublime has ever been said, or a thought ever been expressed more sublimely, than in that inscription of the temple of Isis, Mother Nature: 'I am all that is, that was, and that will be, and no mortal has lifted my veil.' Johann Segner [(1704-1777)] made use of this idea in an ingenious vignette prefixed to his *Naturlehre* [(1770)], so as to imbue the pupil, whom he was about to lead into this temple, with the sacred thrill that is meant to attune the mind to solemn attentiveness" (Kant 1790/1987: 185).

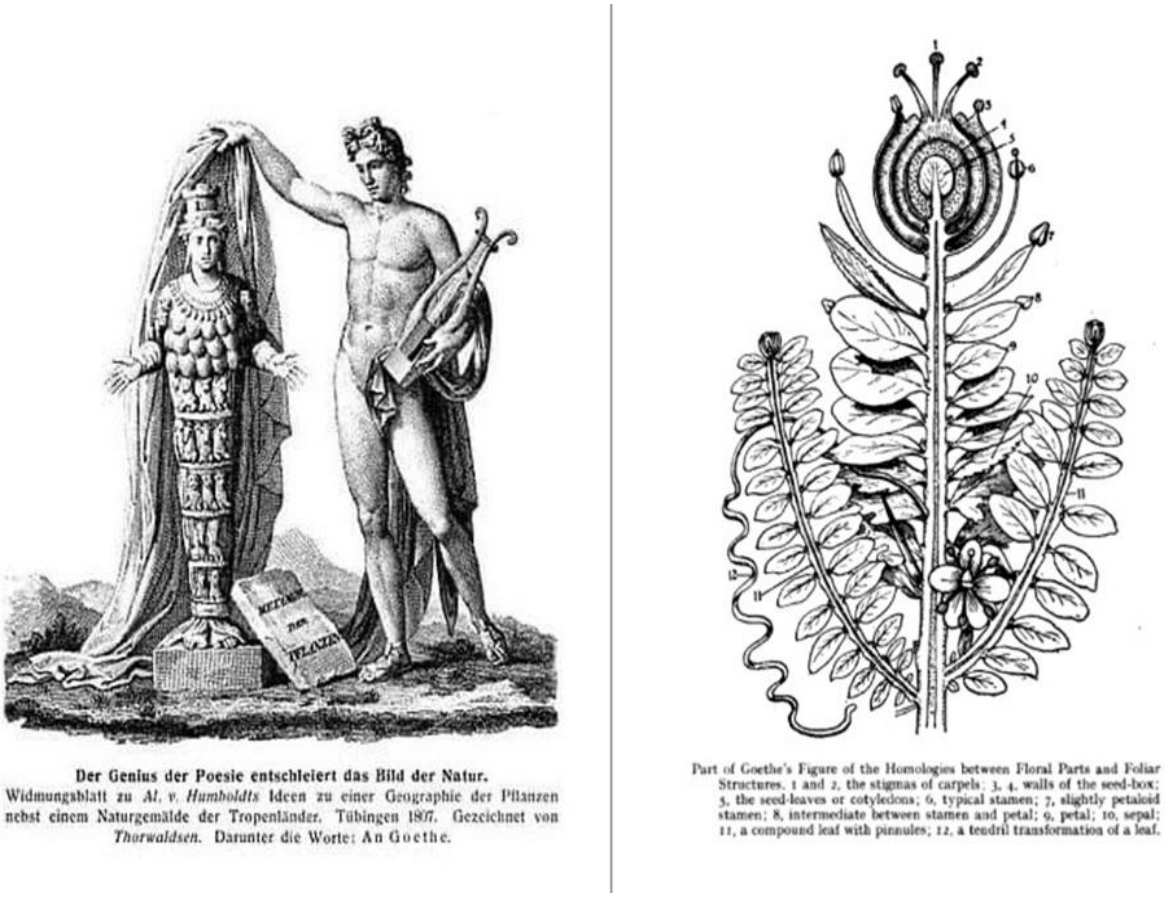
Following along this line of thought several years later, he wrote perhaps of his frustration with ultimately knowing the riddle of life's origin, that "unable to lift the veil of Isis" the philosopher still finds that it is "still thick enough for us to make what we please of the apparition" (Kant 1796/2002: 439). Despite his apparent hopes of a new scientific paradigm for the biological sciences, with fitting tributes to the secrets of Egyptian philosophy and Greek mathematics in his texts, Kant seems to have abandoned this project in the end, leaving it for others to complete.

