

CREATIONISM AND HOW SCIENCE IS MISUNDERSTOOD

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Introduction

Trust in science has become a pressing concern in contemporary society, with public discourse increasingly shaped by uncertainty, ideological scepticism, and the spread of pseudoscientific narratives. Trust in science is crucial in a world saturated with both information and disinformation. Science relies on several foundational principles to evaluate truth claims. Central to this is scientific reasoning (1), which involves testability, falsifiability (something that can be proven wrong), logical consistency, causal inference, tentativeness, and the use of empirical evidence. These reasoning processes are supported by reproducibility (2), which ensures that results can be independently confirmed, and peer review (3), which acts as a critical filter for methodological rigor and validity. Together, these elements form the backbone of scientific reliability and progress.

The conflict between creationism and evolutionary biology is one of the most well-known debates between science and alternative non-scientific perspectives. Despite scientific evidence of more than 150 years from various fields – genetics, palaeontology, developmental biology, and many other disciplines –, the theory of evolution continues to face opposition from groups who reject or reinterpret its principles based on religious or philosophical beliefs. Creationism broadly refers to the belief that life, matter, or the universe were created by a “higher power”, commonly described in religious terms. Creationist views often challenge fundamental principles of science, such as the need for testable claims, natural explanations, and the evolution of scientific knowledge based on new evidence.

The below presentation of different types of creationism in the first part of this article is based on the excellent book *Le guide critique de l'évolution* by Fortin *et al.*¹, which provides not only a comprehensive and detailed analysis of the theory of evolution, but also a presentation of how creationism conflicts with scientific methods. For motivated readers interested in delving deeper into the topic, Fortin *et al.*'s work is highly recommended. While this article does not aim to be exhaustive, it serves as a starting point for understanding the contrasts between creationism and science, and introduces the main types of creationism found in Western societies, as outlined in Fortin *et al.*'s book: i) the outright rejection of scientific findings, ii) the imitation of scientific language and form without adherence to its methods, and iii) the subordination of science to religious or ideological goals as seen in movements like “Intelligent Design (ID)” and “Encompassing Spiritualism”.²

Through these case studies, we will explore the fundamental differences between scientific reasoning and creationist approaches. Contrary to being a belief system, evolutionary theory offers a self-correcting, empirically grounded framework that is essential for understanding the natural world. In the second part of this article, we will address popular objections to evolution raised by creationists and provide scientific explanations as to why these claims are not scientifically valid.

A word about the origins

Note that the origins of creationism are not confined to any single country. Before the advent of modern science, the natural world was explained through religious narratives across all cultures

¹ Fortin, C., Guillot, G., Le Louarn, M.-L., & Lecointre, G. (2021). *Guide critique de l'évolution (2e édition)*. Belin éditions, 704 p. ISBN 979-10-358-0232-5.

² Fortin *et al.*, *op. cit.*, pp. 170-198.

and regions. Nevertheless, modern creationist movements have identifiable geographic and historical contexts in which they became more prominent.

For example, negationist creationism attracted significant public attention in the United States during the early 1920s.³ Mimetic creationism and intelligent design gained greater visibility in the 1960s and 1990s, respectively, also within the U.S.⁴ In contrast, Encompassing spiritualism rose to prominence in France during the 1990s⁵.

While these movements have roots in particular countries, they are now internationally dispersed and remain active today. Many continue to be supported by well-organized institutions in their countries of origin. Nevertheless, for example, despite a national context, encompassing spiritualism constitutes a belief system that can align with a variety of religious traditions around the world, as it emphasises a general spiritual or metaphysical force behind life and existence, rather than specific dogmas. Additionally, it is important to note that the distinctions between the different forms of creationism are not always clear-cut; individuals may support multiple forms simultaneously (e.g., Mimetic Creationism and Intelligent Design), as they all share the core belief in a supernatural cause for the origin and diversity of life. What links these forms and their proponents is not their geographic origin, but rather their shared beliefs.

Therefore, while these forms of creationism have identifiable geographic origins, it is more accurate to view them as religiously rather than geographically defined. This discussion focuses primarily on forms of creationism that emerged in the Western world from Christian contexts; however, creationist beliefs are found across nearly all religious traditions, insofar as they reject scientific explanations for the origins of life.

