

Life's "Abominable" Big Bang

The Cambrian Explosion as Evidence for Intelligent Design

by Günter Bechly

Every good scientific theory worth its name makes precise predictions that allow us to test with real world data if the theory is correct. This is also true for Darwin's theory of evolution, which predicts that big differences between organisms came about by the accumulation of many small differences over long periods of time. This is also called gradualism.

In his seminal book *On the Origin of Species*, Darwin quoted the Latin sentence "*natura non facit saltus*" ("nature does not make jumps") six times, because he was fully aware that only a gradual development would allow for a purely naturalistic mechanism, while saltations (abrupt changes) would imply some kind of miracle-like intelligent interventions. That this gradualism is not a marginal issue, but instead lies at the very core of the theory of evolution, was admitted by one of its most prominent modern defenders, Richard Dawkins, who wrote

in his 2009 bestselling book, *The Greatest Show on Earth*, "Evolution not only is a gradual process as a matter of fact; it has to be gradual if it is to do any explanatory work."

Wouldn't it be great if we had a time machine to check if Darwin and Dawkins were right with this prediction of gradual development? Well, we indeed do have a sort of time machine: it's called the fossil record. Fossils provide a window into deep time; thus, we have hard data and do not have to rely on educated guesses.

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Putting Darwinian Gradualism to the Test

So, does the fossil record support Darwin's prediction? In Darwin's time, it clearly did not, and Darwin was well aware of this problem. In his magnum opus he admitted, "Geology assuredly does not reveal any such finely graduated organic chain; and this, perhaps, is the most obvious and serious objection which can be urged against the theory. The explanation lies, as I believe, in the extreme imperfection of the geological record." In other words, he appealed to the incompleteness of the fossil record and our poor sampling of it to explain away the conflicting evidence. This is no longer possible, because with our enormously expanded knowledge of the fossil record since Darwin's time, the discontinuities have not disappeared but have become even more pronounced.

Furthermore, we meanwhile have developed very good statistical tests (such as the "collector curve") for evaluating the completeness of our sampling of the fossil record. These tests confirm

that sudden appearances of novel life forms followed by stasis are not artifacts of preservation or under-sampling but are genuine data in need of an explanation.

The most well-known event in Earth history featuring such an abrupt appearance is what's called the Cambrian explosion. The Cambrian is a period in Earth history about a half-billion years ago. In the early Cambrian layers, all the different body plans of animals appear suddenly in the fossil record, without any of the postulated precursors documented in earlier layers. Even Dawkins has conceded that, "It is as though they were just planted there, without any evolutionary history." The different body plans are commonly classified as distinct animal phyla, such as echinoderms, mollusks, annelids, arthropods, and chordates, etc. Of the 33 living animal phyla, at least 20 are recorded in the Cambrian explosion, while the missing ones are mostly tiny worm-like organisms confined to very special habitats.

All these different body plans exhibit highly complex distinct organ systems that would have



GEOCHRONOLOGICAL SCALE



required a long chain of thousands of transitional species if they had developed by a stepwise Darwinian mechanism, but these links are totally missing. The two most famous localities for the Cambrian explosion are the Burgess Shale, from the Canadian Rockies, and the Chengjiang Formation in China. Both have preserved even small soft-bodied organisms in such intricate detail that in some cases even their internal organs, such as the gut and nervous systems, can be studied.