Goethe's Archetypes for Living Matter's Formative Principles

Born at Frankfurt, Germany, to a family with Turkish heritage, Goethe initially studied law at Leipzig University from 1765 to 1768, and then, following an illness that required him to return home, he thereafter completed his legal education at University of Strasbourg from 1770 to 1771. While a student in Strasbourg, Goethe became close friends with Johann Gottfried Herder (1744– 1803), a former student of Kant from his earlier educational years in 1762 to 1764. After meeting Goethe at Strasbourg in the 1770s, Herder later wrote the controversial text *Ideas for a Philosophy of the History of Mankind* (4 vols., 1784 to 1791), in which he "compared the transformations of plants' forms through their lives to that of humans and all species" (Rupik 2024:§4.2), a text through which he became somewhat notorious for a theory of evolution. Shortly after completing his law studies at Strasbourg in 1771, Goethe then began his own work researching skull formation patterns in 1775, inspired by attending a session on this topic at the Physikalische Gesellschaft in Zurich given by Johann Kaspar Lavater (1741-1801). The following year, in 1776, he began additional studies of plants, and his researches on both subjects then lead to his eventually enrolling in 1781 for anatomical studies with Johann Christian Loder (1753-1832) at Jena University. Then several years later, working along with professor Loder, Goethe attempted to publish his first scientific paper on this subject of skull formation patterns in 1784, which was, however, rejected by the journal editors (Wells 1967b). For many familiar with Goethe as a lawyer and poet, these researches certainly represented a shift from Goethe's previous interests, a change which was perhaps in part due to his friendship with Kant's former student Herder. As a youth, Goethe had at first been an avid reader of the first of the Pentateuch, Virgil's Aeneid and Ovid's Metamorphoses, and during much of his time in law school, gravitated more toward theater and literature. Later, however, still endeavoring to make his contributions to biology, he submitted to bring together these disparate pursuits when he was entered upon a journey to the Italian peninsula and Sicily from 1786 to 1788. During his travels, Goethe became acquainted with the Egyptologist and Masonic scholar Giuseppe Balsamo (1743-1795) and simultaneously began drafting his work *Metamorphosis of Plants* (published in 1790), a well-received treatise that combined the poetic features of Ovid's work with the detailed descriptions of natural history (Mensch 2014: 93). When he returned to Germany in the 1790s, he also carried out additional physio-chemical and anatomical studies with a new student and collaborator Alexander von Humboldt (1769-1859).

Some of the details of Goethe's scientific contributions to biological theories are often lost in the blur of his voluminous literary output and his somewhat extravagant and disarrayed studies in other subfields. This paper attempts to follow the texts most available in secondary academic literature, although other passages have also been included from primary sources. The general confusion about Goethe's theories of evolution should not be thought of as due to any lack of rigor needed for scientific precision. Goethe recognized that the theory of morphological (or evolutionary) development needed to have a law-like foundation, or it would elude others as an aberrant or random unscientific hypothesis. Toward this end, he proposed his "three formative principles" common to plants: (1) the archetypal leaf, (2) progressive and rarefication of sap up the stem, and then finally (3) the three expansion-contraction cycles of the meristem. Through these three common formative principles, varied within each particular plant species, a vast number of different types were possible for distinct formations. As he famously wrote once: "how could I recognize

that this or that form was a plant if all were not built upon the same basic model?" (Goethe 1790/ 2009: xvii). Elsewhere in his *Italian Journey* (published 1816-1817), he wrote that: "in the organ of the plant which we are accustomed to call the leaf lies the true Proteus who can hide or reveal himself in all vegetal forms. From first to last, the plant is nothing but leaf, which is so inseparable from the future germ that one cannot think of one without the other." (Goethe 1816/1970: 366). Thus, for Goethe's theoretical conception, laws of biological development were preserved in the midst of morphological changes. Robert Bloch notes of his theory of the archetypal, primordial plant, or Urpflanze, that it was "mostly a pure ideal process" and a "conceptual generalization, an idea" (Bloch 1952: 316), although Goethe did indeed attempt to draw this archetypal plant. Even after doing so, however, as Rudolf Magnus notes, Goethe seems to have thought it "might be but a theoretical notion, to be constructed but not necessarily found in nature" (Magnus 1949: 66). Perhaps not realizing the fruitfulness of this idea, following upon his depiction and idealistic descriptions from *Metamorphosis of Plants,* the Urpflanze was taken up by numerous subsequent biologists, including Franz Unger (1800–1870), Anton Kerner von Marilaun (1831-1898), and Julius Sachs (1832–1897), who all drew depictions of it (reprinted in Niklas & Kutschera 2017). To these developmental phenomena, he sometimes applied the terms 'Gleichnis' or 'Bild', almost interchangeably; later the concept was termed "homology" by Richard Owen (1804-1892) as an important basis for the hypothesis of evolutionary descent (Kleisner 2007; Weber 2022). However, Goethe had already significantly outlined the concept prior to Owen.



Der Genius der Poesie entschleiert das Bild der Natur.
Widmungsblatt zu *Al. v. Humboldts* Ideen zu einer Geographie der Pflanzen nebst einem Naturgemälde der Tropenländer. Tübingen 1807. Gezeichnet von *Thorwaldsen.* Darunter die Worte: An Goethe.

Part of Goethe's Figure of the Homologies between Floral Parts and Foliar Structures. 1 and 2, the stigmas of carpels; 3, 4, walls of the seed-box; 5, the seed-leaves or cotyledons; 6, typical stamen; 7, slightly petaloid stamen; 8, intermediate between stamen and petal; 9, petal; 10, sepal; 11, a compound leaf with pinnules; 12, a tendril transformation of a leaf.

Figure 2: (L) Dedicatory page by Humboldt to Goethe in his 1805 *Essay on the Geography of Plants*. Available at eWikimedia Commons. (R) A depiction of Goethe's Urpflanze from p.677 of *Outlines of General Biology* (1931) by J.A. Thomson and P. Geddes. Digitized by Google books.

Goethe's professional friendship with Humboldt is also notable for bringing to light the shared Egyptian philosophy that was taking root in their scholarly retinue during these years. When Humboldt published his research on the plants of the mines of Freiberg, *Florae Fribergensi* (1793), it was soon thereafter brought to Goethe's attention. Having read it and personally discussed with Humboldt his discoveries, Goethe began to support the younger scientist's efforts. For several months in 1797, Humboldt took up residence in Jena to carry out plant and anatomical research, and Goethe himself returned from Weimar to reside in Jena during these months, while they together attended university lectures