Part I: Types of Creationism

Negationist Creationism (NC)

One of the oldest and most overt forms of creationism is known as negationist creationism. It is based on the explicit rejection of science as fundamentally incompatible with the revealed truths of sacred texts. In negationist creationism, there is a total conflict between science and faith. Modern scientific disciplines, especially evolutionary biology, are considered incompatible with a literal interpretation of sacred writings.

There are two main currents of negationist creationism: “Young Earth Creationists (YEC)”, who strictly adhere to the Genesis account and maintain that the universe and earth were created in six days around 6,000 years ago, and “Old Earth Creationists (OEC)”, who accept an older Earth but reject biological evolution. Both currents believe in the direct intervention of a “god”, as the founder of the universe and the diversity of life, and in particular the creation of humanity.

Fortin *et al.* (2021) emphasises that negationist creationism is not passive⁶, but actively oppositional. It seeks to discredit scientific findings by presenting seemingly logical arguments that fall apart under critical examination. One such figure is Adnan Oktar, better known by his pseudonym Harun Yahya, a controversial Turkish preacher, who popularised an Islamic form of creationism heavily influenced by Christian fundamentalist literature.⁷ In 2007, he published *The Atlas of Creation*, a large volume sent free of charge to educational institutions across Europe and the United States. The book argues that the absence of observable disparities between modern species and analogous fossils serves as evidence for the non-occurrence of evolution.

This line of reasoning is based on the flawed assumption that if a modern species closely resembles a fossil specimen, then no evolutionary change has occurred. The argument is based on superficial visual similarity as evidence against evolution, while disregarding the extensive data collected by various scientific disciplines, including comparative genetics, anatomy, palae-

³ Fortin *et al.*, *op. cit.*, p. 173.

⁴ Fortin *et al.*, *op. cit.*, pp. 174-175.

⁵ Fortin *et al.*, *op. cit.*, pp. 187-188.

⁶ Fortin *et al.*, *op. cit.*, pp. 173-174.

⁷ Baudouin C. & Brosseau O. (2008). *Les créationnismes. Une menace pour la société française ?*, Paris, Éditions Syllepses.

ontology, embryology, phylogenetics, and numerous others, which support the theory of evolution. It is evident that the argument under discussion is deficient in its lack of rigorous analytical methodologies. Furthermore, it fails to situate fossils within their appropriate scientific context, instead advancing a simplistic reading based on superficial appearance. Evolution occurs at every scale and not uniquely on the scale of the external morphology and anatomy.

From an epistemological standpoint, this form of creationism sharply diverges from the core principles of the scientific method. It lacks testable hypotheses and critical self-correction, relying instead on dogmatic certainty. Sacred texts are treated as infallible, making their claims unfalsifiable and thus beyond the scope of science. Moreover, its methods are neither reproducible nor subject to peer review, both essential to scientific credibility. The reasoning often relies on misleading visual analogies that lack experimental grounding and avoid critical scrutiny. In essence, negationist creationism does not proffer a scientific alternative; rather, it proposes an alternative replacement narrative, based on religious conviction. The propagation of its publications occurs primarily through religious media and public outreach channels, rather than through recognised scientific channels, and without validation of peer review. Consequently, negationist creationism not only rejects the findings of scientific inquiry but also seeks to subvert both the methodological foundations of science and the channels through which it communicates its knowledge.

Mimetic Creationism (MC)

Mimetic Creationism emerged in the latter half of the 20th century and, as its name discloses, it mimics scientific terminology, methods, and institutional structures, rather than rejecting science as does negationist creationism. In contrast to its explicitly anti-scientific counterpart, mimetic creationism does not manifest an overt opposition to science. This approach gained particular prominence through the promotion of what is termed “scientific creationism,” a rhetorical strategy designed to foster public confidence in

the validity of biological science while rejecting its fundamental principles.