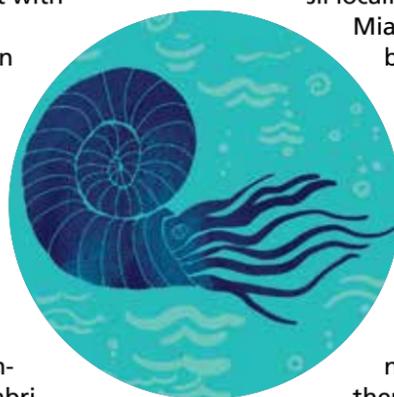
Inconvenient Evidence for Darwinists

Evidence from the Cambrian explosion represents an inconvenient truth for staunch Darwinists, and they have often responded to it with a blunt science denial. Some have claimed that the Cambrian explosion is a misnomer for an event that was not abrupt at all but was indeed as gradual as predicted by the theory. For example, vertebrate paleontologist Donald Prothero claimed that the Cambrian explosion lasted 80 million years. He arrived at this dubious number by simply adding the complete time span of the Ediacaran and Cambrian periods, even though the Cambrian explosion is an event in the Lower Cambrian that lasted at most 20–30 million years, with its main pulse lasting only 5 million years. (A common length of time cited in the technical literature for the Cambrian explosion is 5–10 million years.)

But the actual experts on Cambrian fossils know very well that the Cambrian explosion really was an abrupt event. Here is a quote from a recent monograph on *Epigenetic Mechanisms of the Cambrian Explosion*, by Nelson R. Çabej (2019):

Nevertheless, now, 150 years after *The Origin*, when an incomparably larger stock of animal fossils has been collected, Darwin's gap remains, the abrupt appearance of Cambrian fossils is a reality, and we are still wondering about the forces and mechanisms that drove it. Despite the fact that, from time to time, a small number of students have questioned the reality of the Cambrian explosion on the same ground as Darwin, today's consensus is that Cambrian explosion is a scientific fact.

Other experts have made very similar statements and would laugh Prothero out of the room.



An Explosion of Ad Hoc Hypotheses

→ The Artifact Hypothesis

Since denial of these facts is pretty much hopeless, more serious evolutionists have tried to explain away the Cambrian explosion with different ad hoc hypotheses. The most popular approach has been the artifact hypothesis, which claims that the lack of evolutionary precursors in older strata is either due to their anatomy being too small and soft for preservation or to a lack of suitable sediments like the Burgess Shale that could preserve such organisms.

This argument is no longer tenable, however, since the discovery of about a dozen Ediacaran fossil localities (e.g., the Lantian Formation and Miaohu biota in China or the Zuun-Arts biota in Mongolia) having exactly the same conditions as the Cambrian Burgess Shale. These localities could have preserved even small and soft-bodied ancestors of the Cambrian animals but have only yielded fossil algae and a few problematic fossil taxa of dubious affinity. Even mainstream evolutionists now acknowledge that Ediacaran animals are not missing because we have not found them, but simply because they did not yet exist in the Ediacaran period.

→ Ediacaran Biota as Precursors

Nevertheless, some scientists have thought they could locate the ancestors of the Cambrian animal phyla among the fossils of the Ediacaran biota. In the Ediacaran period, which immediately preceded the Cambrian, the first macrofossils that even a layman would recognize as fossil organisms are recorded. However, these fossils of the Ediacaran biota cannot be potential ancestors of the Cambrian animal phyla because they have a very alien structure unlike any later fossil or living organisms. They have a unique air-mattress-like quilted body without any visible organs or openings, a strange glide symmetry (offset left and right body side), and a weird fractal growth pattern. Nobody really knows what they are, and there are advocates for almost any conceivable option—from giant protists to an independent multicellular kingdom (Vendobionta), to lichens, fungi, algae, or coelenterate-grade animals. Only a handful of enigmatic Ediacaran fossils have even been discussed as potential ancestors of sponges, cnidarians (*Haoootia*), mollusks (*Kimberella*), annelid-like worms (*Yilingia*), and lophophorates

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(*Namacalathus*). However, these are highly controversial and hardly stand up to scrutiny, which is why mainstream experts on these groups have either remained skeptical or rejected such claims. Even if the advocates are correct, such few exceptions would by no means explain the sudden appearance of most other animal phyla in the Cambrian explosion.