on these subjects. When finances became available around this time, Humboldt sought permission at first to join Napoleon's expedition to Egypt, however, which was denied. Following this, he successfully obtained from the Spanish government permission to travel to Central and South America to collect plant seeds and live samples, along with his collaborator Aimé Bonpland (1773-1858). Departing in June 1799, Humboldt and Bonpland visited Venezuala from 1799-1800, Cuba in 1800, the Andes in 1801-1803, Mexico in 1803-1804 and the United States in 1804. His journal during these years was completed up to approximately 4,000 pages, and with Bonpland, their discoveries were published together in a notable book *Essay on the Geography of Plants* (*Ideen zueiner Geographie der Pflanzen*, 1805). On the dedicatory page which included a tribute to Goethe's scientific and philosophical influences on their researches, Humboldt and Bonpland included a rendering of Danish sculptor Bertel Thorvaldsen's (1770–1844) engraving of Apollo unveiling the goddess Isis as a representation of a scientist discovering nature. Years later, hosting a visit of archduke Karl August (1757-1828) for the Weimars Jubelfest on 3 September 1825, Goethe himself included this same portrayal of the Egyptian goddess Isis on the walls of his home (Von Muecke 2022: 1).

After the publication of *Metamorphosis of Plants* (1790) and Humboldt's and Bonpland's *Essay on the Geography of Plants* (1805), Goethe continued to carry out his biological researches. Because his collected works comprise 142 volumes, including 50 volumes of correspondence and 13 volumes of scientific writing, though, it is somewhat a difficult task to provide a succinct summary of his output during the years from 1790 onwards. Biographic reviews demonstrate that his studies included researches of organ homology, morphogenetic patterns, the law of correlation, holistic analysis of organismic behavior, and biological matter's relation to universal nature. Other studies are needed, however, to better catalog Goethe's contributions in these areas. For example, Bloch claims that a number of his conclusions were limited by the underdevelopment in his time of the methods of comparative ontogenetic (embryonic) analysis, experimental morphology, and the theory of evolution (Bloch 1952: 316). As such, much of his research took on a qualitative character rather than that of quantitative analysis. Later studies included additional research on the external and internal influence effecting the formative development of plants, including light, air, climate, locality, temperature and water. He additionally, as has been noted, followed the theory of Caspar Wolff (1733-1794) on the law of gradual decrease regarding loss of foliage and the refinement of sap, while he simultaneously also contributed his own law of "correlation or compensation" as two alternative patterns between the different parts of an organism (ibid.: 317). For the most part in these writings, it seems that Goethe worked to follow the epigenetic theory of gradual development of new structures, rather than the preformist theory of simply enlarging or articulating structures that already existed in tiny form (something ambiguously suggested in Kant's anthropology). Yet Goethe arguably never directly aligned his views with either of these previous sets of theories, and, rather, preferred his own term of metamorphosis as a universal biological principle (Palti 2005: 98).

Among the interesting papers published during these years are his are his re-printed and updated version of his first scientific paper on skull homologies from 1784. Reviewing this paper during the intervening years, Goethe had noted the original draft was "not ably handled" (1807/1903: 361) and later that was it "tumultuously and imperfectly [brought] before the public" (1824/1882: 136). This work, finally presented for the scientific public to read in 1820, included a detailed and lengthy postscript on the history of his research with Loder on this subject, as well as an account of the controversy that the paper had provoked among the journal editors and those certain contemporaries who had read it in manuscript. Very similar to Kant's first unsuccessful foray into an evolutionary paradigm for cosmology, viz, his *Universal Natural History* (1755), which was republished in 1791, followed by complete re-editions in 1798 and 1808, Goethe's earliest studies on morphological evolution were now being made available again in this perceptibly triumphant republication in 1820 (N.B. the illustration plates were not published until 1837). Goethe had speculated that the presence of an intermaxillary bone in humans and other animals was evidence that the skull was under a law of variable morphological formation from the modified vertebrate, which when developed in different species gave rise to their variety—much like the diverse species of plants following from modifications to the three formative principles of stems and leafs. As Goethe wrote: "It seems that nature often cuts down its system of bones, and allows something to be missing here and there" (quoted in Wells 1967b: 367), but that underlying these variations remained, like the archetypal plant, or Urpflanze, an archetypal animal, which he named the Urtier. For this theory and the specific details Goethe used to support his hypothesis, he was particularly opposed by Johann Heinrich Merck (1741-1791) and Samuel von Sömmerring (1755-1830). In the intervening years, Sömmerring especially revised his stance and began supporting its being published for a more broad public evaluation. However, again, as there was an inherent difficulty in representing the Urpflanze, so similarly with the Urtier, which Goethe thought biologists could "portray if not to the senses, then at any rate to the mind" (ibid.: 358). Another reflection, taken from undated and posthumously published notes by Goethe, conveyed this approach to biological archetypes along similar lines:

"The direct experience of archetypal phenomena creates a kind of anxiety in us, for we feel inadequate. We enjoy these phenomena only when they are brought to life through their eternal interplay in the empirical. When archetypal phenomena stand unveiled before our senses we become nervous, even anxious" (Goethe 1833/1996: 108).

Lewes later described this approach as one appropriate for "transcendental anatomists" (Goethe 1903: 109). As a scientific theory, Thomas Henry Huxley (1825-1895) became notable for an 1858 lecture which posited that rather than modified vertebrate producing the variety of skull-types, it was actually a segmented mesodermal tissue that was modified to produce the variety of skulls. More recently, however, it is the consensus that "at present, there is no theory of segmentation that can account for all cephalic iterative structures" (Northcutt 2008: 611). Perhaps Goethe's transcendental anatomy might still avail researchers of a comprehensive perspective for considering these alternative hypotheses.