Mimetic creationists do not present their claims as a matter of faith, but as a scientific alternative to evolution. This tactic includes reinterpretations of geological and biological data to align with a biblical framework. For instance, they claim that fossil records and sedimentary layers are not the result of evolutionary processes over deep time, but the product of a single catastrophe, i.e. the Noah’s Flood (Genesis 6:9-9:17). The Earth is believed to be approximately 6,000 years old. The diversity of life on Earth is attributed to the rapid emergence of new species following a major global flood event. This concept aims to replicate the methods employed by evolutionary science, but it distorts its principles.

Although mimetic creationism may outwardly resemble science, as embodied by the presence of laboratories, “academic” journals, and “scholarly” titles (e.g., delivering PhDs), it nevertheless exhibits a notable deviation from the fundamental methodological standards that underpin the credibility of scientific research. A clear example is the *Answers Research Journal*,⁸ published by Answers in Genesis, an American fundamentalist Christian apologetics organization that defends the ideology of a young Earth. The journal presents articles framed in scientific language, but they are grounded in biblical literalism rather than in testable hypotheses or peer-reviewed evidence. Although the contributors claim to be engaging in scientific inquiry, the process is inherently biased, as they begin with pre-established conclusions derived from scripture and then adapt the scientific interpretation to fit these beliefs. This also illustrates how creationist movements are not necessarily contradictory in their core beliefs but may differ in their methods of dissemination. In this case, we see a clear example of mimetic creationism, adopting the appearance and structure of science, used to promote a young Earth ideology, which is typically associated with negationist creationism. It is imperative that scientific claims meet the multiple criteria to be considered valid: they must 1) follow the scientific reasoning (testability, falsifiability, logical consistency, causal inference,

⁸ Official website: <https://answersresearchjournal.org/>.

empirical evidence and tentativeness), be 2) reproducible and 3) peer-reviewed.

Mimetic creationism is a doctrine that challenges these established norms by beginning with a preconceived notion – the literal truth of Genesis – and manipulating evidence to align with its beliefs. This misrepresentation of the scientific method uses science as a means of persuasion and promotion of its ideology, rather than an open-ended method of investigation.

Of particular concern is the movement's willingness to engage in deceptive tactics. It is a frequent practice among creationists to use scientific terminology in an attempt to disguise their theological beliefs, thereby creating the impression among the general public that their discourse is both authentic and legitimate. In doing so, they do not merely misinterpret individual findings; they distort the very essence of scientific inquiry. From this viewpoint, mimetic creationism is not just a flawed substitute to science; it is a perversion of science itself. The blurring of the boundary between empirical knowledge and faith-based conviction undermines public understanding of the scientific process and why it can be trusted. These kinds of more elaborate creationism (with Intelligent Design) are a threat to the trust in science. Addressing this challenge requires more than defending scientific facts; it demands fostering scientific literacy by explicitly presenting the standards and reasoning that define science as a way of understanding the world.

Intelligent Design (ID)

The Intelligent Design movement posits that certain biological structures are too complex to have developed through natural mechanisms like natural selection and must therefore be the result of an “Intelligent Designer”. According to the movement's central organization - the Discovery Institute -, this position responds to what it calls “the failure of Darwinism to explain the origin of biological complexity”.⁹

One of the movement's most effective strategies is its ability to blur the boundaries between science, philosophy, and theology. Methodological Materialism, the principle that science limits itself to natural causes, is described as an ideological