→ Small Shelly Fossils as Precursors

Another attempt was the claim, made by intelligent design (ID) critic Nick Matzke and others, that so-called small shelly fossils fit the bill as putative ancestors of the Cambrian animal phyla. The problem with this claim is that it commits the fallacy of equivocating between two very distinct and unrelated groups of fossils. The first is the Small-Shelly Fauna *sensu stricto* from the Lower Cambrian, which is nothing but fragments of shells and spines and exoskeletons of Cambrian animal phyla. The other is the Ediacaran Shelly Fauna, which only consists of rather complete body fossils of just three different taxa (*Namapoikia*, *Namacalathus*, and *Cloudina*). These three genera are of enigmatic affinity and are almost certainly unrelated to the bilaterian Cambrian animal phyla. There is neither temporal nor anatomical overlap between these two small shelly faunas; all they have in common is the name. Thus, under closer inspection, this claim is just another case of smoke and mirrors by Darwinists desperate to explain away conflicting evidence.

→ Trace Fossils as Evidence of Precursors

A more reasonable argument was based on the trace fossil record. Trace fossils are fossilized remains of walking and burrowing tracks in the petrified seafloor. The Cambrian explosion correlates with the first appearance of traces of burrowing activity deep into the sediment, which is also called the Cambrian Substrate Revolution. There are also trace fossils from the Ediacaran, but these are strictly confined to the surface of the ancient seafloor. Some of them indeed look like traces of crawling or creeping invertebrates, or even walking tracks of arthropods. Could

these be the otherwise elusive Ediacaran ancestors of the Cambrian animal phyla?

This was a strong argument until a seminal study in experimental paleontology by Giulio Mariotti et al. (2016).² Their study was based on the well-known fact that the Ediacaran seafloor was covered with bacterial mats. So Mariotti and his colleagues decided to grow such bacterial mats in aquarium tanks, stir them up, and see what kinds of artifacts were created by the settling mats. Lo and behold, all the characteristic types of Ediacaran trace fossils could be exactly replicated by folding and shrinking artifacts of these mats, without any animals involved. Since then, a few new worm-like tracks have been discovered, but these could as well have been created by giant protists (this still happens on deep seafloors today) or crawling cnidarians. The only good evidence for an association of traces and possible animal fossils are *Kimberella* and *Yilingia*, but both are of uncertain affinity. Therefore, the trace fossil record is no solution to the Cambrian dilemma after all.

→ From Ad Hoc to the Exotic

Evolutionists who do not deny the suddenness of the Cambrian explosion have suggested a lot of different hypotheses regarding what might have caused this remarkably quick burst of biological novelty. Such hypotheses include nearly anything from global glaciations, raised oxygen content, a surge of nutrients (e.g., phosphorous), plate tectonics, cancer-like freak development by poisoned sea water, an armed race between predators and prey, to even extraterrestrial ancestry by panspermia. Other less exotic suggestions focus on genetic and epigenetic factors, such as microRNAs and HOX genes.

None of these mechanisms can explain how all the complex specified information for new genes and new proteins could originate in such a short time. Therefore, some scientists like Charles Marshall have simply denied that any new genes and new proteins were required. Instead, they have suggested that so-called gene regulatory networks (GRNs) just had to be reshuffled and rearranged like

Lego bricks, without the generation of much new information. However, this claim has been refuted by recent research (e.g., Paps & Holland 2018³ and Heger et al. 2020), which shows that the origin of all the animal phyla and generally all major transitions in the history of life involved the origin of many new genes and new proteins.

Overstated Claims

Finally, here is a recent example that demonstrates how sweeping claims about alleged solutions to the Cambrian problem must always be taken with a large grain of salt: Allison Daley et al. (2018) published a study on the fossil record of Cambrian arthropods.⁴ It was celebrated in press headlines as proof that the Cambrian explosion was a lengthy and gradual event after all; however, if you read the actual report, the findings proved the exact opposite.