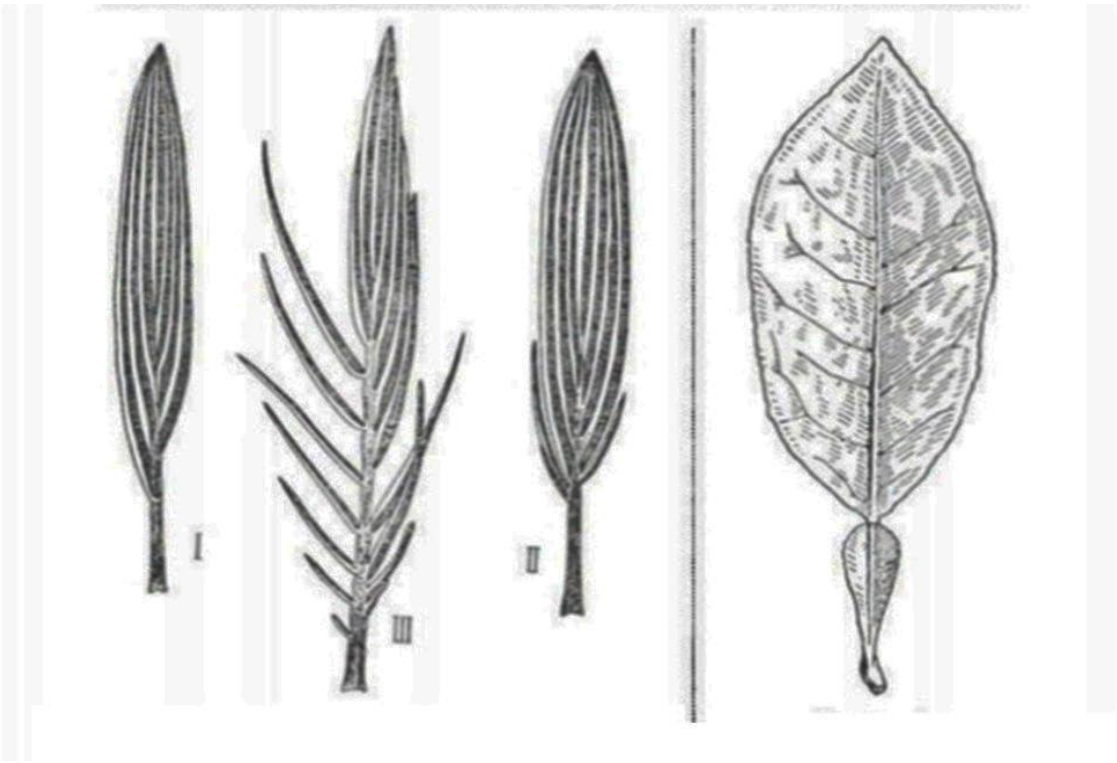


Figure 3: (L) Goethe's drawing of leaf development in the Phoenix dactylifera from (I) simple first leaf; (II) beginning of articulation; (III) advanced articulation. (R) Comparison with leaf of Citrus to elucidate three formative principles. Reprinted in Goethe (1831/1952: 39). Digitized by Google books.

Another notable chapter in Goethe's morphological studies relates to his personal acquaintanceship with and scholarly contributions upon the research of Karl Friedrich Philipp von Martius (1794-1868). On 23 October 1823, Goethe received a letter from Marius which included lithographs of drawings of Brazilian palms. Martius adopted Goethe's visual approach, and entitled this work "Some information about Palms, Their Natural History and Morphology" ("Einiges von den Palmen naturgeschichtlich und morphologisch") which he presented in terms of Goethe's three formative principles. One such species brought to prominence by Martius' travels to Brazil was the Phoenix dactylifera, whose depiction particularly captivated Goethe (Bersier et al. 2019). According to Martius, while the stem grew vertically, the florescence of foliage appeared in a spiral pattern, which he contended were detailed modifications of the Goethean three formative principles. Martius further wrote that this pattern provided evidence for the postulate that these Phoenix palms date back to an earlier geological era. It is interesting to note at this juncture that when Swedish biologist Carl Linnaeus (1707-1778) had studied the Egyptian palms also named after the Phoenix in his *Musa Cliffortiana* (1736), he insisted on "the interpretation of the phoenix [...] that this myth is nothing but a metaphor for the palm tree; there had never been a living bird like the phoenix in nature, Linnaeus stresse[d]" (Schirg 2017: 37). Implicit in his statement might have been the suggestion that intermediate forms between known and unknown species are non-existent, creation being a perfect system of order. Goethe, however, concurred with Martius' hypothesis on the evidence of the earlier development of Phoenix dactylifera, citing the plant fossils that had been

collected by Kašpar Sternberg (1761-1838) in his support. The following year, the two visited in September 1824 in Weimar, discussing Martius' researches and travels in greater detail (Bersier et al. 2019).

Between 1828 and 1831, following the publication of Martius' *Travels in Brazil* (published 1824), Goethe made detailed notes and commentaries on these books. These were published posthumously, and his gloss on Martius' text added ten illustrations to increase the immediacy of the plant research for the reader. However, as Bersier has noted, Goethe's commentaries had notably left omitted Martius' descriptions of the treatment of black slaves and native Indians, which were such an essential part of this second publication. It seems that Goethe preferred to discuss these unfortunate aspects of biological sample collection within a personal setting. When Martius returned for a second visit to Weimar in October 1828, the topic was indeed brought up, as is attested to in both personal notes made by Goethe and his friend also present during the visit, Johann Peter Eckermann (1792-1854). The paradoxical nature of conducting such research, Martius countered in this discussion by defending his Biblical belief in the monogenetic origins of humanity and thus his hope for racial equality. Goethe, however, expressed his support for the evidence of polygenism, that nature's prodigality must have inevitably created numerous species of humans. Moreover, it was also imputed by Goethe to Martius that his Biblical belief entailed a suggestion of degeneration from the pure tribes of Israel. Their evening ended with this "very trenchant" conservation (Bersier et al. 2019). Given Goethe's literary output from these years with references to Egyptian philosophy, it indeed suggests that he had sought a religious system based upon other sources.