presupposition rather than a methodological stance. By framing evolution as a form of faith or ideology, Intelligent Design seeks to present itself as an equally valid alternative. It casts evolutionary biology not as science, but as a worldview, positioning itself as a rational counterpoint. Rhetoric grounded in fallacious reasoning and sophistry is central to the movement's strategy. For instance, the claim that complex structures like the bacterial flagellum could not have evolved naturally exemplifies the *argument from ignorance*, where a claim is assumed true simply because it has not been proven false. The fact that science has not yet fully explained the evolution of such structures does not justify concluding Intelligent Design is correct. Another illustrative example is the use of the *straw man* fallacy, which consists of the misrepresentation or oversimplification of an opponent's argument to make it easier to attack. Hence, Intelligent Design often misrepresents evolutionary theory as asserting that life developed purely by random chance. While in reality mutations occur randomly, natural selection is a non-random process that systematically favours advantageous traits. By blurring the line between empirical science and belief systems, it allows Intelligent Design to present itself as a legitimate scientific perspective. However, in practice, it rests not on testable hypotheses, but on fallacious reasoning, as seen previously, used to promote theological assumptions, most notably the movement's central claim that an intelligent designer exists, which are both untestable and empirically unsupported. Intelligent Design thus presents an epistemological regression, introducing a transcendent entity to explain natural phenomena in contrast to explaining the natural world solely based on natural causes. Fortin *et al.* (2021) emphasise that it is precisely the insistence on avoiding supernatural explanations (materialistic approach) to fill the gaps in our knowledge that has enabled science to progress.¹⁰ If the cause of a phenomenon is always supposed to reside in the impenetrable will of a designer, then there is no longer any reason to search, experiment, or confront hypotheses. Thus, Intelligent Design, by relying on supernatural explanations, hinders scientific research and discovery.

⁹ Cf. <https://www.discovery.org/a/2248/>

¹⁰ Fortin, *et al.*, *op. cit.*, pp. 180-182.

In this sense, under the guise of promoting a scientific alternative, Intelligent Design does not offer a scientific theory, but rather a teleological fallacious argumentation. It transforms the open-ended uncertainties of science, which are the driving force behind research, into arguments for divine intervention. Rather than explaining complexity, it appeals to it as evidence of design, replacing inquiry with wonder. Furthermore, it should be noted that complexity is a concept based on human perception and is difficult to define and apply in a scientific context. While the term “complexity” can be used in science to describe things, it is subjective and should only be used to facilitate communication when discussing scientific matters, rather than being taken literally in scientific reasoning.

Intelligent Design presents its argument in public discourse through a series of rhetorical fallacious strategies such as sophistry that are more effective at influencing public opinion than to convincing scientists. One of the most significant tactics consists of creating the appearance of sophistication. Proponents of movement present detailed and often highly technical criticisms of evolutionary theory, focusing on commonly misunderstood aspects of evolutionary biology and occasionally popularising errors that are difficult for the general public or journalists to assess. By focusing on selective criticisms, Intelligent Design does not seek to offer a coherent alternative theory, but rather to discredit evolutionary biology in general. Moreover, this excessive criticism enables its proponents to appear objective and reasonable, without having to defend content that, if made explicit, would be instantly identifiable as religious. The movement also assumes an air of neutrality by promoting critical thinking rather than explicit religious dogma, as this is a more effective way of rallying a broad audience. This strategy enables Intelligent Design to present itself as an open forum for debate while its actual intention remains the introduction of religious concepts into science. Another of their strategies is the reversal of accusations: they charge science of dogmatism and claim that evolutionary theory functions as a kind of materialist religion. From this perspective, their convictions are not presented as religious beliefs, but as opinions worthy of a place in scientific discussions. By manipulating language, challenging the epistemological foundations of science, and employing the rhetoric of scepticism, these strategies

succeed in eroding public trust in science while evading its rigorous standards for evidence and methodology.

Intelligent Design, as the previously presented types of creationism, fails to meet the requirements of scientific theory. It lacks testable hypotheses, provides no predictive models, and relies on supernatural explanations that contravene the principles of methodological materialism. As such, Intelligent Design belongs to metaphysics or theology, legitimate fields, but not science. The real problem lies in its presentation as a scientific theory while ignoring the associated methodological standards. Essentially, it is creationism in disguise, cloaked in scientific jargon, as for Mimetic Creationism, and it poses a risk to scientific integrity by blurring the line between empirical inquiry and ideological belief.

Encompassing Spiritualism

Compared to the more direct types of creationism discussed earlier, a subtler movement emerged – notably in France – called Encompassing Spiritualism. This version does not refute scientific data or attempt to mimic the scientific method to validate scripture. Instead, it presents itself as conciliatory, embracing theories like evolution while interpreting them through a spiritual or metaphysical lens. It seeks to reconcile science and religion by suggesting evolution serves a higher, possibly divine, purpose.