Here is what they discovered. About 518 million years ago, we find the oldest stem group arthropods like *Anomalocaris*. About 537 million years ago, we find the first evidence for derived crown-group arthropods like trilobites. Thus, the putative descendants are 19 million years older than the putative

ancestors. This forced the scientists to postulate a hypothetical ghost-lineage of stem arthropods that is not documented in the fossil record. The scientists also acknowledged that until 550 million years ago, no arthropods or other animals existed. This would imply that complex arthropods with an exoskeleton, articulated limbs, compound eyes, and gut and nervous systems developed from jelly-like ancestors in only 13 million years. Such a sudden transition to a totally new body plan is simply impossible with a blind Darwinian mechanism, as can be easily demonstrated by population genetic calculations. (This is often called the waiting time problem).

A Consistent Pattern of Abrupt Appearances

Could the Cambrian explosion just be an exception from the rule? Theoretically it could be, but in reality, it is not: similar abrupt appearances of biological novelty are rather the rule and have been consistently found in all periods of Earth history, in all geographical regions, and over all taxonomic categories, from plants and protists to invertebrate and vertebrate animals.

Some examples would be the very origin of life itself; the origin of photosynthesis; the Avalon explosion with the origin of the strange Ediacaran biota prior to the Cambrian; the Great Ordovician Biodiversification Event; the Devonian Nekton Revolution and Odontode Revolution; the Silurian-Devonian Terrestrial Revolution with the origin of land plants; the Carboniferous explosion of winged insects including true metamorphosis; the Triassic explosions of marine reptiles and of tetrapods like dinosaurs; the Cretaceous origin of flowering plants, called an “abominable mystery” by Darwin because it violated his gradualist expectations; the Paleogene origin of butterflies; the Paleogene avian radiation of modern birds and radiation of placental mammals; the Neogene “Big Bang” of our own genus *Homo*; and last but not least, the sudden origin of human culture in the Upper Paleolithic Human Revolution. All these events were named explosions, revolutions, or “Big Bangs” by mainstream paleontologists to highlight their sudden and non-gradual nature, and many have been explicitly compared with the Cambrian explosion.

When the Data Don't Fit, Extend the Synthesis

This consistent pattern of abrupt appearances clearly contradicts the core prediction of gradualism by Darwin's theory. When a theory is so

thoroughly refuted by empirical evidence, it is time to put it to rest and look for better alternatives. Of course, most secular scientists will not consider design as a valid option, so they keep searching for naturalistic alternatives. The earliest attempts were the theory of neutral evolution, put forth by geneticist Motoo Kimura, and the theory of “punctuated equilibria” by paleontologists Niles Eldredge and Stephen Jay Gould. The former fails to explain complex adaptations, while the latter was largely misunderstood, because it was never designed to explain the large macro-evolutionary discontinuities but only minor discontinuities in species-to-species transitions.

A newer attempt is so-called Constructive Neutral Evolution, but it also fails to explain complex adaptations and can only explain superfluous complexity, similar to funny Rube Goldberg machines. Among theoretical biologists, the recognition that Neo-Darwinism has failed is increasingly becoming the mainstream consensus, and a large group now subscribes to a new paradigm called the Extended Evolutionary Synthesis (EES), which proposes a host of new mechanisms like niche construction, phenotypic plasticity, or natural genetic engineering.

This EES has also been called a third way of evolution to distinguish this paradigm from the alternatives of Neo-Darwinism (which has been refuted) and Intelligent Design theory (which is considered forbidden territory). However, none of these third-way mechanisms has yet resolved the failures of Neo-Darwinism, as evidenced by the fact that none of them is emerging as a consensus view, even among EES proponents. They only agree that Neo-Darwinism fails to explain crucial phenomena, such as the origin of biological novelties, phenotypic complexity, and non-gradual transitions, that were explicitly listed as the explanatory deficits of Neo-Darwinism by renowned Austrian evolutionary biologist Prof. Gerd Müller in his keynote talk at the prestigious Royal Society of London 2016 conference, “New Trends in Evolutionary Biology.”

The Design Hypothesis: Still Unrefuted

Since all these alternatives also fail, maybe it is about time to reconsider the design hypothesis. Darwin himself used a common and very reasonable approach that proposes explanations of past events by reference to known causes operative in the present. There is, in fact, a single cause that is known to produce new complex information and specified complex structures. It is the conscious activity of intelligent minds as free agents.