Goethe had already made a notable philosophical-theological commentary on the hypotheses of the origin of life in his *Faust* Part I, published in 1808. The protagonist Doctor Faust had dreamed of recreating his life into its youthful vitality in the test-tubes of his chemistry lab, and in doing so, consulted not only scientific texts, but the apparitions of various Greek and North African metaphysical figures. This fictional Faust at first made a pact with a greyfriar from the woods named Mephistopheles, who promised Faust to recreate his life and restore his youth, but later only blunts his plans and plots evil—leading Faust to turn to other gods. It has been speculated in 20th-century German medical journals that Goethe had based this character on Johann Heinrich Merck (1741-1791), who read Goethe's paper on the intermaxillary bone and later rejected it and ridiculed it (Hellmich 1982: 552). Faust's quest then was perhaps an allegory of Goethe's own research, or it was at least referring to a set of scientific questions to which he himself could relate. For Goethe, as he juggled his various pursuits of morphological research and literary productions, it was certainly challenging to avoid simply wandering idly between them, but in many ways there is evidence suggested by his works that the two projects were mutually stimulating for advancing each other. Indeed, as the poet of the Prologue of *Faust* Part I notes: "Nature spins out her thread, endlessly long, at random on her careless spindle wound," after which the poet continues: "Who divides up this dull monotonous drift into a living rhythm? […] The power of Man, revealed in Poetry!" (Goethe 1808/1998a: 6-7). This, however, was only *Faust* Part I, which was left incomplete until it was later re-edited with *Faust* Part II completed years later in 1831.

In the intervening years of this two-part literary masterpiece, Goethe had conducted numerous scientific researches and had exchanged a considerable amount of correspondence with other scientists. Many of his collaborators had certainly endeavored to expand the horizon of science, something Goethe actively promoted and followed in his own research. Other researchers known to Goethe, however, such as Karl Martius, or those following the influential biologist John Ray (1627-1705) and the contemporary research of Georges Cuvier (1769-1832), had sought in their theories to provide a certain level of confirmation of Biblical accounts of the origin of life and the catastrophes of past geological events (Kelley 2007: 4). In a poem from March 1826, Goethe would outline what might be construed as a *via media* between the various philosophies of the biological sciences being expounded in his time:

> Respect the mystery;
> Let not your eyes give way to lust.
> Nature, the Sphinx, a monstrous thing,
> Will terrify you with her innumerable breasts.
> Seek no secret initiation
> beneath the veil; leave alone what is fixed.
> If you want to live, poor fool,
> Look only behind you, toward empty space.
> If you succeed in making your intuition
> First penetrate within,

> Then return toward the outside,
> Then you will be instructed in the best way.
> (Goethe 1826, quoted in Hadot 2006: 248-249)

It is uncertain from poetic reflections such as these what Goethe specifically intended when he presented them for his scientific contemporaries to read. Was he critical of reductionism beneath a certain level? Or critical of Biblical religion which offered no imagery suitable for his scientific-poetic reveries? Or critical of Egyptian imagery for its elements of the grotesque? Or all of the above, none of the above, or some combination of the above? Contemporary scholar Pierre Hadot, reading these verses, has connected these stanzas quoted here to "Part I of *Faust*, [where] Goethe had vehemently criticized experimentation, artificial observation, and the pretension of tearing her veil away from Nature" (ibid.: 250). As he has noted further, Goethe thought that "art was the best interpreter of nature," and hence what was needed was "a hermeneutics, this time of myth, which tries to uncover the hidden meaning of mythic images, by discovering a historical background, whether Hindu or Egyptian, behind the myths" (ibid.: 251). For Goethe then, the pursuit of his scientific research was inextricably connected to his poetic understanding of philosophies such as those of North Africa, and much like Kant's allusions to the Isis inscription, Goethe needed the artistic language and philosophical imagery of this ancient culture.

In *Faust* Part II, when it was finally published in 1832, the protagonist accompanies the primordial figure Homunculus into the deep waters of creation and finds a discussion about the process of the emergence of life: Thales states: "He wants advice; he's only been half born, it seems, in a most curious fashion. To be born fully, that's now his great passion." To which Proteus responds variously and then states: "A case of true parthenogenesis! Before he should be, he already is." Thales: "And there's another thing that's critical: He seems to me to be hermaphroditical." After which, in reply, Proteus concludes: "[...] He arrives in this world with a choice of lives! But here's no need for much discourse: In the wide sea you must begin your course!" (Goethe 1832/1998b: 116). As J.K. Brown has described in the *Goethe Yearbook*, "it is necessary to begin in the sea as the tiniest of living things and to evolve up the great chain of being; this is the historical flux enlarged to the cosmic scale of modern biology" (Brown 1984: 77). However, in the tragedy of Faust, the recreation of life is never realized. Rather, Faust becomes lulled away from his rebirth by various visions:

"But with our minds already at such desperate odds, we must now lose faith in our senses as well. Empusa appears [...] and proceeds to change into further shapes, thereby provoking the other well-defined figures to restless impatience, though not to self-transformation. Sphinxes, griffins, and ants now appear in infinite profusion, developing out of themselves as it were. We see indeed all the monsters of antiquity, swarming and running to and fro: chimeras, goat-stags and half-human hybrids [...] Our travellers, however, being more or less accustomed to such spook-shows, scarcely notice all this as it hums around them [...] These many events and others as well we must imagine, if we can, as simultaneous, for that is how they happen" (Goethe 1832/2008: 246-247).