In this view, transcendence remains a fallback explanation for phenomena that science has yet to explain. While seemingly harmless or integrative, this raises key methodological and epistemological concerns, chiefly that evolutionary science exists to investigate life's diversity, not to assign it purpose. Encompassing spiritualism blurs the line between causal explanation and metaphysical interpretation. Science aims to explain observable phenomena through testable methods, not to assign meaning or purpose.

Claiming that evolution aimed to produce mankind, for example, is an anthropocentric projection unsupported by scientific evidence. Like other creationist models, this subtly reintroduces ideological finalism under the guise of natural law. Furthermore, it undermines methodological materialism not by rejecting it, but by diluting it, suggesting it is "reasonable" to include divine intention in scientific explanation. This opens the

door to untestable claims that contradict the scientific principle of empiricism.

Once transcendence becomes an acceptable explanatory tool, empirical science loses its foundation. Despite its moderate tone, Encompassing Spiritualism, like other forms of creationism, instrumentalises science. It does not pursue knowledge for its own sake but redesigns valid scientific insights to legitimise preexisting metaphysical or spiritual worldviews. This subtly inserts an agenda in science, imposing meaning or existential reassurance, that lies outside its scope.

By redefining science as a path to spiritual fulfilment, this discourse risks compromising science's autonomy and methodological rigor. It demands science to answer questions it was never meant to address, weakening its explanatory power. Preserving the boundary between science and spirituality is not discriminatory, it is a matter of functional differentiation. Both have their place but conflating them undermines the integrity of scientific knowledge.

Part II: Examination and Debunking of Creationist Arguments

Creationism commonly relies on scientifically discredited claims. These objections stem from flawed reasoning, misinterpretation of data, or a fundamental misunderstanding of the scientific method. Clear, accurate responses are essential to separate scientific reasoning from ideological rhetoric.

A frequent misconception is that evolution is “only a theory” and not a fact. This confusion arises from the lay definition of “theory”, rather than its scientific definition as an extensively evidenced, coherent explanatory framework. The theory of evolution is not speculative; it is a robust model supported by evidence from fossils, comparative anatomy, molecular genetics, developmental biology, and other fields. Evolution is both a fact, observed in species change over

time, and a theory that explains the mechanisms behind this change.

The so-called “missing links” is often cited as evidence against evolution, referring to the supposed absence of transitional fossils, as for example between apes and humans or extinct dinosaurs and birds. However, this rests on a misunderstanding of both the fossil record and evolutionary processes. Evolution is not linear or unidirectional but follows a branching pattern in which all organisms are transitional. While the fossil record is rare due to the low likelihood of fossilisation, it contains well-documented intermediates. For instance, *Archaeopteryx* possesses both reptilian (dinosaurian) and avian characteristics, such as teeth, a long bony tail, and clawed hands – which are reptilian traits – as well as feathers and a wishbone, which are avian traits. This dinosaur is an excellent example of the transition from the dinosaur body plan to the avian body plan.¹¹ It is far from unique, as numerous other dinosaurs and birds show transitional morphologies (e.g. *Microaptor*, *Anchiornis*, and *Confuciusornis*). Another famous example is *Tiktaalik*, which bridges the gap between fish and early tetrapods (four-limbed vertebrates, including amphibians, reptiles, birds, and mammals).¹² The evolution of hominins also provides a clear example of morphological and anatomical transitions. Fossils like *Australopithecus*, *Homo erectus*, *Homo neanderthalensis*, and many others demonstrate gradual anatomical changes over millions of years, such as increasingly larger braincase or upright stance.^{13,14} The sheer volume of transitional fossils renders the “missing link” claim obsolete.

Some creationists argue that the fossil record should show a continuous, uninterrupted progression of evolutionary transitions. But fossilisation is rare and requires specific conditions. Evolution often proceeds in fits and starts rather than in smooth, gradual change. Moreover, many evolutionary changes occur at the population level (change in gene frequencies), not necessarily

¹¹ Brusatte, S. L., O'Connor, J. K., & Jarvis, E. D. (2015). The Origin and Diversification of Birds. *Current Biology*, 25(19), R888-R898, DOI: [10.1016/j.cub.2015.08.003](https://doi.org/10.1016/j.cub.2015.08.003).