This cause does not produce novel information and structures via a gradual process of tiny steps accumulating over long periods of time, but rather can work abruptly with bursts of creativity.

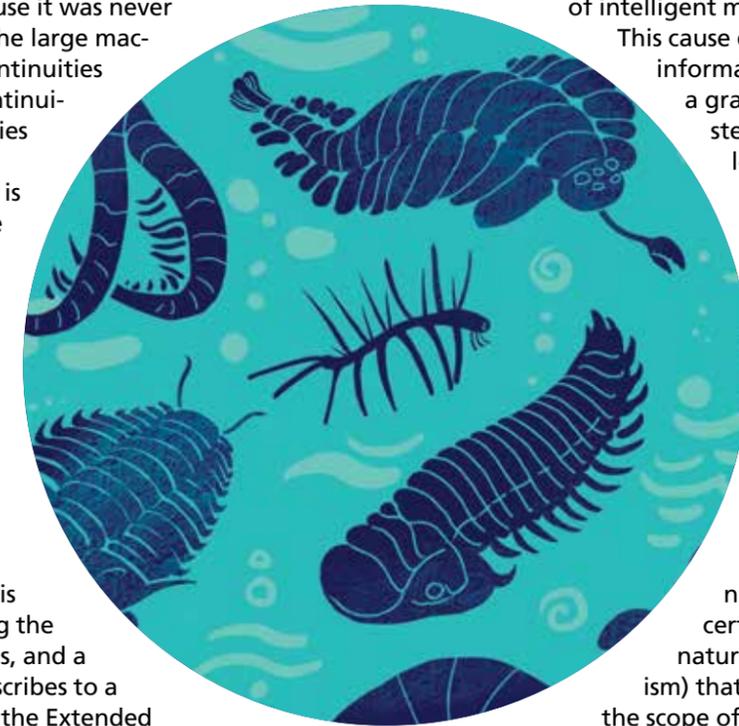
We can make an inference to the best explanation, based on our positive knowledge about the kind of causes capable of producing the effect in question. As good scientists, we should not be biased towards certain worldviews (like naturalism and materialism) that arbitrarily restrict the scope of allowed explanations. Good scientists should follow the

evidence wherever it leads, and discontinuity is the hallmark of intelligent design.

The Cambrian explosion, together with the total evidence of the discontinuous fossil record, strongly suggests that intelligent design is the best explanation for the observed pattern in the data. Materialist invocations of aliens or time-traveling genetic engineers from the future only push the origin-of-life and origin-of-information problem to the next level. While the identity of the designer is a different question altogether, theists nonetheless have the more reasonable and consistent explanation—divine creative activity. ☉

Notes

1. https://evolutionnews.org/2013/07/how_sudden_was/.
2. <https://pubs.geoscienceworld.org/sepms/jedres/article-abstract/86/4/287/145517/Microbial-Origin-of-Early-Animal-Trace-Fossils?redirectedFrom=fulltext>.
3. <https://www.nature.com/articles/s41467-018-04136-5>.
4. <https://www.pnas.org/doi/10.1073/pnas.1719962115>.



Other Notable Explosions!

- **The origin of life itself**
- **The origin of photosynthesis**
- **The Avalon explosion**
- **The Great Ordovician Biodiversification Event**
- **The Devonian Nekton Revolution**
- **Odontode Revolution**
- **The Silurian-Devonian Terrestrial Revolution** (land plants)
- **The Carboniferous explosion** (winged insects, metamorphosis)
- **The Triassic explosions** (marine reptiles and tetrapods)
- **The Cretaceous origin** (flowering plants)
- **The Paleogene origin** (butterflies)
- **The Paleogene avian radiation** (modern birds, placental mammals)
- **The Neogene “Big Bang”** (our own genus *Homo*)
- **The Upper Paleolithic Human Revolution** (human culture)