Just as the character Mephistopheles had likely been inspired by Goethe's contemporary Johann Heinrich Merck (1741-1791) and his opposition to Goethe's first scientific paper, these dream sequences are likely based upon wandering thoughts in Goethe's own mind as he awaited acceptance of his papers or pondered upon the implications on a theory of morphological evolution. Here it is interesting to note, moreover, that Faust the literary character was largely untroubled by the visions of intermediary forms in morphological evolution, but the plague of sickness referenced elsewhere in the text shattered "his belief in the superior efficacy of science, and [his] belief in the benign omnipotence of God" (Hoelzel 1979: 5).

Figure 4: (L) 1887 German edition title page for *Sphinx locuta est* by Ferdinand August Louvier (1830-1900). Digitized by Google books. (R) Artistic renderings of 1925 English edition of Goethe's *Faust* by artist Harry Clarke (1889-1931). Available at Archive.org.

Underlying these literary reflections on the origin of life and its patterns of destruction, there is a suggestive commentary on the debates between preformation versus epigenesis that were characteristic of the embryological and developmental theories of Goethe's time. Both Nielsen (2016) and Walser (2020) have supported this reading. Nielsen contends that "the scene during which Homunculus, a motherless creation, is born satirizes the theory of preformation, if not creation itself" (Nielsen 2016: 59). Walser follows upon these ideas and has noted the catastrophic patterns of generation of Seismos and the Pygmies ("Do not ask us how we got here, / For the fact is, we are there!") are what can be characterized as "simultaneous, parallel, and in a basic sense anti-organic—if organicism, as Goethe's own explanation of plant metamorphosis would suggest, entails the stepwise movement from simple to complex forms in a rhythm dictated by biological forces" (2020: 120). Similarly, Walser further contends this is also the case for the immovable sphinx, the centaur chiron, the ants, and dactyls in Part II, which contradict the hypothesis of Wellmann (2017) that the epigenetic theories of the 17th-18th-centuries were based upon "rhythmic coordination" as the "guiding logic" of development (Walser 2020: 121). Arguably, Goethe's subtle commentaries on these topics of preformation and epigenesis, in the figures of Homunculus' primordial evolution as well as the sphinxes' and griffins' self-realization ("developing out of themselves as it were") represent the conceptual articulations of a meditative scientist who sought other outlets through literary works that could mediate between the conflicting theories. The nuances of these theatrical ideas could also be studied further in the context of the Urpflanze and Urteil.

Other writings, moreover, have posited that Goethe might have actually intended to further veil the intricacies of the biological implications of *Faust* in these scenes. This reading is exemplified by the cryptic text *Sphinx locuta est* (published 1887) by Ferdinand August Louvier (1830-1900), which had provided a detailed Faust dictionary to demonstrate that every word of the text had multiple meanings; some words, according to Louvier, were even in fact anagrams that were meant to be read forward or backwards. The reviewers of *Sphinx locuta est* have called "this treatise a joke" (Godkin 1888: 99) and "a dreadful book which sets out to explain Goethe's *Faust* by means of kabbalism" (Steiner 1987: 77). But such reviews might be overlooking that science and art exist at points of nexus that are difficult to quickly analyze. The same negative criticisms might be equally applied to illustrators of *Faust* such as Harry Clarke

(1889-1931), whose portrayals merge mythological fantasy with elements of scientific realism. While reading the biological theories of preformation and epigenesis into this literary and theatrical production might appear inappropriate to some—to others reading mythological fantasies into portrayals of the lives of scientists such as Doctor Faust might also cross the lines of their scholarly sensitivities. For a work as influential as *Faust*, perhaps both types of commentaries from scientists and artists are welcome.

In the years after Goethe's death, and as his theory of metamorphosis became more broadly discussed in scientific circles, the well-known German evolutionary biologist Ernst Haeckel (1834-1919) notably upheld the merits of his scientific contributions and considered Goethe to be among "the great philosophers of nature who first established a theory of organic development, and who are the illustrious fellow workers of Darwin" (quoted in Kelley 2007: 1). Others, however, had a different opinion of Goethe's scientific contributions. For example, Emil du Bois-Reymond (1818-1896) had written "the scientist Goethe fades into the background. Let us at long last put him to rest" (quoted in Magnus 1949: xi). Similarly, Albert Wigand (1821-1886) made a published effort to criticize Goethe's theory of primordial archetypes and morphogenetic principles in his "Kritik und Geschichte von der Lehre der Metamorphose der Pflanzen" (1846). Among more contemporary writers, it is said that "Goethe stated very clearly the idea of gradual differentiation" but that he only he "accepted evolution to the same limited extent and for same reasons" as those in the generation previous to him, such as Comte de Buffon (1707-1788) and Jean-Baptiste Lamarck (1744-1829) (Wells 1967a: 539). Nonetheless, standing prominent through the various interpretations of Goethe's theory of evolution, remain Darwin's own statements in the third edition of *Origin of Species* (1861) that Goethe was among the oldest forerunners to his theory: "It is rather a singular instance of the manner in which similar views arise at about the same time that Goethe in Germany, Erasmus Darwin in England, and Geoffroy Saint-Hilaire in France, came to the same conclusion on the origin of species, in the years 1794-95" (Darwin 1861: xiv). Additionally, there are also contemporary writers who have actually seen features of Goethe's theory as suggestive of corrections to Darwin's theory. As Marcelo Dornelas and Odair Dornelas in the *Brazilian Journal of Plant Physiology* have noted "in classical formalist or structuralist theories, the strongest correlation unites a commitment to generative laws of form with an aversion to adaptationist explanation as the primary goal of morphology" (Dornelas & Dornelas 2005: 342). The implication of the Darwinian mechanism of adaptation is often that morphological structure is a "secondary tinkering" to living forms rather than the Goethean mechanism of a "primary structuring." Since Goethe left open the possibility of inverting this paradigm, morphology could be construed as primary through the "formative principles" or the Urpflanze and Urteil. While in today's field of theoretical biology, "questions regarding the origin of body plans, and the evolutionary constrains imposed by the molecular mechanisms underlying development, both in animals and in plants, remain largely unanswered," Goethe's modified theory might provide an insightful counterpoint (ibid.: 342).