¹² Daeschler, E. B., Shubin, N. H., & Jenkins Jr, F. A. (2006). A Devonian tetrapod-like fish and the evolution of the tetrapod body plan. *Nature*, 440(7085), 757-763, DOI: [10.1038/nature04639](https://doi.org/10.1038/nature04639).

¹³ Bruner, E., Manzi, G., & Arsuaga, J. L. (2003). Encephalization and allometric trajectories in the genus *Homo*: evidence from the Neandertal and modern lineages. *Proceedings of the National Academy of Sciences*, 100(26), 15335-15340. DOI: [10.1073/pnas.0306030100](https://doi.org/10.1073/pnas.0306030100).

¹⁴ Niemitz, C. (2010). The evolution of the upright posture and gait—a review and a new synthesis. *Naturwissenschaften*, 97(3), 241-263. DOI: [10.1007/s00114-009-0637-3](https://doi.org/10.1007/s00114-009-0637-3).

leaving fossil trace. Nevertheless, palaeontology provides abundant evidence of major transitions, such as the evolution of whales from terrestrial mammals¹⁵ and the origin of horses, traced though changes in size, tooth structure, and limb morphology over millions of years.^{16,17}

Creationists also point to the “sudden appearance” of complex species in the fossil record as a challenge to gradual evolutionary change. This misconception misrepresents punctuated equilibrium theory, which acknowledges that species may stay relatively morphologically “unaltered” for long periods before rapid change. Punctuated equilibrium, well-supported by fossil data, reflects the complexities of evolutionary rates without contradicting the overall process of descent with modification.¹⁸

Proponents of Intelligent Design frequently invoke ‘irreducible complexity’, a concept popularized by molecular biologist Michael Behe, to support their ideology. He argues that certain biological structures, like the human eye or bacterial flagellum, are so complex that they could not have evolved through successive, functional stages and must therefore have been perfectly designed and fully formed. This argument is often linked to the concept of perfection. However, both perfection and complexity are subjective and not scientific criteria. This argument mostly overlooks fundamental evolutionary mechanisms such as “exaptation”, where structures evolve for one purpose and are repurposed, meaning that they end up serving a different purpose, and “incremental adaptation”, which over time yield “complex” systems.¹⁹

The human eye, often cited as an example of a designer’s perfection and irreducible complexity, actually contains several “imperfections” that

challenge the idea of a flawless, intelligent designer. One notable flaw lies in the structure of the retina, the light-sensitive layer at the back of the eye, which is wired “backward”. Instead of photoreceptors (light-sensitive cells) receiving incoming light directly, they are placed behind several tissue layers and face away from the light source. Thus, light must pass through these layers and the photoreceptor back before it can reach the light-sensitive surfaces. Furthermore, the nerve fibres, which carry visual information, converge at a single point on the surface of the retina, the optic disc, where they exit the eye to form the optic nerve. This creates a blind spot, an area with no photoreceptors, resulting in a gap in the visual field. Although the brain compensates for this blind spot, this flaw undermines the idea of a flawless design and better aligns with evolutionary constraints than Intelligent Design.

This “backward” wiring is puzzling from an Intelligent Design standpoint; octopuses, for example, have better-structured eyes with photoreceptors oriented toward the incoming light. But evolutionarily, this flawed design in the human eye makes sense. The eye evolved gradually from simpler forms, constrained by inherited anatomical constraints. Evolution works with existing materials, leading to solutions that are “good enough” rather than optimal. The blind spot exemplifies a consequence of these historical constraints, illustrating how evolutionary processes shape biological structures in sometimes imperfect ways, rather than designing them from scratch for optimal performance. Finally, the argument fails scientifically because, like most creationist claims, it does not propose a testable mechanism to explain the origin of these structures.

¹⁵ Thewissen, J. G., Cooper, L. N., Clementz, M. T., Bajpai, S., & Tiwari, B. N. (2007). Whales originated from aquatic artiodactyls in the Eocene epoch of India. *Nature*, 450(7173), 1190–1194, DOI: [10.1038/nature06343](https://doi.org/10.1038/nature06343).