In the various scientific honors and criticisms applied to Goethe's work, the Egyptian motifs he employed might similarly be subject to contemporary analysis. Hadot along these lines has contended that there are various elements in Goethe's writings that serve "to defend paganism; to criticize the violence done to nature by technology and mechanization of the world; [and] to explain the anguish that his being-in-the-world inspires in modern man" (Hadot 2006: 315-316). Hadot, however, does not connect this to a recorded conversation recorded with Goethe on 30 December 1823, which has very interesting implications in this regard:

"A single idea may give foundation for a hundred epigrams; and the question is, merely, which poet has been able to embody this idea in the most effective and most beautiful manner. But in science the treatment is nothing, and all the effect lies in the discovery. There is here little that is universal and subjective, for the isolated manifestations of the laws of nature lie without us—all sphynx-like motionless, firm, and dumb. Every new phenomenon that is observed is a discovery—every discovery a property. [...] [I]f any one advances anything new which contradicts, perhaps threatens to overturn, the creed which we have for years repeated, and have handed down to others, all passions are raised against him, and every effort is made to crush him" (quoted in Oxenford 1874/2023: 47-48).

By advising the scientist to balance the living poetic and artistic depictions of nature with the isolation of individual laws of nature, Goethe found in the sphinx an apt metaphor for such work. Perhaps like Kant's suggestion that science stagnated in the Egyptian hieroglyphs and monuments, Goethe also realized the motionless stance of the sphinx. He therefore sought an "effective and beautiful manner" of representing his morphological and evolutionary theories that both clarified the theories implied by these earlier North African ideas and also criticized the "sphynx-like motionless, firm, and dumb" for what was the underdevelopment of their science—statements which for Goethe could only be made under the veil of the poetic verse. Perhaps it is no wonder that biographer George Henry Lewes (1817-1878) in his *Life of Goethe* described him to be "as fond of symbols as a priest of Isis" (Lewes 1864: 542).

Conclusion: Preserving a Lost Tradition in Evolutionary Philosophy

Based on the foregoing reflections, Kant and Goethe might rightly be interpreted as intermediaries between the world of ancient North African thought and our contemporary metaphysical and epistemological theories of biology. The veil of Egyptian philosophy—which they sought to penetrate—is an appealing metaphor for the continuous work of science to formulate, refine and substantiate hypotheses which remain forever to a certain degree hidden. Yet it might be asked if re-reading the modern scientific method—and the theory of evolution that rests upon it—into the inscriptions and monuments of North Africa is a historical anachronism or a scholarly faux pas. Those who find such connections meaningful, however, are following Western lines of thought that have important precedents. For example, the works of Sir Ernest Alfred Wallis Budge (1857-1934) provide clear statements of this:

"[I]t is possible that the Egyptians really believed in the existence of composite animals, and that they never understood the impossibility of the head and neck of a serpent growing out of the body of a lion, or the head of a hawk out of the body of a lion, or a human head with the wings of a bird out of the body of a leopard. They were keen enough observers of the animals with which they came in contact daily, and their representations of them are wonderful for the accurate delineation of their forms and characteristics; but of animals which they had never seen, and could only know from the reports of travellers and others, naturally they could not give accurate representations. Man in all ages seems prone to believe in the existence of composite animals [...]" (Budge 1904: 61-62).

These chimerical representations then—presented within what both Kant and Goethe had considered the essentially silent culture of Egyptian science—stood as philosophical monuments for reflection upon the mysterious origins and fates of living forms from the dust which surrounded them. If Budge's interpretation is correct, then Kant and Goethe in making their occasional invocations of this typology were boldly venturing into the realms of an ancient tradition that once towered along the Saïs of the Western Nile and the Giza plains. Moreover, Budge had made claims to read these ideas directly into the Papyrus of Hunefer (fig. 5):