¹⁶ MacFadden, B. J. (2005). Fossil Horses—Evidence for Evolution. *Science*, 307(5716), 1728–1730, DOI: [10.1126/science.1105458](https://doi.org/10.1126/science.1105458).

¹⁷ Solounias, N., Danowitz, M., Stachtaris, E., Khurana, A., Aram, M., Sayegh, M., & Natale, J. (2018). The evolution and

anatomy of the horse manus with an emphasis on digit reduction. *Royal Society open science*, 5(1), 171782. DOI: [10.1098/rsos.171782](https://doi.org/10.1098/rsos.171782).

¹⁸ Eldredge, N., & Gould, S. J. (1972). Punctuated equilibria: an alternative to phyletic gradualism. *Models in paleobiology*, 82, 115.

¹⁹ Gould, S. J., & Vrba, E. S. (1982). Exaptation—a Missing Term in the Science of Form. *Paleobiology*, 8(1), 4–15.

Creationists also claim that evolution is too improbable to account for life's complexity and diversity, and that it cannot be explained by chance alone. This reflects a misunderstanding of the evolutionary processes. Genetic mutations occur randomly, but natural selection is a non-random and cumulative process favouring advantageous traits that enable survival.

Consider a population of turtles exposed to high levels of predation from animals such as crocodiles. At some time, among the hatchlings of a female turtle, random genetic mutations result in individuals with slightly thicker and harder shells. These mutations are not directed or purposeful; they arise by chance through natural genetic variation. However, the consequence of a harder shell is greater protection from predators. Turtles with this trait are more likely to survive attacks and, as a result, have a higher probability of reproducing and passing their genes, including the trait for a harder shell, to the next generation.

Over many generations, this trait becomes increasingly common in the population, as individuals with harder shells consistently enjoy a selective advantage. While the mutation was random, the process of natural selection is non-random and directional: it favours traits that improve an organism's survival and reproduction in a specific environment.

A real-life example of this process is the peppered moth (*Biston betularia*) in England.¹ Before the Industrial Revolution, most of these moths were light-coloured and camouflaged well against lichen-covered birches. After industrial soot darkened the tree bark, a previously rare dark-coloured variant had a survival advantage, as birds more easily spotted the light-coloured ones. Over time, the population shifted toward dark-coloured moths.

Later, as air pollution decreased and tree bark lightened again, light-coloured moths once more had the advantage and became more common. This well-documented case demonstrates how environmental pressures can guide natural selection in a non-random way, just like in the turtle's example.

Despite overwhelming scientific consensus on Earth's age and life's evolutionary history, some creationist claims persist, mainly from negationist and mimetic branches, particularly targeting palaeontology. Two common claims are that the Earth is only a few thousand years old, and that the fossil record resulted from of a single global catastrophe, namely the Genesis flood. Palaeontology, geology, and evolutionary biology provide numerous and consistent evidence against both these claims.

The Earth's age is not speculative. It is determined by multiple, independent, and empirically supported dating techniques. Radiometric dating, based on the known rate of radioactive isotope decay, is rigorously tested and its results are reproducible across laboratories and regions. Its findings are cross-validated with stratigraphy, fossil succession, geomagnetic data, and geochemical markers. Each of these modes of evidence converges on the same coherent geological timescale, dating the origin of the Earth at around 4.54 billion years and placing large-scale evolutionary transitions, such as the emergence of tetrapods in the Late Devonian or the diversification of modern mammals following the Cretaceous–Paleogene extinction, within well-defined temporal horizons.

Palaeontology complements this chronology through its fossil record, which displays a clear and ordered succession of life forms across geological time. Fossils are not randomly and indiscriminately scattered throughout rock layers as a great flood scenario would predict. Instead, they occur in stratigraphic sequences and indicate evolutionary lineages: trilobites are limited to Palaeozoic rocks (about 538.8–251.9 million years)², non-avian dinosaurs to the Mesozoic (about 251.9–66 million years), and anatomically modern humans only to the late Quaternary (about 2.58 million years to present). No modern species appear in ancient strata, and no non-avian dinosaurs in post-Cretaceous deposits. This global consistency of such patterns attests to their authenticity and refutes any implication

¹ Majerus, M. E. (2009). Industrial Melanism in the Peppered Moth, *Biston betularia*: An Excellent Teaching Example of Darwinian Evolution in Action. *Evolution: Education and Outreach*, 2(1), 63–74, DOI: [10.1007/s12052-008-0107-y](https://doi.org/10.1007/s12052-008-0107-y).

² Note that the dates indicated in brackets correspond to the time ranges of the relevant geological eras and periods and not to the estimated existence periods of the mentioned taxonomic groups (e.g., trilobites or non-avian dinosaurs).

that the record could be the product of one cataclysmic event.

Together, the fossil record resembles not so much the random debris of an apocalypse, but the collective result of a deep, dynamic evolution and geological history. The order of fossils in the rock succession, their environmental associations, and the independent dating methods applied to the rocks in which they are found all support a coherent, testable, and self-correcting reconstruction of the history of life on Earth. Far from discrediting evolutionary science, the fossil record is one of the most powerful lines of empirical evidence in its favour and one of the most robust refutations of young-Earth creationist claims.

It should also be emphasised that, unlike creationist representations, science should not be driven by a desire of specific outcomes. The age of the Earth or of specific fossils, and the evolution of life are not matters of preference, but outcomes of rigorous observation, repeatable experimentation, and critical analysis. Science does not dictate what evidence will be discovered; it seeks to discover what the evidence will point to, when carefully examined with the appropriate instruments and methods.

Conclusion

Through examining a variety of forms of creationism, from overt rejection of science to mimetic copies and more insidious forms of religious integration, the discussion has shown that these movements always seek to erode the methodological rigor of science. Far from being a mere clash of opinions, the conflict between creationism and evolutionary science concerns the very criteria by which we establish reliable knowledge of reality.

Creationism, in its various expressions, tends to replace fundamental principles of scientific process (e.g., testability, reproducibility, falsifiability, materialism, peer-reviewing, etc.) with goals that lie beyond the scope of science: seeking meaning, legitimising dogma, or confirmation a preexisting worldview. The scientific process is subverted in each case, often intentionally.

Creationist discourse frequently adopts the appearance of scientific reasoning while undermining its core logic. It replaces a willingness to question with dogmatic certainty, and the provisional nature of hypotheses with ideological affirmation. Whereas science seeks mechanisms based on observable, testable processes, creationist narratives insert supernatural elements, not to advance research, but to end it. Intelligent Design, for example, offers no testable mechanism functioning instead as an ideological strategy that reintroduces supernatural causality under scientific disguise. Similarly, Encompassing Spiritualism blurs the lines between facts and beliefs, weakening the methodological neutrality on which modern science is based. Both approaches blur the distinction between scientific explanation and metaphysical interpretation, a distinction that is foundational to scientific integrity. Such distortions not only confuse public understanding of science – mistaking it for speculative opinion – but also erode trust in core values such as testability, repeatability, and collective validation. More dangerously, they encourage science to serve ideological ends by assigning it goals that are not its own – moral, spiritual, or theological – resulting in a loss of autonomy.

In this context, it is essential to reaffirm what guarantees the legitimacy of scientific knowledge. It is not the authority of tradition, spiritual insight, or majority belief, but the reality check: evidence-based reasoning, replicability of results, and the willingness to constantly revise knowledge in light of new findings. These demanding yet fruitful constraints have enabled the development of coherent, predictive models of biodiversity, genetics, and life's deep history. This does not mean science is infallible, or that it addresses all dimensions of human experience. But it is a unique discipline where intellectual humility and critical process prevail over the authority of dogma. Its trustworthiness lies in its constant awareness of its own limitations.

Against the temptation to confuse investigation with belief, explanation with affirmation, and facts with values, defending the autonomy of science is not an act of militancy; it is an act of lucidity. It is also essential for our societies. In an era of eroding trust in institutions, maintaining the integrity of science preserves our collective ability to understand the world rationally, critically and freely.

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