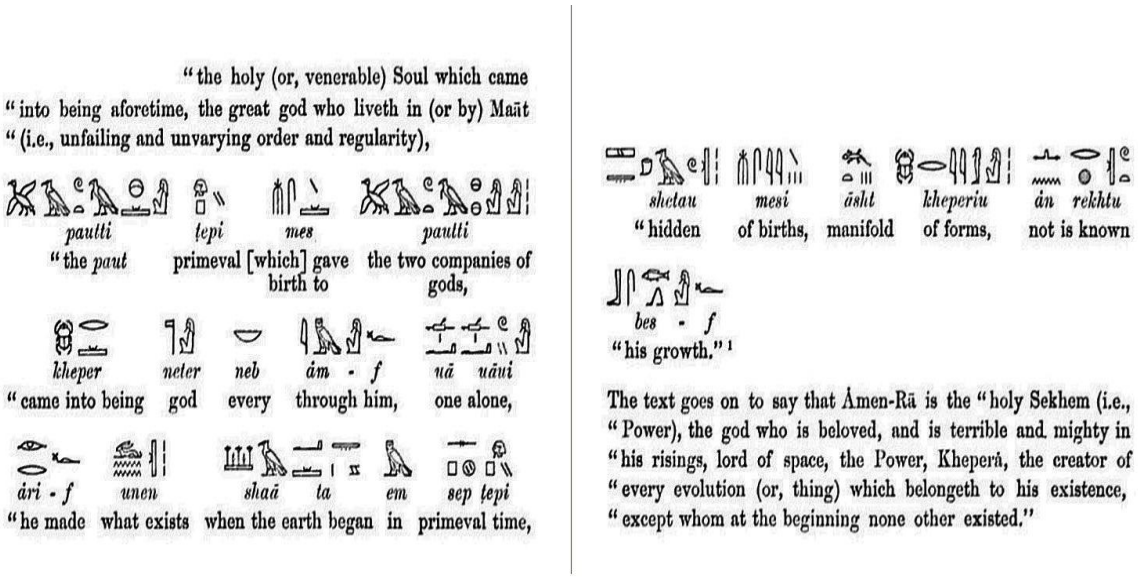


Figure 5: Hieroglyphics and translated text from the Papyrus of Hunefer, published on pp. 131-132 in *The Gods of the Egyptians: or, Studies in Egyptian Mythology*, Vol. 1 (1904) by Sir Ernest Alfred Wallis Budge (1857-1934). Digitized by Google books.

That the people of the ancient near East and North Africa had believed in these "hidden births" and that Amen-Ra was the "creator of every evolution" (ibid.: 131-132) certainly leads to fundamental questions about our narratives of science history. But the evidence from this time in favor of their advanced thought is not merely based on textual analysis. A recent study published in *Science Advances* by Bennett et al. (2022) has "sequenced the genomes of [...] ~4500-year-old equids, together with an ~11,000-year-old Syrian wild ass (hemippe) from Göbekli Tepe and two of the last surviving hemippes." Their results corroborate other cuneiform sources on hybrid animals from this ancient time, and these have been published as evidence of "the genetic identity of the earliest human-made hybrid animals, the kungas of Syro-Mesopotamia" (2022: 1).

Moreover, references to these hybrids are not merely proper to the fields of history and archaeology. Even contemporary biologists of their own accord find these Egyptian images appealing. For example, Nobel laureate Stanley Cohen (1922–2020), writing in *Scientific American*,named certain recombinant molecules after these ancient types represented in statues like those in Giza:

"Mythology is full of hybrid creatures such as the Sphinx, the minotaur and the chimera, but the real world is not; it is populated by organisms that have been shaped not by the union of characteristics derived from very dissimilar organisms but by evolution within species [...] In 1973 [we] reported the constructionin a test tube of biologically functional DNA molecules that combined genetic information from two different plasmids found in the colon bacillus Escherichia coli [...] Soon afterward, [...] we were able to insert into E. coli some genes from an animal: the toad Xenopus laevis [...] We called our composite molecules DNA chimeras because they were conceptually similar to the mythological chimera" (Cohen 1975: 3).

Additionally, the phoenix has been found a useful typological symbol in mathematical biology; for example, a paper by Ryo Yamaguchi et al. (2022) in *PRS: Biological Sciences* has cited this terminology for a set of equations on genetic frequencies and extinction rates: "The hypothesis is named after the Greek myth of the phoenix, which burns to ashes from which the next generation emerges. The phoenix hypothesis predicts that there is a greater degree of reproductive isolation among populations experiencing extinction risk, conditional on the populations successfully adapting and persisting" (2022: 2). Yet both Yamaguchi's phoenix typology and Cohen's sphinx typology leave open deeper questions about the philosophical status of these different lifeforms. While certainly finding ancient philosophy to explain their scientific undertaking, additional considerations still remain for metaphysical, epistemological and even ethical analysis—and veiling the scientific work of these researchers with Egyptian language might not yet be a well-rounded or complete synthesis. As Edwin Etieyibo has contended, for example, regarding African communalistic beliefs, it is unknown whether individual organisms or individual species can ever assert their rights in the context of a global ecological paradigm—even though Darwin's theory has pushed these controversies to the fore (Etieyibo 2018: 177-178).

Since pedagogical research indicates that philosophy plays an important role in the education of students in the biological sciences (Manuel 1981; Matthews 1988), as such, Egyptian philosophy might offer an essential starting viewpoint for forming students to ask these profound metaphysical and ethical questions at the high school and college level. Charles Verharen (2006) has even asserted that there is an essential continuity between "Darwin [who] joined humans together with animals" and the "ancient Egyptians [who] joined spirit together with matter" (2006: 960), and thus, this ancient philosophical tradition might thus anchor all of our studies into the deeper questions of reality as we explore scientific questions. However, not all contemporary scholars of African philosophy would necessarily agree—Kiatezua Luyaluka has alternatively advanced an incisive view that "the epistemic evolution sustained by Comte for Western knowledge, as going from the theological stage to the philosophical one to culminate into the scientific stage, is not transposable as a hypothesized evolution of the Egyptian religion into speculative philosophy" (Luyaluka 2020: 258-259). Nonetheless, considering all of these illustrative contemporary texts on the North African theories of evolution and its implications, it would still seem secure to hold that its imaginative concepts remain quite fully alive in the modern fields of biology and philosophy and, if further developed, could help guide contemporary discussions. For many, though, these enlightening ideas are passed over, or even left "under the veil" of the vast and largely inaccessible literature on these subjects. If the immediate lesson of evolutionary theory is that we must take seriously the requirements imposed upon us for our own need for variation and survival, then perhaps the allusions to Egyptian philosophy used by Immanuel Kant and Johann Wolfgang von Goethe, within their diverse catalog of writings, might be a moment to instruct us:—Will these ancient traditions in evolutionary philosophy, once standing as apparent in their monumental stature, ultimately erode and go extinct before us, without scientists, philosophers, and other scholars collectively working to restore, preserve and duly understand them?

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